ESIA FOR SPP RUDINE 46,55 MW, NIKSIC

Prepared by:

EcoEnergy Consulting LLC

m.kolanowska-matczak@qair.energy

February, 2026

Document Revision History

Rev.	Date	Prepared	Checked	Approved	Description
00	23.02.2026	ESIA Team	Danilo Barjaktarovic	Stefan Klikovac	Sent for review and comments
01					

Contents

Abbreviations

Abbreviation	Full term
AC	Alternating Current
AEWA	Agreement on the Conservation of African-Eurasian Migratory Waterbirds
CBD	Convention on Biological Diversity
CECIS	Common Emergency Communication and Information System
CGES	Montenegrin Transmission System Operator
CMS	Convention on the Conservation of Migratory Species of Wild Animals
CO_2	Carbon Dioxide
DC	Direct Current
EIA	Environmental Impact Assessment
EBRD	European Bank for Reconstruction and Development
EHS	Environment, Health and Safety
ELC	European Landscape Convention
EPA	Environmental Protection Agency
ESIA	Environmental and Social Impact Assessment
ESMP	Environmental and Social Management Plan
ESP	Environmental and Social Policy (EBRD)
ETS	Emissions Trading System
EU	European Union
EUROBATS	Agreement on the Conservation of Populations of European Bats
GHI	Global Horizontal Irradiation
GHG	Greenhouse Gas
GRM	Grievance Redress Mechanism
HV	High Voltage
KO	Cadastral Municipality
LCDS	Low-Carbon Development Strategy
LMP	Labour Management Procedures
MPPT	Maximum Power Point Tracking
MRV	Monitoring, Reporting and Verification
NDC	Nationally Determined Contribution
NECP	National Energy and Climate Plan
NGO	Non-Governmental Organization
OHL	Overhead Transmission Line
OHS	Occupational Health and Safety
PAP	Project-Affected People
PR	Performance Requirement (EBRD)
PV	Photovoltaic
RES	Renewable Energy Sources
RoW	Right of Way
SAC	Special Area of Conservation
SCADA	Supervisory Control and Data Acquisition
SPA	Special Protection Area
SPP	Solar Power Plant
TSO	Transmission System Operator
UNFCCC	United Nations Framework Convention on Climate Change
WEEE	Waste Electrical and Electronic Equipment

1 Introduction

1.1 Overview

Qair Montenegro d.o.o. (the Client) is developing the Rudine PV Project, with a total installed capacity of 46.55 MW in the Municipality of Nikšić, Montenegro. The project area is located approximately 20 km south-east of the city of Nikšić, within cadastral municipality KO Rudine.

The PV power plant will be connected to the national transmission network - 110/35 kV Vilusi substation through an existing 110 kV overhead transmission line Nikšić-Bileća, situated in close proximity to the project area.

The benefits of reconstructing the 110 kV Nikšić–Bileća transmission line are quantified in the Development Plan of the Montenegrin Transmission Network for the period 2023–2032 and demonstrate significant socio-economic, energy and climate-related advantages. The total socio-economic benefit of the Project is estimated at approximately EUR 750,000 per year, with the largest share arising from savings associated with the reduction of greenhouse gas emissions. In this regard, annual savings related to emission costs amount to approximately EUR 542,500 per year, while savings associated with energy costs are not identified, confirming that the Project primarily delivers system-level and climate benefits rather than direct reductions in final energy consumption.

From a climate perspective, the reconstruction contributes to a reduction of system-wide CO_2 emissions by approximately 77,500 tonnes of CO_2 per year, which corresponds to a monetised climate benefit of about EUR 542,500 annually, based on the applied carbon price. In addition, the Project plays a crucial role in facilitating the integration of renewable energy sources, enabling the integration of approximately 304,500 MWh of renewable electricity generation per year, and supporting the connection of new renewable energy capacities in the region served by the Nikšić–Bileća transmission corridor.

The planned reconstruction of all existing towers and the installation of conductors with a cross-section of 240/40 mm², which will eliminate frequent failures caused by conductor breakage that have previously led to tower collapses and an increased frequency of supply interruptions. Taking into account the anticipated connection of approximately 200 MW of renewable energy capacity in the wider project area, the reconstruction of the Nikšić–Bileća transmission line, together with the planned upgrades of the Vilusi substation and the Bileća–Nikšić corridor, represents a key measure to enhance system security, increase network reliability and create the conditions for the uninterrupted operation of existing and planned renewable electricity generation facilities.

The project which is subject of this ESIA report comprises the following main components:

- Solar Power Plant with an installed capacity of 49.875 MWp, including PV modules, inverters, internal cabling, and ancillary infrastructure.
- Internal Infrastructure, including access roads, fencing, drainage system, control building, and maintenance areas.
- Connection Infrastructure, consisting of a reconstructed 110 kV overhead line Nikšić-Bileća (approx. 10 km) from Rudine to the 110/35 kV Vilusi substation and of a planned:
    - A new 110 kV overhead line of approximately 500 m in length, connecting the Rudine Solar PV Plant to the existing 110 kV Nikšić–Bileća line; and
    - A new 110 kV overhead line of approximately 500 m in length, connecting the same 110 kV line to the Vilusi substation.

The location of the above-mentioned project components is shown in Figure 1-1.

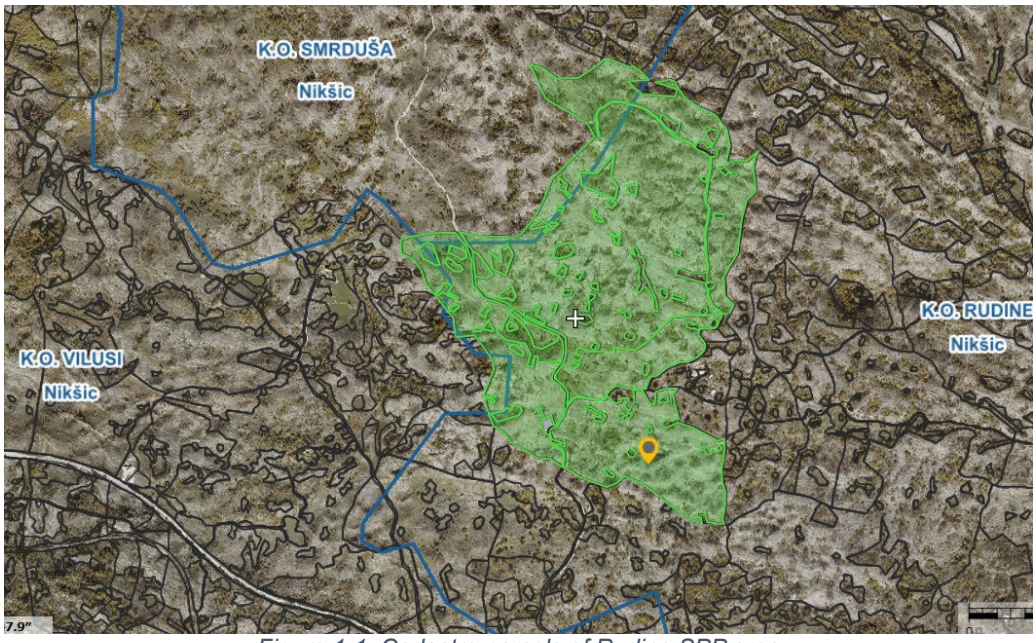


Figure 1-1: Cadastre parcels of Rudine SPP area

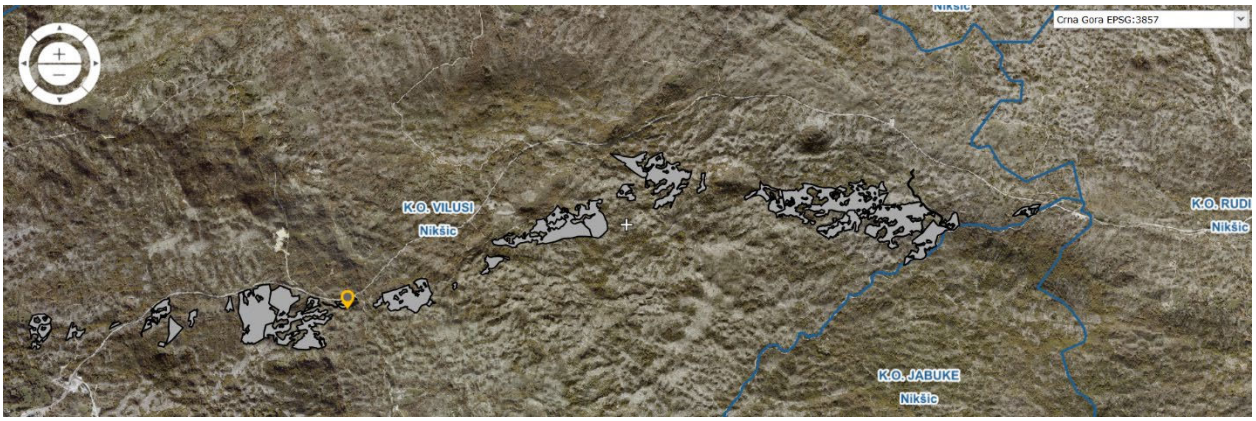


Figure 1-2: Cadastral parcels of of OHL 110kV

The objectives of the Rudine Project are:

- ✓ To generate renewable electricity in line with Montenegro's National Energy and Climate Plan (NECP) and Low-Carbon Development Strategy (LCDS).
- ✓ To contribute to Montenegro's climate commitments, including its Nationally Determined Contribution (NDC) of reducing greenhouse gas emissions by 35% by 2030 compared to 1990 levels.
- ✓ To strengthen energy security by diversifying the national generation mix and reducing reliance on lignite-fired power from the Pljevlja Thermal Power Plant.
- ✓ To bring local socio-economic benefits, including employment opportunities during construction and operation, as well as tax revenues for the Municipality of Nikšić.

1.2 Background

Montenegro has an obligation to meet its share of the very ambitious EU renewable energy source (RES) targets. Specifically, Montenegro has a new target of having 50% of its gross final energy consumption come from RES by 2030, a significantly higher rate than the previously met 2020 target of 33%.

Increased demand for installation of RES creates significant impact for land. This potentially creates a conflict between energy policies on one side and nature preservation and social acceptance on the other. In developing RES projects, investors are often guided by spatial plans that are based purely on wind or solar resource potential and which do not take into account environmental or social/cultural aspects. Assessing potential environmental problems or social/cultural conflicts can reduce the risk of long costly delays or even project cancellation. The Municipality of Nikšić was selected as a pilot area for the development of low-conflict maps due to its size (it is the largest municipality in Montenegro). This project - Mapping of Solar and Wind Potential in Municipality of Niksic informs potential project developers about site sensitivity levels and the potential risks associated with various locations in order to facilitate the development of RES projects. An analysis shows that the total area suitable for solar development in the municipality is estimated at 465.4 km². [1]

The Government of Montenegro issued urban planning technical conditions for the preparation of technical documentation for the construction of a facility for the production of electricity from renewable resources - a solar power plant upon request "Qair Montenegro" d.o.o. Podgorica at Rudina location, Nikšić Municipality, on the 14th of September, 2023. As the Rudine PV project may seek financing from International Financing Institutions or Banks, an Environmental and Social Impact Assessment (ESIA) for its construction, operation, maintenance and decommissioning was considered necessary to be prepared.

1.3 The ESIA Study

1.3.1 Objectives

The main objectives of this ESIA Study are as follows:

- ✓ Confirm the baseline conditions through a review of available data and conducting surveys;
- ✓ Assess the project's environmental and social impacts for all the phases of the project against Project requirements (Montenegrin law, EU directives and EBRD Performance Requirements);
- ✓ Provide an overview of the Project design, identification of sensitive receptors in the Project's area of influence and assessment of Project alternatives;
- ✓ Review of compliance obligations, including applicable national regulations, as well as international lender requirements;
- ✓ To engage with key stakeholders and project-affected people (PAPs) to gain knowledge about the local E&S context and seek feedback on the Project;
- ✓ Determination of applicable mitigation and management measures to be implemented to avoid or minimise potential impacts following good international practice and EBRD Performance Requirements.

1.3.2 Area of influence

The project is located within KO Rudine, Municipality of Nikšić, approximately 20 km from the town of Nikšić, on a plateau of karst terrain. The total footprint of the project is estimated at 74.8 hectares. Both the PV Power Plant and OHLs works will have supporting infrastructure (e.g. offices, construction camps, security system, internal road networks etc.). The OHLs Project will establish a temporary laydown area in the vicinity of the Project (locations to be confirmed).

[1] Božidar Pavlović, Irma Muhović, Biljana Medenica, Dražen Karadaglić (2024) ''Mapping of Solar and Wind Potential in the Municipality of Nikšić''

For the purpose of the environmental and social assessment and baseline data collection, generally a 600 m corridor has been considered for biodiversity and 200m for social assessment, in addition to the project footprint.

1.3.3 Study Methodology

The methodology for preparing the ESIA study is based on:

- Previously conducted research for the purposes of preparing the Scoping Report, which identified areas of concern with regard to environmental and socioeconomic impacts;
- Regulatory review to understand the applicable national legislation and regulatory frameworks;
- Review of existing information on the project and the project location;
- Assessment of alternatives to understand the selection of the proposed project and project components;
- Field research to collect data on physical environment, biological aspects and socio-economic aspects;
- Determination of the baseline conditions related to environmental and social issues;
- A detailed social and environmental assessment of the site and surrounding areas, determination of potential impacts and mitigation measures;
- Preparation the Environmental and Social Management Plan;
- Consultation with stakeholders.

1.3.4 Document structure

The remainder of this report is structured as follows:

Chapter 2 – Review of Regulatory Framework: Overview of Montenegrin environmental and social legislation, international treaties and EBRD Performance Requirements.

Chapter 3 – Project Description: Physical and technical details of the PV plant, substation, and connection line.

Chapter 4 – Considered Alternatives: Summary of the alternatives considered (site, technology, layout, no-project scenario).

Chapter 5 – Baseline Environmental Conditions: Overview of environmental baseline conditions.

Chapter 6 – Socio-economic baseline: Overview of socio-economic and cultural heritage baseline conditions.

Chapter 7 – Potential Impacts and Mitigation Measures: Summary of potential environmental and social impacts and preliminary mitigation approaches.

Chapter 8 – Cumulative Impact Assessment: Summary of potential environmental and social cumulative impact.

Chapter 9 – Environmental and Social Management Plan: Presents the environmental and social management plan (ESMP).

Chapter 10 – Stakeholder Engagement: Activities conducted so far and planned engagement during the Scoping and ESIA phases.

2 Review of Regulatory Framework

This Chapter provides an overview of the national legislation and regulations as well as the related institutional framework relevant to environment and social assessment. Also discussed are the EBRD environmental and social safeguard policies and General Environmental, Health and Safety Guidelines relevant to the proposed project.

Montenegro has been engaged in a continuous process of approximation to the EU acquis in the field of environment and climate change as part of its EU accession negotiations. Negotiations on Chapter 27 – Environment and Climate Change were officially opened on 10 December 2018, with the adoption of a Common Position by the EU, which included eight Closing Benchmarks to be fulfilled before the chapter can be provisionally closed.

Over the past decade, Montenegro has gradually transposed a number of EU directives into its national legislation. The Law on Environmental Impact Assessment (OG 75/18) introduced procedures for screening, scoping, EIA study preparation, public consultation, and decision-making in line with the EIA Directive (2011/92/EU as amended by 2014/52/EU). Progress has also been achieved in the fields of waste management, air quality, and industrial emissions. Further alignment and implementation efforts are ongoing for several horizontal directives, including the Environmental Crime Directive (2008/99/EC) and the Environmental Liability Directive (2004/35/EC).

A particularly important element of Chapter 27 is the establishment of the ecological network in line with the Habitats Directive (92/43/EEC) and the Birds Directive (2009/147/EC). The Environmental Protection Agency (EPA) is responsible for preparing proposals for ecological network areas, including their boundaries, target habitats and species, and management responsibilities. Significant progress has been achieved: by early 2025, approximately 76% of Montenegro's land territory and 10% of its marine territory had been mapped in accordance with Natura 2000 requirements. This represents a major step forward in preparing for the official designation of Natura 2000 sites upon accession, supported by several EU-funded IPA projects. To strengthen this framework further, the drafting of a new Law on Nature Protection is ongoing in 2025, aiming to fully align national legislation with EU directives on habitats, birds, and ecological networks.

In the field of climate change, Montenegro has been a Party to the UNFCCC since 2006, accepted the Kyoto Protocol in 2007, and ratified the Paris Agreement in 2017. The country submitted its Second Nationally Determined Contribution (NDC) in 2021, committing to reduce greenhouse gas (GHG) emissions by 35% by 2030 compared to 1990 levels. The adoption of the Law on Climate Change (2023) established the legal framework for climate policy, including monitoring, reporting and verification (MRV), adaptation measures, and preparations for emissions trading (ETS) alignment.

According to the European Commission's 2024 Country Report for Montenegro, the country is moderately prepared in Chapter 27. While progress has been made, the report highlights the need to further intensify efforts to fulfil the closing benchmarks, particularly through stronger implementation and enforcement of environmental legislation, enhanced waste and water management, and effective nature protection and climate policies. The Commission also underlines the importance of strengthening administrative capacity, including recruitment and training of technical staff, improved institutional coordination, and provision of stable financing. As a positive example, the report notes Montenegro's successful integration of the Operational Center 112 into the EU Civil Protection Mechanism's CECIS system (February 2024), which demonstrates effective progress in the field of civil protection.

2.1 Montenegrin Environmental regulatory context

2.1.1 The EIA Framework

The national legislation in Montenegro that provides a framework for obtaining relevant permits and approval needed for carrying out infrastructure projects[2] (construction permit, operational permit) prescribes carrying out environmental impact assessment for project in List I of the Decree on the project, for which environmental impact assessment is mandatory ("Official Gazette of Montenegro", No. 20/2007, 47/2013, 53/2014, 37/2018), and Decision on the need for environmental impact assessment for project in List II. The main law that outlines the environmental impact assessment is the Law on Environmental Impact Assessment (EIA) ("Official Gazette of Montenegro", No. 75/18.)

Within the ongoing process of harmonisation of the national legislation with EU acquis, the amendments of the Law on EIA fully transposed the Directive of the European Parliament and of the Council 2014/52/EU amending the Directive 2011/92/EU on the environmental impact assessment of certain public and private projects. Following further actions in the accession process, the EIA process in Montenegro will follow changes in the EU legislation and implement relevant amendments when and where applicable.

Developing an Environmental Impact Assessment (EIA) in accordance with the Law on EIA and obtaining approval from the relevant National Authority – Environmental Protection Agency of Montenegro (EPA) is a time-consuming process, which requires at least 9-12 months. This process includes the receipt of the decision for EIA development, field work, drafting of the EIA, publication of the EIA for public access, organisation of a public hearing, comments submission/review of the draft EIA, submission of the EIA for approval and receipt of the approval.

The national legislation prescribes that the EIA report to be produced and submitted for approval of the EPA shall be prepared in Montenegrin language.

The EIA for the Rudine PV Project was prepared by the Consultant and submitted for official approval. EPA approved the EIA by issuing the Decree of approval on 19.12.2024.

2.1.2 The Law on Environment

The Law on Environment ("Official Gazette of Montenegro", No. 52/16) defines the basic principles and instruments to be used to protect the environment, including sustainable development and public participation in environmental matters.

The environmental legal framework within Montenegro also contains laws (and secondary legislation) covering areas summarised below, some of which are aligned with the European Directives and regulations.

2.1.3 The Law on Nature Protection

Law on Nature Protection ("Official Gazette of Montenegro", No. 54/16. 18/19) regulates the conditions and manner of protection and preservation of nature. Nature protection is implemented for:

- preservation and improvement of biological (genetic, species, ecosystem), geological and regional diversity;
- preservation and improvement of individual natural resources;
- determining and monitoring the state of nature;
- harmonisation of human activities, economic and social development plans, programs and projects with the sustainable use of renewable and rational use of non-renewable natural values and resources, in order to preserve them permanently;

[2] The Law on Construction of Objects, (“Official Gazette of Montenegro”, no. 19/25)

- prevention of activities with harmful effects on nature that are a consequence of the linear dependence of economic growth and the use of natural resources;
- protection and preservation of transboundary valuable parts of nature and protected natural assets;
- preservation of natural soil properties, preservation of water quality, quantity and availability, including sea water quality.

2.1.4 The Law on Air Protection

The Law on Air Protection (''Official Gazette of Montenegro'', 25/10, 40/11, 43/15) regulates the manner of air quality monitoring, protection measures, assessment and quality improvement, air quality planning and management. Air, as a natural value of general interest, is part of the environment and has special protection in Montenegro. Protection of air from pollution by radioactive substances, genetically modified organisms, noise and natural disasters are governed by special regulations.

2.1.5 The Law on Waste Management

The Law on Waste Management (''Official Gazette of Montenegro'', 34/24 and 92/24) defines that waste management is performed in accordance with the National Waste Management Plan and Local Municipal Waste Management Plans. Pursuant to the provisions of the Law, the local self-government unit is obliged to review the implementation of the local waste management plan at the Assembly of the local self-government unit once a year.

2.1.6 The Law on Waters

The Law on Waters (''Official Gazette of Montenegro'', no. 27/07, 73/10, 32/11, 47/11, 48/15, 52/16, 84/2018) regulates the legal status and manner of integrated water, water and coastal water management, land and water facilities, conditions and manner of performing water activities and other issues of importance for management of waters and water resources. Funds for financing water management activities are provided in accordance with a special law. This Law applies to: surface and groundwater and mixed waters of river mouths flowing into the sea; mineral and thermal waters; water resource; drinking water deposits in the territorial seas; protection of coastal sea waters from land-based pollution. This law does not apply to the use of mineral and thermal waters for the production of mineral raw materials or geothermal energy.

2.1.7 The Law on Protection from Non-Ionizing Radiation

The Law on Protection from Non-Ionizing Radiation ("Official Gazette of Montenegro", no. 35/13) regulates the protection of human life and health, persons working with non-ionizing radiation sources, and protection of the environment from the harmful effects of non-ionizing radiation, conditions for using non-ionizing radiation sources and other issues of importance related to non-ionizing radiation.

2.1.8 The Law on Protection from Noise in the Environment

Law on Protection from Noise in the Environment ("Official Gazette of Montenegro", no. 28/11, 1/14 and 2/18) determines measures for the prevention or reduction of the harmful impact of noise in the environment and other issues of importance for the protection of the environment and human health from the effects of noise.

2.1.9 The Law on Protection against the Negative Effects of Climate Change

Protection against the negative effects of climate change, reduction of greenhouse gas emissions, protection of the ozone layer and other issues related to protection against the negative effects of climate

change are regulated by the Law on Protection against the Negative Effects of Climate Change (''Official Gazette of Montenegro'', no. 73/19).

2.1.10 Legislation on Landscape

Montenegro is a signatory to the European Landscape Convention (ELC). Signatory countries are obligated to: recognize landscapes in law; establish and implement landscape protection, management and planning policies and establish procedures for public participation.
The implementation of the ELC is included in Spatial Plan of Montenegro until 2040 (''Official Gazette of Montenegro'', no. 68/25).

2.1.11 Other Key National Legislation

The **Energy Law** (''Official Gazette of Montenegro'', no. 28/25) regulates energy activities, the conditions and manner of their performance for the purpose of quality and safe supply of energy to end customers, the manner of organizing and managing the electricity and gas market, as well as other issues of importance for the energy sector.
The **Law on Spatial Planning** (''Official Gazette of Montenegro'', no. 19/25) regulates the system of spatial planning, planning assumptions for sustainable spatial development and regulates other issues of importance for spatial planning.
The **Law on Construction of Objects** (''Official Gazette of Montenegro'', no. 19/25 and 92/25) regulates the manner and conditions of construction of objects, performance of building construction activities and other matters of importance for construction of objects.
The **Law on Expropriation** ("Official Gazette of Montenegro", no. 5/00, 12/02, 28/06, 21/08, 30/17, 75/18,33/24 and 53/25) defines that expropriation may be carried out for the needs of the state, municipality, state funds and state-owned companies which, in accordance with the law, perform activities of public interest.
The **Law on Occupational Health and Safety** (''Official Gazette of Montenegro", no. 34/14, 44/18 and 24/24) defines that the employer is obliged to ensure protective measures by preventing, removing and controlling the risk at work, informing and training employees, along with appropriate organization and the necessary resources.
The **Law on Labour** (''Official Gazette of Montenegro", no. 74/19, 8/21, 59/21, 68/21, 145/21, 77/24 and 86/24). The rights and obligations of employees from the employment relationship, the manner and procedure of their realization are regulated by this law, the collective agreement and the employment contract.
The **Law on Forests** ("Official Gazette of Montenegro", no**.** 77/24 and 92/25) regulates the cultivation, protection, preservation and improvement of forests, planning, methods and conditions of forest use, construction and maintenance of forest roads, forest monitoring, as well as other issues of importance for forests, forest land and forestry.
The **Law on Protection of Cultural Heritage** ("Official Gazette of Montenegro", no. 49/10, 40/11, 44/17 and 18/19) is also one of the laws to be considered when the infrastructure is planned or constructed. In the case of finding an archaeological site, the works have to be stopped and the competent body notified about the findings.

2.2 International Treaties and Conventions

Montenegro is a signatory to a number of international environment and social related treaties, conventions, declarations and protocols. The following are the most relevant:

- UN Framework Convention on Climate Change (UNFCCC);
- Kyoto Protocol;
- Paris Agreement;
- Energy Community Treaty;
- Energy Charter Treaty;
- Convention on Biological Diversity;

- Cartagena Protocol to the Convention on Biological Diversity;
- Convention on the Conservation of European Wildlife and Natural Habitats (Bern Convention);
- Convention on the Conservation of Migratory Species of Wild Animals (Bonn Convention);
- Ramsar Convention on the Protection of Wetlands;
- Convention Concerning the Protection of the World Cultural and Natural Heritage;
- European Landscape Convention;
- Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES Convention);
- Protocol on Areas of Special Protection and Biodiversity of the Mediterranean;
- Agreement on the Protection of Bats in Europe (EUROBATS);
- Agreement on the Protection of African-Eurasian Migratory Waterbirds (AEWA).

2.3 Specific Legislation on Biodiversity Conservation

Biodiversity is a subject to international conventions regulating its protection, the most important of them being the Convention on Biological Diversity (CBD), the Bern Convention on the Conservation of European Wildlife and Natural Habitats (Bern Convention), and the Convention on the Conservation of Migratory Species of Wild Animals (CMS or Bonn Convention). Montenegro has ratified and implemented all of them.

CBD regulates general aspects of biodiversity conservation, whilst the remaining two focus on species and their habitats. Animal species are classified in two appendices by the Bern Convention: Appendix II (Strictly Protected Fauna Species) and Appendix III (Protected Fauna Species). Strictly Protected Flora Species are listed in Appendix I. Meanwhile, the Convention on Migratory Species (CMS) lists species in two appendices: Appendix I (endangered migratory species) and Appendix II (species which have an unfavourable conservation status and which require international agreements for their conservation and management). CMS also has special implementation instruments – international agreements, two of them being relevant here: Agreement on the Conservation of African-Eurasian Migratory Waterbirds (AEWA), and Agreement on the Conservation of Populations of European Bats (EUROBATS). Montenegro has ratified both. In addition, the Rulebook on protection measures and manner of maintaining crossings for wild animals (OG MNE 80/2010) determines the protection measures and the manner of maintaining special technical and technological solutions, which ensure the smooth and safe crossing of wild animals. All bats in Montenegro are protected by law and are in the List of Protected Rare and Endangered Species (Official Gazette of Montenegro, No. 76/06).

In the European Union (EU), bird protection is regulated by the Directive on the Conservation of Wild Birds (Official Journal of the European Union [2009/147/EC]), or the Birds Directive, and bat protection by the Directive on the conservation of natural habitats and of wild fauna and flora (Official Journal of the European Union [1992/43/EEC]), known as the Habitats Directive. All European wild bird species are protected by the Birds Directive, whilst 194 species and sub-species considered particularly threatened and listed in Annex I are the subject of special conservation measures, and Special Protection Areas (SPAs) for their conservation, as well as for all migratory bird species, are designated; all SPAs are included in the Natura 2000 ecological network, set up under the Habitats Directive. All other European plant and animal species are listed in Annex IV of the Habitats Directive – species of community interest in need of strict protection, and in Annex II – species of community interest, conservation of which requires the designation of Special Areas of Conservation (SACs), whilst Annex I lists habitat types of community interest, conservation of which requires the designation of SACs. SACs, together with SPAs, constitute Natura 2000 ecological network. These two directives are also EU implementation mechanisms for the Bern Convention and the CMS.

Being EU candidate country, Montenegro has to fully transpose and implement the EU legislation (acquis Communautaire) by the time of accession. Montenegrin legislation in the relevant areas has already been fully harmonised and mostly implemented. Impact of power lines on birds has been recognised by relevant international institutions and conventions, which have produced guidance documents on the subject, the most relevant being Bird Life International's report prepared for the Bern Convention and the Council of Europe (Haas *et al.* 2003) and CMS/AEWA guidelines (Prinsen *et al. comp.* 2012).

In Montenegro, the Law on Nature Protection (Official Gazette of Montenegro", No. 54/16. 18/19) regulates the protection of bird and bat species, while the Decision on protection of certain species of flora and fauna (OG RCG No. 76/06) lists strictly protected and protected wild species. This law also governs the designation of protected areas, with individual bylaws regulating the proclamation and regulation of specific sites. The same law also prescribes the establishment of the Ecological Network of Montenegro, further regulated by the Rulebook on detailed criteria for determining the area of the ecological network ("Official Gazette“ no. 45/17), which is to become a part of the European network of Natura 2000 sites (SPAs and SACs) at the accession of Montenegro to the EU.

Also, the Law on Nature Protection specifically prescribes that pylons and technical components of medium-voltage and high-voltage power lines must be constructed in a way that will prevent birds and bats from electric shock and mechanical injuries (Article 87 and 117).

2.4 EBRD Performance Requirements

EBRD-financed projects are expected to be designed and operated in compliance with good international practices relating to sustainable development.

The performance requirements provide a solid base from which clients can improve the sustainability of their business operations.

Where possible, projects should avoid adverse impacts on workers, communities, and the environment. If avoidance is not possible, negative impacts should be reduced, mitigated or compensate for, as appropriate.

New facilities or business activities financed by EBRD must be designed to meet the performance requirements from the outset.

2.5 EBRD Environmental and Social Policy

The Rudine Solar Power Plant project will be financed by the European Bank for Reconstruction and Development (EBRD). In line with the EBRD Environmental and Social Policy (ESP, 2024), project is characterised as Category B – projects with E&S impacts that are site-specific and which can be readily assessed and mitigated.
In accordance with the EBRD Environmental and Social Policy from 2024, all projects are required to meet a set of ten Performance Requirements (PRs), which establish the framework for the identification, assessment and management of environmental and social risks and impacts; the relevance of each PR to the Rudine Solar Power Plant is outlined in the following sections:

ESR1 – Assessment and Management of Environmental and Social Risks and Impacts

ESR1 is the cornerstone of the EBRD’s environmental and social framework. It requires clients to identify, assess, and manage environmental and social risks and impacts throughout the project life cycle. For Rudine SPP, this means carrying out a proportionate Environmental and Social Impact Assessment (ESIA) that focuses on site-specific issues such as land take, biodiversity disturbance, landscape and visual change, and construction-related nuisances (dust, noise, traffic). An Environmental and Social Management Plan (ESMP) with topic-specific sub-plans will be developed to ensure that identified mitigation measures are implemented and monitored effectively.

ESR2 – Labour and Working Conditions

This requirement ensures the protection of workers’ rights and the promotion of safe and fair working conditions. It covers issues such as non-discrimination, equal opportunity, prohibition of child and forced labour, and occupational health and safety (OHS). For Rudine, PR2 is particularly relevant during the

construction phase, when contractors will employ temporary workers. The project will adopt Labour Management Procedures (LMP), provide OHS training, and establish a grievance mechanism accessible to all workers.

ESR3 – Resource Efficiency and Pollution Prevention and Control

ESR3 promotes the sustainable use of resources and the prevention or reduction of pollution. For Rudine, this includes efficient use of land and water (especially water needed for panel washing), controlling dust and noise emissions during construction, and managing waste streams responsibly. Special attention will be given to the future decommissioning phase and the end-of-life management of PV modules, which must follow circular economy principles and EU Waste Electrical and Electronic Equipment (WEEE) standards.

ESR4 – Health, Safety and Security

This requirement addresses potential risks to communities that may arise from project activities. For Rudine, relevant issues include traffic safety on local roads during construction, dust and noise impacts on nearby households, and potential glint and glare effects from PV modules. Measures will include a Traffic Management Plan, dust suppression, noise controls, and glint/glare modelling. If security staff are engaged for site protection, they will be trained to operate in line with human rights principles.

ESR5 – Land Acquisition, Restrictions on Land Use and Involuntary Resettlement

ESR5 aims to avoid or minimise physical and economic displacement. The Rudine project is not expected to cause resettlement, but there may be restrictions on land use, especially for grazing or farming activities. In such cases, the project will apply fair and transparent agreements, and if livelihoods are affected, measures will be developed to restore them, in consultation with affected land users.

ESR6 – Biodiversity Conservation and Sustainable Management of Living Natural Resources

ESR6 requires clients to protect and conserve biodiversity and maintain ecosystem services. Although Rudine is located outside designated protected areas, the site includes natural and semi-natural habitats that may host protected flora, birds, bats, reptiles, and invertebrates. Seasonal biodiversity surveys will be undertaken to assess potential impacts. Mitigation measures may include habitat buffers, timing restrictions on works, and monitoring of key species. If critical habitats were to be identified, additional measures would be required in line with the mitigation hierarchy.

ESR7 – Indigenous Peoples

ESR7 protects the rights of Indigenous Peoples. It is not applicable in Montenegro, as there are no groups meeting the EBRD definition of Indigenous Peoples.

ESR8 – Cultural Heritage

ESR8 requires the protection of tangible and intangible cultural heritage. While no known cultural heritage sites are located directly within the Rudine footprint, there is always a chance of encountering archaeological artefacts during earthworks. Therefore, a Chance Finds Procedure will be prepared and implemented. In addition, consultation with the Cultural Heritage Administration will be conducted to confirm the absence of significant assets within or near the project area.

ESR9 – Financial Intermediaries

ESR9 applies to financial intermediary operations (e.g. banks or funds on-lending EBRD resources). As Rudine is a direct investment project, PR9 is not relevant.

ESR10 – Information Disclosure and Stakeholder Engagement

ESR10 requires meaningful stakeholder engagement throughout the project cycle. For Rudine, this includes early disclosure of project information, scoping consultations with local communities and authorities, and continuous dialogue during construction and operation. Special attention will be given to vulnerable groups to ensure inclusive participation. A project-level Grievance Redress Mechanism (GRM) will be established to receive and respond to concerns from workers and communities.

3 Project description

3.1 Physical Description

Qair Montenegro d.o.o. (the Client) is developing the Rudine PV Project, with a total installed capacity of 46.55 MW in the Municipality of Nikšić, Montenegro. The project is located within KO Rudine, Municipality of Nikšić, approximately 20 km from the town of Nikšić, on a plateau of karst terrain. The total footprint of the project is estimated at 74.8 hectares. The nearest settlements are scattered rural households in the Rudine area and along the M6 road corridor towards Vilusi. The OHL has a protection zone of 25 m on either side from the outermost conductor of the line. This safety parameter designates an area along the route with certain limitations, allowing for thoughtful consideration of future use and development in this region. It does not mandate the complete removal of high vegetation within the specified width.

The PV power plant will be connected to the national transmission network - 110/35 kV Vilusi substation through an existing 110 kV overhead transmission line Nikšić-Bileća, situated in close proximity to the project area. The existing SS 110/35 kV Vilusi is located in a rural setting of Niksic. It is outdated and poses a significant risk to the stability of electrical transmission and distribution. This raises concerns regarding the reliability and efficiency of the current infrastructure. To address this, the proposed solution involves a complete overhaul of outdated equipment. The plan includes replacing obsolete components and installing higher capacity transformers and switchgear equipment. This upgrade aims to improve power supply stability and minimise the downtime. The upgrade will be carried out within the current plot limits, requiring no additional land.

To enable secure and reliable evacuation of generated electricity, the reconstruction of an approximately 10 km long section of the 110 kV overhead transmission line (OHL) Nikšić-Bileća between Rudine and the Vilusi 110/35 kV substation is planned. The reconstruction will generally follow the existing alignment of the transmission line corridor (see Figure 3-1), which crosses the rural karst landscape between Rudine and Vilusi, parallel to the M6 main road. The works will include replacement of towers and conductors, and potential adjustments to tower foundations to meet current technical standards and grid requirements. The exact connection point and technical details will be defined in the Main Design, which is currently under preparation. The reconstruction of this line is planned within the CGES Transmission Network Development Plan for the period 2023–2032, which provides the strategic and technical framework for upgrading and reinforcing key sections of the national grid.

In addition to the reconstruction works, the project investor Qair will construct:

- A new 110 kV overhead line of approximately 500 m in length, connecting the Rudine Solar PV Plant to the existing 110 kV Nikšić–Bileća line; and
- A new 110 kV overhead line of approximately 500 m in length, connecting the same 110 kV line to the Vilusi substation.

Detailed Desing for OHL is under preparation and authors of the ESIA team did not has access to details about the reconstruction of existing OHL and construction of new lines for connection to the 110kV line and SS Viluse. The implementation of the project will involve construction activities both at the solar power plant site and along the OHLs route. These activities will include civil works, installation of PV modules and electrical equipment, tower and conductor replacement along the existing line corridor, and commissioning activities.

The project configuration is shown in Figure 3-1 below.

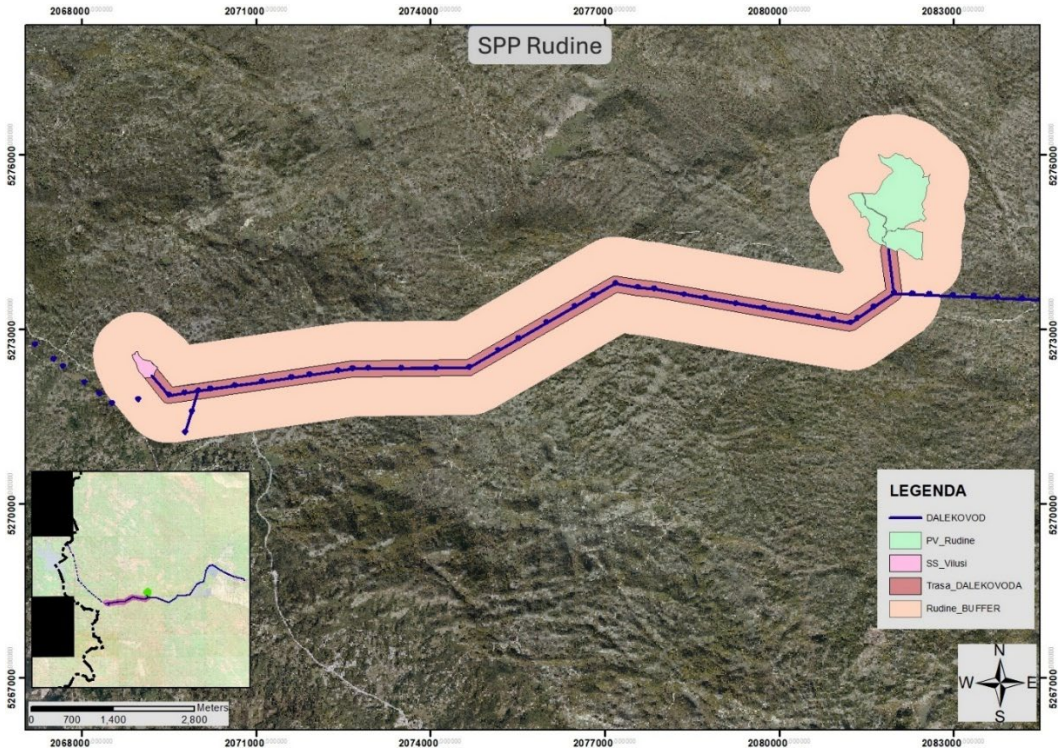


Figure 3-1: Location of the Rudine PV project and connecting transmission lines

3.2 Technical Description

3.2.1 PV Plant

3.2.1.1 Description

Photovoltaic (PV) systems for electricity generation through the conversion of solar energy represent one of the most promising areas of energy sector development. The Rudine PV Project will have an installed capacity of 46.55 MW (AC), with a direct current (DC) peak capacity of 49.875 MWp, and will consist of approximately 79,800 photovoltaic (PV) modules. The estimated annual electricity production is 73 GWh, which will be delivered to the Montenegrin transmission grid.

The main technical parameters of the Rudine PV Plant are presented in the table below.

Table 3-1: Technical parameters of the project

Parameter	Value
Plant name	Rudine Solar Power Plant – Phase 1
Type of facility	Solar power plant
Primary energy source	Solar energy
Installed capacity	46.55 MW
Grid connection voltage level	110 kV
Nominal inverter voltage	0.8 kV
Operating mode	Parallel operation with the Transmission System Operator (TSO) grid
Number and type of PV panels	79,800 panels, Tiger Neo N-type 66HL4M-BDV or equivalent
Rated power of PV panels	625 Wp
Total PV panel capacity	49.875 MWp

Number and type of inverters	133 units, SG350HX or equivalent
Rated power of inverter	350 kW
Total inverter capacity	46.55 MW

3.2.1.2 Selection of Photovoltaic Panels

The Rudine PV plant will comprise a total of 79,800 Jinko Tiger Neo N-type bifacial modules with a rated power of 625 Wp each, or equivalent, with minimum power of 600 Wp, providing a combined installed DC capacity of 49.875 MWp. The area covered by PV modules will be approximately 202,777 m², which represents about 27% of the total site footprint. A picture of such modules is shown in Figure 3-2.

Figure 3-2: Photovoltaic panel layout

The selected bifacial panel has a capacity of 625 Wp, dimensions of 2238 mm × 1134 mm × 30 mm, and a weight of 32.4 kg. Interconnection between panels is achieved using an integrated cable with a cross-section of 1×4 mm², with lengths of (+) 0.4 m and (–) 0.2 m, supplied as part of the panel. The cables must be protected against UV radiation and direct sunlight exposure.
The selection of this type of PV panels at this stage defines only the technical characteristics, and therefore does not predetermine the final choice of product.

3.2.1.3 Mounting structures

The structure of the facility will be designed in accordance with the architectural design, urban-technical conditions, and the functional requirements of the solar power plant. The primary task of the structure is to bear the vertical loads of the solar panels, as well as snow and wind loads, and to withstand seismic loads in the transverse direction.

Typically, for solar power plant projects, the panels are supported on rafters made of steel C-profiles (C 120×60×25×4 or C 120×60×25×3). The main supporting structure, which carries the rafters, consists of steel frames placed at an axial distance of 2.5 m (2.8 m at the perimeter), constructed from the following elements:

- Beam (Rigla): HOP 140×80×4 (or 140×80×3)
- Column (Stub): HOP 70×70×3
- Bracing (Kosnici): HOP 60×60×3

The steel structure is anchored into individual concrete foundations with dimensions 70 × 70 × 80 cm.

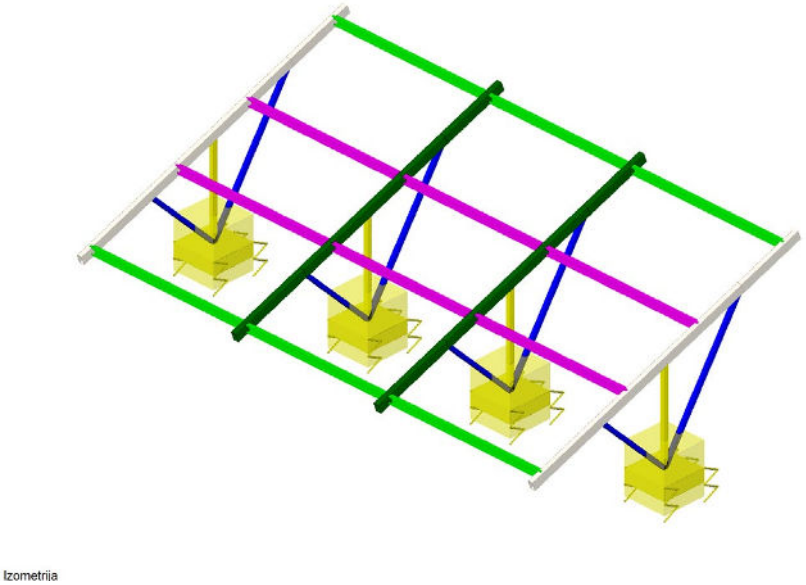


Figure 3-3: Steel structure for solar panels with foundations

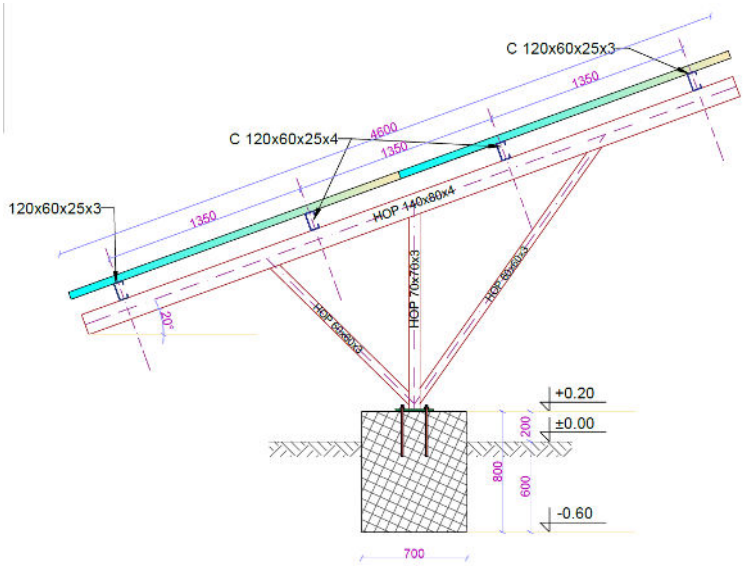


Figure 3-4: Dimensions of the steel structure for solar panels and foundations

3.2.1.4 Inverter

An inverter is an electrical device that converts the direct current (DC) voltage generated by photovoltaic panels into standard alternating current (AC) voltage. In short, the inverter transforms direct current into alternating current. The inverter represents an autonomous device within a photovoltaic system.
For the design of this project, SG350HX inverters manufactured by Sungrow, or equivalent, with minimum power of 350 kW, have been selected. These inverters have an installed capacity of 350 kW, and each contains 12 MPPT devices, each with 2 DC inputs, which monitor and manage the input voltage in real time to ensure maximum output power at all times.
An inverter used for PV plant is shown in Figure 3-5.

Figure 3-5: Appearance of the SG350HX Inverter

The inverters must be equipped with appropriate communication and control interfaces. System operation is monitored by connecting the inverters to a LAN network using suitable communication cables. The inverter is equipped with anti-islanding protection, meaning it automatically disconnects in case of a grid power outage. In other words, it is not possible to feed electricity into the grid if grid voltage is absent. The inverter performs automatic synchronisation with the distribution grid at 0.8 kV.
The selection of inverter type defines only the technical characteristics and does not determine the final choice of product.

3.2.1.5 Configuration of the PV Plant

The installed capacity of the plant, i.e. the sum of the power of all inverters, amounts to 46.55 MW. The plant will be connected to the transmission network through a 110/35 kV substation with a capacity of 2 × 31.5 MVA.

The plant will include 10 internal substations (35/0.8 kV, 2 × 2.5 MVA each). Nine of these substations will connect 14 inverters each (350 kW per inverter), while one substation will connect 7 inverters of 350 kW. Each inverter will be connected to 600 panels of 625 Wp, meaning that the DC power per inverter amounts to 375 kWp. In total, the plant will use 133 inverters and 79,800 panels, with a total DC capacity of 49.875 MWp.

The final choice of substation type will be made during the preparation of the Detailed Design. At that stage, the investor or designer may opt for different voltage levels and transformer capacities, while the total capacity and number of inverters must remain unchanged, i.e. the plant capacity will remain 46.55 MW.

Each inverter will be connected to 600 panels, arranged in 20 strings (30 panels per string, 2 strings per MPPT input). The panels will be mounted on the ground on steel structures designed to provide optimal annual energy generation. Inverters will be placed on steel structures in the shade of the panels, in positions defined in the design drawings.

Given the installed capacity of the plant, it is necessary to provide an appropriate transformer facility for its connection to the transmission network. During the preparation of the Conceptual Design, the designer considered the construction of a 110/35 kV substation (2 × 31.5 MVA) with an associated 110 kV overhead line for integration into the transmission grid. However, the final connection method will be defined in the Detailed Design after the connection conditions are issued by the Montenegrin Transmission System Operator (CGES). Based on these conditions, the single-line diagram and the block scheme of the supply system will be prepared.

Within the 110 kV facility, it will be necessary to install a metering cell with the required measuring equipment and an indirect settlement meter. This meter will allow for bidirectional measurement of energy flows: on the one hand, the measurement of energy consumed by auxiliary systems of the plant, and on the other hand, the measurement of electricity delivered from the plant to the transmission network.

From the layout, it can be observed that the panels are arranged in multiple similar segments, each consisting of several rows. Each row is made up of two panels mounted one above the other, forming strings of 60 panels per row. This configuration enables easier construction and DC cabling. All panels within one segment are connected to a single inverter. Each row is spaced in such a way as to prevent shading of the row behind it. The segments are separated to allow vehicle access corridors.

The layout (See **Error! Reference source not found.**) drawing also shows the positions of the substations. The **35/0.8 kV substations** are positioned along the central corridor of the solar plant, while ensuring that they do not cast shadows on the panels. The **110/35 kV connection substation** is located at the lower end of the plot.

Figure 3-6: Overall layout of the Rudine PV Plant

Depending on the chosen installation method and type of mounting structure in the Detailed Design, the preparation of foundations for supporting posts will vary. The most invasive option involves the construction of concrete foundations with dimensions of 40 × 40 cm. While the exact number of required posts cannot be determined at the Conceptual Design stage (it will be defined in the civil works of the Detailed Design), the maximum number is estimated at around 40,000 posts, corresponding to a total foundation surface area of approximately 6,400 m², with spacing to be calculated during detailed design.

The **traffic infrastructure** is planned to retain existing road routes on the site, complemented by a newly planned central corridor which, considering slope and position, will serve as the main connection to the future substation. This eliminates the need for additional new access roads. In addition to providing unobstructed access for construction vehicles, this road will also ensure vehicle access during the operation of SPP Rudine, for the purposes of overhaul, maintenance, and other interventions.

3.2.1.6 Cable laying in Trenches

For free laying of cables in a trench, a 10 cm layer of fine sand (0–4 mm) is placed at the bottom, after which the cable is laid using rollers at 4–6 m spacing to avoid dragging or twisting. The drum is mounted on fixed stands, and the cable is unwound from the top side, with slack left in a snake-like pattern to compensate for temperature and soil settlement (approx. 3% extra length).

Cables must not be damaged during handling (no sharp edges, pulling force ≤ 5 × D^2; bending radius ≥ 15 × D). Laying is not allowed below +5 °C without special measures (e.g. pre-heating).

After laying and surveying the exact position for the cable cadastre, the cable is covered with an additional 14 cm sand layer. Multiple cables in the same trench are placed with 7 cm spacing, with PVC protective covers 10 cm above. Backfilling is done in 20 cm compacted layers (≥92% density), with red warning tape installed at 40 cm above the cable.

3.2.1.7 Security of Location

The solar power plant site is planned to be fenced in accordance with the **guidelines from the baseline biodiversity study**. The fence will be 2 m high, with the bottom section elevated 20 cm above ground to allow the unobstructed passage of small animals.

Figure 3-7: Example of panel fencing

For this purpose, a panel fence is envisaged, positioned along the PV fields at a distance of 3–5 m from the panels, serving to protect the installation. The fence will have a reinforced concrete foundation, through which a Fe/Zn grounding strip will be laid, with visible grounding connections provided.

Entrance gates are also foreseen, both along the main corridor and at points where existing roads will be intersected by the fencing.

In order to secure the site, the implementation of a video surveillance system for the solar power plant is planned, which is essential for ensuring the safety of the facility. The concept aims to provide comprehensive monitoring that covers key areas where authorised and unauthorised entry into the solar power plant premises may occur, including substations and associated infrastructure.

The proposed system will include high-resolution cameras strategically positioned to ensure coverage of critical zones. The cameras will be equipped with night-vision capability and weather-resistant housing to

ensure continuous operation under various environmental conditions. Motion detection and advanced analytical functions will be integrated to trigger alarms in the event of unauthorised access.

Video recordings will be transmitted to the central control room, enabling real-time monitoring and remote access via mobile devices.

Lighting of the site is planned in a way that minimises potential negative impacts on nocturnally migrating bird species, with the installation of light sensors to avoid continuous illumination during certain periods.

3.2.1.8 Operation and Maintenance

Once commissioned, the Rudine Solar Power Plant will operate in parallel with the Montenegrin transmission grid, delivering an expected annual output of approximately 73 GWh of renewable electricity. The plant will be monitored and controlled via a SCADA system installed in the control room, enabling real-time supervision of generation, voltage, and performance of individual inverters and substations.

Operation activities will include:

- Panel cleaning, carried out periodically to maintain efficiency, using water from the on-site reservoir.
- Vegetation management, primarily mowing or controlled grazing, to ensure panels remain unshaded.
- Routine inspection and maintenance of modules, inverters, transformers, cables, and the 110/35 kV substation.
- Health, safety and environmental monitoring, in line with the Environmental and Social Management Plan (ESMP).
- Security and surveillance, including video monitoring and lighting adapted to minimise impacts on nocturnally migrating bird species.

The operational lifetime of the solar power plant is estimated at 25–30 years, in line with the warranties of PV modules and inverters.

3.2.1.9 Decommissioning

At the end of its operational life, the Rudine PV Plant will be decommissioned in accordance with Montenegrin legislation, EU environmental standards, and EBRD requirements.

Decommissioning activities will include:

- Dismantling and removal of PV modules, inverters, transformers, mounting structures, and ancillary facilities.
- Recycling and recovery of PV modules, electronic equipment, and metals, in line with the EU Waste Electrical and Electronic Equipment (WEEE) Directive.
- Removal of foundations (up to 40,000 concrete piles), to the extent technically and environmentally feasible, with restoration of the terrain.
- Waste management, ensuring safe handling, transport, and disposal or recycling of all decommissioned materials.
- Site rehabilitation, including soil stabilization and possible return of land to agricultural or other uses, depending on owner’s decision and local spatial planning requirements.

A detailed Decommissioning Plan will be prepared closer to the end of the project’s life cycle, in consultation with the relevant authorities, landowners, and stakeholders.

3.2.2 The Overhead Transmission Lines (OHLs)

The grid connection of the Rudine PV Plant will be achieved through the reconstruction of an existing 110 kV transmission line, owned by the Montenegrin Transmission System Operator (CGES), and the construction of two short new sections of overhead line.

Reconstruction of the 110 kV OHL Nikšić–Vilusi–Bileća – The 110 kV overhead transmission line Nikšić–Vilusi–Bileća has been in operation for more than 60 years and, due to its operational characteristics, no longer ensures reliable operation. In addition, a number of solar power plants are planned in the wider area served by the 110/35 kV Vilusi substation and the Nikšić–Vilusi–Bileća transmission line. In order to ensure reliable operation of the transmission line and the evacuation of the generated electricity, it is necessary to reconstruct the Nikšić–Vilusi–Bileća transmission line by constructing a new line within the corridor of the existing one, from Nikšić to the border with Bosnia and Herzegovina.

Also, the planned reconstruction covers a section of approximately 10 km of the existing 110 kV Nikšić–Bileća transmission line, extending from the Rudine area to the Vilusi substation. These works are in line with the CGES Transmission Network Development Plan for the period 2025–2032, which foresees this reconstruction as part of the national grid reinforcement strategy. Reconstruction will involve replacement of existing towers where necessary, installation of new conductors and insulators, and foundation rehabilitation, as well as improvements to grounding systems.

In addition, the project investor Qair will construct:

- A new 110 kV OHL of approximately 500 m, connecting the Rudine Solar PV Plant to the existing Nikšić–Bileća line; and
- A new 110 kV OHL of approximately 500 m, connecting the same line to the Vilusi substation.

The transmission corridor follows the route of the existing line, crossing a karst plateau with sparse vegetation and low population density, which significantly reduces potential environmental and social impacts. The reconstruction and new OHL sections will run through predominantly karst and pasture land, without intersecting protected areas or zones of international ecological importance.

The environmental impacts are expected to be limited, as the works are largely confined to the existing transmission corridor. In addition, standard mitigation measures will be applied, including bird-protection devices, dust suppression, and good construction practices to avoid pollution and soil disturbance.

No underground cable is planned for this connection, as the terrain and technical conditions make overhead lines the most feasible and cost-effective option.

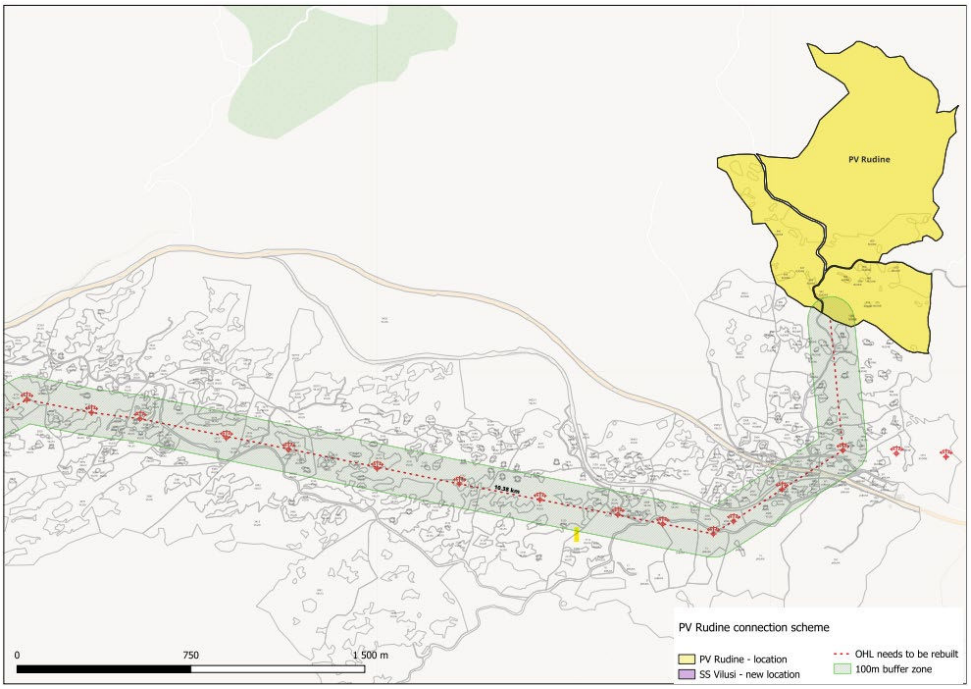


Figure 3-8: Rudine PV Plant connection scheme – part 1

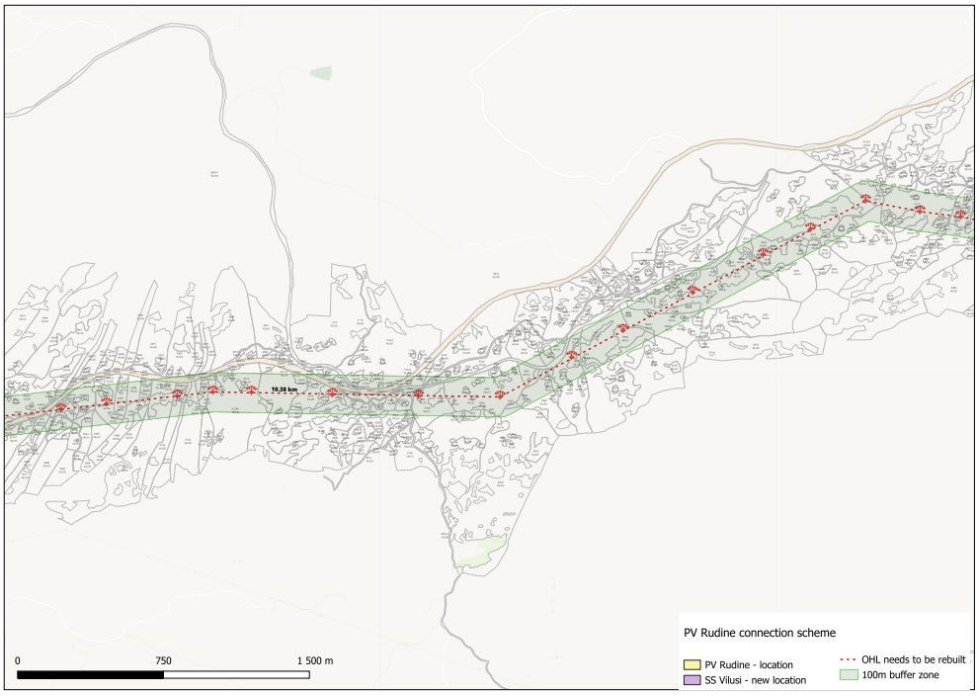


Figure 3-9: Rudine PV Plant connection scheme – part 2

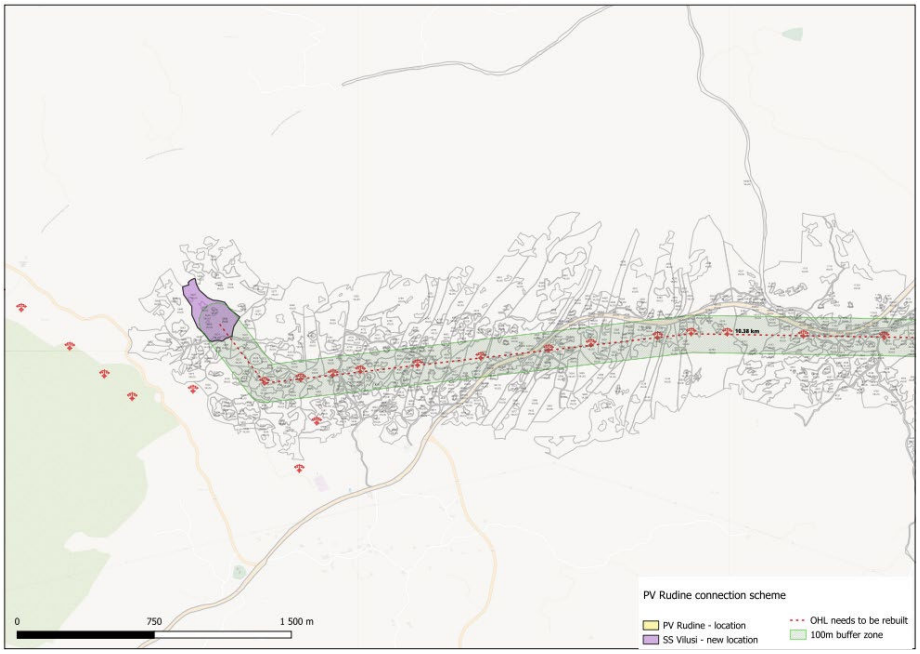


Figure 3-10: Rudine PV Plant connection scheme – part 3

3.2.3 PV Plant Substation

The Rudine Solar Power Plant will be connected to the Montenegrin transmission network through a newly constructed 110/35 kV substation located within the project site. The substation will be equipped with two transformers of 31.5 MVA each, ensuring reliable step-up transformation from the medium voltage level to the 110 kV transmission level.

The internal configuration of the solar power plant foresees the use of 10 medium-voltage substations (35/0.8 kV, 2 × 2.5 MVA each). Nine of these substations will connect 14 inverters each (350 kW per inverter), while one substation will connect 7 inverters, leading to a total of 133 inverters. Each inverter will be connected to 600 panels of 625 Wp, grouped into 20 strings (30 panels per string, 2 strings per MPPT input).

The overall installed DC capacity of the solar power plant is 49.875 MWp, with an AC output capacity of 46.55 MW.

The final choice of substation type and voltage levels will be confirmed during the Detailed Design phase, in accordance with the technical connection conditions issued by CGES. At that stage, the single-line diagram and block scheme of supply will also be finalised.

The 110 kV facility will include a metering cell equipped with appropriate measuring devices and a bidirectional settlement meter. This will allow both measurement of energy consumed by the plant's auxiliary systems and measurement of energy delivered to the transmission network.

3.2.4 Construction Camps

No permanent or temporary construction camps or workshops are foreseen under this Project. Personnel will be transported from their accommodation to the work fronts, or accommodated in the vicinity of the Project Area. Meal delivery will be arranged in shifts based on agreements with local catering services, and designated eating areas (canteens) will be established on the site in accordance with applicable hygiene and safety requirements.

3.2.5 Batching Plants

The concrete required for all construction works will be ordered from licensed producers in the wider project area. As a result, no new batching plants are expected to be installed.

3.3 Resources

The material required for the project components, such as steel and aluminum will be mainly sourced from the international market. The cement will be sourced from cement plants located in the nearby area and quarry and borrow material will be sourced locally from existing quarries.

3.4 Manpower

required manpower will be decided depending on the contractor's construction methodology and policy. Both skilled and unskilled labour will be recruited from the local communities in the proximity of the OHL RoW as far as possible, in order to complete the proposed Project within the timeline and to the benefit of the local economy.

According to the Montenegrin legislation and the quality plan of the future contractor on the project, the key figures with special responsibilities in relation to the Law on protection on work are the following:

- Chief Project Engineer or Chief Engineer
- Responsible engineer
- Site Manager and Company Representatives
- Coordinator of protection and health at work of Qair Montenegro
- Work protection Project Advisor / Health Safety Expert
- Site Managers and Commissioning Managers
- Project Engineers and Field Supervision
- Contractors and subcontractors
- Workers

number of workers is envisaged to be around 50-60 for whole project, mainly from local communities for whom no accommodation will be needed. Therefore, minimum socioeconomic impacts related to influx of foreign workers is anticipated.

4 Considered Alternatives

4.1 Introduction

In line with the EU EIA Directive (2014/52/EU) and the EBRD Environmental and Social Policy, the assessment of reasonable alternatives is a mandatory component of the ESIA process. This section outlines the alternatives that have been considered for the Rudine PV Plant project, including strategic options, site location, technological configurations, and the "no project" alternative. The analysis of alternatives provides the basis for selecting the preferred project design, ensuring that environmental and social impacts are minimised while maximising benefits in terms of renewable energy generation and contribution to Montenegro's energy and climate targets.

4.2 Exploitation of Solar Energy

Montenegro's energy sector remains heavily dependent on the Pljevlja lignite-fired thermal power plant, which accounted for around 43% of national GHG emissions from power generation in 2022 (EPA, 2024). The recently drafted Low-Carbon Development Strategy (LCDS, 2025), aligned with the NECP and the EU

Green Deal objectives, identifies the retirement of TPP Pljevlja by 2041 and a massive expansion of renewable energy, particularly solar and wind, as key measures for achieving climate neutrality by 2050.

In this context, the development of large-scale solar PV plants, such as Rudine, represents a strategic alternative to continued reliance on coal and fossil fuels. Compared to fossil generation, solar PV offers:

- ✓ Zero direct GHG emissions during operation,
- ✓ Reduced air pollution and health impacts,
- ✓ Alignment with Montenegro's NDC commitment (35% GHG reduction by 2030 compared to 1990),
- ✓ Consistency with the LCDS scenario, which projects solar to become the dominant generation technology by 2035.

Alternative renewable sources such as hydropower and wind energy are also part of Montenegro's decarbonisation pathway, but both have greater environmental and social constraints: large hydropower is associated with biodiversity and resettlement concerns, while wind farms may have higher impacts on birds and bats. In comparison, solar PV projects like Rudine are considered more compatible with Montenegro's decarbonisation trajectory, offering a balanced trade-off between technical feasibility, environmental impacts, and economic viability.

Only four solar power plants operate in Montenegro, with smaller installed capacities of up to 5 MW.

4.3 Location Alternatives

The selection of the Rudine site (approx. 74.8 ha in cadastral municipality KO Rudine, Municipality of Nikšić) was based on a combination of technical, environmental, and socio-economic criteria. When considering alternative locations for a solar power plant of comparable capacity in Montenegro, several factors were taken into account:

Solar irradiation potential – the site offers high solar exposure, consistent with national solar potential maps. In the case of Rudine, the key parameter used as an indicator of natural solar potential is the **Global Horizontal Irradiation (GHI)**, expressed in kWh/m² per day. Areas with GHI below **3 kWh/m²/day** were excluded from consideration due to low economic potential. An analysis of GHI data for the Municipality of Nikšić shows that on **99% of its territory the irradiation level exceeds this minimum threshold**. The subsequent suitability map for solar development in Nikšić (see **Error! Reference source not found.**) was prepared by overlaying binary datasets of GHI and land-use/environmental constraints at a resolution of 28×28 m. The total area suitable for solar development in the municipality is estimated at **465.4 km²**. Assuming that approximately **2 ha of land are required per 1 MW of solar capacity**, the theoretical solar potential of the municipality is **23.27 GW**.

Proximity to transmission infrastructure – the location allows for efficient connection to the 110 kV transmission network with limited new linear infrastructure.

Land availability and use – the area consists largely of rocky karst terrain with shallow soils and limited agricultural productivity, which reduces the risk of significant impacts on fertile land or displacement of high-value economic activities.

Avoidance of sensitive receptors – the site is located at a sufficient distance from settlements, cultural heritage sites, and protected areas.

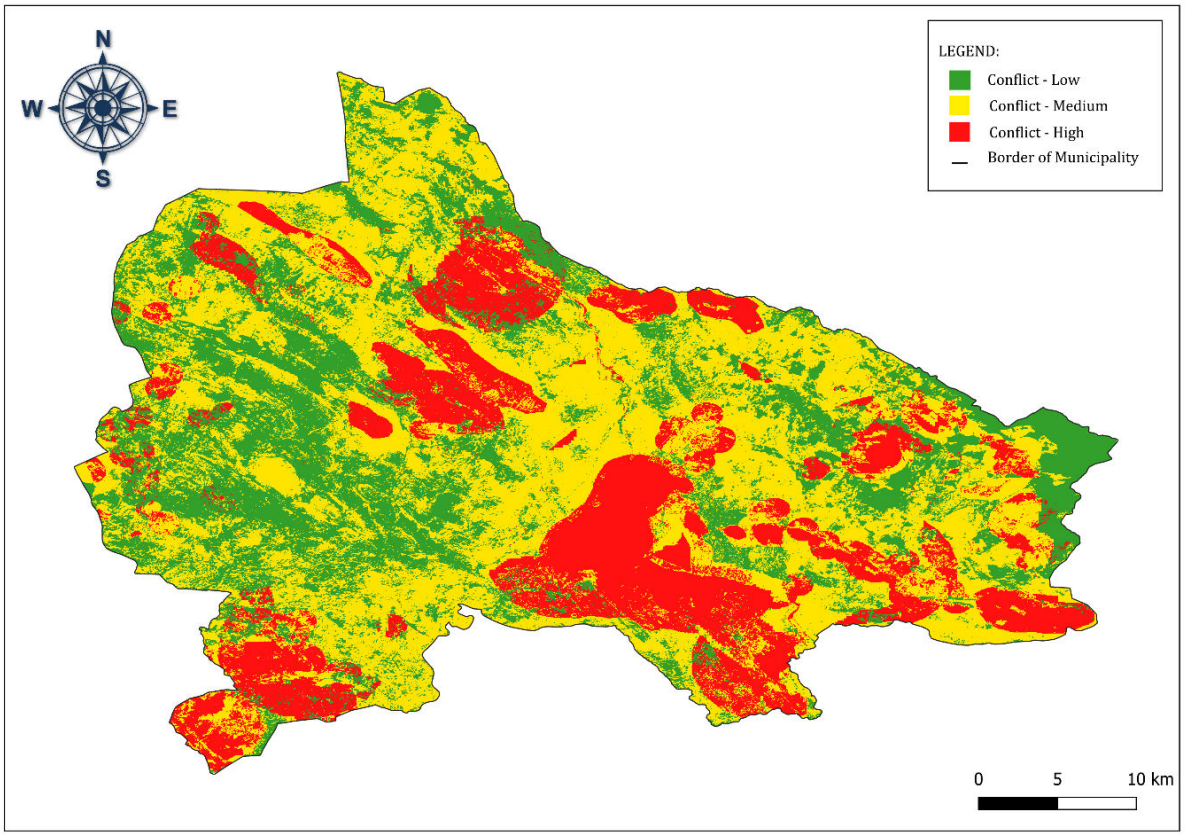


Figure 4-1: Conflict maps[3]

Importantly, according to the **map prepared by The Nature Conservancy (TNC)**, which identified areas of higher and lower conflict potential for renewable energy development in Montenegro, the Rudine location falls within a **zone of lowest conflict**.

The following map presents the location of the planned Rudine Solar Power Plant in relation to the solar conflict map for Niksic and as can be seen, the location of the planned Rudine Solar Power Plant does not fall within any conflict zone. On the contrary, by overlaying the maps it is concluded that the project site lies within the green zone.

[3] Božidar Pavlović, Irma Muhović, Biljana Medenica, Dražen Karadaglić (2024), ‘’Mapping of Solar and Wind Potential in the Municipality of Nikšić’’

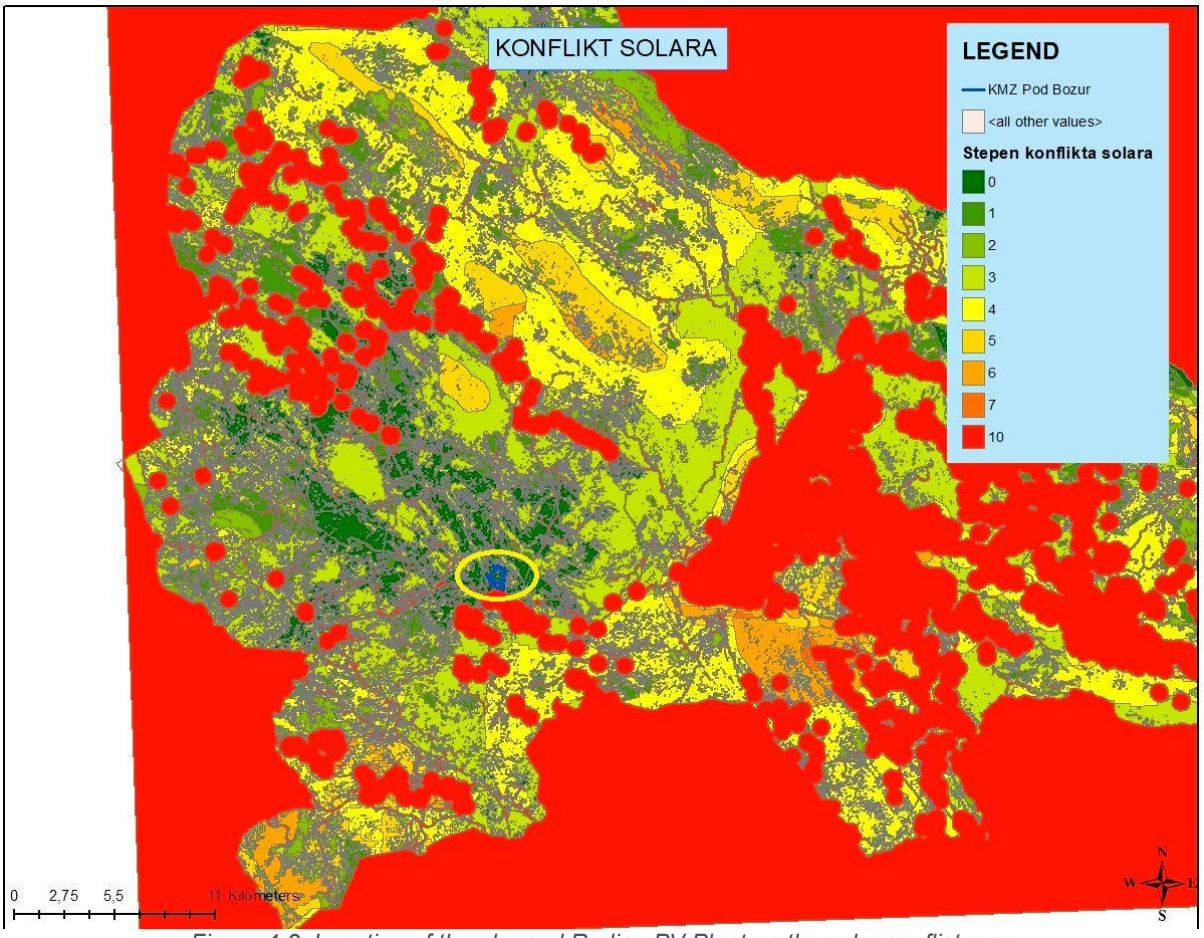


Figure 4-2: Location of the planned Rudine PV Plant on the solar conflict map

This independent assessment confirms that the site is among the more suitable areas in the country for solar PV development, balancing renewable energy expansion with the protection of biodiversity and socio-economic values.

While alternative sites were considered during the initial screening process, most were associated with either greater distance from the grid, higher agricultural value, or proximity to sensitive ecological areas.

Based on this comparative analysis, the Rudine site was selected as the preferred location, as it presents the **lowest overall level of environmental and social conflict** while meeting the technical requirements for a 46.55 MW solar power plant.

4.4 Technological Options for the PV Plant

When planning the Rudine Solar Power Plant, several technological alternatives were considered, in line with best practice and technical-economic feasibility assessments.

PV module technology. Two types of modules were assessed: conventional monofacial modules and bifacial modules. Monofacial modules convert solar radiation only from the front side, whereas bifacial modules capture reflected radiation from both front and rear sides, thus increasing yield, especially on high-albedo surfaces such as rocky or light-coloured terrain. Considering the site characteristics and the potential to optimise generation, bifacial **Jinko Tiger Neo N-type modules** with a nominal power of 625 Wp were

selected, or equivalent, with minimum power of 600 Wp. This option maximises annual electricity production while maintaining competitive costs.

Mounting system. A comparison was made between fixed-tilt mounting structures and single-axis trackers. Trackers can increase energy yield by following the sun's movement throughout the day, but they involve higher investment and O&M costs, require more complex foundations, and may have greater landscape impact. Also, a comparation was made between commonly used materials for solar panels mounting structures: aluminium and steel. Each material has its unique attributes. Aluminium is popular material. It is lightweight which makes aluminium structures easy to handle and install. Aluminium is commonly utilized in the construction of roof and ground mount system. Steel offers a significant advantage in terms of strength and material consumption compared to aluminum for large-scale solar power plants. For Rudine, given the karstic terrain and the need to balance costs, efficiency, and environmental considerations, the selected solution is fixed-tilt steel profiles anchored on concrete foundations. This provides structural stability, lower visual prominence, and easier maintenance.

Inverter technology. Both central inverters and string inverters were considered. Central inverters are cost-efficient for large-scale projects but may reduce system flexibility and increase the risk of partial generation losses. String inverters allow modularity, easier maintenance, and better adaptability to potential shading or module failures. For Rudine, the selected option is a distributed inverter system with **133 Sungrow SG350HX string inverters** (350 kW each), providing a total AC capacity of 46.55 MW, or equivalent, with minimum power of 350 kW. This solution enhances system reliability and facilitates monitoring.

Grid connection options. In principle, both underground cable and overhead line solutions were considered for connection to the transmission network. The final solution foresees a new 110/35 kV substation with two 31.5 MVA transformers and connection to the CGES 110 kV network. The detailed configuration (OHL versus UGC for specific segments) will be determined in consultation with the transmission system operator, balancing technical, environmental, and social considerations.

In summary, the selected technology for Rudine SPP—bifacial modules, fixed-tilt mounting, distributed string inverters, and a dedicated 110/35 kV substation—was identified as the most technically reliable, economically viable, and environmentally appropriate solution for the site conditions.

4.5 Technological Options for the Transmission Line

The connection of the PV plant to the grid will be realised by **reconstructing the existing 110 kV overhead transmission line** between the project site and the **Vilusi substation**, with a total length of approximately **10 km**. The reconstruction will take place along the existing alignment, thus minimising the need for new land take and reducing potential environmental impacts.

Two technological options were considered:

1. **Overhead Line Reconstruction (Preferred Option)**
    - Replacement of existing towers with new steel lattice structures where necessary;
    - Replacement of conductors and insulators to meet current technical standards;
    - Rehabilitation of foundations and access paths;
    - Implementation of bird-protection devices to increase line visibility and reduce collision risk.
    - This option is technically feasible, cost-effective, and uses existing corridors, minimising new environmental and social impacts.
2. **Underground Cable (Not Preferred)**
    - While technically possible, this option would require significant earthworks, including trenching across rugged karst terrain, resulting in higher construction impacts and costs.
    - Maintenance and fault detection would be more complex.

- For these reasons, this option was discarded in the preliminary design stage.

The **overhead line reconstruction** option was therefore selected as the **technically and economically most viable** alternative, aligned with existing infrastructure and consistent with transmission system operator (CGES) requirements.

4.6 The No-Project Scenario

The “no-project” scenario represents the situation in which the Rudine Solar Power Plant is not constructed. This alternative is required under both the EU EIA Directive and EBRD PR1, as it provides a baseline against which the benefits and impacts of the project can be evaluated.

Under the no-project alternative:

- The site would remain in its current state, consisting of karst terrain with shallow soils and limited agricultural or grazing use. No construction works would occur, and no new infrastructure would be developed.
- There would be no potential negative impacts associated with land take, visual change, construction nuisance (dust, noise, traffic), or biodiversity disturbance.
- However, the positive impacts of the project would also not materialise. Montenegro would miss the opportunity to generate approximately 73 GWh of renewable electricity annually, equivalent to the consumption of over 15,000 households, and to avoid associated greenhouse gas (GHG) emissions.
- The country would remain more reliant on conventional generation sources, particularly lignite from the Pljevlja Thermal Power Plant, which is scheduled for gradual phase-out under the National Energy and Climate Plan (NECP) and the Low-Carbon Development Strategy (LCDS).
- The potential socio-economic benefits of the project including local employment during construction, tax revenues for the municipality, and the contribution to national RES targets—would be foregone.

5 Baseline Environmental Conditions

5.1 Geographical Position

Central region of Montenegro consists of the capital Podgorica, the historical capital Cetinje, then the towns of Danilovgrad and Nikšić. This is the area abundant in cultural and historical monuments, and some exceptional natural features.

The area of the Municipality of Nikšić covers 2,065 km², making it the largest municipality in Montenegro, accounting for 14.95% of the country’s territory. By population size, it is the second largest municipality, with 11.6% of Montenegro’s inhabitants.

The favourable geographical position and natural conditions have made Nikšić a crossroads of routes and a hub for connecting the mountainous, central, and coastal parts of Montenegro, as well as neighbouring countries and territories.

In addition to the area of the present municipality, the gravitational zone of Nikšić extends northeast towards the Tara River valley, Upper Morača, a large part of the Bjelopavlići plain, and the Katunski karst, covering an area of about 5,000 km².

The location of the project is in the southwestern part of the Nikšić municipality.

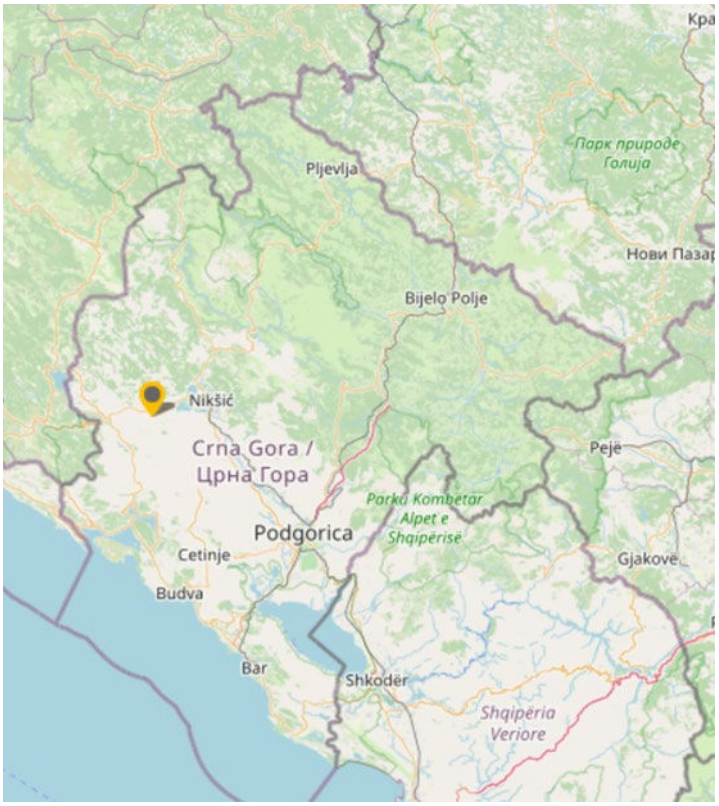


Figure 5-1: Location of the project area

5.2 Physical characteristics

The Rudine area is located within the Karst region of Montenegro. This region is characterised by thick layers of carbonate rocks, predominantly limestone, with strongly developed karst erosion, poor soil cover, and limited water availability. The geomorphological and climatic conditions of this karst plateau shape the ecological sensitivity and land use potential of the project area.

The ring of coastal mountains prevents the direct thermal influence of the Adriatic Sea. However, the amount of precipitation is high due to the penetration of humid Mediterranean air masses through the Bay of Kotor. Average annual precipitation varies significantly in the wider area: Cetinje – 3,993 l/m², Grahovo – 3,140 l/m², Nikšić – 1,993 l/m², and Crkvice – 4,742 l/m².

The karst region extends north of the Orjen–Lovćen–Sutorman–Rumija mountain chain, reaching up to the Duga Gorge–Nikšić line. Within this zone, several limestone mountains rise, including Somina, Njegoš, Golija, Plješevice, and Budoša. The landscape is further structured by large karst plateaus and fields such as Cetinje, Njeguši, Dragalj, Grahovo, Nudo, and Nikšić.

5.3 Climate

Nikšić represents a typical example of a transitional climate in Montenegro. This is a result of its central geographical position and its openness to maritime climatic influences, combined with the complex relief and the impact of surrounding high mountains. The fragmented relief creates diverse microclimates, with variations between closed depressions, open plateaus, and mountain slopes with different orientations. Relief also strongly influences the amount of precipitation: on mountains closer to the sea (Bijela Gora, Pusti Lisac, Lupoglav), precipitation increases with altitude up to 1,100 m and then decreases, while in the interior mountains the highest precipitation occurs at 1,500–2,000 m.

Certain parts of Nikšić municipality are more exposed to maritime influences than others. For instance, the Pješivci area and the Nikšić Field are open to maritime air through the Donja Zeta valley and Zeta plain

towards Lake Skadar, and through the Bojana River valley towards the Adriatic Sea. The climate of Grahovo Field is shaped by its openness towards Boka Kotorska via Dragaljsko Polje and Ledenice, while the Banjani and Oputne Rudine areas are partly exposed through the Trebišnjica valley towards southern Dalmatia. Artificial reservoirs such as Slano, Krupac and Vrtac lakes influence the climate of the Nikšić Field, while Lake Bileća affects the lower areas of Banjani and Oputne Rudine. Industrialisation and urban expansion of Nikšić after World War II also contributed to local climatic changes.

The most important climatic elements are sunshine, air temperature, pressure, relative humidity, cloudiness, precipitation, and winds.

Sunshine: Nikšić records an average of 2,250 hours of sunshine annually, with the highest monthly average in July (322 h) and the lowest in December (97 h).

Temperature - The mean annual temperature is 10.9°C. January is the coldest month (1.5°C) and July the warmest (20.7°C), with an annual amplitude of 19.2°C. Negative temperatures occur from October to May, with values below –5°C recorded from November to March. On average, there are 65 days per year with minimum temperatures below 0°C, and about 20 days per year with maximum temperatures above 30°C. Heating is typically required for about 200 days per year (October–May). Frost is frequent, with an average of 66 frost days annually.

Humidity and cloudiness - Average annual relative humidity ranges from 68.6% in Nikšić to 79.8% in Grahovo, with the lowest values in July. Nikšić records about 29 foggy days annually, mostly around accumulation lakes and river valleys. The town has on average 94 clear days (26%), 107 cloudy days (29%), and the remainder moderately cloudy.

Precipitation - Precipitation varies significantly across the municipality. The highest values are recorded at Crkvice, near the municipal border, with an average of 4,742 mm/year (maximum 8,063 mm). Grahovo averages 3,140 mm, Nikšić 1,993 mm, and Velimlje 1,599 mm. At the Rudine site, average annual precipitation is about 1,783 mm. November is the wettest month across all locations. Snow accounts for about 12% of total precipitation, with an average of 19 snow days per year and 30 days with snow cover. Snowfall generally occurs between October and May, peaking in January.

Wind - Nikšić is characterised by strong north–south winds, with northerly winds prevailing (23.5%) followed by southerly (19.4%). The bora (north wind) is the dominant strong wind, bringing lower temperatures, clearer skies, and reduced humidity. Southerly winds bring warmth, cloudiness, and rain. Due to relief effects, the southern foehn occasionally appears, causing rapid warming, snowmelt, and local flooding. The maestral, a humid and rainy wind, is present in the western parts of the municipality closer to the coast.

5.3.1 Climate change

In the Project area, the only relevant meteorological station is located in the municipality of Niksic. The settlement of Vilusi is approx. 35 km west of Niksic and Rudine approx. 25 km. Consequently, the meteorological station in Niksic was deemed the most relevant for the climatological analysis.

The following table presents mean annual climatological data for the period 1961-2024[4][5],serving as the base period for all future climate projections.

[4] https://www.meteo.co.me/page.php?id=40
[5] https://www.meteo.co.me/page.php?keyword=reports

Table 5-1: Main Climatic Indicators – Nikšić (1961–2024)

Parameter	Unit	Mean value (1961–2024)
Mean annual air temperature	°C	**11.3**
Mean annual minimum air temperature	°C	**6.1**
Mean annual maximum air temperature	°C	**16.4**
Mean annual relative humidity	%	**69**
Cloudiness	0–10	**5.0**
Atmospheric pressure	mb	**941**
Mean annual precipitation	mm	**1,950**
Number of precipitation days	days	**135**
Sunshine duration	h/year	**2,200**
Water vapor pressure	mb	**9.4**
Number of summer days (Tx ≥ 25 °C)	days	**68**
Number of tropical days (Tx ≥ 30 °C)	days	**22**
Number of tropical nights (Tn ≥ 20 °C)	days	**1**
Number of frosty days (Tn < 0 °C)	days	**68**
Number of ice days (Tx < 0 °C)	days	**5**
Days with snow cover (>1 cm)	days	**26**
Maximum snow depth (mean annual maximum)	cm	**105**

A comparative assessment of climatological indicators for the periods 1961–1990 and 1991–2024 for the Nikšić meteorological station indicates statistically and climatologically significant changes, primarily reflected in air temperature regimes and selected climate extremes.

Air temperature

The mean annual air temperature in the period 1991–2024 shows a clear increase compared to 1961–1990, confirming a persistent warming trend in the Nikšić area. This warming is further reflected in:

- an increase in the number of summer days (Tx ≥ 25 °C),
- a notable increase in the frequency of tropical days (Tx ≥ 30 °C),
- a slightly higher occurrence of tropical nights, which were almost absent in the 1961–1990 period.

In parallel, cold-related indicators show an opposite trend, with a reduction in the number of frosty and ice days, indicating milder winter conditions.

Precipitation regime

The comparison of mean annual precipitation indicates a slight decrease in average total annual precipitation in the period 1991–2024 compared to the 1961–1990 reference period. In addition to the overall reduction, precipitation is characterized by greater inter-annual and seasonal variability, with:

- more pronounced dry spells during the summer months,
- concentration of precipitation events in shorter periods, particularly during autumn and winter.

Snow-related indicators

Snow-related indicators show a declining trend, reflected in:

- a reduced number of days with snow cover greater than 1 cm,
- high variability in maximum annual snow depth, despite occasional extreme snow events.

This trend is consistent with rising winter temperatures and a shorter duration of snow cover.

Atmospheric humidity, cloudiness and sunshine

Relative humidity shows minor changes, remaining broadly stable between the two periods, while cloudiness does not indicate a significant long-term trend. Conversely, sunshine duration exhibits a moderate increase, consistent with warmer and drier conditions during parts of the year.

Overall conclusion

Overall, the comparison between the two periods confirms that the 1991–2024 period is warmer and climatically more variable than the 1961–1990 reference period for the Nikšić area. The observed trends are consistent with regional and national climate change patterns in Montenegro and are particularly relevant for long-term spatial planning, infrastructure resilience, water resource management, and renewable energy development in the wider Nikšić area.

5.3.2 Climate Resilience Assessment

To assess the Project's vulnerability to climate change, an analysis was carried out considering both the Project location's exposure to climate changes and the sensitivity of the Project's components to such changes. The results of this assessment are presented below.

Exposure of the Project area to climate change

The climate exposure analysis, presented in the ESIA, considered the risks and vulnerabilities associated with climate variables identified through an analysis of future climate change projections. The following exposure assessment matrix was utilised:

Exposure assessment	
Low	no significant climate exposure
Medium	medium climate exposure
High	high climate exposure

The Project location is evaluated to have low exposure to extreme rainfall and medium exposure to extreme temperatures, wind, and lightning.

However, an evaluation of historical climate-related hazards, along with projections based on the national-level disaster risk assessment document, has not been conducted. Consequently, an updated analysis and exposure assessment are presented below.

In the national-level document *Disasters Risk Assessment of Montenegro*, prepared by the Government of Montenegro in December 2021, the extreme weather and climate events potentially occurring in Montenegro's territory have been identified. These include: (i) heavy rains and storms leading to floods, (ii) snowstorms accompanied by cold waves, and (iii) heat waves causing droughts and forest fires. It is anticipated that climate change will not only escalate the frequency and severity of these extreme events in Montenegro, excluding snowstorms, but also potentially trigger various other hazards unrelated to weather, such as landslides. Below is a summary of historical climate risk observations and the vulnerability of the Project area to these climate risks.

Storm and winds. Storm winds are especially pronounced on the coast and in higher areas, particularly in the northern region of Montenegro. Historical data indicates an average annual occurrence of strong and stormy winds (> 68 km/h) during the period 1990-2020: 27 days in the coastal region and 20 days in the central region[6]. Additionally, in February[7] and August[8] of 2023, the city's infrastructure sustained damage due to powerful winds. Projections from the regional EBU-POM[9] model suggest an anticipated decrease in the average daily wind speed throughout the year by approx. 5% by 2100, compared to the base period of 1961-1990.

Floods[10]. The Municipality of Nikšić has experienced recurrent flood events over the past decade, with several significant incidents recorded between 2019 and 2024. Flooding has affected both urban areas and rural settlements, demonstrating the spatially widespread nature of flood risk.

During periods of intense and short-term rainfall, water has repeatedly flooded residential buildings, basements, local roads and public infrastructure, including the flooding of the Home for the Elderly and temporary disruption of traffic routes. Particularly vulnerable areas include Mokra Njiva, Miločani, Gornje Polje and villages in the Župa area (e.g. Gornja Kuta), where buoyant runoff, local streams and inadequate drainage capacity contributed to flooding events .

Flood events in October 2024 confirmed increased vulnerability of rural and peri-urban areas, where sudden runoff from surrounding slopes and local watercourses caused inundation of agricultural land, access roads and residential properties. Emergency services reported multiple interventions, although the situation was subsequently stabilised through local response measures .

Overall, observed flood incidents in Nikšić indicate that extreme precipitation events remain a relevant natural hazard, exacerbated by topographic characteristics and insufficient drainage infrastructure, and should be considered in future spatial planning and infrastructure development. These observations are consistent with broader climate variability trends, which suggest an increased frequency of short-duration, high-intensity rainfall events.

Snowfall. During the reference period 1991–2020, the average number of days with snow cover exceeding 1 cm in the Nikšić area was approximately 27 days per year, reflecting the predominantly continental and mountainous climatic influence. Snow cover is a regular winter occurrence, although its duration and depth show considerable inter-annual variability.

Climate projections indicate a pronounced decrease in mean annual snow accumulation toward the second half of the 21st century, with reductions of up to −80% to −90% expected for inland and central Montenegrin regions, including Nikšić. This trend is consistent with the observed decline in the number of frosty and ice days, indicating progressively milder winter conditions.

Despite the overall decreasing trend, episodic heavy snowfall events still occur, occasionally resulting in significant snow cover depths and temporary disruption of transport and infrastructure, particularly in rural and higher-elevation areas of the Municipality of Nikšić.

Erosion and landslides. The southwestern slopes of Orjen Mountain, encompassing the Project area from Vilusi to Herceg Novi, constitute geologically and morphologically 'suitable' terrain for erosion and

[6] Government of Montenegro, Disasters Risk Assessment of Montenegro, December 2021
[7] https://mondo.me/Info/Drustvo/a1145273/primorje-crne-gore-jaki-vjetrovi.html
[8] https://www.avaz.ba/vijesti/region/852170/supercelijska-oluja-pogodila-i-crnu-goru-haos-u-herceg-novom
9 Eta Belgrade University – Coupled Atmospheric Ocean Model

landslides. The instability of these terrains is particularly influenced by zones of flysch plastic and impermeable rocks. Typically, in a tectonic relationship, thick masses of rigid, well-petrified rocks, mainly limestone, overlay these zones. The solid masses exert pressure and deform the softer flysch formations, causing blocks to break off and slide along the edges. This process intensifies during rainy periods, especially in the event of earthquakes. In November 2023, a rockslide occurred near Vilusi on a local road*11*.

Droughts. Drought monitoring in Montenegro is conducted by the Institute for Hydrometeorology and Seismology of Montenegro by calculating the Standard Precipitation Index (SPI) value. According to the drought vulnerability map, Vilusi area is characterised as moderately vulnerable*12*.

Fires. The Montenegro region is prone to forest fires*13*, often triggered by exceptionally high temperatures, lightning strikes, or the careless ignition of open-air fires. From 2001 to 2024, Nikšic lost 3.9 kha of tree cover, equivalent to a 5.0% of the 2000 tree cover area. This does not account for gains in tree cover over the same period. In 2020, Nikšic had 73 kha of natural forest, extending over 37% of its land area. In 2024, it lost 59 ha of natural forest, equivalent to 36 kt of CO_2 emissions.

In Nikšic, from 2001 to 2024, 11% of tree cover loss occurred in areas where the dominant drivers of loss resulted in deforestation. In Nikšic, the peak fire season typically begins in late June and lasts around 12 weeks. There were 4 VIIRS fire alerts reported between 25th of November 2024 and 24th of November 2025 considering high confidence alerts only. This is normal compared to previous years going back to 2012.

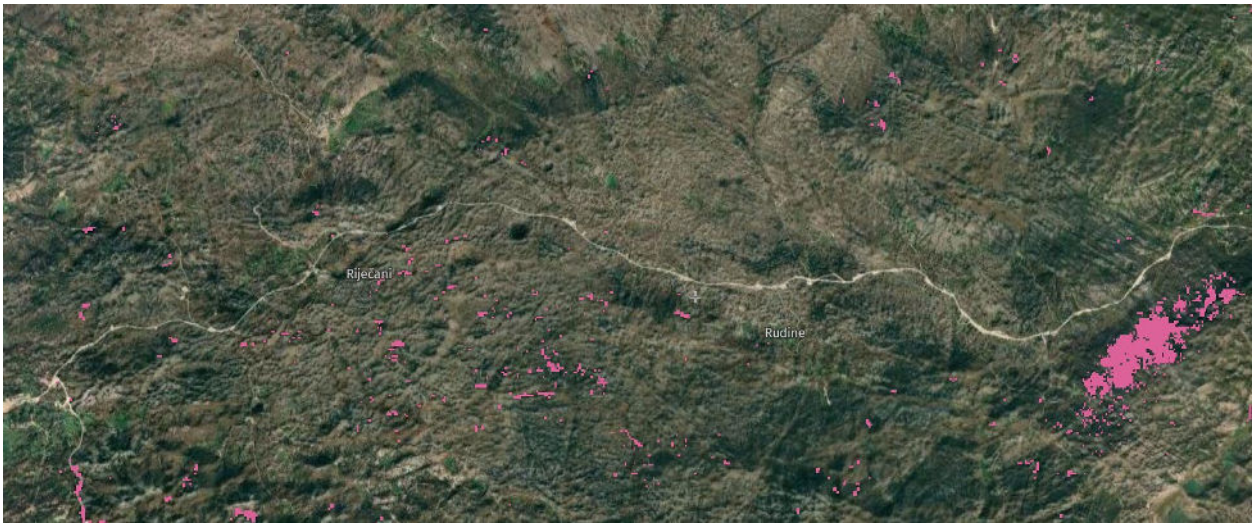


Figure 5-2: Tree cover losses by fires in closer Project area

Earthquakes. Considering Montenegro's seismic rezoning map*14*, the seismic hazard decreases from the coast towards the interior of the mainland. Consequently, the Project area exhibits low probability of earthquakes in Rudine and Vilusi area. According to available data from the Institute for Hydrometeorology and Seismology of Montenegro, over the past year and a half, several minor earthquakes, with a magnitude below 3 degrees on the Richter scale and at a depth of less than 20 m, have been recorded in the Project area.

Lightening. The occurrence of lightning in the Project area is primarily associated with the occurrence of strong storms.

[11] https://www.dan.co.me/crna-gora/put-vilusi-belosave-od-jutros-prohodan-5206938
[12] https://www.meteo.co.me/page.php?id=48
[13] GEF, UNDP and Montenegro Ministry of Sustainable Development and Tourism; Montenegro Third National Communication on Climate Change; 2020
[14] http://www.seismo.co.me/questions/12.htm

During the period from the establishment of the Commission for the Assessment of Damage Caused by Natural Hazards until 31 December 2024, a total of 528 compensation claims were submitted from the Municipality of Nikšić, representing the highest number of claims nationwide. The majority of claims were related to damage to residential and other buildings caused by the earthquake that affected Nikšić in 2023. Following on-site inspections and review of the submitted documentation, the total estimated value of damage in Nikšić amounted to EUR 419,193.00. In accordance with Article 6 of the Decision on Detailed Criteria for the Use of Current and Permanent Budget Reserve Funds, financial compensation was approved up to a maximum of 10% of the assessed damage value. Claims related to primary school buildings and religious facilities were rejected.

In addition, severe weather events recorded in July and August 2024 caused damage to agricultural holdings within the Municipality of Nikšić. Approximately 150 claims were submitted on this basis, of which 76 claims were resolved by the end of 2024, while the remaining claims were not approved due to limited budgetary resources.

Considering the information provided, an updated analysis of the Project area's exposure to climate changes is presented below.

Climate variable	Exposure
Storm and winds	Medium
Floods	Medium
Snowfalls	Low
Erosion and landslides	Medium
Droughts and fires	High
Earthquakes	Medium
Lightning	Medium

Sensitivity of the Project type/components to climate change

The sensitivity analysis of the Project type (transmission infrastructure and equipment) concerning climate change was conducted within the existing ESIA. The following sensitivity assessment matrix was utilised:

Sensitivity assessment	
Low	no significant climate sensitivity
Medium	medium climate sensitivity
High	high climate sensitivity

The overall infrastructure is assessed to be **medium sensitive to temperature increases and wildfires**. T**ransmission network** (comprising towers and conductors) is **highly sensitive to strong winds**. The **transmission network's sensitivity to flooding** is rated as **low**, and the entire system's sensitivity to lightning is also rated as low. Given the potential for lightning to cause damage to the transmission network, resulting in interruptions to the electricity supply, and considering the mitigation measures already proposed in the ESIA aimed at mitigating the negative impacts of lightning, the **sensitivity rating of project components to lightening** should be evaluated as **medium**.

Below is a summary of the sensitivity analysis of the project components to climate change, encompassing variables that were not analysed in the ESIA.

Climate variable	Sensitivity
Storm and winds	High (for transmission network)
Floods	Low
Snowfalls	Low
Erosion and landslides	Medium
Droughts and fires	Medium
Earthquakes	Medium
Lightening	Medium

Component Solar Power Plant (SPP) Rudine shows a **moderate sensitivity to climate change**, primarily related to temperature increase, intense precipitation events and wildfire risk.

The sensitivity of the SPP to **high air temperatures is assessed as medium,** as elevated temperatures can lead to reduced photovoltaic module efficiency and increased thermal stress on inverters, transformers and auxiliary electrical equipment during summer periods. The sensitivity to **flooding is assessed as low**, as the project area is hydrologically dry, with no rivers, streams or flood-prone areas present. However, sensitivity to intense short-duration rainfall and surface runoff is assessed as medium, as extreme precipitation events may cause temporary surface water accumulation, runoff along access roads, and local erosion around foundations, particularly if adequate drainage measures are not ensured. The **sensitivity of the solar power plant to erosion and localised landslides is considered medium**, especially during the construction phase due to soil disturbance and terrain modification. During operation, this risk is expected to be reduced through appropriate ground stabilisation and drainage measures. Sensitivity to snowfall and low winter temperatures is assessed as low, as snow accumulation is generally limited in duration and does not significantly affect PV system integrity; however, occasional heavy snowfall events may temporarily reduce electricity production. The sensitivity of the SPP to droughts and wildfires is assessed as medium, given the potential for increased vegetation dryness and wildfire occurrence during extended hot and dry periods. Appropriate vegetation management and fire-prevention measures are therefore required.

Sensitivity to lightning is assessed as medium, taking into account the presence of extensive electrical installations and the mitigation measures already foreseen in the ESIA, including earthing, surge protection and lightning protection systems.

Climate variable	Sensitivity
Storm and winds	High
Floods	Low
Snowfalls	Low
Erosion and landslides	Medium
Droughts and fires	Medium
Earthquakes	Medium
Lightening	Medium

Vulnerability of the Project to climate change

Considering the previously assessed exposure of the Project area to climate change and the sensitivity of the Project components to such changes, an analysis was conducted to evaluate the Project's vulnerability to climate change. For this evaluation, the following matrix was used in the ESIA:

Vulnerability assessment			
Sensitivity	**Exposure**		
	Low	**Medium**	**High**
Low	Low	Low	Low
Medium	Low	Moderate	Moderate
High	Low	Moderate	High

The same matrix has been used for the updated analysis. The results are presented below.

Climate variable	Exposure	Sensitivity	Vulnerability
Storm and winds	Medium	High (for transmission network and solar pannels	Moderate
Floods	Medium	Low	Moderate
Snowfalls	Low	Low	Low
Erosion and landslides	Medium	Medium	Moderate
Droughts and fires	High	Medium	Moderate
Earthquakes	Medium	Medium	Moderate
Lightening	Medium	Medium	Moderate

GHG Emissions

The potential impacts of the Project on climate are associated with the emission of greenhouse gases (GHG) resulting from the production and use of construction materials and from the operation of construction equipment during the construction phase, as well as from operation and maintenance activities in the operational phase of the 110 kV OHL, the 110/35 kV substation Rudine and the Rudine Solar Power Plant (SPP).

To assess the magnitude of these impacts, GHG (CO_2) emissions were calculated for both the construction and operational phases, as presented below.

Construction phase

The most significant CO_2 emissions during the construction phase originate from the production and utilisation of construction materials, as well as the operation of construction equipment (machinery).

Calculation of CO_2 emissions from construction materials

In order to calculate CO_2 emissions caused by construction material production and usage, the corresponding input data were sourced from the Preliminary Design (*Table 5-2*).

Table 5-2: Materials that will be used during construction activities

Project component	Material / Equipment	Quantity	Unit
Overhead Line (110 kV)	Structural steel	**137.13**	**t**
	Reinforced concrete – MB30	**331.08**	**m³**
	Lean concrete – MB15	**33.53**	**m³**
	Reinforcement steel (column foundations)	**12.95**	**t**
	ACSR (Aluminium-steel) conductor 240/40 mm²	**27.10**	**t**
Solar Power Plant (Rudine)	Reinforced concrete – MB30	**–**	**m³**
	Lean concrete – MB15	**12.08**	**m³**
	Reinforcement steel (foundations)	**11.20**	**t**
	Structural steel	**19.34**	**t**

Main Substation – Rudine (110/35 kV)	Lean concrete – MB15	**20.30**	**m³**
	Reinforced concrete – MB30	**300.00**	**m³**
	Reinforcement steel (foundations)	**33.00**	**t**
	Structural steel	**55.00**	**t**
	Main substation (110/35 kV)	**1**	**unit**
Electrical Equipment	PV modules (625 Wp)	**–**	**pcs**
	String inverters (350 kW)	**–**	**units**
	MV/LV substations (35/0.8 kV)	**–**	**units**

Note: Emissions resulting from the construction of access roads have not been considered, as their design (including the specification of construction materials) has not been prepared yet.

Calculation of CO_2 emissions from construction equipment

Input data for the calculation of CO_2 emissions from construction equipment include: type of equipment, fuel consumption, number of units in operation and operating hours. These inputs are determined based on available literature and experience from similar projects.

For the 110 kV OHL it is assumed that one fleet of construction machinery is used per 5 km of line, that equipment operates 4 hours per day, 5 days per week, and that diesel is used as fuel. The CO_2 emission factor for diesel combustion is 2.49 kg CO_2/litre. Average fuel consumption for each type of equipment is derived from manufacturers' catalogues and scientific publications. (5-3).

Table 5-3: Input data for calculating CO_2 emissions from construction equipment – 110 kV OHL (10 km)

Type of equipment	Number of units	Fuel consumption [l/h]
Truck	2	18.31
Truck crane	2	16.00
Truck tractor	2	18.31
Bulldozer	2	33.16
Backhoe	2	6.00
Concrete mixer	2	3.00
Drilling rig truck	2	45.00
Water carrier	2	13.00

5-4: Input data for calculating CO_2 emissions from construction equipment – Solar Power Plant Rudine

Type of equipment	Number of units	Fuel consumption [l/h]
Truck	2	18.31
Excavator / backhoe	2	6.00
Bulldozer	1–2	33.16
Concrete mixer	2	3.00
Compactor / roller	1	12.0
Telehandler / small crane	1	16.0
Water carrier	1–2	13.00

Table 5-5: Input data for calculating CO_2 emissions from construction of substation

Equipment	Number of units	Fuel Consumption (l/h per unit)
Truck	1	18.31
Truck crane	1	16
Bulldozer	1	33.16
Backhoe	1	6

Concrete mixer	1	3
Drilling rig truck	1	45
Water carrier	1	13

Total CO_2 emissions during construction activities

The total CO_2 emissions during the construction phase, considering both emissions from construction materials and construction equipment, are presented in Table 6.

5-6: Total CO_2 emissions during construction phase (Project: 110 kV OHL, SS and SPP Rudine)
CO_2 emissions during construction phase

Component	Total emissions – construction materials (t CO_2/year)	Total emissions – construction equipment (t CO_2/year)	Total (t CO_2/year)
110 kV Overhead Line (approx. 34 towers, ~0.5 year)	629.40	791.28	1,420.68
Solar Power Plant Rudine (~2 years)	35.11	453.02	488.13
Main Substation (110/35 kV)	161.38	348.22	509.6
Total – Project (annualised)	825.89	1,592.52	2,418.41

The total annualised CO_2 emissions generated from construction activities are therefore estimated at approximately **2,311 t CO_2/year**.

Considering that total CO_2 emissions in Montenegro in 2024 amounted to 2.38 million tonnes, the construction of the Project would result in an increase of about 0.10% in national annual emissions (well below 1%).

Operation phase

CO_2 emissions in the operational phase

CO_2 emissions in the operational phase of the Project (110 kV OHL, SS 110/35kV and SPP Rudine) are anticipated considering:

- routine reconstruction and maintenance activities for the OHL and solar power plant infrastructure;
- auxiliary electricity consumption at the SPP Rudine (SCADA and control systems, inverter stations, small HVAC and lighting of the control/operations building).

Since the Transmission System Operator and the Investor did not provide specific data on expected energy use for operation and maintenance, the calculation is based on experience from similar projects and available literature.

OHL and SPP reconstruction and maintenance activities

Based on previous projects and the infrequent need to replace OHL and SPP components, it is assumed that, on average, **1% of the total CO_2 emissions generated during the construction phase** will occur annually due to routine reconstruction and maintenance.

For this Project, construction-phase emissions were estimated at:

- 110 kV OHL: 629.40 t CO_2/year (materials) and 791.28 t CO_2/year (equipment)
- SPP Rudine: 35.11 t CO_2/year (materials) and 453.02 t CO_2/year (equipment)
- Main Substation Rudine (110/35 kV): 53.61 t CO_2/year (materials) and 348.23 t CO_2/year (equipment)

Applying the 1% factor gives the annual maintenance-related emissions shown below.

Table 5-7: CO_2 emissions from reconstruction and maintenance activities

Component	Sub-component	CO_2 emissions [t CO_2/year]
OHL – maintenance	Construction materials	6.29
	Construction equipment	7.91
	Total OHL maintenance	14.21
SPP Rudine – maintenance	Construction materials	0.35
	Construction equipment	4.53
	Total SPP maintenance	4.88
Main Substation Rudine – maintenance	Construction materials	0.54
	Construction equipment	3.48
	Total substation maintenance	4.02
Total – system maintenance (all components)		**23.11**

- **Auxiliary electricity consumption at SPP Rudine**

Auxiliary electricity consumption at the solar power plant is mainly associated with the operation of SCADA and control systems, inverter stations, small HVAC for the control/operations building and security/technical lighting. In the absence of detailed design data, a conservative installed auxiliary power of 50 kW is assumed, operating 24 hours per day, 365 days per year.

The annual electricity consumption of auxiliary systems is therefore:

- **50 kW × 24 h/day × 365 days/year = 438,000 kWh/year (438 MWh/year).**

For the operational phase, the **grid emission factor of 52.6 g CO_2/kWh** is used, consistent with the National Energy and Climate Plan WAM (with additional measures scenario) projections for 2030.

This results in:

- **438,000 kWh/year × 52.6 g CO_2/kWh ≈ 23.04 t CO_2/year.**

Table 5-8: CO_2 emissions from auxiliary electricity consumption at SPP Rudine

Component	Value
Assumed auxiliary power	50 kW
Operating hours	24 h/day, 365 days/year
Annual electricity consumption	438,000 kWh/year
Grid emission factor	52.6 g CO_2/kWh
CO_2 emissions – auxiliary systems	**23.04 t CO_2/year**

- **Heating, ventilation, air conditioning, and lighting systems in substations**

CO_2 emissions from heating, ventilation, cooling and lighting systems in the 110/35 kV substation Rudine are calculated using the input data below.

Table 5-9: Input data for calculation of CO_2 emissions from heating, ventilation, cooling, and lighting systems in the substations

Component	Value	Unit
Heating system		
Average building heat consumption	80[15]	W/m^2
Assumed average heat area of substation	40	m^2
Estimated average number of heating hours	1,440	hours/year
Ventilation system		
Average building ventilation consumption	0.5[16]	kWh/m^2 year
Air conditioning system		
Average building conditioning consumption	35[17]	kWh/m^2 year
Lightening system		
Assumed number of LED bulbs in substation	5	-
Power of LED bulb	9	W
Assumed bulb working hours	12	hours/day

Based on these assumptions, the indicative annual electricity consumption for HVAC and lighting in TS Rudine is[18]:

- Heating: 3.2 kW × 1,440 h/year = **4,608 kWh/year**
- Ventilation: 0.5 kWh/m²·year × 40 m² = **20 kWh/year**
- Air conditioning: 35 kWh/m²·year × 40 m² = **1,400 kWh/year**
- Lighting: 0.045 kW × 12 h/day × 365 days/year ≈ **197 kWh/year**
- Total HVAC and lighting electricity consumption: **≈ 6,225 kWh/year**.

[15] https://www.adax.lt/en/calculator.htm
[16] https://www.sciencedirect.com/science/article/abs/pii/S0378778812003854
[17] BRE Client Report for the Department of Energy & Climate Change, Study on Energy Use by Air Conditioning: Annex D: Monitored Consumptions, June 2016
[18] European Commission (2013). *Energy Consumption and Energy Savings in the EU-27*. Commission Staff Working Document SWD(2013) 143 final. Brussels.
EN 16798-1 (2019). *Energy performance of buildings – Ventilation for buildings – Indoor environmental input parameters for design and assessment of energy performance*. European Committee for Standardization (CEN), Brussels.
EN ISO 52016-1 (2017). *Energy performance of buildings – Energy needs for heating and cooling – Calculation procedures*. International Organization for Standardization (ISO), Geneva.
EN 15193-1 (2017). *Energy performance of buildings – Energy requirements for lighting*. European Committee for Standardization (CEN), Brussels.
IFC (2017). *Good Practice Handbook: Energy Efficiency and Greenhouse Gas Accounting*. International Finance Corporation, World Bank Group, Washington, DC.

Values are consistent with EU reference consumption ranges for small non-residential buildings in Mediterranean climate conditions.

Using the same grid emission factor (52.6 g CO_2/kWh), emissions are:

- Heating: = 0.24 t CO_2/year
- Ventilation: = 0.00 t CO_2/year
- Air conditioning: = 0.07 t CO_2/year
- Lighting: = 0.01 t CO_2/year

Subtotal HVAC and lighting: **≈ 0.32 t CO_2/year**.

- **Electricity consumption for control systems in TS Rudine**

The majority of electricity consumption in the substation is associated with the operation of the automated control and protection system. Other minor electricity uses are disregarded.

Table 5-10: Input data for calculation of CO_2 emissions from control systems in TS Rudine

Component	Value	Unit
Estimated power of the substation own-needs network (automated control system)	12.44	kW
Working hours	24	hours/day

Annual electricity consumption of the control system:

- 12.44 kW × 24 h/day × 365 days/year ≈ **108,974 kWh/year**

Using the same grid emission factor (52.6 g CO_2/kWh):

- 108,974 kWh/year × 52.6 g CO_2/kWh ≈ **5.73 t CO_2/year**

Total TS Rudine operational emissions (HVAC, lighting and control systems) are therefore:

- **≈ 6.06 t CO_2/year**

Total CO_2 emissions during the operational phase

Combining all operational emission sources:

- System reconstruction and maintenance (OHL, SPP and TS): **≈ 23.11 t CO_2/year**
- Auxiliary electricity consumption at SPP Rudine: **≈ 23.04 t CO_2/year**
- TS Rudine HVAC, lighting and control systems: **≈ 6.06 t CO_2/year**

Total operational emissions for the Project are thus estimated at **approximately 52.2 t CO_2/year**.

In comparison with national emissions of 2.38 million t CO_2/year, operational emissions of the Project correspond to around 0.002% of Montenegro's annual emissions and are therefore considered very low. These residual operational emissions are more than offset by the displacement of fossil-fuel based electricity generation in the power system through the renewable electricity produced by SPP Rudine.

Component	Sub-component	CO_2 emissions (t CO_2/year)
OHL reconstruction and maintenance	Construction materials	6.29
	Construction equipment	7.91
	Total – OHL maintenance	**14.21**
Substation Rudine (110/35 kV)	Heating	0.24
	Ventilation	0.001
	Air conditioning	0.07
	Lighting	0.01
	Own electricity consumption (control systems)	5.73
	Total – Substation operation	**6.06**
Solar Power Plant Rudine – auxiliary systems	SCADA, HVAC and lighting	**23.04**
Total – Operation phase		**43.31**

The total annual CO_2 emissions generated during the operation phase of the Project are estimated at approximately 43.31 tonnes per year.

Considering that total CO_2 emissions in Montenegro amounted to 2.38 million tonnes in the reference year, the operational activities of the Project would account for around 0.002% of total annual national emissions.

Emissions associated with the operation of the 110 kV overhead line and the 110/35 kV Rudine substation are therefore negligible at the national level, while the overall climate impact of the Project is strongly positive due to the displacement of fossil-fuel-based electricity generation by renewable power produced at the Rudine Solar Power Plant.

Project's Alignment with the Paris Agreement

The conducted assessment demonstrates that the Project has a clearly positive contribution to climate change mitigation and does not result in any long-term increase in greenhouse gas emissions. The Project supports the integration of renewable energy sources into the Montenegrin power system, contributes to system stability and grid resilience, and enables a reduction in system-wide CO_2 emissions through the displacement of fossil-based electricity generation.

Greenhouse gas emissions associated with the Project are limited to the construction phase and minor operational activities, are temporary or negligible in scale, and represent only a very small fraction of national greenhouse gas emissions. No elements of the Project introduce carbon lock-in risks, and the infrastructure is fully compatible with long-term decarbonisation pathways envisaged at the national and European levels.

The Project is consistent with the objectives of the Paris Agreement, as implemented through Montenegro's national climate and energy framework, including the NECP and renewable energy targets. A more detailed assessment of alignment with the mitigation and adaptation goals of the Paris Agreement is typically undertaken as part of the financing institutions' internal appraisal processes and is therefore not required as a standalone assessment within this ESIA.

Greenhouse Gas Emissions from Biomass Loss

Scope and methodological approach

The assessment of greenhouse gas (GHG) emissions associated with biomass removal for the Rudine Solar Power Plant is based on the IPCC methodological framework (Good Practice Guidance for LULUCF, 2003; IPCC Guidelines for National Greenhouse Gas Inventories, 2006, with 2019 Refinement) and national parameters derived from the First National Forest Inventory of Montenegro (2013). The calculation was performed using the estimated volume of felled biomass (m^3) within the project footprint (PV panel area and transmission line corridor), applying biomass expansion factors (BEF), wood density values and the standard carbon fraction (0.5). The estimated carbon loss (C) was subsequently converted to CO_2 equivalent using the stoichiometric conversion factor of 44/12 (3.67).

- Quantification of carbon loss (Rudine)

Vegetation clearance is planned within the PV panel installation area and along the transmission line corridor. The estimated biomass removal and associated carbon loss are as follows:

PV panel area: felling of 330.18 m^3 of biomass, corresponding to a carbon loss of **153.88 kg C**, equivalent to approximately **564.3 kg CO_2e** (0.56 tCO_2e).

Transmission line corridor: felling of 868.48 m^3 of biomass, corresponding to a carbon loss of **412.01 kg C**, equivalent to approximately **1,511.0 kg CO_2e** (1.51 tCO_2e).

Total estimated carbon loss for the Podbožur site (PV panels and transmission line combined) amounts to **565.89 kg C**, corresponding to approximately **2,075.3 kg CO_2e** (2.08 tCO_2e).

The one-off GHG impact from biomass carbon loss (approx. 2.08 tCO_2e) represents around **0.00006%** of Montenegro's total annual GHG emissions (approx. 3.5 MtCO_2e, excl. LULUCF; 2022), and is therefore negligible at the national scale.

5.4 Geology

The territory of the Municipality of Nikšić is predominantly composed of marine sediments, uplifted from the sea by tectonic forces and shaped by external processes. Rock formations of geological ages ranging from the Upper Paleozoic to alluvium are present.

Permian deposits are composed of black carbonaceous and clay shales with thin coal interbeds, overlain by clay shales, marly grey layers, and thin-bedded limestones up to 40 m thick. In the Mesozoic, Triassic sediments are developed in the Nikšićka Župa area and west of the Nikšić Field around Grahovo and Vilusi. Middle Jurassic sediments are found in small areas at Crvena Kita, underlying large deposits of red bauxite. Lower Jurassic dolomites are identified around Praga, at the foothills of Mount Vojnik, west of Jasenovo Polje, near Šišman, at the foothills of Budoš, along the margins of the Nikšić Field, in Broćanac, Ljeskovi Dolovi, Brestice, around Vilusi, and in several other locations in the Grahovo Field area.

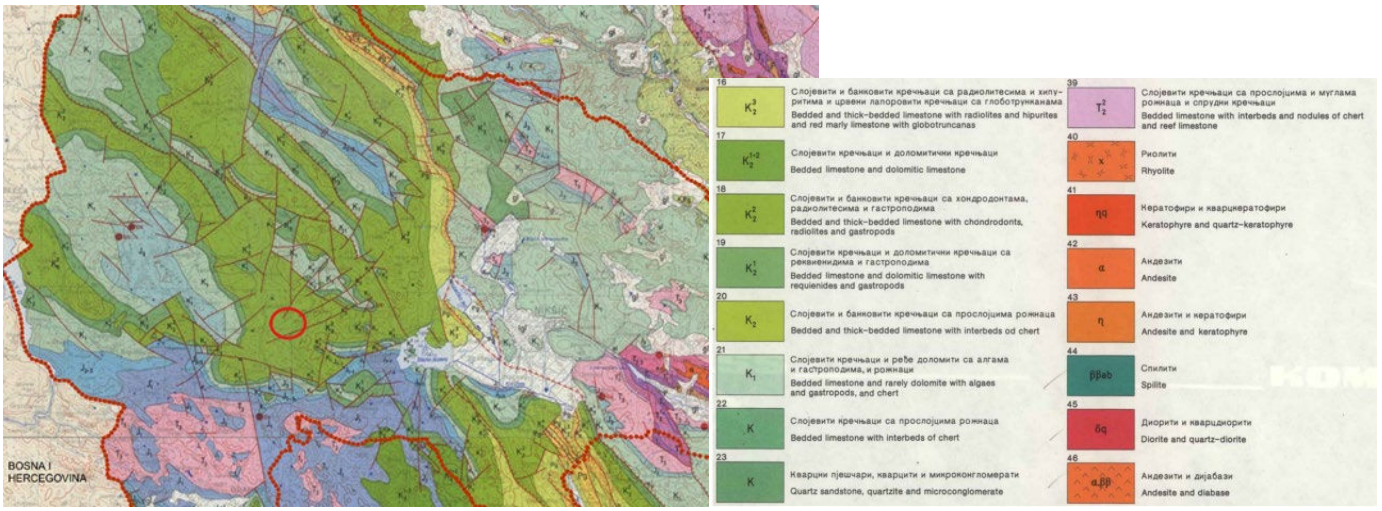


Figure 5-3: Position of SPP Rudine on Geological map of the Municipality of Nikšić (Source: Amendments to the Spatial-Urban Plan of the Municipality of Nikšić, Official Gazette of Montenegro 72/24)

Lower Cretaceous sediments (limestones and dolomites) are widespread across the municipality, including parts of Prekornica (towards Dužice), the Štitovo plateau, areas of Vojnik, Studena, Tovići, Paklina, the northeastern slopes of Njegoš, the Srijeda mountain slopes, Zlostup, and Golija. These formations also extend west of Trepča, across parts of Rudine, around Velimlje, from Milovići to Petrovići, and areas of Budoš and Ljeskovi Dolovi.

Upper Cretaceous sediments consist mainly of pure limestones with occasional dolomites. They are present in parts of Prekornica, Međeđa, Ostroške Grede, Planinica, Cerovo, Srednja Gora, the villages of Bogmilovići, Vitasojevići, Milojevići, as well as in Budoš, Riđanske Rupe, Zla Gora, **Rudine**, Grahovo, Banjani, and Oputne **Rudine.**

5.5 Geomorphology

The Nikšić field is geomorphologically and hydrologically the most interesting field in the karst of the Dinarides and in the world. The area of the field is 66.5 km^2. The field has an irregular shape and its flat is inclined from the north and northwest to the south and southeast.

In the territory of the Municipality of Nikšić there are a large number of caves and pits, only a small portion of which have been explored. In areas such as Grahovo, **Bijele Rudine**, Banjani, Oputne Rudine, Golija, Duga, and Pješivci, where massive limestone formations (3,000–4,000 m thick) dominate, characteristic vertical karst landforms such as pits and shafts are common. The better-known caves are found around karst fields and along valley slopes, mostly representing former underground watercourses.

In the Grahovo area, notable caves include Đakovića Cave in the hamlet of Bare on the northeastern edge of Grahovo Field, and nearby Vranjska Cave. Additional caves are located in the village of Zagora (two caves), in Jabuka (one cave), and the Vodena Cave in Kličevac. Caves are also present in Gornje Polje (hamlet of Zagulj) and in the area of Nudol. Around Vilusi, in the Pitoma Brda area and at Šćepan Gradina, two caves have been identified.

Numerous sinkholes with steep sides are especially widespread in the western part of the municipality, particularly on the karst plateau of Rudine and Zla Gora. Their bottoms often descend into swallow holes or pits, and larger ones are typically filled with terra rossa.

On the karst **plateau of Rudine**, valleys are also common. The largest is Velimlje Uvala, with relatively gently sloping sides and without strongly developed surface karst features. A series of smaller elongated

uvalas gravitate towards this depression, formed in the system of ancient river valleys that have since dried up, with flows redirected underground due to karst erosion (M. Radulović).

5.6 Hydrogeology

The Nikšić Field is a closed karst plain with specific and complex hydrological and hydrogeological conditions, resulting from the geological, geomorphological, and climatic characteristics of the area.
Due to the natural conditions that characterise it, this closed karst plain functions as a drainage system, receiving significant volumes of water from a catchment area of about 1,000 km², with annual precipitation of around 2,000 l/m². However, the specific hydrogeological regime has also resulted in pronounced infiltration of surface waters through porous karst rocks towards deeper horizons. [19]

Increasingly evident climate change – manifested in the past decade through rising air temperatures, prolonged dry periods, irregular precipitation patterns, more intense rainfall, occasional record multi-day storms during the dry season, and a reduction in annual snowfall – has led to disturbances in groundwater flows, more frequent formation of torrential streams, floods, landslides, and rockfalls.

The reduction in annual snowfall, as projected by IPCC scientists, may negatively affect water supply.

Larger amounts of snow in the catchment areas of springs delay the occurrence of the hydrological minimum (to September), compared to springs in catchments with less snowfall, where the hydrological minimum may occur as early as the beginning of August – i.e. during the period of peak water demand.

5.7 Tectonic and Seismic Characteristics

5.7.1 Tectonics

The Municipality of Nikšić is characterised by a complex tectonic structure. Of the main tectonic zones identified within Montenegro, the territory of Nikšić includes the Deep Karst Zone and the Kuči Zone. The boundary between these zones is defined by dislocation planes oriented in the Dinaric direction.

The steep structural plane of the Deep Karst Zone towards the coast and the Budva geological zone extends from the Dragalj Field, along the foothills of Bijela Gora, towards Nudo and the left side of the Trebišnjica River valley in the direction of Bileća. This zone includes the karst plateau, Nikšić White Rudine, the Grahovo area, Banjani and Oputne Rudine. Structurally, this corresponds to the Trešnjevo–Vilusi–Vraćenovići anticlinorium, while the central depression of Montenegro—from the Gatačko Polje through Golija, Duga and Nikšić Polje towards the southeast, extending to parts of Pješivci and Bjelopavlići—represents a synclinorium.

The Deep Karst Zone covers the largest part of the Municipality of Nikšić and comprises all structural elements of the Outer Dinarides. It is characterised by numerous parallel folds aligned in the Dinaric direction, as well as a dense network of faults, predominantly oriented in the Dinaric direction with additional transverse faults. The northeastern part of the municipality belongs to the anticlinorium of the Kuči Zone, which includes the mountains Golija, Vojnik, Maganik and Prekornica.

The geotectonic position of the Dinarides has resulted in pronounced seismic instability across the territory of Montenegro.[20]

[19] Mitrović L (2023) ‘’*Bolje razumijevanje voda usled klimatskih promjena,* NVO ‘’Društvo mladih ekologa“ Nikšić

[20] *Amendments to the Spatial-Urban Plan of the Municipality of Nikšić, Official Gazette of Montenegro 72/24*

5.7.2 Seismicity

The territory of the Municipality of Nikšić is located along the northern edge of the most seismically active zone of the Dubrovnik and Montenegrin coast. It can be established that the municipality lies in a zone where earthquakes of intensity VII–VIII° MCS may be expected. In the Donja Zeta valley earthquakes may reach up to VIII° MCS, while in the Nikšić Field and the areas of Duga and Golija up to VII° MCS. The southwestern part of the municipality (around Grahovo) falls within the VIII° MCS zone. Most of the municipal territory belongs to the VII° MCS zone, while only the northeastern boundary lies in the VI° MCS zone.

Within the municipality, relatively weaker earthquakes have been recorded, with maximum magnitudes up to 4.9 on the Richter scale. Earthquakes occur most frequently between Nikšić and Grahovo, towards Gatačko Polje, and along the northeastern boundary of the municipality. The Grahovo area belongs to a belt of increased seismic activity. The strongest earthquakes in this belt occurred in the Bay of Kotor, immediately adjacent to the southern municipal boundary, with intensities recorded at about IX° MCS (magnitude ~6.5). In Gatačko Polje, the strongest earthquake reached magnitude 5.6.

The usual focal depths (hypocentres) of recorded earthquakes range between 4 and 47 km. The highest maximum intensities originate from the major Montenegro earthquake of 1979.

Figure Figure 5-3 shows the spatial distribution of main seismic events with magnitudes greater than 4 on the Richter scale in the wider area around the town of Nikšić.

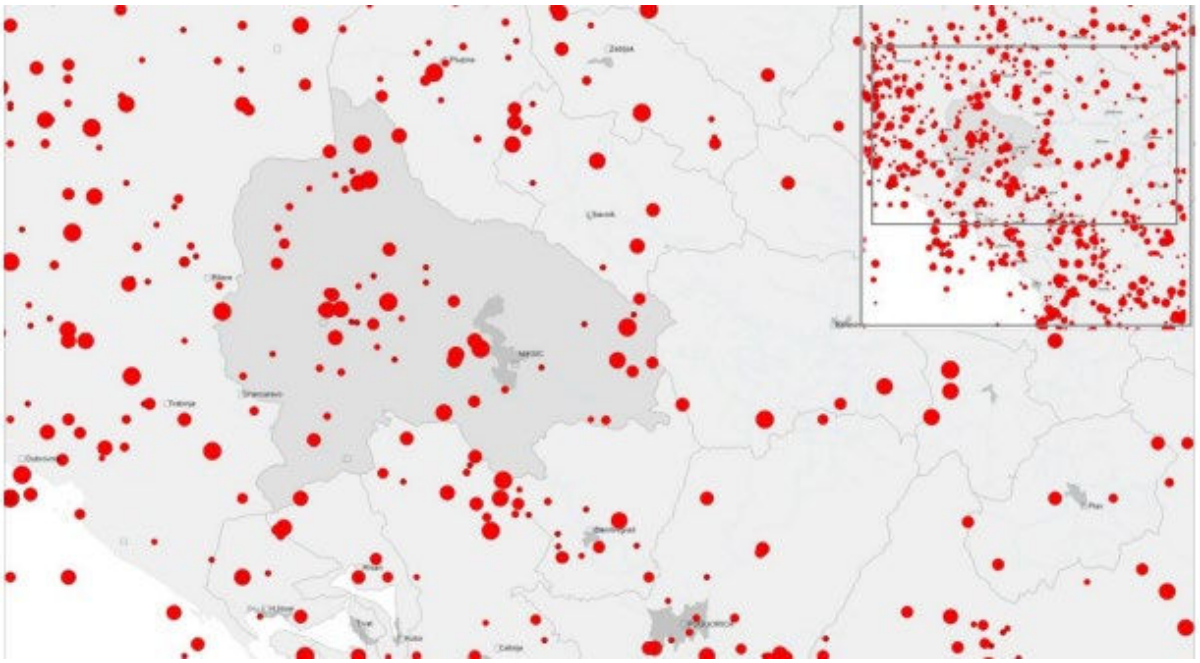


Figure 5-4: Spatial distribution of major seismic events with magnitudes greater than 4 on the Richter scale in the wider area around the town of Nikšić (Source: Amendments to the Spatial-Urban Plan of the Municipality of Nikšić, Official Gazette of Montenegro 72/24

5.8 Soil

5.8.1 Soil types

Current soils in the karst fields and the agricultural areas of the Municipality of Nikšić located in valleys have developed as a result of the combined effects of torrential river processes, morainic deposition, and colluvial transport of soil material from higher elevations into terrain depressions.

Eutric brown soils of varying parent material dominate these areas, while in the lower river courses rendzinas and eutric brown soils on gravel substrates are present.

Extensive areas of typical karst terrain, characterized by numerous elevations and slopes, are dominated by very shallow to shallow soils, including black soils (chernozems), rendzinas, and brown soils on limestone and dolomite substrates, which are often affected by erosion.

Soils in the project area are shallow, skeletal, and poorly developed, with low fertility and limited agricultural productivity. The land is currently used mainly for extensive grazing and low-intensity agriculture, with little or no arable farming potential. The limited soil depth and stony structure also restrict vegetation growth, which contributes to the generally open character of the landscape.

5.8.2 Soil pollution

Soil monitoring and testing of hazardous substances in Montenegro is conducted in line with the Law on Environment (Official Gazette of Montenegro 52/16, 73/19), the Law on Agricultural Land (OG RCG 15/92, 59/92, 27/94; OG MNE 73/10, 32/11), and the Rulebook on Maximum Allowed Concentrations of Hazardous and Harmful Substances in Soil (OG RCG 18/97). Monitoring is also harmonised with the requirements of the Stockholm Convention on Persistent Organic Pollutants (POPs).

The programme includes analysis of heavy metals (Cd, Pb, Hg, As, Cr, Ni, F, Cu, Mo, B, Zn, Co), as well as sequential extraction methods which provide better insight into the remobilisation potential of these elements in soils.

Soils in the wider Nikšić area show localised exceedances of heavy metals and organic pollutants, particularly near industrial and landfill sites. However, most elevated concentrations are linked to the natural geochemical composition of karstic terrain rather than anthropogenic contamination. Within the Rudine project site itself, no soil contamination hotspots have been identified, and baseline conditions are consistent with a typical karst plateau, characterised by shallow, rocky, and low-fertility soils.

5.9 Hydrology

The waters of the municipality of Nikšić are the most important natural resource and the greatest potential. The largest part of the area of the municipality of Nikšić belongs to deep karst, where the composition is dominated by limestone. Large amounts of precipitation are lost underground through numerous sinkholes, cracks and pits. Nevertheless, in the area of the Nikšić field itself, the wealth of surface and underground waters is great, and the field itself is considered the richest karst field in the Dinarides precisely because of the wealth of water and hydrographic objects.

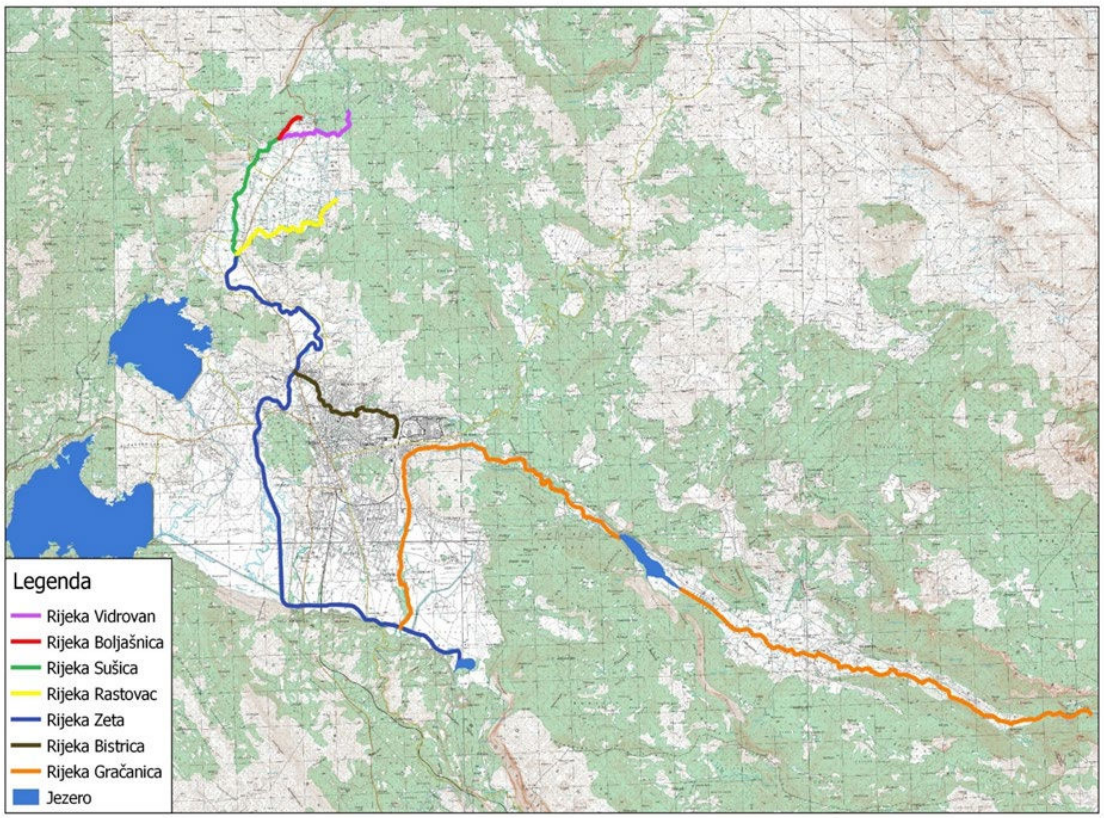


Figure 5-5: Main watercourses and lakes in the Nikšić Field

The Rudine SPP site is located within the catchment area of the Nikšić Field, at its southwestern edge. Since the geological structure of the terrain consists of permeable karstified Upper Cretaceous limestones, there is no surface runoff or permanent watercourses. The nearest surface water body is the Slano reservoir, located about 10 km from the project site.

As for the Rudine area itself, apart from the Vrelo spring under Mount Njegoš, no natural springs exist. Traditionally, residents dug wide and deep wells in places with clay layers (ubli), where rainwater would collect and be used for human and livestock needs. After World War II, local authorities organised the population to build such primitive water intakes in different parts of Rudine. Some households also constructed covered cisterns, known as “bistjerne”.

Thus, Oputne Rudine, Banjani, and Nikšićke Rudine are essentially water-scarce areas. During periods of heavy rainfall, flooding occurs in Velimsko Polje, Trepča, and less frequently in Nikšićke Rudine. The population relies on cisterns, clay wells (ubli), ponds, and snowmelt for water supply.

This part of western Montenegro represents a typical karst region, developed on highly tectonised carbonate rocks. All landforms and processes characteristic of bare karst (holokarst) are present. The hydrographic network is poorly developed, while small specific hydrogeological features (rock basins and ponds) occur. These serve as “hotspots” of biodiversity in the study area, as they represent the only water sources in an otherwise water-scarce karst environment.

Within the boundaries of the planned Rudine Solar Power Plant, on plot no. **797, KO Rudine**, there is one such artificial pond, constructed a few years ago for the purpose of watering goat herds and meadows.

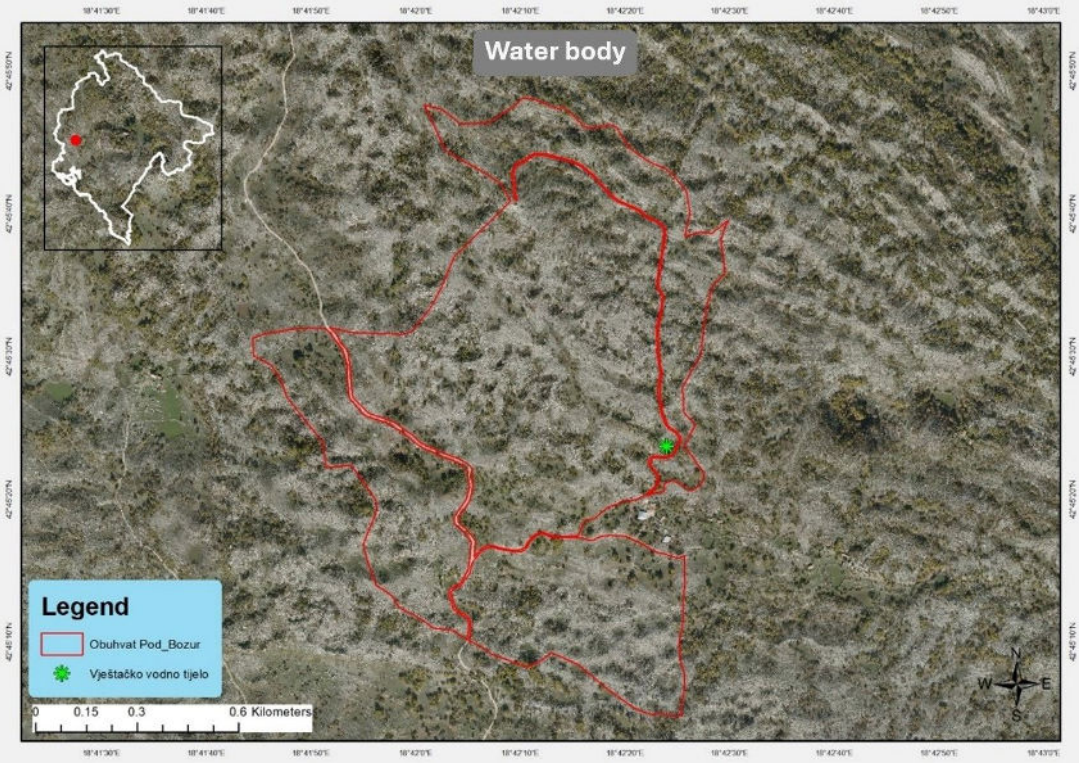


Figure 5-6: Water feature of anthropogenic origin within the project area (artificial pond at plot no. 797, KO Rudine, green star

5.9.1 Water pollution

Groundwater

Monitoring of 38 groundwater bodies was carried out in 2024 (including 6 springs, 3 dug wells, and 28 new boreholes). The assessment followed the *Rulebook on Groundwater Status* (Official Gazette of Montenegro 52/2019) and relevant chemical status parameters.
Most sampling points indicated **good to very good quality** based on basic physico-chemical parameters (pH, BOD_5, conductivity, nitrates, phosphates, etc.). Occasional detection of pollutants such as **lead** (0.21 µg/l) was recorded, while arsenic, cadmium, mercury, and pesticides were generally below detection limits.

Microbiological analyses at some locations indicated the presence of coliform bacteria (425–460/100 ml), fecal coliforms (3–14/100 ml), and live bacterial counts (25–76/ml). Certain boreholes (e.g. Zaljutnica in Golija, Rjecani in Banjani, Glibavac in Brezna) were assessed as **moderate to poor status** due to elevated values of BOD_5, total phosphorus, and TOC. All these boreholes are located in Municipality of Niskic.

Surface Water

There are **no natural surface water bodies** within or immediately adjacent to the Rudine project area. Within the project footprint itself (parcel no. 797, KO Rudine), there is only a small **artificial pond** constructed for livestock watering, which is now occasionally used for agricultural irrigation. The nearest larger water body is the **Slano Reservoir**, located approximately 10 km from the site.

The Rudine plateau is a typical karst region with highly permeable limestone, limited surface water, and challenging water supply conditions. Groundwater quality is variable, but generally assessed as good, while surface water bodies are scarce and not a limiting factor for project development.

5.10 Atmospheric Quality

In accordance with European and national legislation in the field of air protection, for the purpose of monitoring and assessing air quality, the territory of Montenegro has been divided into three air quality zones. The municipality of Nikšić belongs to the central zone.

Continuous automatic monitoring of air quality in Nikšić has been carried out since mid-2009. The initial location of the automatic monitoring station was in Nika Miljanića Street (across from the hospital) until March 2012, after which a new location was established in the courtyard of the Stojan Cerović Gymnasium, in line with the Decree on establishing the network of measurement sites for air quality monitoring (Official Gazette of Montenegro, Nos. 44/10 and 13/11).

Measurements, data processing, and analysis of air quality have been performed in accordance with:

- ✓ Law on Air Protection (Official Gazette of Montenegro, Nos. 25/10, 40/11, 43/15, 73/2019 and 84/2024),
- ✓ Decree on defining pollutants, limit values, and other air quality standards (Official Gazette of Montenegro, No. 25/12),
- ✓ Rulebook on the manner and conditions for air quality monitoring (Official Gazette of Montenegro, Nos. 21/11, 32/16),
- ✓ Decree on establishing the network of measurement sites for air quality monitoring (Official Gazette of Montenegro, Nos. 44/10, 13/11, 64/18).

Within project area and its air quality zone, monitoring equipment has also been installed in the locality of Velimlje, as part of the EMEP programme (monitoring transboundary transport of air pollutants), under the responsibility of the Institute of Hydrometeorology and Seismology.

Sulphur Dioxide (SO_2)

Between 2013 and 2024, no exceedances of SO_2 limit values were recorded in Nikšić. The legal thresholds are defined on an hourly basis (200 µg/m³, maximum 18 exceedances per year) and on a daily basis (125 µg/m³, maximum 3 exceedances per year). Concentrations remain low due to the absence of large facilities burning high-sulphur fuels.

Nitrogen Dioxide (NO_2)

Annual average concentrations of NO_2 remained below the limit of 40 µg/m³. Hourly concentrations also did not exceed the threshold of 200 µg/m³ (maximum 18 exceedances per year). The main sources are traffic and domestic heating during winter, but critical concentrations were not recorded.

Ground-level Ozone (O_3)

The maximum daily 8-hour average concentrations were compared against the target value of 120 µg/m³, which should not be exceeded more than 25 times per year, calculated as a three-year average. Episodic peaks occur during summer due to photochemical reactions, but they are not frequent.

Carbon Monoxide (CO)

All recorded maximum 8-hour average concentrations were below the limit of 10 mg/m³. CO is not a significant issue in Nikšić due to the lack of intensive traffic and large emission sources.

Particulate Matter – PM_{10}

This is the most critical air pollutant for Nikšić. Daily concentrations of PM_{10} frequently exceeded the prescribed limit of 50 µg/m³ (with a maximum of 35 days per year allowed). Although the situation has

improved compared to 2013, the number of exceedance days remains well above the permitted level. The main sources include solid fuel heating, transport, industry, and resuspension of dust.

Benzo(a)pyrene and Heavy Metals in PM_{10} (Pb, Cd, As, Ni)

The annual average concentration of benzo(a)pyrene was 3 ng/m³, which is above the target value of 1 ng/m³. Its sources include biomass combustion, domestic heating, industry, transport, and wildfires. Heavy metals are monitored in line with regulations, and while concentrations are generally below the limit values, continued monitoring is required.

Particulate Matter – $PM_{2.5}$

Measurements indicate significant pollution with $PM_{2.5}$, especially during the winter season. The limit value of 20 µg/m³ (EU Directive 2008/50/EC) has been in force since 2020. In 2022, only 6 days of measurements were recorded (due to equipment malfunction), which is below the minimum required for a full air quality assessment.

For Nikšić, the main air quality challenges are PM_{10}, $PM_{2.5}$, and benzo(a)pyrene, while SO_2, NO_2, and CO remain well below the limit values. Ozone occasionally peaks in summer but does not frequently exceed regulatory thresholds. In the Rudine rural plateau, baseline air quality is expected to be significantly better than in the urban core of Nikšić, with fewer anthropogenic sources of pollution.

5.11 Noise and vibration

accordance with the Law on Environmental Noise Protection (Official Gazette of Montenegro, No. 28/11 of 10.06.2011, 28/12 of 05.06.2012, 01/14 of 09.01.2014), environmental noise is undesirable or harmful outdoor noise caused by human activity, including noise from the road, rail and air transport and from industrial installations for which an integrated permit is issued. The Law on the Limit Values of Noise in the Environment, the Manner of Determining Noise Indicators and Acoustic Zones and Methods for Assessing the Harmful Effects of Noise (Official Gazette of Montenegro, No. 60/11) has resulted from the Law.

Environmental noise monitoring in Montenegro was carried out in accordance with the Environmental Noise Monitoring Programme for 2024. The Programme covered 15 measuring locations in 14 municipalities of Montenegro: Podgorica, Nikšić, Žabljak, Petrovac, Budva, Kotor, Ulcinj, Kolašin, Mojkovac, Bijelo Polje, Berane, Bar, Tivat, and Pljevlja. At all measuring locations, multi-day noise measurements were conducted during the period January–May 2024.

Within the territory of the Municipality of Nikšić, noise level measurements were conducted at the location of the General Hospital Nikšić (JZU Opšta bolnica), Nikca od Rovina Street, on the plateau above the reception department.

Measurements were carried out during the daytime period (Lday, 7:00–19:00 h), evening period (Levening, 19:00–23:00 h), and night-time period (Lnight, 23:00–7:00 h).

Noise levels at this location were measured during the period from 9 to 16 May 2024.

The measurement results are presented in Table 5 as average values for the following indicators:

- **Lday** – daytime noise level indicator (7:00–19:00 h),
- **Levening** – evening noise level indicator (19:00–23:00 h),
- **Lnight** – night-time noise level indicator (23:00–7:00 h), and
- **Lden** – overall noise level indicator for day, evening, and night periods combined.

Table 5-11:Noise Level Indicator Values at the Measuring Location in Nikšić

Indicator	Lday (dB)	Levening (dB)	Lnight (dB)	Lden (dB)
Measured values	54.4	52.4	49.2	52
Limit values	50	50	40	—

The measured noise level indicators for day, evening, and night periods during the seven-day monitoring cycle exceed the prescribed limit values.

Based on the above legislation, municipalities have adopted decisions on acoustic zoning of their territories, which is a basic condition for the implementation of the Rulebook on noise limit values in the environment, the method of determining noise indicators and acoustic zones and methods of assessing the harmful effects of noise. By determining acoustic zones, limit values are prescribed for defined parts of the municipal territory, which is important for protection against noise in the environment, as well as for future planning of construction of facilities and issuing permits.

Table 5-12: Environmental Noise Zones and Limit Values (Day–Evening–Night) – Nikšić

Zone	Description of Zone	Lday (7–19 h)	Levening (19–23 h)	Lnight (23–7 h)	Examples of Locations in Nikšić
1. Quiet natural zone	Protected natural areas, ecologically sensitive areas	35 dB	35 dB	30 dB	Natural sites proposed for protection: 1. Part of Orjen National Park (Bijela Gora) 2. Lukavica 3. King Nikola's Protected Forest (Zabran Kralja Nikole) and the Gračanica Springs 4. Bjeloševska Bara (near Gornje Morakovo) Archaeological site: Crvena Stijena (Petrovići)
2. Quiet zone within the agglomeration	Parks, recreational areas, cultural–historical units	40 dB	40 dB	35 dB	Urban Cultural-Heritage Area 1. City Park 2. King Nikola's Palace 3. Historic Fortification "Bedem" 4. Pedestrian promenade from the Gymnasium to VI Crnogorska Street 5. Freedom Square (Trg Slobode) and adjacent streets: Manastirska, Novice Cerovića, Karađorđeva, Novaka Ramova 6. Njegoševa Street Protected Natural Assets 1. Arboretum – Botanical Garden in Grahovo

					2. Trebjesa Forest Park (protected natural landscape) Natural Sites Proposed for Protection 1. Estavela Gornjepoljski Vir
3. Zone with increased noise protection	Facilities of special public interest	50 dB	50 dB	40 dB	General Hospital Nikšić, Health Centre, schools, kindergartens, cemetery, churches
4. Residential zone	Predominantly residential areas	55 dB	55 dB	45 dB	Kličevo, Humci, Ozrinići, Rastovac and wider residential areas
5. Mixed-use zone	Combination of residential, commercial and business activities	60 dB	60 dB	50 dB	Nikšić city centre, Njegoševa Street, Voja Lješnjaka Street
6b. Zone heavily affected by road traffic noise	Major roads, bypasses, transport corridors	60 dB	60 dB	55 dB	- Main roads M3, M6, transit corridor around the town, - Road - R-12 Vilusi – Delevuša - Road R-11 Vilusi – Osječenica – Grahovo - Granica
6c. Zone heavily affected by railway noise	Areas near railway stations and active rail lines	55 dB	55 dB	50 dB	Area surrounding the Nikšić Railway Station
7. Industrial zone	Heavy industry, production and logistics	*At the boundary of this zone, noise must not exceed the limit values of the neighbouring zone*	—	—	Steel Plant (Željezara), Steel industry complex, Rubeža industrial area
8. Mineral extraction zone	Quarries and gravel pits	*At the boundary of this zone, noise must not exceed the limit values of the neighbouring zone*	—	—	Quarries in Banjani and areas within the Nikšić field

The wider Rudine project area is characterised as a rural karst plateau, consisting mainly of pastures, shrublands, and abandoned agricultural land, with very limited economic activities. There are no industrial or infrastructure facilities that would act as significant sources of noise or vibration. The only potential contributors to ambient noise are everyday activities of local residents and occasional agricultural or traffic movements along local roads.

The Environmental Impact Assessment (EIA) confirms that no significant noise sources exist within or near the project footprint. Baseline conditions can therefore be considered as representative of a typical rural environment with low background noise levels, generally within the thresholds recommended by the World Health Organization (WHO) for outdoor rural areas (40–45 dB daytime, <35 dB nighttime).

No vibration-generating activities are present in the area. Given the karst geological setting and the absence of heavy industry or transport corridors, baseline vibration levels are negligible.

As part of the ESIA process, targeted baseline noise measurements will be conducted at the nearest settlements that could potentially be affected during construction works. These measurements will establish reference values and ensure that project activities remain within applicable national and EBRD standards for noise and vibration.

5.12 Biodiversity

5.12.1 Overview

The territory of the Municipality of Nikšić covers a relatively large area (almost one quarter of the total territory of Montenegro). This region is characterised by diverse climatic influences, geological substrates, soil types, relief forms, and anthropogenic pressures. Such conditions have resulted in the formation of varied habitats, which in turn support diverse flora, fauna, and ecological communities (biocenoses), all of which interact continuously with their habitats, influencing and transforming one another.

Ecologically significant areas – The importance of endemic, as well as generally rare and/or threatened species found in a particular area, has been emphasised through various international initiatives and programmes designed to identify centres or key areas for the biodiversity of certain groups, and thus for their conservation. These include IPA (Important Plant Areas), IBA (Important Bird Areas), IMA (Important Mammal Areas), IFA (Important Fish Areas), etc.

EMERALD sites are identified under the Convention on the Conservation of European Wildlife and Natural Habitats (the Bern Convention, 1979) and according to Resolution 4 (habitat types) and Resolution 6 (species). This Convention forms part of EU law and is applied across Europe and partly in Africa. Within the EU, EMERALD sites correspond to Special Areas of Conservation Interest (SACI).

In the territory of the Municipality of Nikšić, EMERALD sites of particular importance for nature protection include: Orjen, Golija, and Ledenice.

For the purpose of preparing the Biodiversity Baseline Study of the project area, and in line with contractual obligations, existing literature sources relevant to the site were collected. In addition, a multidisciplinary field survey was carried out by experts specialised in different groups of organisms, namely:

1. Invertebrate fauna;
2. Amphibians and reptiles (batrachofauna and herpetofauna);
3. Avifauna (birds);
4. Mammal fauna; and
5. Flora and vegetation.

The conservation status of species at both national and international levels was defined in accordance with national legislation as well as ratified international conventions/protocols, including:

- Decision on the protection of rare, sparse, endemic and endangered plant and animal species (Official Gazette of Montenegro, No. 76/06);
- EU Habitats Directive;
- EU Birds Directive;
- Bern Convention on the Conservation of European Wildlife and Natural Habitats;
- Bonn Convention on the Conservation of Migratory Species of Wild Animals.

5.12.2 Habitats and flora

5.12.2.1. Habitats

During the habitat survey carried out within the project area, particular emphasis was placed on the land intended for the construction of the proposed solar power plant, as well as on the associated transmission line corridor. The assessment area along the transmission line was defined by including a buffer zone extending 300 m on both the left and right sides of the planned route, in order to adequately capture potential direct and indirect impacts.

Within this section, habitats identified in the surveyed area are described and classified in accordance with the CORINE Land Cover classification and the Natura 2000 habitat classification framework.

During the field surveys of the project area of photovoltaic power plant, three different NATURA 2000 habitats were identified (Figure 5-7):

- ✓ 91M0 Pannonian-Balkanic Turkey oak–sessile oak forests;
- ✓ 62A0 Eastern sub-Mediterranean dry grasslands (*Scorzoneretalia villosae*); and
- ✓ 6510 Lowland hay meadows (*Alopecurus pratensis*, *Sanguisorba officinalis*).

Due to the terrain morphology and its geological characteristics, namely the presence of deep limestone substrates, these habitats are fragmented and occur in a discontinuous pattern, limited to locations where microclimatic and pedological conditions are favorable for their development.

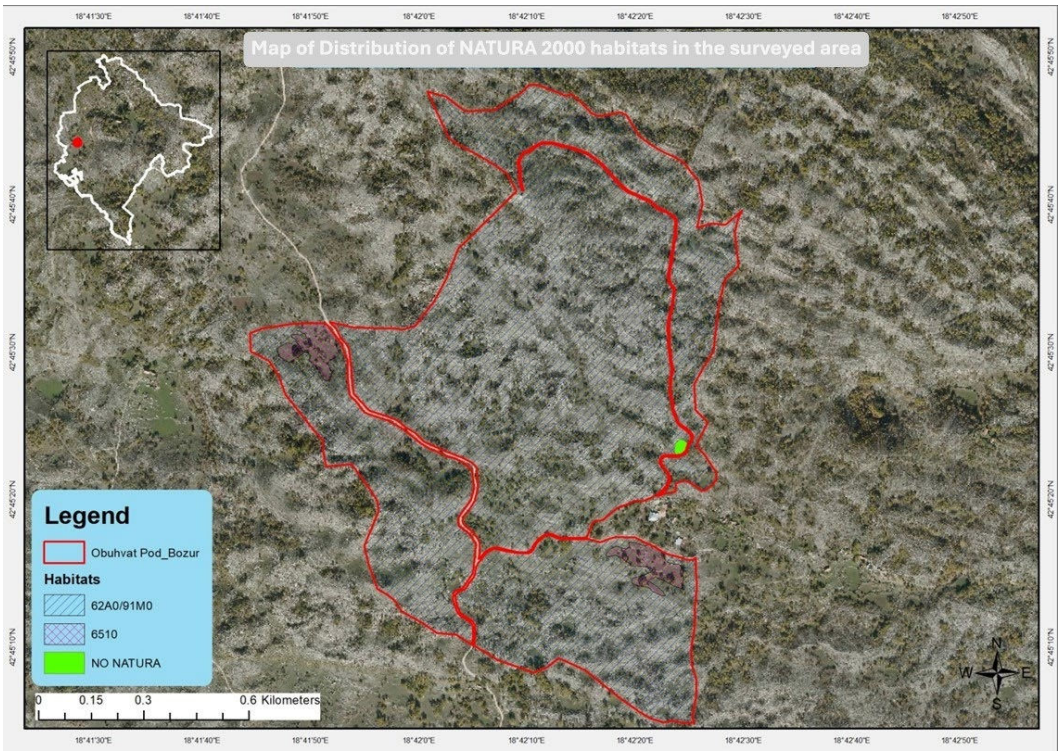


Figure 5-7: Distribution of NATURA 2000 habitats within photovoltaic power plant area

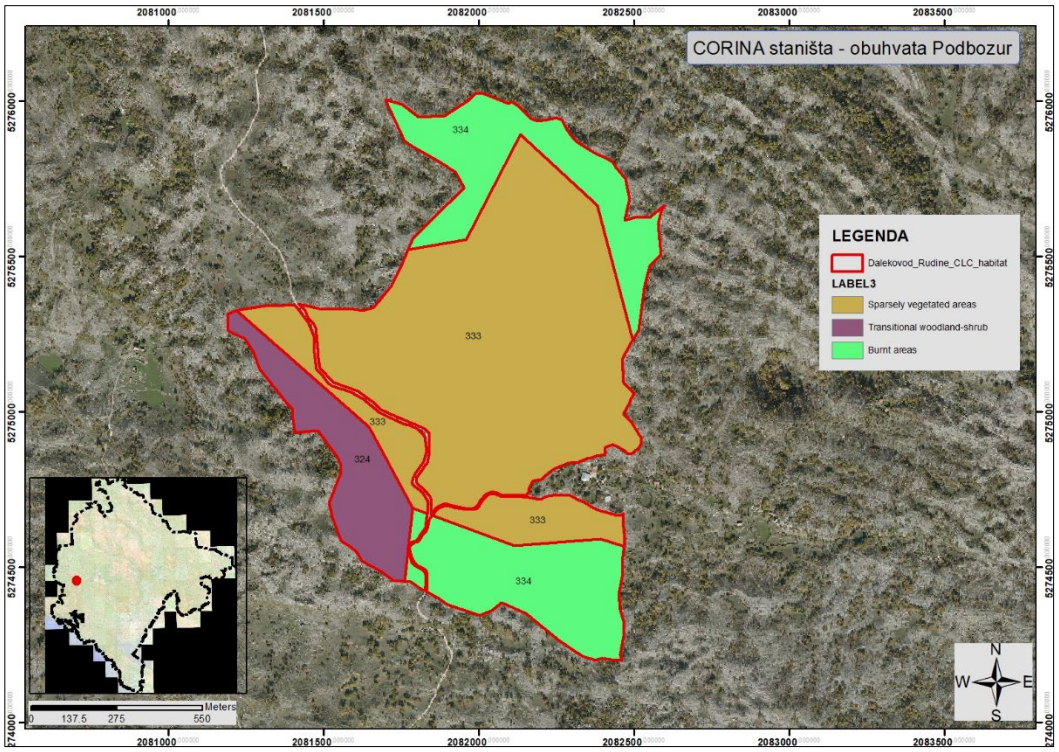


Figure 5-8 Corina habitats within photovoltaic power plant area

Figure 5-8 shows habitat coverage of the same are according to CORINE Land Cover system. Our research showed three habitat types are identified within the photovoltaic power plant area:

- ✓ CLC 333 – Sparsely vegetation area
- ✓ CLC 324 – Transitional woodland-shrub
- ✓ CLC 334 – Burnt areas

As previously explained, for the purposes of this Environmental and Social Impact Assessment, field surveys were also conducted along the route of the planned transmission line, which represents an associated infrastructure component of the project. The transect along the proposed transmission line alignment, with a total width of 600 m, encompasses a spatially extensive and environmentally heterogeneous area, characterised by varying geomorphological, pedological and microclimatic conditions.

Given this heterogeneity, the occurrence of a higher number and diversity of habitat types is expected within the transmission line corridor. Consequently, this zone was assessed using the Natura 2000 habitat classification system, as this framework provides a higher ecological resolution and allows for a more detailed identification and evaluation of habitat diversity, sensitivity and potential ecological receptors along the planned transmission line route.

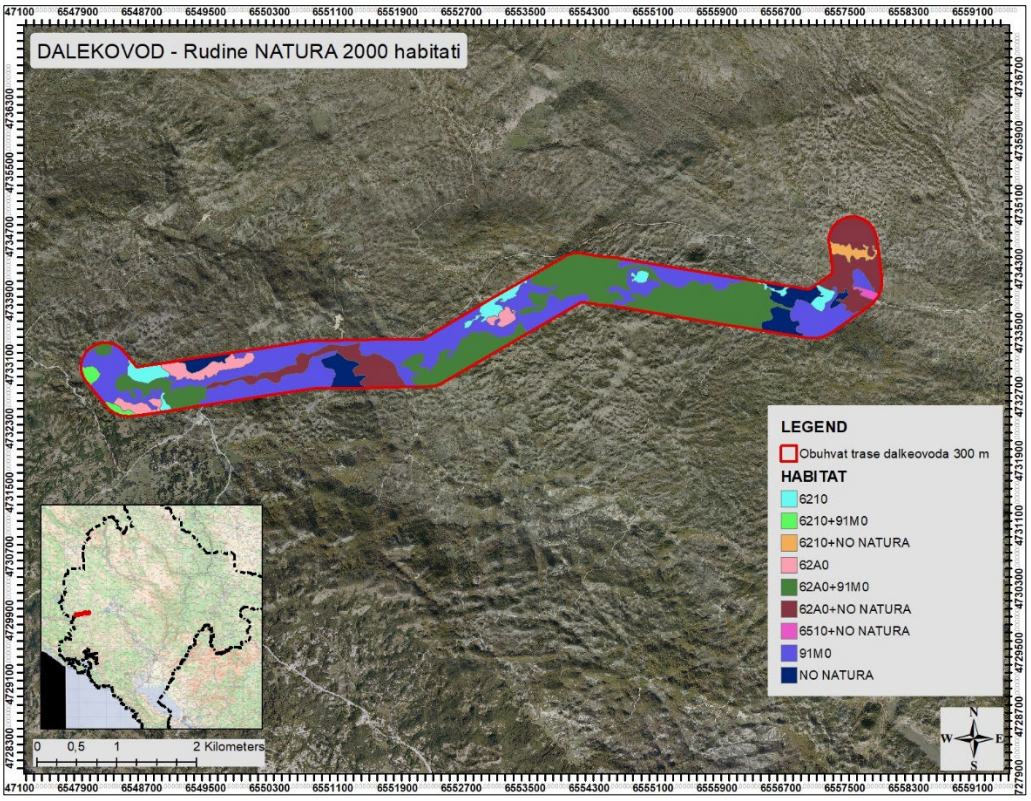


Figure 5-9 Habitats within the transmission line corridor (Natura 2000 system)

During the field surveys of the project area within the transmission line corridor, four different NATURA 2000 habitats were identified (Figure 5-9):

- ✓ 6210 – Semi-natural dry grasslands and scrubland facies on calcareous substrates (*Festuco-Brometalia*)
- ✓ 91M0 – Pannonian-Balkanic turkey oak–sessile oak forests
- ✓ 62A0 – Eastern sub-Mediterranean dry grasslands
- ✓ 6510 – Lowland hay meadows (*Alopecurus pratensis*, *Sanguisorba officinalis*)

Among the habitat types identified within the study area, habitat type 6210 – Semi-natural dry grasslands and scrubland facies on calcareous substrates (Festuco-Brometalia) is considered a priority habitat under Annex I of the EU Habitats Directive, where orchid-rich grassland communities are present.

The remaining habitat types identified (91M0, 62A0 and 6510) are listed in Annex I of the Habitats Directive but are not classified as priority habitats.

5.12.2.2. Flora

For the purposes of this Environmental Impact Assessment, a Biodiversity Baseline Survey was carried out by an expert team through several field campaigns. The objective of the floristic research was to determine the current state and main characteristics of flora in the project area. Fieldwork identified 126 plant species, providing a solid basis for further floristic and vegetation studies.

Although the project footprint is relatively small and there was no legal requirement for a baseline study, the investor proactively commissioned this survey. The site is not located within a protected area and has no national or international conservation designation.

Field surveys were conducted in April–May (covering peak vegetation and flowering periods, including orchids) and in June for insects. During this time, surveys also coincided with the peak activity of invertebrate, amphibians and reptiles, birds and mammals ensuring all species were recorded. The Biodiversity Baseline Report also incorporated previous studies, including data collected for Natura 2000, which added to the quality of the documentation. Some species of mammals and birds were recorded within a 500 m to several km radius of the project site, representing mobile (vagile) forms.

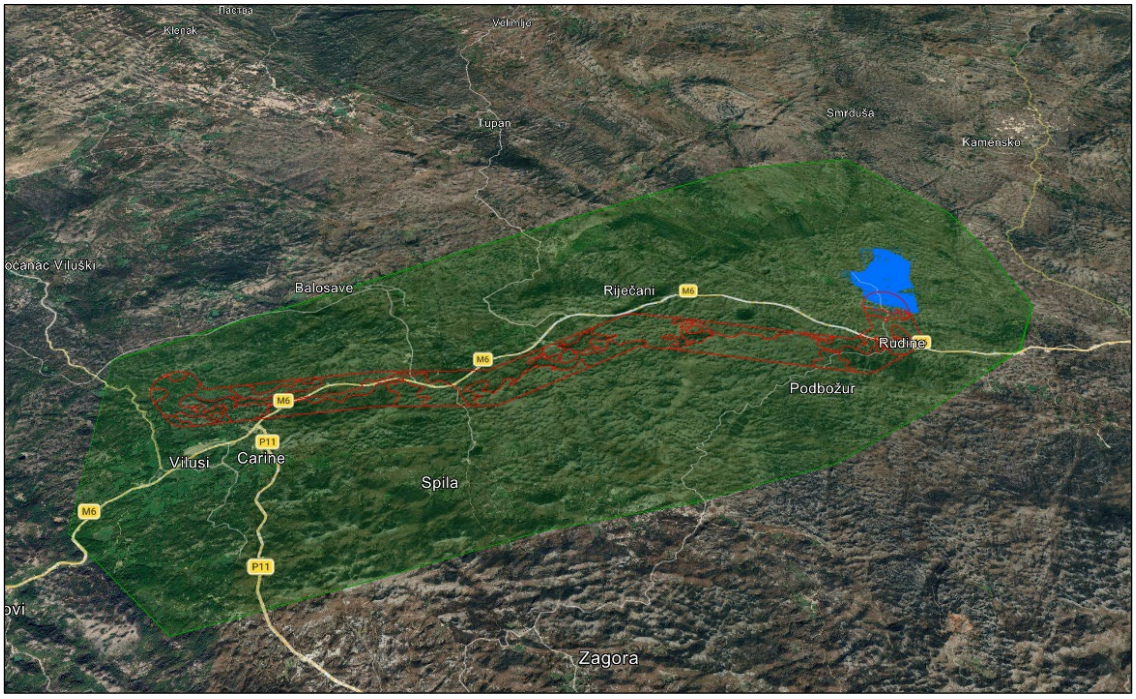


Figure 5-10 The zone where biodiversity surveys were conducted (green area), the area of the planned photovoltaic power plant (blue area), and the transmission line corridor (red area)

Table 5-13: Overview of plant species collected during field surveys (legend: +/- species protected under national law (Official Gazette of Montenegro, No. 76/06); species listed in: HD – Habitats Directive; IUCN Red List – Mediterranean)

Latine name of plants	MNE Law protected	IUCN	Habitat
***Acer campestre* L.**	-	LC	91M0
***Achillea millefolium* L**	-	LC	62A0
***Achillea millefolium* L.**	-	LC	62A0
***Ajuga reptans* L.**	-	-	62A0
***Anacamptis morio* (L.) R. M. Bateman, Pridgeon & M. W. Chase**	+	NT	62A0
***Asplenium ceterach* L.**	-	LC	62A0
***Agrimonia eupatoria* L.**	-	LC	6510
***Arrhenatherum elatius* (L.) J. Presl & C. Presl**	-	LC	6510
***Asplenium trichomanes* L.**	-	LC	62A0
***Asplenium ruta-muraria* L.**	-	LC	62A0
***Anchusella cretica* (Mill.) Bigazzi & al.**	-	-	62A0
***Anthoxanthum odoratum* L.**	-	-	62A0
***Anthyllis vulneraria* L.**	-	-	62A0

***Arabis hirsuta* (L.) Scop.**	-	-	91M0
***Aristolochia rotunda* L.**	-	-	91MO
***Armeria canescens* (Host) Boiss.**	-	-	62A0
***Asparagus acutifolius* L.**	-	LC	91M0
***Asperula taurine* L.**	-	-	91M0
***Asphodelus aestivus* Brot.**	-	LC	62A0
***Bellis perennis* L.**	-	-	62A0
***Bothriochloa ischaemum* (L.) Keng**	-	-	62A0
***Brachypodium pinnatum* (Huds.) P. Beauv.**	-	-	62A0
***Briza media* L.**	-	-	6510
***Bromus erectus* Huds.**	-	LC	62A0
***Bupleurum veronense* Turra**	-	-	62A0
***Carex humilis* Leyss.**	-	-	62A0
***Carlina acaulis* L.**	-	-	62A0
***Carpinus orientalis* Mill.**	-	LC	91M0
***Centaurea jacea* L.**	-	-	6510
***Chrysopogon gryllus* (L.) Trin.**	-	-	62A0
***Clinopodium vulgare* L.**	-	-	
***Cornus mas* L.**	-	LC	91M0
***Corylus avellana* L.**	-	LC	91M0
***Cotinus coggygria* Scop.**	-	LC	91M0
***Crataegus monogyna* Jacq.**	-	LC	91M0
***Cruciata glabra* (L.) Ehrend**	-	-	91M0
***Daucus carota* L.**	-	LC	6510
***Dianthus carthusianorum* L.**	-	-	6510
***Dactylis glomerata* L.**	-	-	6510
***Dorycnium pentaphyllum subsp. germanicum* (Gremli) Gams**	-	-	62A0
***Euphorbia cyparissias* L.**	-	-	91M0
***Euphorbia spinosa* L.**	-	-	62A0
***Eryngium amethystinum* L.**	-	-	62A0
***Edraianthus tenuifolius* (Waldst. & Kit.) A. DC.**			62A0
***Fragaria vesca* L.**	-	LC	91M0
***Frangula rupestris* (Scop.) Schur**	-	LC	91M0
***Fraxinus ornus* L.**	-	LC	91M0
***Fritillaria messanensis subsp. gracilis* (Ebel) Rix**	-	-	62A0
***Galium schultesi* Vest**	-	-	91M0
***Galium verum* L.**	-	LC	62A0
***Genista sericea* Wulfen**	-	LC	62A0
***Geranium purpureum* Vill.**	-	-	91M0
***Geranium sanguineum* L.**	-	-	62A0
***Glechoma hirsute* Waldst. & Kit**	-	DD	91M0
***Globularia cordifolia* L.**	-	-	62A0
***Hedera helix* L.**	-	LC	91M0
***Helleborus odorus* Willd.**	-	-	91M0
***Hepatica nobilis* Schreb.**	-	LC	91M0
***Hieracium pillosela* L.**	-	-	6510
***Hieracium racemosum* Willd.**	-	-	
***Hippocrepis comosa* L.**	-	-	62A0
***Hippocrepis emerus* (L.) Lassen**	-	-	91M0
***Iris reichenbachii* Heuff.**	-	-	62A0
***Koeleria splendens* C. Presl**	-	-	62A0
***Knautia arvensis* (L.) DC.**	-	-	6510
***Lathyrus niger* (L.) Bernh.**	-	LC	91M0

***Leontodon hispidus* L.**	-	-	62A0
***Lithospermum purpurocaeruleum* L.**	-	-	
***Lotus corniculatus* L.**	-	LC	62A0
***Luzula forsteri* (Sm.) DC.**	-	-	91M0
***Micromeria juliana* (L.) Benth. ex Rchb.**	-	-	62A0
***Micromeria parviflora* Rchb.**	-	-	62A0
***Muscari racemosum* Mill.**	-	-	62A0
***Neotinea tridentata* (Scop.) R. M. Bateman, Pridgeon & M. W. Chase**	+	LC	62A0
***Ononis spinosa* L.**	-	LC	6510
***Ophrys scolopax subsp. cornuta* (Steven) E. G. Camus**	+	LC	62A0
***Ophrys sphegodes* Mill.**	+	LC	62A0
***Orchis provincialis* Balb. ex Lam. & DC**	+	LC	62A0
***Orchis simia* Lam**	+	LC	62A0
***Origanum vulgare* L.**	-	LC	62A0
***Ostrya carpinifolia* Scop.**	-	LC	91M0
***Petrohargia saxifraga* (L.) Link**	-	-	62A0
***Plantago holosteum* Scop.**	-	-	62A0
***Plantago lanceolata* L.**	-	LC	6510
***Plantago media* L.**	-	-	6510
***Polygala comosa* Schkuhr**	-	-	62A0
***Polygonatum odoratum* (Mill.) Druce LC**	-	-	6510
***Potentilla hirta* L.**	-	-	62A0
***Potentilla micrantha* DC**	-	-	91M0
***Primula vulgaris* Huds.**	-	-	91M0
***Prunus mahaleb* L.**	-	-	91M0
***Prunus spinosa* L.**	-	LC	62A0
***Pteridium aquilinum* (L.) Kuhn**	-	LC	6510
***Pulmonaria officinalis* L.**	-	LC	91M0
***Pyrus pyraster* (L.) Burgsd.**	-	LC	91M0
***Quercus cerris* L**	-	LC	91M0
***Quercus pubescens* Willd.**	-	LC	91M0
***Rosa canina* L.**	-	LC	91M0
***Rorippa pyrenaica* (All.) Rchb.**	-	LC	62A0
***Ruta graveolens* L.**	-	LC	62A0
***Rubus ulmifolius* Schott**	-	-	91M0
***Salvia officinalis* L.**	-	LC	62A0
***Sanguisorba minor* Scop.**	-	-	6510
***Satureja montana* L.**	-	-	62A0
***Satureja subspicata* Bartl. ex Vis. subsp. subspicata**	-	-	62A0
***Scilla lakusicii* Šilic**	+	-	62A0
***Silene vulgaris* (Moench) Garcke**	-	LC	6510
***Sedum acre* L.**	-	LC	62A0
***Sedum album* L.**	-	-	62A0
***Sedum hispanicum* L.**	-	-	62A0
***Smyrnium perfoliatum* L.**	-	-	6510
***Symphytum tuberosum* L.**	-	-	62A0
***Taraxacum sect. Taraxacum* F. H. Wigg**	-	LC	6510
***Teucrium capitatum* L.**	-	-	62A0
***Teucrium chamaedrys* L.**	-	LC	62A0
***Teucrium chamaedrys* L.**	-	LC	62A0
***Teucrium montanum* L.**	-	-	62A0
***Thymus longicaulis* C. Presl**	-	-	62A0
***Tragopogon tommasinii* Sch. Bip.**	-	-	62A0

***Trifolium incarnatum* L.**	-	-	62A0
***Tragopogon pratensis* L.**	-	-	6510
***Trifolium pratense* L.**	-	LC	6510
***Tulipa sylvestris* L.**	-	-	62A0
***Urtica dioica* L.**	-	LC	62A0
***Valeriana tuberosa* L.**	-	-	62A0
***Veronica chamaedrys* L.**	-	-	91M0
***Veronica officinalis* L.**	-	LC	91M0
***Vicia grandiflora* Scop.**	-	LC	91M0
***Vincetoxicum hirundinaria* Medik.**	-	-	62A0

5.12.3 Fauna

Invertebrates

Within the different habitat types identified during field surveys, and based on available literature data for the Rudine – Vilusi area (Figure 5-10), the presence of a total of 201 invertebrate taxa was recorded. These include 18 taxa of snails (Gastropoda), 29 species of spiders (Araneae), 6 species of dragonflies and damselflies (Odonata), 52 species of butterflies (Lepidoptera), 47 taxa of beetles (Coleoptera), 36 taxa of hymenopterans (Hymenoptera), 11 species of grasshoppers and crickets (Orthoptera), and 2 species of mantises (Mantodea).

Table 5-14 List of Gastropoda species recorded within the wider project area

Latin name	IUCN	Natura 2000	MNE Law protected
***Arion* spp.**	LC		
***Arion subfuscus* Draparanaud, 1805**	LC		
***Chilostoma* spp.**	LC		
***Cochlodina laminata* Montagu1803**	LC		
***Cochlostoma* spp.**	LC		
***Deroceras* spp.**	LC		
***Granaria frumentum* (Draparnaud, *1801*)**	LC		
***Helix vladica* (Kobelt, 1898)**	LC		X
***Limax cinereoniger* Wolf, 1803**	LC		
***Limax maximus* (Linaeus, 1758)**	LC		
***Limax wohlberedti* (Simroth, 1900)**	LC		X
***Monacha cartusiana* O. F. Müller, 1774**	LC		
***Pomatias elegans* (Müller, 1774)**	DD		
***Tandronia* spp.**	LC		
***Vitrea subrimata* (Reinhardt, 1871)**	DD		
***Vitrea* spp.**			
***Xerolenta obvia* (Menke, 1828)**	LC		
***Herilla* spp.**	LC		

Gastropod species of conservation importance:

- *Limax wohlberedti* (Simroth, 1900) International and national protection status: This species is protected in Montenegro under the *Decision on the Protection of Certain Plant and Animal Species* ("Official Gazette of the Republic of Montenegro", No. 76/06).
- *Helix vladika* (Kobelt, 1898) International and national protection status**:** This species is protected in Montenegro under the *Decision on the Protection of Certain Plant and Animal Species* ("Official Gazette of the Republic of Montenegro", No. 76/06). The species is a Balkan endemic.

Table 5-15 List of Araneae species recorded within the wider project area

Latin name	IUCN	Natura 2000	MNE Law protected
***Eresus kollari* (Rossi, 1846)**	NE		
***Crustulina scabripes* (Simon, 1881)**	NE		
***Steatoda paykulliana* (Walckenaer,1805)**	NE		
***Crustulina guttata* (Wider, 1834)**	NE		
***Enoplognatha ovata* (Clerck, 1757)**	NE		
***Linyphia triangularis* (Clerck, 1757)**	NE		
***Araneus quadratus* Clerck, 1757**	NE		
***Larinioides patagiatus* (Clerck, 1757)**	NE		
***Agalenatea redii* (Scopoli, 1763)**	NE		
***Argiope bruennichi* (Scopoli, 1772)**	NE		
***Araneus angulatus* (Clerck, 1757)**	NE		
***Mangora acalypha* (Walckenaer, 1802)**	NE		
***Hogna radiate* (Latreille, 1817)**	NE		
***Pardosa agrestis* (Westring, 1861)**	NE		
***Pardosa monticola* (Clerck, 1757)**	NE		
***Pisaura mirabilis* (Clerck, 1757)**	NE		
***Tegenaria campestris* (C.L. Koch, 1834)**	NE		
***Clubiona pallidula* (Clerck, 1757)**	NE		
***Euophrys rufibarbis* (Simon, 1868)**	NE		
***Phelegra bresnieri* (Lucas, 1846)**	NE		
***Ebrechtella tricuspidata* (Fabricius, 1775)**	NE		
***Misumena vatia* (Clerck, 1757)**	NE		
***Evarcha falcata* (Clerck, 1757)**	NE		
***Marpissa muscosa* (Clerck, 1757)**	NE		
***Myrmarachne formicaria* (De Geer, 1778)**	NE		
Araneus diadematus (Clerck, 1757)	NE		
Zoropsis spinimana (Dufour, 1820)	NE		
Pardosa lugubris (Walckenaer, 1802)	NE		
Metellina segmentata (Clerck, 1757)	NE		

Within the area covered by the study, the presence of 29 spider species was recorded (Table 5-14). None of the recorded species are considered to be of conservation concern.

Within the area covered by the study, field surveys recorded the presence of 52 Lepidoptera species, observed in both adult and larval stages. In addition, the presence of tree (3) butterfly species of conservation importance was documented within the wider project area (Table 5-16).

Table 5-16 List of Lepidoptera species recorded within wider project area

Latin name	IUCN	Natura 2000	MNE Law protected
***Aglais io* (Linnaeus, 1758)**	LC		
***Aglais urticae* (Linnaeus, 1758)**	LC		
***Anthocharis cardamines* (Linnaeus, 1758)**	LC		
***Aporia crataegi* (Linnaeus, 1758)**	LC		
***Argynnis adippe* (Denis& Schiffermüller, 1775)**	LC		
***Aricia agestis* (Denis& Schiffermüller, 1775)**	LC		
***Brenthis hecate* (Denis& Schiffermüller, 1775)**	LC		
***Brintesia circe* (Fabricius, 1775)**	LC		
***Colias crocea* (Fourcroy, 1785)**	LC		
***Cupido argiades* (Pallas, 1771)**	LC		
***Erebia ligea* (Linnaeus, 1758)**	LC		
***Erynnis tages* (Linnaeus, 1758)**	LC		
***Euplagia quadripunctaria* (Poda, 1761)**	NE	X	
***Glaucopsyche alexis* (Poda, 1775)**	LC		
***Gonepteryx rhamni* (Linnaeus, 1758)**	LC		
***Hipparchia fagi* (Scopoli, 1763)**	NT		
***Iphiclides podalirius* (Linnaeus,1758)**	LC		X
***Issoria lathonia* (Linnaeus, 1758)**	LC		
***Lasiommata megera* (Linnaeus, 1764)**	LC		
***Leptidea sinapis* (Linnaeus, 1758)**	LC		
***Libythea celtis* (Laicharting, 1782)**	LC		
***Limenitis reducta* (Staudinger, 1901)**	LC		
***Lycaena phlaeas* (Linnaeus, 1761)**	LC		
***Maniola jurtina* (Linnaeus, 1758)**	LC		
***Melanargia galathea* (Linnaeus, 1758)**	LC		
***Melitaeaphoebe*(Denis& Schiffermüller,1775)**	LC		
***Melitaea trivia* (Denis& Schiffermüller, 1775)**	LC		
***Nymphalis antiopa* (Linnaeus, 1758)**	LC		
***Nymphalis polychloros* (Linnaeus, 1758)**	LC		
***Papilio machaon* (Linnaeus, 1758)**	LC		X
***Pieris brassicae* (Linnaeus, 1758)**	LC		
***Pieris mannii* (Mayer, 1851)**	LC		
***Pieris napi* (Linnaeus, 1758)**	LC		
***Pieris rapae* (Linnaeus, 1758)**	LC		
***Plebejus idas* (Linnaeus, 1761)**	LC		
***Polygonia c-album* (Linnaeus, 1758)**	LC		
***Polygonia egea* (Cramer, 1775)**	LC		
***Polyommatus amandus* (Schneider, 1792)**	LC		
***Polyommatus icarus* (Rottemburg, 1775)**	LC		
***Polyommatus thersites* (Cantener, 1835)**	LC		
***Pyrgus serratule* (Rambur, 1839)**	LC		
***Satyrium ilicis* (Esper, 1779)**	LC		
***Satyrium pruni* (Linnaeus, 1758)**	LC		
***Satyrium spini* (Denis& Schiffermüller, 1775)**	LC		
***Scolitantides orion* (Pallas,1771)**	LC		
***Vanessa atalanta* (Linnaeus, 1758)**	LC		
***Vanessa cardui* (Linnaeus, 1758)**	LC		
***Coenonympha pamphilus* (Linnaeus, 1758)**	LC		
***Pararge aegeria* (Linnaeus, 1758)**	LC		
***Thymelicus sylvestris* (Poda, 1761)**	LC		

***Ochlodes sylvanus* (Esper, 1777)**	LC		
***Celastrina argiolus* (Linnaeus, 1758)**	LC		

Lepidoptera species of conservation importance

- *Papilio machaon* Linnaeus, 1758 – Swallowtail, International and national protection status: This species is protected in Montenegro under the *Decision on the Protection of Certain Plant and Animal Species* ("Official Gazette of the Republic of Montenegro", No. 76/06).
- *Iphiclides podalirius* (Linnaeus, 1758) – Scarce Swallowtail, International and national protection status: This species is protected in Montenegro under the *Decision on the Protection of Certain Plant and Animal Species* ("Official Gazette of the Republic of Montenegro", No. 76/06).
- *Euphydryas aurinia* (Rottemburg, 1775), International and national protection status: This species is listed in Annex II of the EU Habitats Directive (Natura 2000) and in Annexes I and II of the Bern Convention on the Conservation of European Wildlife and Natural Habitats.

A total of forty-eight (47) Coleoptera taxa were recorded during field surveys conducted for the purposes of this study. A list of taxa with their respective conservation status is provided in tabular form. Two beetle species recorded within the project area are of conservation importance (Table 5-17).

Table 5-17 List of Coleoptera species recorded within wider project area

Latin name	IUCN	Natura 2000	MNE Law protected
***Trechus montenegrinus* (Müller, 1923)**	NE		
***Calosoma sycophanta* (Linnaeus, 1758)**	NE		
***Hydroporus tessellatus* (Drapiez, 1819)**	NE		
***Agabus sturmii* (Gyllenhal, 1808)**	NE		
***Acanthocinus* sp.**	NE		
***Pogonocherus* sp.**	NE		
***Molorchus* sp.**	NE		
***Cerambyx scopolii* Fuessly, 1775**	NE		
***Cerambyx cerdo* Linnaeus, 1758**	VU	X	X
***Monachamus* spp.**	NE		
***Callidum* sp.**	NE		
***Ropalopus* sp.**	NE		
***Oryctes nasicornis* (Linnaeus, 1758)**	NT		X
***Melolontha melolontha* (Linnaeus, 1758)**	NE		
***Polyphylla fullo* (Linnaeus, 1758)**	NE		
***Potosia cuprea* Fabricius, 1775**	NE		
***Harmonia quadripunctata* (Pontopiddian, 1763)**	NE		
***Exochomus quadripustulatus* (Linnaeus, 1758)**	NE		
***Calvia decemguttata* (Linnaeus, 1767)**	NE		
***Coccinula quatuordecimpustulata* (Linnaeus, 1758)**	NE		
***Coccinella quinquepunctata* Linnaeus, 1758**	NE		
***Adalia bipunctata* (Linnaeus, 1758)**	NE		
***Adalia decempunctata* (Linnaeus, 1758)**	NE		
***Hippodamia variegata* (Goeze, 1777)**	NE		
***Hippodamia tredecimpunctata* (Linnaeus, 1758)**	NE		
***Nephus quadrimaculatus* (Herbst, 1783)**	NE		
***Brumus quadripustulatus* (Linnaeus, 1758)**	NE		
***Coccinella septempunctata* Linnaeus, 1758**	NE		
***Coccinella undecimpunctata* Linnaeus, 1758**	NE		
***Halyzia sedecimguttata* (Linnaeus, 1758)**	NE		

***Harmonia axyridis,* (Pallas, 1773)**	NE		
***Tomicus* sp.**	NE		
***Blastophagus* spp.**	NE		
***Hylurgops* spp.**	NE		
Ips sp.	NE		
***Ips amitinus* Eichhoff, 1872**	NE		
***Pissodes* sp.**	NE		
Squamapion spp.	NE		
***Hylobius abietis* (Linnaeus, 1758)**	NE		
***Otiorhynchus regliae* Reitter, 1913**	NE		
***Rhinoncus* spp.**	NE		
***Sitona ambiguus* Gyllenhal, 1834**	NE		
***Dima elateroides* Charpentier, 1825**	NE		
***Blaps mucronata* (Latreille, 1802)**	NE		
***Phyllotreta cruciferae* (Goeze, 1777)**	NE		
***Ocypus olens* (Müller, 1764)**	NE		
***Cetonia aurata* (Linnaeus, 1758)**	NE		

Coleoptera species of conservation importance

- *Oryctes nasicornis* (Linnaeus, 1758) – *European rhinoceros beetle,* International and national protection status: This species is protected in Montenegro under the *Decision on the Protection of Certain Plant and Animal Species* ("Official Gazette of the Republic of Montenegro", No. 76/06).
- *Cerambyx cerdo* (Linnaeus, 1758) – *Great capricorn beetle,* International and national protection status: Classified as Vulnerable (VU) on the IUCN Red List. Listed in Annexes II and IV of the EU Habitats Directive (92/43/EEC) and in Annexes I and II of the Bern Convention on the Conservation of European Wildlife and Natural Habitats. The species is also protected in Montenegro under the *Decision on the Protection of Certain Plant and Animal Species* ("Official Gazette of the Republic of Montenegro", No. 76/06).

Within the area covered by the study, based on available literature data and field surveys conducted for the purposes of this assessment, the presence of 11 Orthoptera species and 2 Mantodea species was recorded. A table presenting the protection and threat status of the recorded species is provided (Table 5-18). Within the study area there was no species with conservation interest.

Table 5-18 List of Otrhoptera and Mantodea species recorded within wider project area

Latin name	IUCN	Natura 2000	MNE Law protected
***Decticus verrucivorus* (Linneus, 1758)**	LC		
***Tettigonia viridisima* Linneus, 1758**	LC		
***Pholidoptera femorata* (Fieber, 1853)**	LC		
***Sepiana sepium* (Yersin, 1854)**	LC		
***Oecanthus pellucens* (Scopoli) 1763**	LC		
***Aiolopus strepens* (Latreille, 1804)**	LC		
***Aiolopus thalassinus* (Fabricius, 1781)**	LC		
***Chorthippus dorsatus* (Zetterstedt, 1821)**	LC		
***Eupholidoptera chabrieri* (Charpentier, 1825)**	LC		
***Acrometopa macropoda* (Burmeister, 1838)**	LC		
***Ephippiger discoidalis* (Fieber,1853)**	LC		
***Mantis religiosa* Linneus, 1758**	NE		
Ameles decolor (Charpentier, 1825)	NE		

A total of thirty-six (36) Hymenoptera taxa**,** belonging to four families **(**Vespoidae, Pamphiliidae, Apidae and Formicidae**),** were recorded within wider project area site during field surveys conducted for the purposes of this study. A table presenting the protection and threat status of the recorded species is provided. No Hymenoptera species of conservation importance were identified within survey area (Table 5-19).

Table 5-19 List of Hymenoptrera species recorded within wider project area

Latin name	IUCN	Natura 2000	MNE Law protected
***Vespa crabro* Linnaeus, 1758**	NE		
***Vespula germanica* (Fabricius, 1793)**	NE		
***Polistes* spp.**	NE		
***Acantholyda* spp.**	NE		
***Bombus campestris* (Panzer, 1801)**	NE		
***Bombus lucorum* (Linnaeus, 1761)**	NE		
Bombus terrestris (Linnaeus, 1758)	NE		
***Bombus soroeensis* (Fabricius, 1793)**	NE		
Bombus rupestris (Fabricius, 1793)	NE		
***Bombus pomorum* (Panzer, 1805)**	NE		
Xylocopa violacea (Linnaeus, 1758)	NE		
***Andrena bicolor* Fabricius,1775**	NE		
Andrena colletiformis Morawitz,1874	NE		
Halictus subauratus (Rossi 1792)	NE		
Lasioglossum morio (Fabricius 1793)	NE		
Macropis europaea Warncke, 1973	NE		
Macropis fulvipes (Fabricius, 1804)	NE		
***Bombus lucorum* (Linnaeus, 1761)**	NE		
Bombus terrestris (Linnaeus, 1758)	NE		
***Bombus soroeensis* (Fabricius, 1793)**	NE		
***Bothriomyrmex adriacus* Santschi, 1922**	NE		
***Camponotus aethiops* (Latreille, 1798)**	NE		
***Camponotus vagus* (Scopoli, 1763)**	NE		
***Crematogaster schmidti* (Mayr, 1853)**	NE		
***Formica fusca* Linnaeus, 1758**	NE		
***Lasius flavus* (Fabricius, 1782)**	NE		
***Lasius lasioides* (Emery, 1869)**	NE		
***Lasius paralienus* Seifert, 1992**	NE		
***Messor* cf. *structor* (Latreille, 1798)**	NE		
***Myrmica* spp.**	NE		
***Plagiolepis* spp.**	NE		
***Solenopsis fugax* (Latreille, 1798)**	NE		
***Tapinoma nigerrimum* (Nylander, 1856)**	NE		
***Manica rubida* (Jurine, 1807)**	NE		
***Themnothorax parvulus* (Schenck, 1852)**	NE		
***Tetramorium cespitum* (Linnaeus, 1758)**	NE		

Within the area covered by the study, field surveys recorded the presence of 6 Odonata species**.** No dragonfly or damselfly species of conservation importance were identified within the surveyed area (Table 5-20).

Table 5-20 List of Odonata species recorded within wider project area

Latin name	IUCN	Natura 2000	MNE Law protected
***Lestes dryas* Kirby,1890**	LC		
***Ischnura elegans* (VanderLinden,1820)**	LC		
***Enallagma cyathigerum* (Charpentier,1840)**	LC		
***Aeshna mixta* Latreille, 1805**	LC		
***Sympetrum meridionale* (Selys,1841)**	LC		
***Sympetrum sanguineum* (O.F.Müller, 1764)**	LC		

Amphibians

Within the study area, five amphibian species were recorded during the survey period. With regard to the batrachofauna of the study area, aquatic habitats represent highly important biotopes, as they function as key reproductive sites for amphibians. Within the surveyed area, one water body was recorded, consisting of an open-type water intake structure (captation) of anthropogenic origin with surface of approximately 400 m^2. The captation is fenced and is used by the local population for livestock watering.

Figure 5-11 Water intake structure - captation of anthropogenic origin

With the exception of the Greek crested newt (*Lissotriton graecus*), which is an endemic species of the Balkan Peninsula, all other recorded amphibian species are characterised by a wide distribution across Europe and Eurasia and are not considered threatened according to the IUCN Red List categories (Table 5-21). As the Greek crested newt was only recently elevated to full species status (formerly a subspecies of the smooth newt, *Lissotriton vulgaris graecus*) (after Wielstra et al., 2018), its conservation status has not yet been assessed by the IUCN (NE).

Table 5-21 List of Amphibian species recorded within wider project area

Latin name	IUCN	Natura 2000	MNE Law protected
Bufo bufo	LC	X	X
Bufo viridis	LC	X	X
Bombina variegata	LC	X	X
Pelophylax ridibundus	LC	X	
Lissotriton graecus	LC	X	X

Reptiles

Given that the study area is under a pronounced influence of the Mediterranean climate, in addition to species typical of continental regions, a number of reptile species characteristic of Mediterranean environments are also present. Field surveys conducted during the summer and autumn survey periods of 2025 confirmed the presence of all reptile species previously recorded during the spring survey period.

Supporting this, out of a total of 14 reptile species recorded within the study area (Table 5-22), ten species belong to taxa characteristic of the Adriatic coastal zone and, consequently, of the Mediterranean climatic region. These include the Hermann's tortoise (*Testudo hermanni*); lizard species typical of karst habitats such as the Dalmatian algyroides (*Algyroides nigropunctatus*), Dalmatian wall lizard (*Podarcis melisellensis*), blue rock lizard (*Dalmatolacerta oxycephala*), Balkan green lizard (*Lacerta trilineata*), and the European glass lizard (*Pseudopus apodus*); as well as snake species including the four-lined snake (*Elaphe quatuorlineata*), Balkan whip snake (*Hierophis gemonensis*) and eastern Montpellier snake (*Malpolon insignitus*).

The remaining recorded species, which have a wider distribution and can also be found in more continental and northern regions**,** include the common wall lizard (*Podarcis muralis*)**,** European green lizard (*Lacerta viridis*) and the nose-horned viper (*Vipera ammodytes*)**.**

Table 5-22 List of Reptile species recorded within wider project area

Latin name	IUCN	Natura 2000	MNE Law protected
Testudo hermanni	NT	X	X
Pseudopus apodus	LC	X	X
Podarcis muralis	LC	X	X
Podarcis melisellensis	LC	X	X
Algyroides nigropunctatus	LC	X	X
Dalmatolacerta oxycephala	LC	X	X
Lacerta viridis	LC	X	X
Lacerta trilineata	NE		X
Hierophis gemonensis	NE		X

Malpolon insignitus	LC	X	X
Elaphe quatuorlineata	NT		X
Vipera ammodytes	LC	X	

The Dalmatian wall lizard (*Podarcis melisellensis*) and the Balkan whip snake (*Hierophis gemonensis*) are endemic to the Balkan Peninsula, while the Dalmatian algyroides (*Algyroides nigropunctatus*) is considered a Balkan sub-endemic, as only a very small part of its distribution range extends beyond the Balkans into north-eastern Italy.

The Hermann's tortoise (*Testudo hermanni*) and the four-lined snake (*Elaphe quatuorlineata*) are classified as Near Threatened (NT) species and are listed in Annex II of the EU Habitats Directive.

With the exception of the nose-horned viper (*Vipera ammodytes*), which has not yet been designated as a protected species under national legislation, all other recorded reptile species are protected in Montenegro.

Birds

During ornithological surveys conducted within the project area, a total of 38 bird species were recorded over the monitoring period from April to September (Table 5-23). The recorded assemblage includes species associated with forest habitats, open and semi-open landscapes, agricultural areas, as well as synanthropic and migratory species, indicating a relatively diverse avifauna typical of the wider landscape context.

Table 5-23 List of Bird species recorded within wider project area

Latin name	IUCN	Natura 2000	MNE Law protected
Aegithalos caudatus	LC	X	X
Accipiter gentilis	LC	X	X
Anthus pratensis	LC	X	X
Anthus trivialis	LC	X	X
Buteo buteo	LC	X	X
Circaetus gallicus	LC	X	X
Corvus corax	LC	X	X
Cuculus canorus	LC	X	X
Cyanistes caeruleus	LC	X	X
Delichon urbicum	LC	X	X
Dendrocopus syriacus	LC	X	X
Emberiza cia	LC	X	X
Emberiza citrinella	LC	X	X
Falco tinnunculus	LC	X	X
Fringilla coelebs	LC	X	X
Garrulus glandarius	LC	X	X
Hirundo rustica	LC	X	X
Lanius collurio	LC	X	X
Luscinia megarhynchos	LC	X	X
Motacilla alba	LC	X	X

Motacilla cinerea	LC	X	X
Oenanthe oenanthe	LC	X	X
Oriolus oriolus	LC	X	X
Parus lugubris	LC	X	X
Parus major	LC	X	X
Passer domesticus	LC	X	X
Phoenicurus phoenicurus	LC	X	X
Pica pica	LC	X	X
Saxicola rubetra	LC	X	X
Saxicola torquata	LC	X	X
Streptopelia decaocto	VU	X	X
Streptopelia turtur	LC	X	X
Sturnus vulgaris	LC	X	X
Sylvia cantillans	LC	X	X
Sylvia communis	LC	X	X
Turdus merula	LC	X	X
Turdus viscivorus	LC	X	X
Upupa epops	LC	X	X

All identified species are listed as Least Concern (LC) on the IUCN Red List, with the exception of one species, the European turtle dove (*Streptopelia decaocto*), which is classified as Vulnerable (VU), indicating an unfavourable population trend at the global level. From a legal and conservation perspective, all reorded species are subject to protection under Montenegrin national legislation, as indicated in the relevant legal framework. In addition, all species recorded within the study area are included within the scope of the Natura 2000 network, reflecting their relevance under European nature conservation policy and the EU Birds Directive.

The dominance of species classified as Least Concern suggests that the avifaunal assemblage of the project area is primarily composed of widespread and ecologically adaptable species. However, the presence of a globally Vulnerable species increases the conservation sensitivity of the area and should be carefully considered during project planning and implementation. Overall, although no critically endangered or endangered bird species were recorded, the fact that all identified species are legally protected at the national level and relevant within the Natura 2000 framework indicates that the project area supports avifauna of conservation importance. Consequently, appropriate mitigation and monitoring measures should be applied to avoid or minimise potential adverse impacts on bird species and their habitats during construction and operational phases.

Mammals

During field surveys conducted in April and May 2024, the presence of **sixteen (16) mammal species** was recorded within the study area (Table 20), belonging to six taxonomic orders. Surveys carried out during the period June–September 2025 confirmed the presence of the same species, with no additional taxa recorded compared to the previous survey period (Table 5-24).

Table 5-24: List of Mammal species recorded within wider project area

Latin name	IUCN	Natura 2000	MNE Law protected
Erinaceus roumanicus	LC		
Sorex minutus	LC		
Talpa caeca	LC		
Lepus europaeus	LC		
Apodemus sylvaticus	LC		
Sus scrofa	LC		
Martes foina	LC		
Vulpes vulpes	LC		
Rhinolophus hipposideros	LC	X	X
Myotis blythii	LC	X	X
Pipistrellus pipistrellus	LC	X	X
Pipistrellus pygmaeus	LC	X	X
Pipistrellus khulii	LC	X	X
Pipistrellus nathusii	LC	X	X
Eptesicus serotinus	LC	X	X
Nyctalus noctula	LC	X	X

From a conservation perspective, the most significant mammal group recorded within the study area is bats (Order Chiroptera), with a total of eight (8) species detected. The following bat species were recorded in the area: the lesser horseshoe bat (*Rhinolophus hipposideros*), lesser mouse-eared bat (*Myotis blythii*), common pipistrelle (*Pipistrellus pipistrellus*), soprano pipistrelle (*Pipistrellus pygmaeus*), Kuhl's pipistrelle (*Pipistrellus kuhlii*), Nathusius' pipistrelle (*Pipistrellus nathusii*), serotine bat (*Eptesicus serotinus*), and the common noctule (*Nyctalus noctula*).

All recorded bat species are strictly protected under Montenegrin national legislation, as well as under relevant international and European conservation frameworks, including the EU Habitats Directive (92/43/EEC) and the Bern Convention. Several of the recorded species, including Rhinolophus hipposideros and Myotis blythii, are listed in Annex II and/or Annex IV of the Habitats Directive, and are therefore considered species of high conservation importance within the Natura 2000 network.

Due to their ecological requirements and sensitivity to habitat loss, disturbance, artificial lighting and linear infrastructure, bats represent a highly sensitive ecological receptor. Consequently, their presence within the study area is of particular relevance for the impact assessment, and appropriate avoidance, mitigation and monitoring measures should be incorporated during both the construction and operational phases of the project to prevent significant adverse effects on bat populations.

5.13 Ecosystem services

In the area of Rudine, there are many medicinal herbs (hawthorn, linden, yellow gentian, St. John's wort, lily of the valley, buckthorn, wild mint, violet, heather, nettle, black mallow, wild rose, rosehip...). There are beehives installed.

The project area provides limited services to the local population and beyond. The local population occasionally uses the area for picking medicinal herbs, livestock grazing or small-scale wood collection.

The Municipality of Nikšić belongs to the Central Hunting Area, which also includes the territories of the municipalities of Kolašin and Mojkovac. The hunting area of the Municipality of Nikšić covers approximately 213,494 ha, comprising three hunting zones. Habitat conditions are favourable for a wide range of wildlife species, including brown bear, wolf, hare, roe deer, martens, wild boar, chamois, fox, badger, wildcat and stone marten, as well as various species of game birds, such as wild ducks, partridges, rock partridges and Eurasian woodcock.

5-25: Hunting zones in Municipality of Niksic

Hunting Zone	Area (ha)
"Nikšić"	137,857 ha
"Bratogošt"	48,958 ha
"Grahovo"	26,679 ha

Feedback from stakeholders suggests that no other ecosystem services are developed in the area.

5.14 Land use and Landscapes

5.14.1 Land use Patterns at PV subsites

The Rudine plateau itself is a typical karst landscape, consisting of open grasslands, scattered shrubs, sinkholes, and rocky outcrops. Settlement patterns are dispersed, with low population density and limited agricultural potential due to scarce water resources. Despite these limitations, the area holds potential for livestock farming and small-scale use of medicinal and aromatic plants as well as facilities for packaging medicinal herbs and other organic products. Additionally, the region has potential for the exploitation of construction stone.

The planned solar power plant will be located within this open karst setting, which is sparsely populated and characterised by minimal infrastructure, yet valued for its traditional land use, cultural features, and ecological significance.

5.14.2 Landscape Characteristics of the Project Area – subsites and substation

According to the Mapping and Typology of Landscapes of Montenegro[21], the Rudine area is located within the Karst region of Montenegro. This region is characterised by thick layers of carbonate rocks, predominantly limestone, with strongly developed karst erosion, poor soil cover, and limited water availability. The geomorphological and climatic conditions of this karst plateau shape the ecological sensitivity and land use potential of the project area.

The deep karst surface generally has a thin and fragmented soil cover, with fertile land occurring mostly at the bottoms of dolines, sinkholes, and valleys, or on isolated dolomitic plateaus. As a result, agricultural land is patchy and often marginal. The karst region is considered ecologically sensitive, owing to its limestone and limestone–dolomite substrate, degraded and fragile forest and grassland ecosystems, and pronounced erosion processes driven by high rainfall.

The landscape of Rudine is defined by a mosaic of open grasslands, scattered forest patches, rocky plateaus, and karst depressions, creating a visually diverse but ecologically fragile environment. The presence of anthropogenic features, such as cisterns (bistjerne), dry-stone walls, and extensive pastures, reflects long-standing adaptation to harsh natural conditions.

At the regional level, based on the Mapping and Typology of Landscapes of Montenegro, the project site belongs to Section 3.4 – Mountainous areas of the Nikšić region. At the local level, the site is categorised

[21] https://www.gov.me/en/documents/bc1290b5-2461-479e-9206-c4a505ef28f3

under Section 3.4.2 – Mountainous areas of Rudine and Banjani. See **Error! Reference source not found.**.

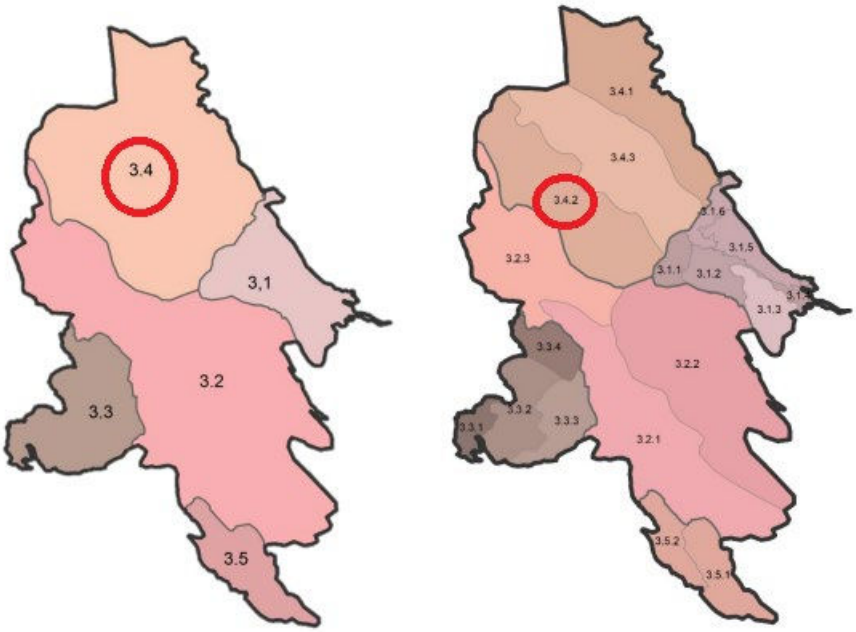


Figure 5-12: Regional (left) and local (right) level of landscape characteristics

The landscape of the project location is shown in the images below.

Figure 5-13: The project area

Figure 5-14: The project area

Figure 5-15: The project area

5.14.3 Land Use Patterns OHL

To enable secure and reliable evacuation of generated electricity, the reconstruction of an approximately 10 km long section of the 110 kV overhead transmission line (OHL) Nikšić-Bileća between Rudine and the Vilusi 110/35 kV substation is planned. The reconstruction will generally follow the existing alignment of the transmission line corridor (see Figure 3-1), which crosses the rural karst landscape between Rudine and Vilusi, parallel to the M6 main road. The works will include replacement of towers and conductors, and potential adjustments to tower foundations to meet current technical standards and grid requirements. The exact connection point and technical details will be defined in the Main Design, which is currently under preparation. The reconstruction of this line is planned within the CGES Transmission Network Development Plan for the period 2023–2032, which provides the strategic and technical framework for upgrading and reinforcing key sections of the national grid.

5.14.4 Landscape Characteristics of the Project Area – OHL

According to the Mapping and Typology of Landscapes of Montenegro[22], the Vilusi area is also located within the Karst region of Montenegro.

The landscape of Vilusi area is defined by a mosaic of open grasslands and scattered forest patches, less rocky plateaus and karst depressions, creating a visually attractive natural environment. The village of Vilusi is the centre of the region, with a gentle appearance that has always been attractive and well-populated. The M6 main road passes through the village, the road to Boka and Bileća. There are two industrial plants, a local office, a school, a post office, a cultural centre, shopping and catering establishments in the village of Vilusi.

6 Socio-economic baseline

6.1 Introduction

The following baseline covers the social development tendency as well as the social features of the impacted cadaster municipalities.

6.2 Demographics

According to the results of the 2011 census, the Municipality of Nikšić had 72,824 inhabitants, representing 11.6% of the total population of Montenegro. Of this number, 57,278 lived in the urban area, 63,280 in the Nikšić Field including the town, 3,731 in Župa Nikšićka, 424 in the southern zone with Bogetići, 1,638 in the western zone, and 485 in the northern zone.

Between 1991 and 2003, the population of the municipality increased by 1,404, while in the following census period it decreased by 2,458. During the same periods, the urban population increased by 2,563 and then decreased by 1,242. In the observed period, only the rural settlements in the Nikšić Field showed continuous population growth—500 in the first period and a much smaller increase of 55 in the second—mainly due to the growth of three settlements: Miločani, Ozrinići, and Rastovac. Other parts of the municipality experienced continuous population decline, with the intensity of depopulation accelerating in the most recent inter-census period.

The following diagram illustrates that the population of the Municipality of Nikšić has been in continuous decline from 2011 to 2023.

[22] https://www.gov.me/en/documents/bc1290b5-2461-479e-9206-c4a505ef28f3

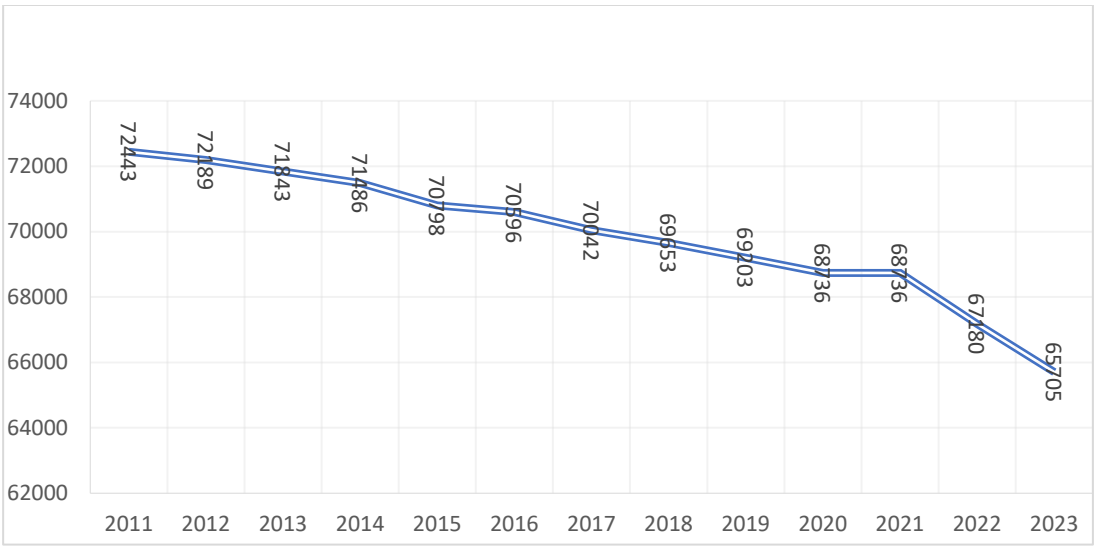


Figure 6-1: Number of inhabitants in the municipality of Nikšić[23]

The population density is 36.45 inhabitants/km², which classifies the Municipality of Nikšić among municipalities with a medium population density. This figure is 1.23 times lower than the national average density of Montenegro, which amounts to 44.8 inhabitants/km².

The natural population growth rate in the Municipality of Nikšić has been in constant decline, as shown in the following Table below.

Table 6-1: Natural population growth in the Municipality of Nikšić (2017–2023)

Year	Birth rate (‰)	Mortality rate (‰)	Natural increase (‰)
2017	9.2	12.1	-2.9
2018	8.8	12.7	-3.9
2019	8.4	12.5	-4.1
2020	7.6	13.4	-5.8
2021	7.2	15.1	-7.9
2022	6.9	14.8	-7.9
2023	~7.0	~12.6	-5.6 (est.)

According to the results of the 2023 Census, the cadastral municipality (KO) Rudine has a total population of 18 inhabitants, distributed across 10 households and 28 dwellings. This reflects the broader trend of extreme depopulation and ageing in rural areas of Nikšić municipality, where settlements are sparsely populated and characterised by limited economic activity and underutilised housing stock.

[23] https://www.monstat.org/cg/page.php?id=222&pageid=57

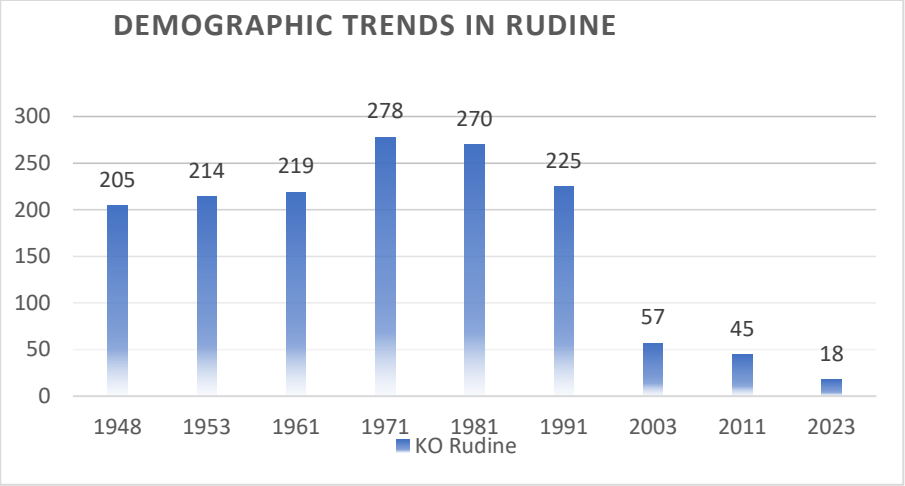


Figure 6-2: Demographic trends in LC Rudine

According to the results of the 2023 Census, the cadastral municipality (KO) Vilusi has a total population of 130 inhabitants. This also reflects the broader trend od depopulation.

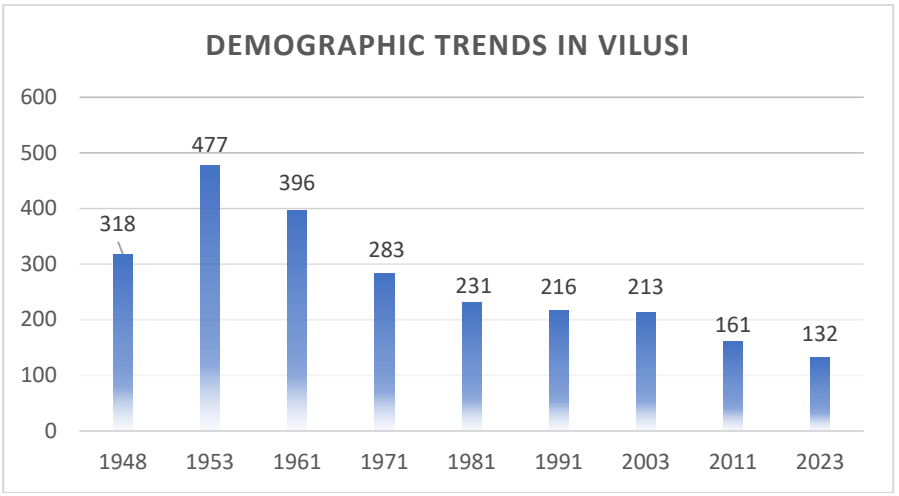


Figure 6-3: Demographic trends in LC Vilusi

6.3 Economy and Employment

The wider Rudine area is predominantly rural and sparsely populated, which is characteristic of many hinterland areas in Montenegro. Settlements in Rudine consist mostly of small clusters of households, while the nearby settlement of Vilusi represents the nearest local centre with a relatively higher population density and access to basic services. The demographic structure is unfavourable, with a high share of elderly residents and a continuing trend of out-migration of younger population towards Nikšić, coastal municipalities and abroad.

Economic activity in the Project area is limited. The majority of residents rely on pensions as their primary source of income, supplemented by small-scale agriculture for household consumption. Agricultural activities are generally extensive rather than intensive and include livestock grazing, hay production and limited crop farming, largely dependent on natural conditions and traditional practices. Commercial agricultural production is minimal, and no larger agribusiness or processing facilities are present in the immediate Project area.

Employment opportunities within the Rudine area are scarce. Most economically active residents commute to Nikšić or Vilusi for employment, mainly in public services, trade, construction, transport, and small-scale private businesses. Seasonal and informal employment is also present, particularly in agriculture and construction. Overall unemployment and economic inactivity remain significant challenges at the local level, particularly among younger age groups.

In this context, the Rudine Solar Power Plant Project represents a potential source of temporary employment during the construction phase, primarily through demand for construction workers, equipment operators, transport services and auxiliary services. Although long-term employment opportunities during the operational phase will be limited due to the nature of photovoltaic projects, the Project may still contribute positively through indirect economic benefits, use of local suppliers and service providers, and increased local fiscal revenues.

No major adverse impacts on existing economic activities or employment patterns are anticipated as a result of the Project, given the limited current economic use of the land and the absence of intensive agricultural or commercial activities within the Project footprint.

6.4 Use of land and natural resources

According to the 2024 Census of Agriculture, the Municipality of Nikšić has 3,187 agricultural holdings and over 15,600 hectares of utilised agricultural land. The overwhelming majority of this land consists of meadows and pastures (over 90%), confirming the traditional importance of livestock farming in the region.

Cattle and sheep breeding dominate the livestock sector, with 11,520 cattle (including nearly 7,000 dairy cows) and 26,755 sheep, of which 18,830 are breeding sheep. Goat farming is also notable, with close to 8,800 animals, while pig farming is modest in comparison, with just over 10,000 pigs. Poultry production is significant, counting more than 613,000 birds, primarily laying hens. Beekeeping is also present, with nearly 13,000 beehives recorded.

Overall, the data indicate that agriculture in Nikšić is predominantly extensive and livestock-oriented, with limited areas of arable land, orchards, and vineyards. This reflects both the karstic geography and socio-economic conditions of the Rudine plateau and surrounding rural zones.

Table 6-2: Agricultural resources in the Municipality of Nikšić (2024 Census of Agriculture)

Indicator	Value
Number of agricultural holdings	3,187
Utilised agricultural land (total)	15,653.2 ha
- Meadows and pastures	14,207.5 ha
- Arable land	1,087.4 ha
- Orchards (plantations + extensive)	261.6 ha
- Vineyards	12.9 ha
Number of livestock units (LU)	24,254.4
Cattle (total)	11,520
- of which dairy cows	6,976
Sheep (total)	26,755
- of which breeding sheep	18,830
Goats (total)	8,778
- of which breeding goats	5,710
Pigs (total)	10,308
- of which breeding sows	654
Poultry (total)	613,263
- of which laying hens	588,617
Beehives	12,971

During the site visit to the planned SE Rudine location, carried out on 20 October 2024, interviews were conducted with local residents at two locations. The first location, at a distance of about 25 m from the project site, consists of a cluster of houses, auxiliary buildings, and barns to the east of the project area. The second location refers to households situated approximately 180 m to the west of the project boundary.

At the first location, an interview was conducted with D.P., 68 years old, the owner of a property with a building located 55 m from the project boundary. He does not reside permanently at this property but lives in Kličevo, visiting Rudine occasionally to maintain his land. None of the other houses at this location are permanently inhabited; the owners only occasionally visit their properties, which in the meantime have become neglected. On two nearby plots, onions and potatoes are cultivated for personal use. This location, which once had dozens of inhabitants, is now depopulated, with no permanent residents, as confirmed by the most recent Census of Montenegro.

At the second location, an interview was carried out with D.P. and his brother, both between 60 and 70 years old, who are permanently settled there. They make their livelihood through agricultural activities and part-time work in the town of Nikšić. This household keeps two cows and several chickens.

None of the residents interviewed expressed opposition to the project or voiced any negative opinions.

A survey of the entire project area did not identify any other households within a 200 m corridor from the project boundaries.

6.5 Community organization and local institutions

The local community has historically played an important role in providing basic services and support to the population of Vilusi and the surrounding rural settlements, including the wider Rudine area. Community-level organization has enabled coordination of local needs related to infrastructure, access roads, public services, and communication with municipal authorities.

Due to its proximity to the municipal centre of Nikšić and its favourable geographic position, Vilusi has the potential to further strengthen its role as a local service centre during the planned development period. These advantages may be utilised to support the revitalisation of the settlement and the gradual improvement of living conditions in line with modern standards of local community development. This includes better access to public services, improved communal infrastructure, and strengthened links between residents, local institutions, and municipal authorities.

Local institutions in the project area primarily operate at the municipal level, with the Municipality of Nikšić responsible for public administration, spatial planning, social services, education, healthcare, and local infrastructure. Community affairs are typically addressed through municipal structures rather than through fully decentralised local bodies. Nevertheless, informal networks, local representatives, and community leaders continue to play an important role in communication between residents and authorities, particularly in sparsely populated rural areas such as Rudine.

6.6 Access to Education, Social Services and Infrastructure

The project area is located approximately 20 km southwest of the town of Nikšić, within a sparsely populated karst plateau. The nearest settlements are scattered rural households in the Rudine area and along the M6 road corridor towards Vilusi. The road network, consisting of main and regional roads, is underdeveloped and has a number of limiting factors, such as the age of the road network.

In the Municipality of Nikšić population use public transport, their own transportation or taxi services to ensure mobility and access some of their basic human needs (education, healthcare services etc.). The system of public city and suburban traffic in Nikšić is organized on the lines established by the Plan of lines in city and suburban linear road traffic in the territory of the Municipality of Nikšić. The system of interlocal

and international scheduled traffic is organized according to the competences of the Directorate for Transport. Intercity and international traffic takes place from the Nikšić bus station, and passengers are picked up/dropped off along stops on main and regional roads.

Education facilities

In the project area, the number of children is very low. Mostly, education institutions are located in the town of Nikšić. In the Municipality of Nikšić there are:

- 1 kindergarten with 18 educational units and 3 educational groups at elementary schools;
- 11 elementary schools and 5 regional units within three parent schools;
- 4 high schools;
- Elementary and High School for music education;
- Two higher education institutions: Faculty of Philosophy and Faculty of Sports and Physical Education;
- Dormitory of pupils and students "Braća Vučinić".[24]

There is an elementary school in the village of Vilusi.

Health care facilities

There are healthcare facilities in the town of Nikšić. Healthcare facilities operating within the PHI Health Center and PHI General Hospital are located within the central city zone, in areas for healthcare, and outpatient clinics are located in its surroundings. The facilities of the PHI Special Hospital for Pulmonary Diseases are in the northern peripheral zone, and specialist private institutions are in the central city zone, in areas for housing and central activities. In recent years, a significant number of private healthcare facilities have been opened, which greatly supplement the diagnostic treatment of patients. There are 16 registered private healthcare institutions in the field of dentistry and 9 private institutions in other fields (internal medicine, ultrasound diagnostics, pediatrics, gynecology, etc.) in the municipality. [25]

There are not healthcare facilities in the Rudine and Vilusi area. The local population uses healthcare facilities in the territory of the Municipality of Nikšić as well as the Clinical Centre of Montenegro in the city of Podgorica.

Other services

There are two industrial plants, a local office, a post office, a cultural centre, shopping and catering establishments in the village of Vilusi. [26]

6.7 Community Health, Safety and Security

During the site visit to the planned SE Rudine location, carried out on 20 October 2024, interviews were conducted with local residents at two locations. The first location, at a distance of about 25 m from the project site, consists of a cluster of houses, auxiliary buildings, and barns to the east of the project area. The second location refers to households situated approximately 180 m to the west of the project boundary.

Citizens were primarily interested in whether and how the Solar Power Plant will affect the environment and the quality of life in the settlement. After the explanation and description of the basic features of the mechanism of the solar power plant and arguments that the project will in no way adversely impact the

[24] *Amendments to the Spatial-Urban Plan of the Municipality of Nikšić, Official Gazette of Montenegro 72/24*

[25] *Amendments to the Spatial-Urban Plan of the Municipality of Nikšić, Official Gazette of Montenegro 72/24*

[26] *Amendments to the Spatial-Urban Plan of the Municipality of Nikšić, Official Gazette of Montenegro 72/24*

environment and threaten their agricultural production and property, the citizens accepted the project and nurture a positive attitude.

None of the residents interviewed expressed opposition to the project or voiced any negative opinions.

After meaningful engagement with the impacted local communities, the initial health and safety concerns related to development of the Project were successfully managed. The efforts of the representatives of the investor to disseminate relevant information about the project and the risks associated with the construction and operation, have resulted in a better understanding and ultimately acceptance of the Project. There are no concerns of citizens in relation to the negative consequences of the construction and functioning of the Rudine PV Project, its impact on the quality of the environment, the conditions of agricultural production and the property of households.

6.8 Poverty and Vulnerability

Specific, disaggregated data on poverty levels and social vulnerability for the settlements of Vilusi and Rudine are not available in official statistics. Therefore, the assessment is based on data and strategic documents at the municipal level (Municipality of Nikšić), complemented by field observations and stakeholder consultations undertaken during project preparation.

The Municipality of Nikšić includes both urban and extensive rural areas, with rural settlements generally characterised by population decline, ageing demographics, limited employment opportunities and reduced access to services. Vilusi and Rudine follow this general rural pattern. The population is sparse, with a high proportion of elderly residents and pensioners, while younger households are less represented due to long-term out-migration.

According to the Local Plan for the Improvement of Social Inclusion and Development of Local Social Services (2022–2026), vulnerable groups at the municipal level primarily include:

- elderly persons,
- persons with disabilities and their families,
- children and youth at risk,
- women exposed to domestic and gender-based violence, and
- Roma and Egyptian communities.

Although Roma and Egyptian populations are not recorded in Vilusi and Rudine, rural households in these areas may still face economic vulnerability, particularly due to dependence on pensions, low and irregular income, limited agricultural productivity, and reduced access to employment and public services.

National statistics show that Montenegro has a relatively high risk of poverty or social exclusion, particularly among children and young people, while older persons often rely on pensions and social transfers. In rural areas, vulnerability is not always linked to extreme poverty but rather to social isolation, limited mobility, and restricted access to health, social and support services.

Field consultations and interviews conducted during the preparation of the EIA and scoping activities did not identify cases of extreme poverty directly linked to the Project Area. Local residents did not express concerns related to land tenure insecurity, displacement, or loss of livelihoods. Land acquisition for the Project was carried out on a voluntary, market-based basis, and there were no indications of disproportionate impacts on vulnerable households.

Nevertheless, given the demographic structure of the area, elderly residents, single-person households and households with limited income sources are considered potentially vulnerable. These groups will therefore be given particular attention during Project implementation through:

- ongoing stakeholder engagement,
- accessible grievance mechanisms, and
- monitoring of potential indirect social impacts during construction and operation.

No adverse impacts on poverty levels or vulnerability are anticipated as a result of the Project, provided that the mitigation and engagement measures defined in the ESIA and SEP are effectively implemented

A survey of the project area identified a few households within a 200 m corridor from the project boundaries. The owners of households are between 60 and 70 years old.

6.9 Supply chain

Supply chain risks may represent a relevant environmental, social and governance (ESG) consideration for the Rudine Solar Power Plant (SPP) Project, particularly during the construction phase, when demand for construction materials, equipment and services is highest. Such risks may include human rights issues, labour standards, occupational health and safety, environmental management practices, and ethical conduct of suppliers and contractors, especially where supply chains extend beyond the local or national context.

In recognition of these potential risks, Qair Rudine d.o.o. will apply a responsible procurement approach designed to minimise indirect environmental and social impacts associated with its supply chain. The Project will prioritise suppliers and contractors who demonstrate compliance with applicable national legislation, international standards and EBRD Performance Requirements.

Minimum Requirements for Suppliers and Contractors

All major suppliers, contractors and subcontractors engaged for the Project will be required, at a minimum, to demonstrate the following:

- Technical Capacity
- Proven technical capability and experience relevant to the scope of works;
- Reference list of similar projects implemented within the last five years;
- Possession of all required licenses, permits and professional accreditations in accordance with Montenegrin legislation;
- Adequate workforce and financial capacity to deliver contracted services safely and effectively.

Environmental Management

- Compliance with national environmental legislation and permitting requirements;
- Procedures and practices related to environmental protection, including waste management, hazardous materials handling, water and energy use, air emissions, noise, vibration control and spill prevention;
- Where applicable, the existence of an environmental management system (formal or informal) proportionate to the scale of activity.

Social Performance and Human Rights

- Commitment to internationally recognised human rights principles, including those reflected in the UN Guiding Principles on Business and Human Rights;
- Explicit prohibition of child labour, forced labour and any form of modern slavery;

- Respect for workers' rights, including freedom of association and fair working conditions;
- Zero tolerance for discrimination, harassment and gender-based violence (GBV), including sexual exploitation and abuse/sexual harassment (SEA/SH).

Occupational Health and Safety

Adoption of occupational health and safety measures consistent with national legislation and good international industry practice;

Availability of adequate training, work instructions and personal protective equipment (PPE);

Implementation of safety procedures to prevent accidents, injuries and unsafe working conditions.

Ethics and Integrity

- Commitment to ethical business practices, including prohibition of bribery, corruption, fraud and facilitation payments;
- Transparent contractual relationships and compliance with applicable laws.

Human Resource Management

- Compliance with labour legislation regarding employment conditions, wages, working hours and social contributions;
- Prohibition of recruitment fees charged to workers and retention of personal identification documents;
- Minimum age of employment aligned with national legislation and international standards (no under 15 years for non-hazardous work, and no under 18 years for hazardous activities).

Supply Chain Oversight

Qair Rudine d.o.o. will ensure that contractual arrangements with contractors and subcontractors include provisions requiring compliance with environmental, social, health and safety (ESHS) requirements applicable to the Project. Monitoring of contractor performance will be carried out through supervision activities during the construction phase.

Where equipment or technologies are sourced from international markets, particular attention will be given to identifying potential supply chain risks. Where necessary, additional due diligence measures may be applied proportionate to the level of risk identified.

6.10 Cultural Heritage

The cultural landscape represents a part of the environment where human activities have created recognizable forms that testify to history, culture, and heritage in harmony with nature. As such, it should be identified, preserved, and protected. Spatial planning documents have recognised areas of exceptional value for maintaining the cultural landscape identity of the municipality. These include: Bedem Fortress, Carev Bridge, Roman Bridge, Church of St. Elijah on Planik, Golo Brdo, Monastery of St. John the Baptist (Jovan Do), Kosijerevo Monastery, and Monastery of St. Luke in Župa.

Neither within the immediate vicinity nor in the wider area surrounding the planned Rudine SPP site are any of the above-mentioned cultural and historical assets located.

7 Impact Assessment and Mitigation

7.1 Introduction

The present chapter identifies and assesses the environmental and socioeconomic impacts and risks of the Project and provides a description of the foreseen measures to address them.

Significance of the residual impacts and risks is assessed taking into account the implementation of mitigation measures. These are either built into the project design, i.e. basically by the routing and siting efforts to avoid or minimise conflicts with the natural and socioeconomic (including cultural heritage) environment or are in addition identified as part of the assessment. The latter measures shall need to be detailed and implemented in the final design of the Project.

An overview of the technical scope of the ESIA (i.e. the resources/receptors to be assessed) is presented in Table 7-1. Further information on the resources/receptors potentially affected by the Project activities is provided in Chapters 5 and 6 of the ESIA.

Table 7-1: Technical scope of the ESIA

Environment	Resource/Receptor
Physical Environment	Ambient Air Quality and Climate
	Noise
	Hydrology and Water Resources (Groundwater and Surface Water)
	Geology and Soil
	Landscape
Biological Environment	Ecology (*incl. Habitat, Flora, Fauna*)
	Protected Areas
Socioeconomic Environment	Economy and Employment
	Land and Livelihoods
	Traffic and Transport
	Cultural Heritage

The spatial scope of the ESIA depends on the respective resource/receptor. For some types of impacts, the spatial scope does not extend beyond the construction corridor while for others (such as ambient air quality) it may well extend several kilometres from the likely source of pollution / nuisance.

The temporal scope of the ESIA is restricted to the three main phases of the Project:

- Construction
- Operation and Maintenance
- Decommissioning

The duration of activities within each of these main phases can vary considerably and each has its own potential environmental and socioeconomic impacts and risks. Construction for all project components will last several months, and for some components, such as the transmission line, will only last a few weeks in each location, depending on the stage of activities. Operation, in contrast, covers a long period. The design lifetime of the PV plant is 25-30 years it could actually be used much longer. Decommissioning will take place in the future; therefore, impacts of this phase are somewhat uncertain at this stage.

As previously mentioned, the assessment of impacts will be resource/receptor led. Each topic in the following is presented in a systematic manner detailing:

Predicted impacts – the sensitivity of the affected resource/receptor and the magnitude of the potential impact/risk, prior to the implementation of any mitigation measure;

Mitigation measures to address the impact / risk – the key measures adopted, and

Significance of residual impacts – the significance of any remaining impacts after the incorporation of mitigation, whether not significant, minor, moderate or major.

The most important and effective mitigation measure is avoidance of sensitive resources/receptors altogether through an informed project siting process. Key sensitivities such as valuable ecological features, settlements and cultural heritage resources can be avoided by the Project footprint as far as possible, minimizing the need for mitigation.

Impacts assessed in the following sections are therefore those that could not be avoided or mitigated further through project design and which require complementary mitigation measures.

7.2 Methodology for Impact Assessment

The significance of potential impacts was assessed using the risk assessment methodology that considers impact magnitude and sensitivity of receptors described below.

7.2.1 Magnitude of Impacts

The potential implications of the Project have been categorized as major, moderate or minor based on consideration of the parameters such as i) duration of the effect; ii) spatial extent of the impact; iii) reversibility; iv) likelihood; and v) legal standards and established professional criteria.

Where it was possible, the magnitude of each potential impact of the Project has been identified according to the categories outlined in Table 7-2.

Table 7-2: Parameters to determine magnitude of impacts

Parameter	Major	Moderate	Minor
Duration of potential impact	Long term (beyond the project life)	Medium Term (within the project life span)	Limited to construction period
Spatial extent of the potential impact	Widespread far beyond project boundaries	Beyond next project components, site boundaries or local area	Within project boundary
Reversibility of potential impacts	Potential impact is effectively permanent, requiring considerable intervention to return to baseline	Environmental or social parameter needs a year or so with some responses to come back to baseline	Baseline returns naturally or with limited response within a few months
Legal standards and established professional criteria	Breaches national standards and or international guidelines/obligations whichever is more stringent	Complies marginally with national standards and international lender requirements whichever is more stringent	Parameter is well below national standard and international lender requirements whichever is more stringent
Likelihood of potential impacts occurring	Occurs under typical operating or construction	Happens under worst case (negative consequences)	Occurs under abnormal, exceptional or emergency

Parameter	Major	Moderate	Minor
	conditions (Certain)	or best case (positive impact) working conditions (Likely)	conditions (occasional)

7.2.2 Sensitivity of Receptor

The sensitivity of a receptor has been determined based on a review of the population (including proximity/numbers/vulnerability) and the presence of features on the site or the surrounding area. For the most important potential impacts of the project, sensitivity of the related receptor was determined using the criteria outlined in Table 7-3.

Table 7-3: Criterial for determining sensitivity of receptors

Sensitivity Determination	Definition
Severe	Vulnerable receptor with little or no ability to absorb proposed changes or limited opportunities for mitigation.
Mild	Vulnerable receptor with some ability to absorb proposed changes or moderate opportunities for mitigation
Low	Receptor with good ability to absorb proposed changes or/and excellent opportunities for mitigation

7.2.3 Assigning Significance of Impacts

Following the assessment of impact magnitude and determining the quality and sensitivity of the receiving environment or potential receptor, the significance of each potential impact was established using the impact significance matrix shown in Table 7-4.

Table 7-4: Assessment of Impact Significance

Magnitude of Impact	Sensitivity of Receptors		
	Severe	Mild	Low
Major	High	High	Medium
Moderate	High	Medium	Minor
Minor	Medium	Minor	Minor

7.3 Hazard Risks Assessment

A hazard risk assessment is a critical examination of health and safety hazards at a construction site and operation and maintenance (O/M) work. Performing regular hazard risks assessments can help construction and O/M stakeholders comply with occupational health and safety (OHS) regulations. Hazard risks assessments can help OHS teams implement corrective measures to protect workers from health and safety threats during construction and operation stages.

7.3.1 Hazard Risks Assessment Codes

The principle behind the Hazard Risks Assessment System and the assignment of Hazard Risks Assessment Codes (HRACs) is to identify and mitigate workplace hazards. HRACs are based on the hazard severity, probability of occurrence, and number of people exposed or potentially adversely affected in the event of an accident. While all hazards should be resolved as soon as possible, the Hazard Risks Assessment System is a safety risk ranking method to assist in making informed decisions concerning

hazard control while providing decision makers with a consistent and defensible approach for prioritizing safety hazard abatement efforts based on available resources and with consideration towards competing demands and priorities.

7.3.2 Likelihood and Consequence of Hazards

HRACs require assigning a value for both the likelihood / probability of an outcome occurring, and the consequence or severity of a potential outcome. Based on these assigned values, a matrix is used to place the specific hazard within a specific location of the matrix. This location can then be used to determine an HRAC number for that hazard activity.

The Likelihood of a hazard is classified as per the table below.

Table 7-5: Likelihood classification for hazards

Likelihood	Definition
Frequent	Immediate danger to the health and safety of the public, staff, resources, or property; occurs frequently or continuously.
Likely	Probably will occur in time if not corrected, or probably will occur one or more times during the life of the system.
Occasional	Possible to occur in time if not corrected.
Rarely	Unlikely to occur, may assume exposure will not occur.

The Consequence or severity of a hazard occurring is classified as per the table below.

Table 7-6: Consequence classification for hazards

Consequence	Definition
Catastrophic/Fatal	Imminent and immediate danger of death.
Critical/Major	Significant injury or illness diagnosed by a physician or other license professional, which involves days away from work.
Minor	Medical treatment beyond first aid
First aid	Minimal threat to human safety and health, property, or resources, but is still in violation of a standard.

7.3.3 Hazard Risks Assessment Matrix

The hazard risks assessment matrix is presented in Table 7-7.

This matrix helps the OHS team to prioritize workplace hazards by identifying them as high, serious, medium, and low. Those hazards identified as high will require the most stringent controls available as well as immediate attention. Specific workplace controls can be applied so that the associated hazards are more effectively controlled and therefore, result in a revised assessment category to a more acceptable level.

Table 7-7: Worksite hazards

Probability	Severity			
	Catastrophic	Critical/Major	Minor	Negligible
Frequent	High	High	Serious	Medium
Probable/Likely	High	Serious	Medium	Low
Occasional	Serious	Medium	Low	Low

Remote/Rare	Medium	Low	Low	Low

7.4 Ambient Air Quality and Climate

7.4.1 Overview

This section assesses the potential impacts on local air quality as a result of the Project activities, while it also discusses the climatic impacts of the Project, including Greenhouse Gas emissions.

The Project's contribution to ground level pollutant concentrations might produce changes on air quality. Air pollution may affect atmospheric properties, materials, vegetation, human health, and in general contribute to safety hazards and interfere with the enjoyment of life and property.

Key potential impacts on ambient air quality during the Project are the following:

Table 7-8: Key potential impacts to Ambient Air Quality

Construction Phase	Operations Phase	Decommissioning Phase
• Temporary impacts on local air quality due to atmospheric emissions during Project construction from earthworks, construction machinery and vehicle movements. Main pollutants emitted will be particulate matter and dust.	• Vehicle movements associated with maintenance shall be minimal, therefore no key potential impacts foreseen. • Ozone and NOx emissions due to the Corona effect are produced in tiny quantities, therefore no key potential impacts foreseen • Potential emissions of SF_6 from substations	• Temporary impacts on local air quality mainly related to substation decommissioning and vehicle movements. Main pollutants emitted will be particulate matter and dust.

7.4.2 Construction phase

7.4.2.1 Potential impacts

During Project construction, the potential impacts on local air quality are related to the following activities:

- Temporary dust emissions from earthworks, excavations, vehicle movement, stockpiles, unpaved surfaces, etc. at the PV power plant and along the transmission line route and substation area, access roads, yards and camps during Project construction.
- Temporary emissions of exhaust gases into the atmosphere from vehicles involved in Project construction (i.e. excavators, bulldozers, trucks, cars).

7.4.2.2 Dust and PM Emissions

During the construction of the proposed Rudine PV power plant, OHL and substation, there will be site preparation and construction activities (removal of vegetation, levelling works, digging for foundations, trenching, civil works, etc.), all of which have the potential to generate dust. Such emissions can be divided into dust and particulate matter (PM10).

Dust consists of large airborne particles of material, which are resident in the atmosphere for short time after release, as they are heavy enough to fall out of suspension in the air relatively quickly. Therefore, effects of these emissions will be localised and they do not cause long-term or wide spread changes to local air quality but their deposition on nearby properties causes soiling and may therefore result in complaints of nuisance, which is usually temporary.

Depending on wind speed and turbulence during construction, it is likely that the majority of dust will be deposited in the area immediately surrounding the source (up to 200 m away). Therefore, properties within 200 meters of the construction sites are most likely to experience nuisance without appropriate mitigation measures.

The main sources of dust during the construction and dismantling activities include:

- transport routes, construction vehicle movements and other project related traffic;
- soil excavation, handling, storage, stockpiling, spillage and disposal;
- site preparation and restoration after completion;
- internal and external construction works on the substation.

The majority of the dust emissions are likely to occur during the working hours of construction activity. However, in the instance of exposed soil produced from certain earthwork activities, there is potential for dust generation to occur 24 hours per day.

Particulate matter (suspended particles), is released during disturbance of aggregate material in the same manner as dust. However, it is much smaller in size (typically less than 10 micrometres) and it remains suspended in the atmosphere for a longer period and can be transported over a wider area than dust by wind. It is small enough to be drawn into the lung during breathing, which could cause an adverse reaction in sensitive members of the public. As a result of this potential impact on health, a limit value for PM10 is defined in the Montenegrin legislation on air quality.

Typical sources of PM10 during the construction phase are similar in nature to those for dust. Particulate matter is also released from the running engines of site plant, such as compressors, generators, etc. As the magnitude of the PM10 emissions is relatively small, any adverse effects resulting from them are likely to be relatively short-term with negligible effects outside the boundaries of the construction sites.

The magnitude of the impact at receptors in the project area is considered moderate under not favourable climatic conditions, i.e. low precipitation and wind speed > 3m/sec blowing towards the receptor.

The sensitivity of nearby receptors is considered mild, given the rural character of the area and the limited number of sensitive receptors in the immediate vicinity. Taking into account the temporary nature of emissions, their localised extent and the implementation of standard dust suppression measures, the residual impact significance is assessed as minor.

7.4.2.3 Emissions from Vehicles

Construction traffic associated with the proposed project will contribute to existing traffic levels on the surrounding road network. The main pollutants of concern associated with road traffic are NO_2, PM10, CO and C_6H_6. Of these pollutants, NO2 and PM10 are the emissions most likely to result in exceeding of the relevant air quality standards or objectives.

The greatest potential for impacts on air quality from traffic associated with this phase of the proposed Project would be in the areas immediately adjacent to the principal means of access for construction traffic. In construction zones, the dust generated by vehicle movements and local air pollutant emissions from vehicles may be temporarily elevated during the busiest periods of construction activity.

Without mitigation measures, air quality impacts resulting from transportation and vehicle use are expected to be **local in spatial extent**, **short-term in duration** and **reversible**, with a **minor to moderate magnitude** depending on traffic intensity and prevailing meteorological conditions.

Given the predominantly rural character of the Project area and the limited number of sensitive receptors in the vicinity of access routes, the **sensitivity of receptors is considered medium**. With the

implementation of standard mitigation measures, including traffic management, speed limitation on unpaved roads and regular surface wetting where required, the **residual impact significance is assessed as minor**.

7.4.2.4 Mitigation Measures

The most effective way to manage and prevent dust and particulate emissions is through effective control of the potential sources. Specific mitigation measures designed to ensure that emissions from these sources are minimized are listed below:

- Planning of activities to minimise the use of vehicles and machinery, limitation of deliveries to full capacity loads, scheduling and restricting personnel movements to minimise journeys, minimisation of supply distances (if and where possible), and limitation of driving on existing tracks as much as possible;
- Open excavation areas shall be minimised where possible;
- Stockpiling shall be minimised by proper coordination of earthworks and excavation activities (excavation, grading, compacting, etc.);
- Wet suppression which includes watering, spraying dusty surfaces, in case of need, especially in dry weather at least twice a day (morning and afternoon);
- Temporary termination or restriction of construction works if intensive dust emission occurs, while mitigation measures are put in place.
- All construction machinery and equipment shall be maintained in good working order and not left running when not in use;
- There shall be no burning of any material anywhere on construction sites;
- Drivers shall be trained in careful driving, resulting to low vehicle emissions;
- Vehicle speeds shall be restricted on construction sites;
- Vehicles carrying aggregate material and workings shall be covered at all times.
- Limit excavation for new tower foundations to the minimum footprint required by design, and backfill and compact as soon as possible to reduce exposed surfaces.
- Clean dismantled steel sections and other materials on-site before loading, and cover loads during transport to prevent dust release along haul routes.
- After dismantling and installation of new towers, regrade and restore disturbed ground surfaces (including temporary crane pads and access routes) to prevent dust emissions from bare soil.

The measures listed above are good construction practice measures and are designed to ensure that the construction activities do not generate excessive dust or particulate material release.

Implementation of such measures will ensure that no significant dust effects occur during project construction of the proposed project. Further mitigation measures shall be developed on a site-specific basis depending on the planned construction activities and their proximity to the receptors. The site-specific mitigation measures will need to ensure that properties within 200 m of the locations where earthworks are to be carried out shall not be subject to significant dust nuisance.

7.4.2.5 Residual impact

The following table summarises the residual impacts on air quality from project construction.

Table 7-9: Residual impacts to Ambient Air Quality during construction

Impact / Risk	Measure to Address the Impact / Risk	Significance of Residual Impact / Risk
Construction Phase		
Vehicle Emissions	• Maintenance of equipment and vehicles. • Training of operators and drivers • Restrict vehicle speeds on construction sites	**NOT SIGNIFICANT** • Construction traffic and machinery emissions are similar to existing traffic on rural roads. Impact should be negligible with the anticipated mitigation measures in place.
Dust emissions to sensitive receptors when precipitation is adequate and wind speed <3 m/s	• Minimize open excavation areas where possible. • Minimize stockpiling by proper coordination of earthworks and excavation activities. • Reduce dust emissions by water sprinkling measures. • Temporary terminate or • Restrict construction works if intensive dust emission occurs. • Inspect local roads regularly and clean if necessary. • Maintain all construction machinery and equipment in good working order and do not left running when not in use. • No burning of any material anywhere on construction sites	**MINOR** • Reduced risk of dust entrainment
Dust emissions to sensitive receptors when precipitation is low and wind speed >3 m/s blowing towards receptor	Same mitigation measures as above	**MODERATE** • Higher risk of dust entrainment, especially for the settlements of Rudine and Vilusi.

7.4.3 Operation and Maintenance phase

Likely impacts to ambient air from vehicles used during maintenance are diffused and will be limited, localized, and temporary. Any such impacts are considered not significant.

7.4.4 Decommissioning phase

It cannot currently be foreseen how exactly the project components will be decommissioned in a few decades from now. In case the underground cable with its proprietary technical elements is removed, similar ambient air impacts from ground works will occur as for construction.

Residual impacts will be similar in nature to those that arise during construction, but with lower magnitudes. Similar mitigation measures anticipated for the construction phase with regards to the dust generation will apply. No significant adverse air quality impacts to sensitive receivers in the vicinity are anticipated from decommissioning activities.

7.4.5 Climate-related impacts

The contribution of photovoltaic power plant electricity generation and electricity transmission infrastructure to climate change has been widely addressed in scientific literature and project-level environmental assessments. Climate-related impacts associated with the Project can be grouped into the following categories:

- Direct non-generation emissions, including:
  - greenhouse gas emissions embodied in construction materials;
  - emissions resulting from energy and fuel use during construction activities;
  - limited emissions associated with vegetation clearance and site preparation.

These emissions occur primarily during the construction phase, are temporary in nature and are relatively small in scale compared to national and sectoral greenhouse gas emissions.

- Generation-related effects, including:
  - reduction of technical losses within the power system;
  - improved reliability and stability of electricity supply;
  - expansion of transmission capacity enabling the integration and evacuation of renewable electricity;
  - indirect support to electrification and decarbonisation of energy end use.

Through these mechanisms, photovoltaic power plants and associated transmission infrastructure contribute to the displacement of fossil fuel–based electricity generation and support long-term emission reductions at the system level.

Overall, photovoltaic power plants are widely recognised as having a net positive impact on climate change mitigation. Accordingly, the Project is expected to contribute to a reduction of greenhouse gas emissions over its operational lifetime by facilitating renewable energy generation and its integration into the power system.

7.4.5.1 SF6 Emissions

In electric power systems, SF6 gas is used in medium voltage and high voltage switchgear for insulation (such as in gas-insulated switchgear and ring main units) and breaking (in circuit breakers and load break switches). Additionally, less common uses of SF6 in electric power systems include high voltage gas-insulated lines, outdoor gas-insulated instrument transformers, and other equipment.

Potential sources of SF6 emissions occur from 1) losses through poor gas handling practices during equipment installation, maintenance, and decommissioning and 2) leakage from SF6 -containing GIE. Closed-pressure equipment is the category of GIE that is the most susceptible to SF6 emissions. Emissions associated with sealed-pressure equipment mostly occur during the manufacturing process and at disposal.

Potential sources of SF6 emissions at various stages of the project could be as follows:

- Installation of equipment: While hermetically sealed-pressure switchgear is completely filled with SF6 at the factory prior to shipping, closed-pressure switchgear is partially filled with SF6 or N2 at a pressure slightly above atmospheric for shipping. It is completely filled to the required pressure when installing equipment. During the installation process of closed-pressure systems, emissions of SF6 can occur, especially if staff are not properly trained or are operating faulty refilling equipment.

- Equipment operation: As closed-pressure GIE seals wear out as a result of normal operation, gas leaks can occur in several locations, such as at the flanges, fittings, seals, or bushings, as well as from the casting. GIE can deteriorate and result in emissions of SF6 if subject to:
  - high ambient temperatures and heat produced by the current passing through the circuit breaker;
  - chemical changes resulting from arcing due to current interruptions (e.g., SF6 by-products reacting with the gasket material), if water is present to mix with by-products;
  - corrosion due to the external environment, such as salt spray from the ocean and pollution;
  - lightning, fires, storms, or other catastrophic events that can also cause sudden and severe damage to equipment. Additionally, poor maintenance, poor construction, and component failure can also cause leaks in operating GIE.

- Equipment servicing: Servicing the equipment to repair leaks and refilling to operating pressure creates opportunity for potential emissions. For example, hoses on gas filling carts can wear out and create leaks during top offs, so all equipment and equipment parts should be checked prior to use. Similarly, faulty recovery equipment can result in gas losses. Some companies routinely analyze the SF6 in serviced equipment to detect any harmful by-products, but even though safety control protocols, such as safety integrity level (SIL) or performance level d (PLd), can help to reduce the risk, this kind of analysis also releases SF6 . Even when leaking equipment is prioritized for repair or replacement, delays due to extreme weather or inability to take equipment off-line may impede timely repair and replacement.

- Storage: It is common for companies to keep a stock of SF6 cylinders; additionally, partially-filled GIE that are recently purchased and not yet installed may be stored temporarily on-site. Storage cylinders or deenergized GIE present another potential SF6 emissions source.

- Decommissioning, disposal, or recycling: All equipment, including hermetically sealed-pressure, has to be decommissioned properly to reduce emissions of SF6 . The gas must be either recycled or destroyed, either by the gas producer or a specialized service. When closed-pressure equipment is opened, SF6 can be released to the atmosphere, especially if decommissioning staff are not properly trained to handle SF6 and prevent its release. Emissions from sealed-pressure equipment can occur when staff decommissioning such equipment are not aware that it contains SF6 or that the SF6 should be recovered. This risk is greater when different service teams manage closed-pressure and sealed-pressure equipment, and only the former are trained to handle SF6 .

Available data shows that SF6 emissions from manufacturing of electrical equipment are estimated to be 12 percent of the total SF6 emissions, while installation of equipment combined with equipment operation and servicing represent 76 percent of total reported emissions. Emissions from retiring, disposing, and recycling of equipment are estimated to constitute 12 percent.

To prevent potential negative impacts which may occur from leakage of SF6 in to atmosphere following measures have to be implemented:

- Leak detection techniques identify gas leak from SF6 insulated equipment. Leak detection methods vary from simple techniques such as soap and water solutions to more sophisticated techniques such as thermal imaging cameras that visualize the source of SF6 leaks. Such cameras exploit the strong infrared absorption of SF6 to detect it. Thermal imaging cameras can detect minor, chronic leaks that are not detectable with conventional methods (i.e. soapy water or halogen leak detectors) without the to take equipment out of service. A limitation to thermal imaging is having the correct background to insure image visibility. A more cost-effective method for chronic leaks is bagging. This method takes plastic lining taped to various sections of the switchgear to trap any escaped gas. Upon waiting several hours, a user can slide the wand of a standard halogen leak detector under the plastic. All detection methods have relative advantages and disadvantages in terms of cost, outage times, and efficacy (e.g., false

positives). A number of Partners utilize an optical gas imaging camera to immediately detect small SF6 leaks.

- Monitoring programs also identify leaks and help understand the specific characteristics of company's equipment at various locations. Leak detection frequency and strategies can vary. Some companies have established leak detection teams that are equipped with such technologies as thermal imaging cameras and sniffers to identify leaks. Such teams regularly inspect switchgear with available tools. Technologies are available to provide real-time monitoring of SF6 leaks and to identify and prioritize leaking components that require the most immediate repair. For example, SMUD institutes an inspection and maintenance program that includes monthly visual inspections to check for gas pressure.

- Leak repair on identified leaks is typically handled by applying a sealing material to the component that is leaking. Leak repair should be done using new gaskets and desiccant, as well as lubricant for flanges and o-rings. Kits are usually available from the manufacturer. Equipment should always be tested before and after repairs, using proper SF6 recovery procedures and equipment. Some leak repair technology is available that uses clamps and sealant injection. This method reduces down time of the equipment, which reduces costs by avoiding loss of transmission. Leak repair requires planning ahead. Several utilities have leak prioritization plans that address worst performers first. GIE replacement can be the more effective mitigation strategy for the worst performers.

- Upgrading and replacing equipment is a successful strategy that can significantly reduce emissions. Over time, engineering design changes have reduced the amount of SF6 necessary for the operation of switchgear and increased the tightness of equipment, resulting in smaller leakage amounts and less frequent leakage over time. Low and medium voltage systems can use CO2, a vacuum, and "Clean Air" (i.e., N2 and O2) as base gases. For medium and high voltage systems, more non-gas filled and vacuum equipment is now on the market. For high-voltage systems, equipment with alternative insulating gases (including clean air as well as fluoronitrile and fluoroketone which typically use CO2 as the base gas in switchgear) is scheduled to become available in 2018 for vacuums between 72.5 kV and 145 kV. These alternatives have lower GWPs ranging from less than one to 2,100. SF6 alternatives are promising but might require some industry adaption, including new equipment and maintenance procedures that will necessitate training and adjustments to manage systems with different insulating mediums. A systematic approach to identifying and anticipating equipment replacement and repair needs can significantly reduce overall emissions.

- Proper decommissioning: At the end of life, all SF6 equipment, including hermetically sealed-pressure switchgear, should be properly decommissioned to avoid emissions. Any remaining gas should be fully extracted using recovery systems that achieve acceptable blank-off pressure (i.e., vacuum generated during the recovery process to levels of 35 Torr and lower depending on the size of the GIE). Used SF6 should be purified either on-site or off-site. Heavily arced, contaminated gas that is non-reusable can be sent to specialized incineration plants for destruction. Proper handling and disposing of non-reusable SF6 gas is important for safety reasons and can help to avoid emissions of contaminated gas. Although it might not be obvious, proper decommissioning also applies to hermetically sealed-pressure switchgear, which will eventually breakdown and release SF6 if not properly disposed.

7.4.6 Potential impacts to the project due to climate change

This section assesses the potential impacts of climate change on the Project, focusing on physical climate-related risks that may affect project components during the construction, operation and maintenance phases. The assessment follows the impact assessment methodology described in Sections 7.2.1 to 7.2.3,

taking into account the sensitivity of project components in combination with the magnitude of potential climate-related impacts. The analysis is qualitative and proportionate to the scale and nature of the Project, and is based on historical climate data for the Project area, observed climate trends in Montenegro, and generally accepted projections indicating increasing temperatures, more frequent extreme weather events and prolonged dry periods.

An increase in average and peak air temperatures may reduce the efficiency of photovoltaic modules during heatwaves and cause additional thermal stress on inverters, electrical cabinets and auxiliary equipment. For the overhead transmission line, higher ambient temperatures may lead to minor conductor expansion and increased sag; however, these effects remain within standard design tolerances. The **magnitude of this impact is assessed as moderate, while the sensitivity of receptors is considered medium**. Taking into account design-related mitigation measures, the **residual impact significance is assessed as minor**.

Although the Project area represents a predominantly water-scarce karst environment with no permanent surface watercourses, short-duration intense rainfall events may occur. Such events may result in localised surface runoff, minor erosion around foundations and temporary access constraints along unpaved access roads. **These impacts are expected to be short-term and reversibl**e. The **magnitude of potential impacts associated with extreme precipitation is assessed as minor to moderate, while the sensitivity of receptors is considered low to medium**. With appropriate drainage and erosion control measures in place, the **residual impact significance is assessed as minor**.

Prolonged dry periods and high summer temperatures increase vegetation dryness and consequently the risk of wildfires, which are a known hazard in the wider Rudine area. Wildfires could temporarily affect access roads, overhead conductors or photovoltaic structures if not adequately managed. However, vegetation management, maintenance of firebreaks and the implementation of emergency response procedures significantly reduce this risk. The magnitude of potential impacts related to droughts and wildfires is considered moderate, while receptor sensitivity is assessed as medium, resulting in a residual impact significance ranging from minor to moderate during extreme events.

Strong winds and storm events may exert mechanical stress on overhead line components and photovoltaic mounting structures. Overhead transmission infrastructure is inherently more exposed to wind loads than other project components. Nevertheless, all structures will be designed in compliance with applicable national standards and international engineering practices. The magnitude of this impact is assessed as moderate, with receptor sensitivity considered medium for the solar power plant and moderate for the overhead line. Consequently, the residual impact significance is assessed as moderate for the overhead line and minor for the solar power plant.

Snowfall in the Project area is generally limited in both frequency and duration. Occasional heavy snowfall may temporarily reduce solar electricity generation or result in minor additional loads on structures; however, it does not represent a long-term risk to project integrity. The magnitude of this impact is assessed as minor, receptor sensitivity as low, and the residual impact significance as minor.

Lightning strikes may affect electrical equipment associated with the solar power plant and the overhead transmission line. This risk is effectively mitigated through the installation of grounding systems, surge protection devices and lightning protection systems incorporated into the Project design. The magnitude of potential lightning-related impacts is assessed as moderate, the sensitivity of receptors as medium, and the residual impact significance as minor.

7.5 Noise and vibrations

7.5.1 Overview

This section assesses the potential impacts on the acoustic climate of the Project area that may arise from the Project activities.

During construction and sources of impact are related to machinery noise emissions that have an effect on the area adjacent to the working site. Noise sources in this phase will be temporary in nature and depend on the number and type of machinery used for each activity. The noisiest activities during construction will predominantly be concentrated at areas that require hammering for the earthworks. Any heavy ground works also have the potential to generate vibrations.

Table 7-10: Key potential impacts to Acoustic Environment

Construction Phase	Operations Phase	Decommissioning Phase
• Disturbance of nearby settlements from working sites (earthworks) or from transportation of equipment and machinery. • Potential for sleep disturbance; day and night-time nuisance and potential stress from construction activity noise.	• Low-level noise from the Corona effect; negligible at receptor level.	• Disturbance of nearby settlements from working sites or from transportation of equipment and machinery. • Disturbance from dismantling works and associated traffic; temporary nuisance similar to construction phase. • Potential for sleep disturbance; potential stress from decommissioning activity noise.

7.5.2 Construction phase

7.5.2.1 Potential impact

In general context, the construction and dismantling activities could be divided into a number of distinct processes. They may be described as follows:

- construction of vehicular access to PV power plant and OHL sites including substation;
- construction of towers foundations;
- PV, SS and OHL towers assembly and erection;
- attachment of the HV equipment and conductors;
- general road improvements and other similar works.

Based on available project information, there is no need for blasting during the construction process. Therefore, no noise and vibration effects associated with blasting are expected during construction activities.

Noise sources will be intermittent and will depend on the number and types of machinery used for each activity; therefore, the noise impact related to this project phase will vary throughout the day and with the different operations.

Mechanical equipment which is planned to be involved in the construction of the proposed PV project includes, but is not limited to: truck loader, excavator, hydraulic hammer and breaker, mobile crane, air compressor, dump trucks, generators, concrete pump, etc.

The table below gives an overview of the noise levels at reference distance of 16 m from the source from various machines that are most frequently used in construction. The values in the table are based on data from literature.

Table 7-11: Noise levels from construction equipment

Noise during construction	Level of noise (dB) at 16 m from the source
Compressor	81
Excavator	80
Ballast equalizer	82
Ballast tamper	83
Compactor	82
Concrete mixing	85
Pump for concrete	82
Vibrator for concrete	76
Crane	88
Mobile crane	83
Bulldozer	85
Generator	81
Machine for flattening	85
Circular saw (metal cutting)	76
Woodcutter	84
Track loader	85
Track	88

Hilly areas of the proposed project, where the population is sparse, will have extremely low background noise levels and therefore the noise from construction or transport sources would be audible over a greater distance although this would not necessarily constitute a significant effect.

This noise is reducing fast by moving away from the source. At a distance of 200 m, the anticipated construction noise is expected to be below 60 dB(A). To give an example of the anticipated noise levels by the Project, the table below presents noise levels from a number of common activities / sources.

Table 7-12: Noise level from various sources

Source / Activity	Sound level [dB (A)]
Threshold of hearing	0
Rural night-time background	20 – 40
Quiet bedroom	35
Wind farm at 350 m	35 – 45
Average home conditions	50
Car at 100 m	55
Busy general office or conversational speech	60
Vacuum cleaner at 1 m	70
Kerbside of busy road at 5 m	80

Source / Activity		Sound level [dB (A)]
Truck	at 100 m	65
	at 10 m	90
Pneumatic drill at 7m		95
Disco (1 m from speaker)		100
Jet aircraft	at 250 m	105
	at 50 m	140
Threshold of discomfort		120
Threshold of pain		130 / 140

The table below presents noise predictions for different individual construction processes based on information available in relevant literature.

Table 7-13: Noise prediction for each construction process

Distance from the source [m]	Construction of vehicular access to project location	Civil works at PV site and construction of tower foundations	Metal structures at PV site, tower assembly and erection	Electrical installations
0-50	≤76	≤77	≤68	≤70
50-100	≤69	≤70	≤62	≤63
100-200	≤62	≤63	≤56	≤56
200-400	≤55	≤56	≤50	≤48
400-600	≤51	≤52	≤46	≤44
600-800	≤48	≤49	≤43	≤41
800-1000	≤46	≤46	≤41	≤39

The Montenegrin legislation assigns limit values to the noise emitted depending on the type of the receptor and the time of the day.

Table 7-14: Limit values of noise as per Montenegrin legislation

Zone	Area type	Level of noise expressed in dB(A)	
		Ld and Le	Ln
1	Areas for recreation, hospital zones, cultural localities, big park areas	50	40
2	Touristic area, camps, school zones	50	45
3	Residential zones	55	45
4	Combined residential – commercial areas, residential – trading areas, playgrounds	60	50
5	City centres, craftsmen and trade zones, zones along roads, main roads and highways	65	55
6	Industrial, storage and service areas and terminals for transport without residential buildings	Noise values at the borders of these noise zones should not excess limit values for the neighbouring zone	

- Ld – day (period from 07:00 to 19:00)
- Le – evening (period from 19:00 to 23:00)

- Ln – night (period from 23:00 to 07:00)

The predictions of Table 7-12 indicate that a wide area is potentially affected by the construction noise, although the noise effects predicted at any location are unlikely to be present at a consistent level throughout the entire construction period due to the discontinued nature of construction activities in terms of locations (such as foundation at tower locations).

This is also particularly true of 'linear' activities such as access road upgrading, and the attachment of the conductor where relatively high noise levels could potentially occur in the immediate vicinity of any works, but with noise levels soon returning to normal as the work moves on.

Given the analysis above, the noise impacts at sensitive receptors closer than 300 m from the noise source are considered **moderate**. Noise impacts to receptors further than 300 m from the noise sources are considered **minor.**

Noise-sensitive receptors in the Project area mainly include residential buildings and occasional agricultural dwellings located along access roads and in the vicinity of certain construction sites. Due to the predominantly rural character of the area, low background noise levels and limited number of permanently exposed receptors, the **sensitivity of receptors is assessed as medium**. Taking into account the temporary and intermittent nature of construction activities, compliance with applicable noise limits and the implementation of standard mitigation measures, **the residual impact significance is assessed as moderate** for receptors located within 300 m of construction activities **and minor** for receptors beyond 300 m.

The planned construction activities and use of equipment and machinery will be a source of vibration. Vibration may potentially affect cultural heritage sites and/or other sensitive receptors (i.e. communities, buildings, ecological areas, area of geomorphological importance) in proximity of the work sites.

The response of people to vibrations on the ground is influenced by many factors. Some of those factors are physical, like amplitude, duration and frequency content of vibrations, while other factors like the type of population, age, gender and expectations are physiological. This means that people's reaction to vibrations is subjective and differs among people. It is generally accepted that for the majority of people, vibration levels in excess of between 0.15 and 0.3 mm/s peak particle velocity are just perceptible.

The table below presents distances at which vibration may be perceptible for certain type of construction activity. These figures are based on historical field measurements and information available in literature.

Table 7-15: Distances at which vibration may be perceptible

Construction activity	Distances at which vibration may be perceptible [m]
Excavation	10-15
Vibratory compaction	10-15
Heavy vehicles	5-10

It may be concluded that it is highly unlikely that vibration from construction activities will be perceptible in the vicinity of the residential dwellings**.**

Noise levels according to EHS Guidelines are provided below.

Table 7-16: One-Hour Equivalent Noise Level Limits (LAeq) by Receptor Type

	One-Hour L_{Aeq} Noise Limits (dBA)	
Receptor	**Daytime (07:00–22:00)**	**Nighttime (22:00–07:00)**
Residential; institutional; educational	55	45
Industrial; commercial	70	70

7.5.2.2 Mitigation measures

Relevant regulations concerning the management of construction activities shall be fully respected. Construction, transport activities, including materials and equipment near the settlements, which imply increased emission of harmful noise, shall not be conducted during the holidays, especially during the night and through the weekend.

All construction procedures shall be properly planned to reduce the time of utilization of equipment that creates most intense harmful noise. Working hours and rules shall be established based on the needs to reduce the noise causing nuisance and disturbance, especially by avoiding the cumulative effect of increased noise due to simultaneous operation of different kinds of construction machinery and equipment.

Several other measures of good construction practice shall be overtaken to mitigate noise from construction works:

- Any compressors brought on to construction sites would be sound reduced models fitted with acoustic enclosures.
- All pneumatic tools would be fitted with silencers.
- Switch off equipment when not in use.
- Care would be taken when unloading vehicles to minimise noise. Delivery vehicles would be routed so as to minimise disturbance to local residents. Delivery vehicles would be prohibited from waiting within or close to the site with their engines running, where possible.
- All machinery items shall be properly maintained and operated in order to avoid causing excessive noise.
- Limit noisy activities to the least noise-sensitive times of day.
- Restrictions on periods of operation and locations of specific construction activities will be agreed by the contractor with the relevant local authority.
- At workplaces where noise exceeds 85 dB, the use of PPE (earmuffs or earplugs) is mandatory.

In order to limit the possible negative impact of noise in the vicinity of the nearest residential buildings during the implementation of the project, it is necessary to undertake the following:

- It is necessary to regularly monitor the level of noise generated on the construction site due to the introduction of corrective measures for exceeding the permitted levels;
- All machinery used must meet the standards related to noise emission;
- Reduce the noise at transformer stations and aggregates to the smallest possible extent by an adequate selection of equipment first of all;
- Reduce noise at substations and aggregates by choosing an appropriate transformer, building a separate foundation and using elastic rubber pads under the transformer;
- Perform wall treatment in the substation that will enable adequate sound insulation;
- When performing work, it is necessary for employees to use personal protective equipment to protect hearing from damage (ear protection).

In addition to the measures listed above, the following procedures shall be overtaken in order to minimise the potential for negative effects of the construction works:

- The provision of a grievance mechanism for receiving complaints and acting upon them, and Regular liaison with the local authorities to discuss activities and the progress of the project.

7.5.2.3 Residual impacts

The table below summarises the residuals impacts to the acoustic environment during Project construction.

Table 7-17: Residual impacts to Acoustic Environment during construction

Impact / Risk		Measure to Address the Impact / Risk	Significance of Residual Impact / Risk
Construction Phase			
PV site earthworks, steelworks, towers assembly, HV equipment, and SS installation	Receptors located within 200 m from work areas	• All construction activity to occur between 06:00 and 22:00 hours • Noise-reduction technologies in the equipment and machinery (i.e. silencer) • Use of the lowest noise work practices and equipment • Good maintenance of machinery and vehicles • Turn off equipment and vehicles when not in use • All vehicular movements to and from the site to only occur during the scheduled normal working hours • Provision of a grievance mechanism • Liaison with local authorities	**MODERATE** • Foreseen noise level >50 dB(A) for most construction works (level determined by WHO) • Temporary disturbance
	Receptors located >200 m from work areas		**MINOR** • Temporary disturbance • Receptors sufficiently distant (>300 m) from work areas, meaning that noise level < 50 dB(A) for most construction works

7.5.3 Operation and Maintenance phase

During operation phase it can be expected minor noise emission from transmission lines due to the corona effect.

Corona is a phenomenon associated with all energized transmission lines. Under certain conditions, the localized electric field near an energized conductor can be sufficiently concentrated to produce a tiny electric discharge that can ionize air close to the conductors. This partial discharge of electrical energy is called corona discharge, or corona. Several factors, including conductor voltage, shape, and diameter, and surface irregularities such as scratches, nicks, dust, or water drops, can affect a conductor's electrical surface gradient and its corona performance. Corona is the physical manifestation of energy loss, and can transform discharged energy into very small amounts of sound, radio noise, heat, and chemical reactions of the air components. According to voltage level, the planned a new 110 kV overhead line of approximately 500 m in length, connecting the Rudine Solar PV Plant to the existing 110 kV Nikšić–Bileća line and a new 110 kV overhead line of approximately 500 m in length, connecting the same 110 kV line to the Vilusi substation, will be with minor Corona effect in very short term, mainly during raining days.

For substations, in general, there are three basic sources of audible noise. Each of these has its own characteristic spectrum and pattern of occurrence due to the nature of the noise generating mechanisms involved:

- The transformer noise is approximately constant with a low frequency hum occurring at harmonics of the supply frequency (100 and 200 Hz are usually dominant);
- The transformer coolers generate more broadband noise, although they are not in continual operation;
- Switchgear noise is generated by the operation of circuit breakers and has short duration.

For PV power plants, in general, the noise level is minor during rotation of PV cells-tracker system and has short duration.

7.5.4 Decommissioning phase

It cannot be foreseen today which decommissioning approaches will be taken at the time of decommissioning, but Qair d.o.o. is committed that this will be state-of-the-art at the time when it occurs.

It is expected that similar equipment, machinery and vehicles will be used during Project decommissioning as used for Project construction and similar noise impacts will occur from relevant activities.

7.6 Hydrology

7.6.1 Overview

This section assesses the impacts on water resources at the study area that may arise from the construction, operation and decommissioning phases of the Project.

The Rudine plateau and the Vilusi area are a typical karst landscape with scarce water resources. There is no surface water of natural origin on the location of the Project, nor in its vicinity. The construction of Rudina Power Plant with connection to the electricity transmission network does not affect the geology of the soil, so it does not affect the movement of underground water in the places where construction works are carried out.

Within the footprint of the planned Rudine Solar Power Plant, on cadastral plot no. 797, KO Rudine, there is an existing water intake structure (captation basin) that was used until 2021 to supply the former goat farm (Figure 7-1). At present, this basin is used occasionally for irrigating agricultural plots cultivated with onions and potatoes by a single household.

In the event that the relocation of the existing water structure is required under the Main Design, the Investor is obliged to construct an equivalent replacement water structure outside the Project construction area, in agreement with the local residents. The Investor and the local community have agreed that the captation will be relocated to an adjacent location where a natural pond already exists, which fills during rainfall events. The proposed location is shown in Figure 7-2.

The selected location has a sufficient natural slope, enabling gravity-based water use by the local population for domestic and agricultural purposes.

Figure 7-1: An existing water intake structure (captation basin)

Figure 7-2: Proposed new water intake structure

However, a number of key potential impacts remain, as shown in the table below.

Table 7-18: Key potential impacts to Hydrology

Construction Phase	Operation Phase	Decommissioning Phase
• Changes in surface drainage water patterns and run-off • Sediment plumes from runoff at plant site, camps, OHL working strip and access roads • Oil & chemical contamination from machinery and fuel storage • Wastewater and solid waste generation from camps/work sites	• Oil & chemical contamination from machinery and fuel storage	• Oil & chemical contamination from machinery and fuel storage

Potential hydrological impacts during construction include temporary changes in surface drainage patterns, localised runoff generation, sediment mobilisation from disturbed surfaces, and accidental contamination from fuel, oils or construction chemicals.

Minor to moderate, limited to periods of active construction and intense rainfall events, and spatially confined to construction areas and access roads. Groundwater systems: **Low sensitivity**, due to depth and limited interaction with shallow construction works. Local water users (captation basin): **Medium sensitivity**, due to reliance on individual water structures in a water-scarce environment.

Applying the impact significance matrix (Table 7-4), residual impacts during construction are assessed as **minor**, provided that standard mitigation measures (proper drainage, sediment control, spill prevention and controlled fuel storage) are implemented.

7.6.2 Construction phase

7.6.2.1 Potential impacts

During construction, impacts to water resources in the project area may be due to the following:

- Preparation, construction and operation of temporary facilities (i.e. construction sites);
- Movement of vehicles, equipment and personnel;
- Upgrade of existing access roads or building new ones;
- Construction waste management and storage and handling of fuels and chemicals.

7.6.2.2 Dewatering and sediment plumes due to earthworks

Potential impacts to surface and ground waters may result from earthworks outside, due to the following:

- Installation of solar panels requires a flat surface. This can affect the natural drainage and absorption of water in the soil.

It is necessary to carefully plan how the water will be drained from the site. With the implementation of good construction practice mitigation measures, potential impact is considered to be minor.

7.6.2.3 Accidental pollution

Although no sensitive watercourses have been identified in the area of Rudine PV Power Plant, accidental pollution of water resources by solid, liquid wastes and accidental spill of hydrocarbon/ fuels can occur during construction activities.

Spills may be of the following sources:

- Inert construction wastes, such as earth (not including excavated material, which is destined to be backfilled when the area is restored), unused construction material, etc., generated during preparation and restoration of worksites. These wastes pose low risk of pollution and they shall be disposed of at a controlled disposal site;
- Domestic wastes, such as latex, cardboard, wood, rags, food, etc.; these wastes shall be collected and disposed in controlled disposal sites. The waste from the designated waste area shall be regularly collected and disposed at an approved disposal site;
- Special and hazardous wastes, such as the oily waste associated with vehicle and heavy equipment maintenance; unused or waste chemicals, paints and solvents; and, any other waste, sludge or debris that are unsuitable for disposal in village/town type landfills. Such wastes shall be segregated for collection and disposal;
- Sanitary wastewater. This wastewater comes from sanitary installations within the construction camp site. The construction camp shall install suitable pre-treatment systems, in compliance with any applicable legislation. Biological digesters shall be used for those installations where the average

workforce exceeds 10-15 people. In case of minor facilities, specific techniques, such as phyto-depuration or sub-irrigation, shall be considered.

The discharge of liquid or solid waste to water resources is strictly prohibited. Waste management shall be kept closely in line with the legal framework and best practice principles. A specific Wastewater and Waste Management Plan shall be prepared and implemented.

Temporary effects of sediment plumes on surface water may be caused by potential contamination from fuels, lubricant oils and chemicals (surface water and groundwater). Source of given impacts are storage and handling of fuels and chemicals, to be used for construction machinery. Accidental spills from vehicles, storage tanks and chemical stores, metalworking and welding can pollute water resources.

7.6.2.4 Effects on the existing water regime of watercourses

No watercourses have been identified in the location of the Project nor in its vicinity.

7.6.2.5 Mitigation measures

A number of mitigation measures shall apply during construction to avoid or minimise impacts to water resource:

- Minimize the time necessary for works to be finished.
- Full reinstatement of land drainage features.
- Sound engineering practices at the construction sites.

For the case of accidental pollution from waste and fuels/lubricants, the following measures shall be applied:

- Contractor shall develop a Wastewater and Waste Management Plan to avoid solid or liquid waste discharges.
- All wastes shall be segregated and separated on-site to facilitate proper disposal. General non-hazardous solid wastes shall be segregated at source into recyclable and non-recyclable wastes and stored in marked containers. Recyclable materials shall be given to local recycling facilities or a net economic benefit and the remaining materials shall be disposed at a site approved by the Local Authority.
- Waste reduction at the source shall be considered in tenders by supply and construction contractors.
- All areas for which there is a risk of leaks or spills during plant and vehicle storage, maintenance or refueling, and areas where materials with polluting potential will be stored shall be bounded. Use oil catch pans under vehicles when performing maintenance. Conduct maintenance only on impervious floor (e.g. tarpaulin sheet).
- Appropriate spill containment equipment shall be available at refuelling sites. All drivers shall be trained in emergency spill response procedures.
- Hazardous substances shall be stored within impermeable bounded areas to protect groundwater from pollution by accidental spills.
- Store all chemicals in secured storage area with impervious (cement or plastic sheet) floor and bund wall. Handle all chemicals according to their MSDS.
- Development of a Hazardous Materials Management Procedure in order to detail procedures for working with chemical products.
- Development of a Spill Prevention and Response Plan to avoid and react on any pollution that may accidentally occur as a result of hydrocarbon/fuels spills.

7.6.2.6 Residual impacts

The table below summarises the residual impacts to water resources during Project construction.

Table 7-19: Residual impacts to water resources during construction

Impact / Risk	Measures to Address the Impact / Risk	Significance of Residual Impact / Risk
Construction Phase		
Earthworks for solar panels and tower installations and construction of substation	• Minimal modification of channel morphology • Full reinstatement of land drainage features	**MINOR**
Construction sites	• All areas for which there is a risk of leaks or spills will be bunded • Sound engineering practices at the construction sites • Prompt installation of erosion control and reinstatement.	**MINOR**
Accidental pollution of water resources by solid and liquid wastes	• Wastewater and Waste Management Plan • Hazardous Materials Management Procedure • Spill Prevention and Response Plan	**NOT SIGNIFICANT**

7.6.3 Operation and Maintenance phase

Solid and liquid wastes generated by the Project during operation and maintenance can accidentally pollute water resources, affecting resource quality. The main sources that may generate pollution of freshwater resources are:

- Production and disposal of solid and liquid wastes. During the operation phase only limited amounts of waste are envisaged, due mainly to maintenance activities in the substation. The following types of wastewaters have been taken into consideration: rainwater, sanitary sewer from installations within buildings and oily water. The oily water is surface water from areas which may be polluted in case of leakages; and
- Storage and handling of fuels and chemicals, including transformer oils and dielectric fluids.

The treatment according to local and international standards of all operation and maintenance discharges will ensure that no significant impacts to water resources are envisaged during Project operation and maintenance.

7.6.4 Decommissioning phase

The impacts of decommissioning will depend on the approach and technologies available at the time. Regarding impacts to water resources, in case of removing the towers and wires, or parts of PV plant and substation, impacts will be similar to construction stage. In case tower foundations are not removed, impacts will be much less and will mainly comprise the management of waste arising from metallic structures and wires.

7.7 Geology and Soils

7.7.1 Overview

This section assesses the impacts on the geology and soils at the study area that may arise from the construction, operation and decommissioning phases of the Project.

Soil disturbance is expected primarily at locations of permanent installations (the photovoltaic power plant, the 110/35 kV substation and OHL tower foundations), as well as at temporary construction areas, including access roads and working corridors. The wider Project area is characterised by shallow soils developed over karstified carbonate bedrock, with a limited soil profile and naturally low regenerative capacity.

Project Component	Permanent Land Take
Rudine Solar Power Plant (PV fields, internal roads and auxiliary facilities)	approx. *[to be defined based on Main Design]*
110/35 kV Substation Rudine	approx. *[to be defined based on Main Design]*
110 kV Overhead Transmission Line (tower foundations)	Permanent land take limited to tower foundation footprints

Project Component	Temporary Land Take
Solar Power Plant construction areas (temporary yards, access, storage areas)	approx. *[to be defined based on construction layout]*
110 kV Overhead Transmission Line working corridor	approx. *[to be defined]*
Temporary access roads and construction camps	approx. *[to be defined]*

Key potential impacts on geology and soils are summarised in Table 7-19.

Table 7-20

Construction Phase	Operation Phase	Decommissioning Phase
• Disturbance and degradation of soil due to erosion • Accidental pollution of soil by solid and liquid wastes or spills of hydrocarbons / fuels • Soil occupation / Surface Sealing	• Accidental pollution of soil by accidental spills • Soil occupation / Surface Sealing	• Accidental pollution of soil by accidental spills, solid and liquid wastes • Erosion and degradation of soil

7.7.2 Construction phase

7.7.2.1 Potential impacts

During construction, impacts on geology and soils in the project area may be due to the following:

- Preparation, construction and operation of temporary facilities (i.e. construction sites);
- Soil contamination due to accidental pollution by solid and liquid wastes or spills of hydrocarbons / fuels and mineral oils;
- Movement of vehicles, equipment and personnel;
- Upgrade of existing access roads or building new ones;
- Construction waste management and storage and handling of fuels and chemicals.

7.7.2.2 Soil Erosion

The removal of vegetation cover and excavation works may increase the susceptibility of soils to erosion, particularly during periods of intense rainfall. This risk is more pronounced in areas with sloping terrain, shallow soil cover and temporary exposure of bare ground.

Magnitude of impact is Moderate, due to the spatial extent of vegetation removal and soil disturbance during construction. Sensitivity of receptors is Medium, reflecting shallow soils with limited thickness and dependence on vegetation cover for stability. Residual impact significance is Moderate prior to mitigation and minor following the implementation of erosion control measures, such as minimisation of disturbed areas, progressive rehabilitation, drainage control and surface stabilisation.

7.7.2.3 Soil Compaction

Soil compaction may occur as a result of heavy machinery movements, particularly in areas where soils are temporarily exposed or moist. Compaction reduces soil porosity and permeability and may affect soil structure.

Given that construction will be carried out in phases and that existing access tracks will be used where possible, the spatial extent of soil compaction will be limited.

Magnitude of impact is evaluated as Medium, sensitivity of receptors as Medium, residual impact significance as Minor to moderate prior to mitigation and minor after restoration measures (loosening, grading and reinstatement).

Impacts associated with the temporary use of existing access roads are considered of minor significance.

7.7.2.4 Soil Pollution

Accidental pollution of soil during construction of Rudine PV Power Plant could occur through direct spillage of materials such as oils or hydraulic fluids from vehicles and machinery, and surface run-off. However, any potential spillages will generally be of small quantities and localised in nature, therefore the magnitude of such potential impacts is considered low and the resulting impact significance is minor.

7.7.2.5 Mitigation measures

A number of mitigation measures shall apply during construction to avoid or minimise impacts to soil and subsoil:

- Topsoil or any parent material removed prior to construction shall be separately stripped, handled, stored and replaced.
- Soil stockpiles shall be protected from run-off, e.g. by heavy rainfall, by covering with sheets.
- Exposed site areas should be kept to a minimum during construction or revegetated as soon as possible.
- Fuel handling, especially bulk storage, shall take place in secure bunded areas, in compliance with a Spill Prevention Plan. Similar conditions shall apply to lubricant oils, chemicals and liquid wastes. Should a spill occur, polluted soils shall be cleaned up or removed for appropriate disposal. All wastes shall be handled, stored and disposed of as per local regulations.
- Waste management shall be kept closely in line with the legal framework and best practice principles. All waste shall be collected, stored and transported separately in appropriate and approved bins and containers. A specific Waste Management Plan shall be performed.
- During earthworks, top layer of better-quality soil shall be separated, kept separately and protected from pollution, and reused after for restoration.
- Fuel tanks shall be with double wall and shall fulfill all the local requirements.
- Construction site shall have sand or sawdust in case of spillage of oil.

- For each type of waste adequate collection, management and disposal system shall be maintained according to waste management plan Waste Management
- Excess material generated as a result of construction activities shall be reused for construction of necessary infrastructure and for surfaces reconstruction. In accordance with waste management plan, excess material shall not to be disposed into the surrounding environment but will be disposed in the designated area.
- During construction, waste shall be managed in accordance with waste management plan, which shall be acknowledged by contractors and subcontractors. Responsible persons for supervision of waste management procedures are described in waste management plan.

7.7.2.6 Residual impacts

The table below summarises the residuals impacts to subsurface and soils during Project construction.

Table 7-21: Residual impacts to Subsurface and Soils during construction

Impact / Risk	Measures to Address the Impact / Risk	Significance of Residual Impact / Risk
Construction Phase		
Soil Erosion	• Top soil shall be removed prior to construction, properly stored and reinstated after construction • Original surface contours shall be reinstated after construction where practical. • Storage of the original surface soil resources (to be re-used)	**MODERATE** • Moderate impacts are anticipated.
Earthworks for solar panels and tower installations and construction of substation	• Soil stockpiles shall be protected from heavy rainfall (covering). • Access areas to heavy machinery will be restricted to the construction zone and access roads.	**MINOR** • Minor impacts are anticipated.
Soil Pollution and accidental spills	• Fuel and other hydrocarbons handling, especially bulk storage, shall take place in secure bunded areas • Waste management shall be carried out in line with the Waste Management Plan	**MINOR** • Minor impacts are anticipated.

7.7.3 Operation and Maintenance phase

No significant impacts to soil and subsoil are envisaged during Project operation. During maintenance, apart from control of vegetation, the maintenance crew will periodically check for evidence of soil erosion and advise on the need of stabilization measures where necessary.

7.7.4 Decommissioning phase

The impacts of decommissioning will depend on the approach and technologies available at the time. Regarding soil impacts, in case of removing the solar panels and components of substation, towers and wires, impacts will be similar to construction stage. Soil profiles will be disturbed, but as long as Qair d.o.o.

follows the international best practice (diligent care in excavation, separation and appropriate storage of topsoil and subsoil, de-compacting of construction corridor, appropriate disposal of waste materials) it is ensured, that soils will be reinstated to their previous conditions, as close as technically feasible. This way, soils will be available again for agricultural use and re-vegetation.

7.8 Landscape

7.8.1 Overview

This section assesses the main potential impacts on visual component over the Project area that may arise as a result of the Project activities and proposes mitigation and management measures. Impacts may occur on a landscape resource, such as a high landscape value, or a sensitive receptor. The assessment is divided into the three main phases of the Project: construction, operation and decommissioning.

The key potential impacts to the landscape include the following:

Table 7-22: Key potential impacts to the landscape

Construction Phase	Operation Phase	Decommissioning Phase
• Physical changes to the landscape general unity (fragmentation) due to construction works. • Changes in the view shed and aesthetic value to residents • Temporary adverse landscape impacts on aesthetic and perceptual attributes of the surrounding landscape character areas, through increased vehicular traffic for the duration of the construction	• Presence of the PV Power Plant in the receiving landscape • Presence of the substation in the receiving landscape • Presence of the OHLs in the receiving landscape in the length of 2x500 m	• Disturbance of the landscape unity by demobilisation and abandonment of facilities and infrastructure

7.8.2 Construction phase

7.8.2.1 Potential impacts

The landscape of Rudine is defined by a mosaic of open grasslands, scattered forest patches, rocky plateaus, and karst depressions. The presence of anthropogenic features, such as cisterns, dry-stone walls, and extensive pastures, reflects long-standing adaptation to harsh natural conditions.

Figure 7-3: Vegetation in the area of the planned Rudine PV Power Plant

Construction activities will result in physical changes to the overall landscape's unity. The area does not comprise any landscape type of conservation significance, and therefore, the sensitivity is considered low. This is especially the case for the area of the Rudine PV Power Plant. As result, Moderate landscape fragmentation impact for the Rudine PV Power Plant is expected.

The 110 kV Nikšić–Bileća OHL reconstruction will generally follow the existing alignment of the transmission line corridor which crosses the rural karst landscape between Rudine and Vilusi, parallel to the M6 main road, and thus no landscape fragmentation issues are anticipated.

Reconstruction of the existing 110 kV Nikšić–Bileća overhead transmission line will largely follow the established transmission corridor, which already represents a linear anthropogenic feature within the rural karst landscape. As such, additional fragmentation of the landscape is not anticipated. The construction of two new overhead line sections, each approximately 500 m long, connecting the Rudine Solar Power Plant to the existing transmission line and to the Vilusi substation, will introduce new linear elements; however, these elements will be located within a landscape context that already accommodates similar infrastructure. Given their limited length, coherence with the existing transmission corridor and the temporary nature of construction activities, the overall effect on landscape character is expected to be limited.

The magnitude of impact will be negligible to low and the direct landscape fragmentation effect negligible to low, and of relatively short duration.

Visual impacts are subjective and refer to how people perceive a certain space. The overall visual impact refers to:

- Direct impact of project components on viewpoints in terms of visual barriers;
- Reactions of people who are under visual influence;
- General impact on the visual appearance of the landscape - ranging from degradation to enhancement of the landscape image.

The construction works on the Project location will hardly be visible to anyone with the exception of those travelling along the road leading from M6 main road to the project location. The area of the Project is generally sparsely populated and the view of the Project location is blocked by the hills and the vegetation. From the location of the few households, visual impacts will be negligible because of these locations are sheltered by nearby hills that block the view of the project area. Negative effects will be achieved by approaching these locations from the local road. Considering these facts, it can be concluded that visual impact is not significant.

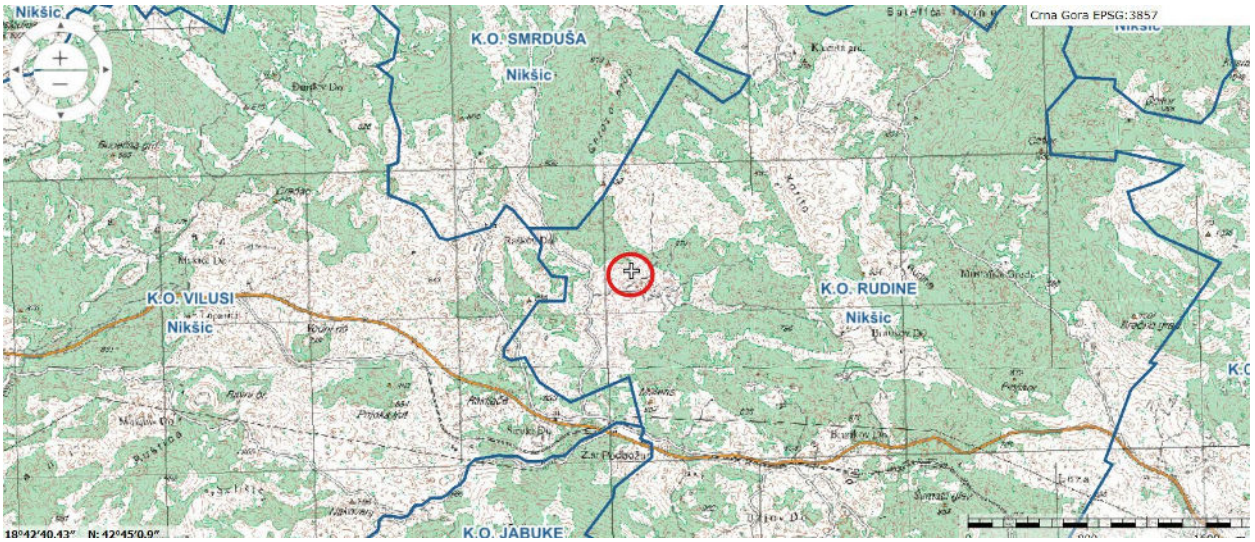


Figure 7-4: The Project area and the M6 main road (yellow line)

Construction works on the reconstruction of existing OHL will be viewed from the M6 main road.

Adverse landscape impacts on aesthetic and perceptual attributes of the surrounding landscape character areas, through increased vehicular traffic for the duration of the construction are temporary. The magnitude of impact will be negligible to low and the direct landscape effect negligible to low, and of relatively short duration.

7.8.2.2 Mitigation measures

The following measures will be implemented during Project construction to mitigate the impacts presented above:

- Materials and machinery will be stored tidily during the works.
- Lighting of compounds and construction sites will be restricted to working hours with the exception of security lighting only.
- On completion of works all temporary structures, surplus materials and wastes will be completely removed.
- Implement dust control measures during construction.

7.8.2.3 Residual impacts

The following table presents a summary of the residual impacts to landscape following mitigation.

Table 7-23: Residual impacts to landscape during construction

Impact / Risk	Measure to Address the Impact / Risk	Significance of Residual Impact / Risk
Construction Phase		
Landscape fragmentation	• All areas used for construction of the Rudine PV Power Plant and new to OHLs will be restored to their pre-construction state, as close as practically feasible • Materials and machinery will be stored tidily during the works	**MINOR**

Impact / Risk	Measure to Address the Impact / Risk	Significance of Residual Impact / Risk
Changes in the aesthetic value to residents and visitors	• On completion of works all temporary structures, surplus materials and wastes will be completely removed • Lighting of compounds and construction sites will be restricted to working hours with the exception of security lighting only • Implement dust control measures during construction.	**MINOR**

7.8.3 Operation and maintenance phase

The operation phase of a PV Power Plant involves the ongoing maintenance, monitoring, and functioning of the installed solar panels and associated infrastructure. This chapter aims to assess the potential landscape impacts during the operation phase of the solar power plant. It examines the effects on land cover, landscape character, and other aesthetic and perceptual attributes, while also considering the potential mitigation measures to minimize adverse impacts.

7.8.3.1 Potential impact

Potential impacts to the landscape during operation are due to the physical presence of the Project structures.

The Rudine PV Power Plant and associated substation as a permanent structure will be added to the landscape and will produce negative impacts to passengers and local people. The OHLs will be an additional structure to existing transmission facilities and the visual impact on residents and visitors will be localised and of low significance. The OHL NIkšić-Bileća is an existing transmission line therefore it has no impact to the landscape once constructed.

The total area for the Rudine PV Power Plant comprises 74.8 ha, and it is embraced in the curvature of the existing terrain. As a result, the magnitude of the impact to the landscape is moderate. The area does not comprise any landscape type of conservation significance, and therefore, the sensitivity is considered low. As a result, impact significance is considered Moderate for the Rudine PV Power Plant, and for the OHLs after all works are completed, not significant.

7.8.3.2 Mitigation Measures

The following mitigation measures will apply:

- A vegetation screen alongside the Project area will be provided to reduce visual impacts in the long term.

7.8.3.3 Residual impact

The following table presents a summary of the residual impact associated to the impacts identified.

Table 7-24: Residual impacts to landscape during operation

Impact / Risk	Measures to Address the Impact / Risk	Significance of Residual Impact/ Risk
Operation Phase		
Permanent presence of project structures	• Provide vegetation screen along substation parcel.	**MINOR**

7.8.4 Decommissioning phase

The decommissioning phase will create impacts to the visual amenity of the landscape similar to the ones during construction. Although all the necessary reinstatement activities will take place, loss of some floristic landscape features (such as vegetation, mature trees) is inevitable.

7.9 Biodiversity

7.9.1 Overview

The development of the proposed solar power plant and the associated overhead transmission line (OHL) may result in a range of temporary and permanent impacts on biodiversity and habitats, depending on the project phase and the sensitivity of ecological receptors present within the project area.
Potential impacts are primarily related to land take, habitat modification, disturbance, and the presence of linear infrastructure, and may affect both terrestrial habitats and fauna groups recorded within the study area.
The assessment of impacts has therefore been structured according to the construction phase and the operational (exploitation) phase, as these phases differ in terms of impact pathways, duration and reversibility.

Table 7-25 Key potential impacts on biodiversity

Impact category	Construction phase	Operational phase	Decommissioning phase
Habitat loss and land take	Temporary and permanent habitat loss due to vegetation clearance and earthworks within the solar plant footprint and OHL corridor	Permanent habitat loss within the solar power plant footprint	Temporary habitat disturbance during dismantling; restoration possible
Habitat fragmentation and connectivity	Temporary fragmentation and edge effects, particularly along the OHL corridor and access roads	Long-term fragmentation effects related to permanent infrastructure	Fragmentation effects cease following removal
Disturbance to fauna (general)	High short-term disturbance from noise, machinery and human presence	Low to moderate long-term disturbance from maintenance	Short-term disturbance during dismantling
Bird collision and electrocution risk (OHL)	Low to moderate during OHL installation	Moderate long-term collision and electrocution risk	Temporary risk during dismantling; eliminated after removal
Impacts on bats	Disturbance from noise, lighting and habitat alteration	Potential barrier and disturbance effects	Temporary disturbance; long-term effects removed
Soil degradation and pollution risk	Localised soil compaction, erosion and pollution risk	Low, mainly from maintenance activities	Temporary, localised disturbance
Impacts on amphibians – permanent water body (captation) disturbance	High risk if earthworks, machinery movement or pollution affect the water body; potential loss or degradation of	Moderate risk if water regime, water quality or surrounding terrestrial habitat are altered;	Temporary risk during dismantling; potential for habitat recovery if water body remains intact

	breeding habitat and increased mortality of eggs and larvae	disturbance may affect breeding success	
Reversibility of impacts	Mostly reversible, except permanent land take	Largely irreversible during operation	Mostly reversible; restoration possible
Overall impact significance	**Moderate,** potentially high for amphibians if the water body is affected	**Low to moderate**, moderate for amphibians if indirect impacts occur	**Low,** short-term

7.9.2 Construction phase

7.9.2.1 Overall potential impacts

The construction phase of the proposed solar power plant and the associated overhead transmission line (OHL) represents the period during which the most intensive short-term impacts on biodiversity and habitats are likely to occur. Construction activities will include site preparation, vegetation clearance, earthworks, construction of access roads, installation of foundations for solar panels and transmission line pylons, and erection of the OHL. These activities may affect both terrestrial and aquatic habitats within the project area, as well as ecological connectivity at the local scale.

Potential impacts during this phase are primarily related to direct habitat loss and modification, increased human activity, and the creation of linear infrastructure, which together may result in habitat degradation, fragmentation and disturbance to fauna. Although construction-related impacts are generally temporary in nature, their magnitude and significance depend on the extent of land take, the location of sensitive habitats, and the timing of construction works in relation to key biological periods.

During the construction phase, the main potential impacts on biodiversity and habitats include direct loss and alteration of habitats due to vegetation clearance, soil stripping and earthworks within the footprint of the solar power plant, along the OHL corridor, and at locations of temporary and permanent access roads. Additional habitat loss and degradation may occur as a result of the construction and widening of access tracks required to reach pylon locations, as well as the excavation of foundations for transmission line towers, which may lead to the removal of vegetation and topsoil and to localised changes in habitat structure.

The establishment of access roads, construction platforms and transmission line corridors may result in habitat fragmentation and edge effects, reducing habitat continuity and potentially disrupting movement routes of wildlife. Such fragmentation effects may be particularly relevant in heterogeneous landscapes, where relatively small areas of habitat loss can disproportionately affect ecological connectivity.

Construction activities are also expected to cause disturbance to fauna, resulting from increased noise, vibration, dust, artificial lighting and the presence of workers and machinery. These disturbances may lead to temporary displacement of wildlife, avoidance of construction areas, and disruption of normal behaviour such as feeding, breeding and resting. Small and less mobile species may additionally be exposed to an increased risk of direct injury or mortality due to ground works and vehicle movements.

Within the project area, the presence of a small permanent water intake structure (captation) represents an important ecological feature, particularly in a landscape with limited availability of permanent aquatic habitats. Construction works carried out in its vicinity may result in physical damage, alteration of the hydrological regime or deterioration of water quality, for example due to sediment runoff, accidental spills or changes in surface water flow. Such impacts could reduce the suitability of the habitat for aquatic and semi-aquatic fauna and negatively affect species dependent on this water body for key life-cycle stages.

Overall, construction-related impacts on biodiversity and habitats are expected to be short-term and largely reversible, provided that construction activities are properly managed. However, in the absence of appropriate avoidance and mitigation measures, impacts associated with habitat loss, fragmentation, disturbance and potential degradation of sensitive habitats, including permanent water bodies, could be of moderate to locally high significance.

Here are the key impacts on biodiversity and habitats during construction phase of this project:

- **Direct habitat loss and alteration** due to vegetation clearance, soil stripping and earthworks within the footprint of the solar power plant, the overhead transmission line (OHL) corridor and associated infrastructure.
- **Habitat fragmentation and loss of ecological connectivity**, resulting from the creation of linear elements such as access roads, construction tracks and the OHL corridor, potentially disrupting wildlife movement routes.
- **Localised habitat destruction** associated with the construction of access roads and working platforms, as well as excavation of foundations for transmission line pylons, leading to permanent or semi-permanent changes in habitat structure.
- **Disturbance to fauna** caused by increased noise, vibration, dust, artificial lighting and human presence during construction activities.
- **Temporary displacement of wildlife**, particularly mobile species, due to avoidance of active construction areas.
- **Increased risk of direct injury or mortality** for small, slow-moving or ground-dwelling fauna as a result of ground works, trenching and vehicle movements.
- **Degradation of habitat quality**, including soil compaction, erosion, dust deposition and changes in microhabitat conditions.
- **Potential impacts on aquatic and semi-aquatic habitats**, particularly the permanent water intake structure (captation), through physical damage, alteration of the hydrological regime or deterioration of water quality caused by sediment runoff or accidental pollution.
- **Disturbance during sensitive biological periods**, such as breeding, spawning or larval development, potentially reducing reproductive success of affected species.
- **Cumulative effects of multiple construction activities**, where combined impacts of habitat loss, fragmentation and disturbance may exceed the effect of individual activities alone.

7.9.2.2 *Impacts on habitats and flora*

The construction of the photovoltaic power plant, transmission power line and its associated facilities requires the removal of vegetation and surface grading across relatively large areas of land. This may cause habitat loss, degradation and fragmentation of habitats, leading to a reduction in both plant and animal species richness. On project area flowing habitats were recorded:

- **6210 – Semi-natural dry grasslands and scrubland facies on calcareous substrates (Festuco-Brometalia)**. This habitat type represents the dominant and most widespread habitat within the project area and the wider region characterised by deep limestone substrates under sub-Mediterranean climatic conditions.It forms extensive semi-natural grassland communities maintained by traditional land use and natural processes, supporting a high level of plant diversity and providing important foraging habitats for numerous fauna species. Habitat type 6210 is the only habitat recorded within the project area that is of conservation importance at the EU level, listed under Annex I of the Habitats Directive, and may be considered a priority habitat where orchid-rich grasslands are present. Due to its broad spatial distribution, localised habitat loss is not expected to significantly affect its regional conservation status; however, the habitat remains sensitive to fragmentation, soil disturbance and changes in land management.
- **91M0 – Pannonian-Balkanic turkey oak–sessile oak forests**. This habitat type occurs in a fragmented and spatially limited manner, primarily on slopes and areas with more developed soils within the project area. It represents a structurally complex forest habitat that provides important shelter, breeding and foraging opportunities for forest-dependent fauna. Although listed under Annex I of the Habitats Directive, this habitat is not classified as a priority habitat, and its presence within the project area is limited compared to surrounding grassland habitats.The main sensitivity

of this habitat relates to edge effects, fragmentation and disturbance, particularly where forest patches are intersected by linear infrastructure.

- **62A0 – Eastern sub-Mediterranean dry grasslands**. This habitat type is present in small, discontinuous patches, typically occurring in areas where microclimatic and soil conditions favour the development of dry grassland communities. It contributes to overall habitat heterogeneity and supports plant species adapted to dry, open conditions, but occupies a relatively limited surface area within the project area. Habitat type 62A0 is listed under Annex I of the Habitats Directive but is not considered a priority habitat at the EU level. Its sensitivity is mainly related to soil disturbance, overgrowth following land abandonment, and physical habitat loss.

Detail septal distribution within the project site is given on figures 5.7 and 5.9 (chapter 5.12.2.1. Habitats).

Impacts on habitats within the solar power plant area and associated facilities

The area designated for the construction of the solar power plant, associated infrastructure and substation covers a total of 74.02 ha. Within this area, the dominant habitat types are 62A0 (Eastern sub-Mediterranean dry grasslands) and 91M0 (Pannonian-Balkanic turkey oak–sessile oak forests), while habitat type 6510 (Lowland hay meadows) is present to a lesser extent.

The permanent project footprint, including solar panels, associated facilities and the substation, will occupy 35.98 ha, representing the area subject to direct and permanent habitat loss.

Table 7-26 Habitat loss within the area of photovoltaic power plant

Code	CORINA HABITAT	TOTAL (ha)	Taken by the panels and buildings (ha)	Percentage of loss (%)
333	Sparsely vegetated areas	45.58033	24.95408	54.74748
324	Transitional woodland-shrub	7.707519	3.01927	39.17305
334	Burnt areas	20.74212	8.00949	38.61462
TOTAL		**74.02996**	**35.98284**	48.60578

a) <u>Habitat loss and modification</u>

Of the total area occupied by project infrastructure (35.98 ha):

- approximately 92% is located within habitats 62A0 and 91M0,
- while the remaining 8% affects habitat type 6510.

Within the solar power plant zone (excluding the transmission line corridor):

- approximately 50% of the existing area of habitats 62A0 and 91M0 will be directly converted and covered by solar panels and associated facilities, resulting in permanent loss and structural modification of these habitats;
- approximately 35% of habitat type 6510 within this zone will be occupied by project infrastructure, leading to a significant reduction in its local extent, despite its more limited spatial distribution.

The installation of solar panels and associated infrastructure will result in the replacement of natural and semi-natural vegetation with artificial surfaces and managed areas, leading to a long-term change in land use and habitat structure.

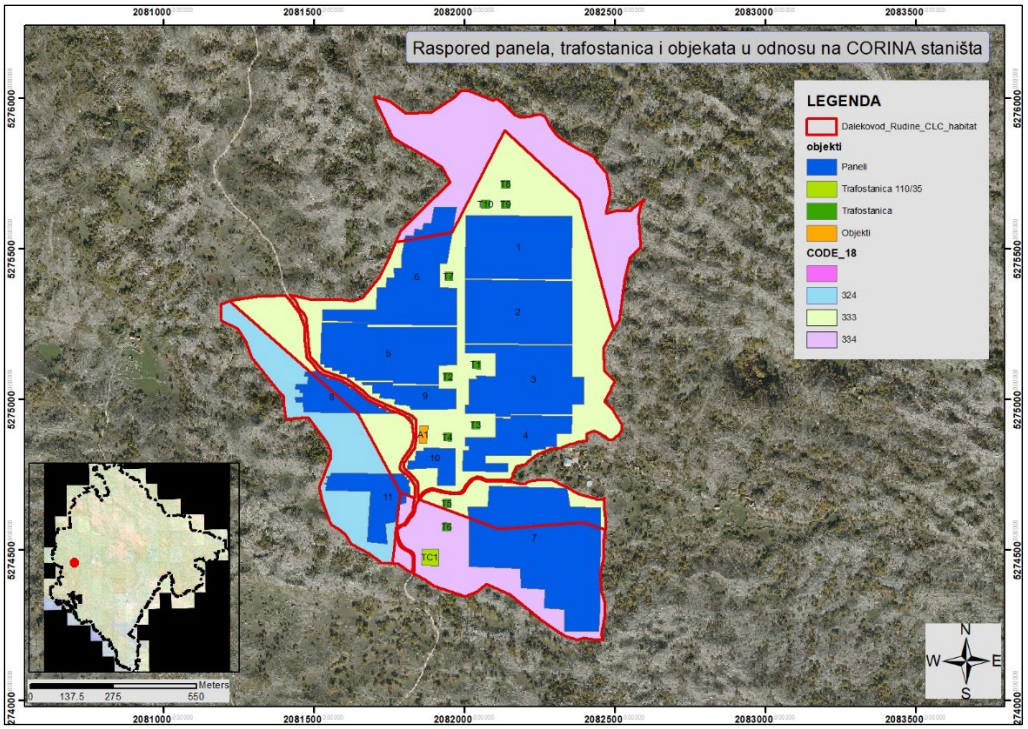


Figure 7-5 Habitat degradation with the photovoltaic power plant area

b) Habitat fragmentation and edge effects

The spatial arrangement of solar panels, internal access roads and technical facilities will contribute to the fragmentation of remaining habitat patches, particularly affecting habitats 62A0 and 91M0. Although these habitat types are relatively widespread at the regional level, the reduction of continuous habitat areas within the project site may lead to:

- increased edge effects,
- changes in microclimatic conditions, and
- reduced habitat quality in adjacent, non-developed areas.

For habitat type 6510, which is already present in a limited and fragmented pattern, the proportional loss of habitat area may result in higher local sensitivity, even though the habitat is not classified as a priority habitat at the EU level.

c) Overall impact significance for habitats within the solar plant area

Given that the solar power plant area is dominated by non-priority Annex I habitats (62A0 and 91M0), and that these habitats are widespread in the wider landscape, the regional conservation status of these habitat types is not expected to be significantly affected in any amount. However, impacts at the local scale are expected to be moderate, due to the extent of permanent habitat conversion. Impacts on habitat type 6510, although affecting a smaller absolute area, may be considered of moderate significance at the local level, due to the relatively high proportion of habitat loss within its limited distribution in the project area.

Overall, the development of the solar power plant and associated facilities will result in permanent habitat loss, modification and fragmentation within the project footprint, requiring careful consideration in the subsequent definition of mitigation and habitat management measures.

Impacts on habitats within the overhead transmission line (OHL) corridor

The overhead transmission line (OHL) corridor represents a linear project component where biodiversity impacts are expected to occur primarily at discrete locations associated with tower foundations and at areas where temporary or permanent access routes need to be created to enable construction machinery to reach tower sites. In this context, the majority of direct impacts can be characterised as point-based (tower foundation sites), while impacts associated with access track opening and clearing may be more relevant due to their linear nature and their potential to cause localised habitat fragmentation.

Within the OHL corridor, the dominant habitat types are 91M0 (Pannonian-Balkanic turkey oak–sessile oak forests) and 62A0 (Eastern sub-Mediterranean dry grasslands). Consequently, potential adverse impacts related to vegetation clearance, habitat loss and fragmentation are expected to primarily affect these habitat types.

a) Habitat loss, clearance and fragmentation

Direct habitat loss will occur at tower foundation locations, where vegetation will be removed and soil excavated for construction purposes. These impacts are expected to be spatially limited and localised (point-based) and therefore of relatively low overall magnitude in the context of the entire corridor width.
However, the opening of access tracks and the creation of temporary working areas may result in a more noticeable contribution to habitat disturbance, including:

- localised clearance of vegetation,
- fragmentation of habitat patches, and
- edge effects along newly created linear features.

Although these access routes are not expected to be extensive relative to the total corridor area, they represent the component with the highest potential to cause habitat fragmentation during the construction phase.

b) Expected significance for dominant habitat types (62A0 and 91M0)

Given that habitat types 62A0 and 91M0 are widely present and broadly distributed within the wide landscape surrounding the project corridor, the expected habitat loss and fragmentation associated with tower foundations and access routes are not anticipated to result in a significant negative effect on the regional conservation status of these habitat types.
Nevertheless, at the local scale, temporary impacts are expected in the form of:

- localised habitat disturbance and reduction in habitat quality,
- increased fragmentation in the immediate vicinity of access routes, and
- short-term disruption of habitat continuity.

c) Overall conclusion for the OHL corridor

Overall, impacts on habitats within the OHL corridor are expected to be low to moderate at the local scale, driven mainly by vegetation clearance and fragmentation associated with the construction of access tracks, while impacts at tower foundation locations are expected to remain localised and limited. Considering the broad distribution of the dominant habitat types (62A0 and 91M0) in the wider area, no significant adverse effects at the regional level are anticipated as a result of this project component.

Potential impacts on flora

Floristic surveys conducted within the project area recorded a diverse assemblage of plant species associated primarily with Eastern sub-Mediterranean dry grasslands (62A0) and Pannonian-Balkanic turkey oak–sessile oak forests (91M0), with a smaller contribution from lowland hay meadows (6510). The recorded flora is largely composed of widespread and ecologically common species, whose distribution

ranges extend well beyond the borders of Montenegro and cover broader parts of the Balkan Peninsula and south-eastern Europe.

a) General sensitivity of the recorded flora

The majority of recorded plant species are classified as Least Concern (LC) according to the IUCN Red List or have not been assessed, and do not represent species with restricted distribution ranges or narrow ecological requirements. As such, the overall sensitivity of the recorded flora at the regional and national scale is considered low.

Several species recorded within the project area are protected under Montenegrin national legislation, primarily orchid species associated with habitat type 62A0, including *Anacamptis morio*, *Neotinea tridentata*, *Ophrys scolopax*, *Ophrys sphegodes*, *Orchis provincialis* and *Orchis simia*. Although these species are legally protected, their distribution is not limited to the project area, and they are known to occur across a wide range of suitable habitats in Montenegro and the wider region.

b) Construction phase impacts on flora

During the construction phase, impacts on flora will be primarily related to:

- Direct removal of vegetation, resulting from land clearance for solar panels, associated infrastructure, access roads and transmission line tower foundations;
- Permanent loss of plant individuals within the project footprint, particularly within habitats 62A0 and 91M0;
- Localised damage to vegetation due to soil stripping, compaction, excavation and vehicle movements;
- Indirect impacts, including dust deposition on plant surfaces, changes in soil structure and localised alteration of moisture conditions.

These impacts will result in a local reduction in floristic diversity within the construction footprint, but are not expected to affect the regional or national conservation status of any recorded plant species, given their wide distribution and ecological tolerance.

c) Impacts on protected and conservation-relevant plant species

Protected orchid species recorded within the project area are associated mainly with semi-natural dry grasslands (62A0). Where construction activities overlap with suitable orchid habitats, localised loss of individuals may occur. However, considering:

- the limited spatial extent of direct impacts relative to the available habitat in the wider area,
- the broad distribution of these species beyond the project site, and
- the absence of endemic or critically endangered plant species,

the overall impact on protected plant species is assessed as low to moderate at the local scale, and negligible at the regional scale.

d) Overall assessment of impacts on flora

Overall, the project will result in localised and partly permanent impacts on flora within the direct footprint of the solar power plant and associated infrastructure. However, due to the widespread distribution, favourable conservation status, and ecological resilience of the recorded plant species, no significant adverse effects on flora are expected at the national or regional level. With appropriate site management and mitigation measures, impacts on floristic diversity are assessed as acceptable within the context of the project.

On the following table we are giving summary of the construction-phase impacts on habitats and flora.

Table 7-27 Summary of the construction -phase impacts on habitat and flora

Receptor	Impact type	Description of impact
Habitats	Permanent habitat loss	Conversion of natural and semi-natural habitats within the solar power plant footprint into built and managed areas
Habitats	Habitat fragmentation	Fragmentation caused by access roads, infrastructure layout and OHL corridor
Habitats	Edge effects	Creation of new habitat edges altering microclimatic conditions
Flora	Direct loss of plant individuals	Removal of vegetation and permanent loss of plant individuals within the construction footprint
Flora	Loss of protected plant species	Localised loss of legally protected orchid species associated with dry grasslands
Flora	Vegetation disturbance (OHL towers)	Localised vegetation removal at tower foundation locations
Flora	Vegetation clearance for access tracks	Linear vegetation clearance causing localised fragmentation and degradation
Flora	Indirect impacts	Dust deposition, soil compaction and altered soil conditions affecting plant vitality
Habitats & flora	Recovery potential	Natural recolonisation of temporarily disturbed areas outside permanent footprint

The following impact significance matrix provides an overview of the potential effects of the construction phase on habitats and flora within the project area. The assessment is based on the predicted magnitude of impacts, the sensitivity of affected receptors, and the expected duration and reversibility of changes. This approach allows for a consistent comparison of different impact pathways and supports the identification of impacts requiring mitigation. The matrix therefore forms the basis for evaluating the overall significance of construction-related impacts on habitats and flora.

Based on the results of the matrix, construction-related impacts on habitats and flora are predominantly assessed as **low and low to moderate in significance at the local scale**. No significant adverse impacts on the conservation status of habitats or plant species at the regional or national level are anticipated, provided that project implementation is supported by appropriate avoidance and mitigation measures.

Table 7-28 Impact significance matrix – habitats and flora (construction phase)

Receptor	Impact	Magnitude	Sensitivity	Duration / Reversibility	Overall significance
Habitats (62A0, 91M0, 6510)	Permanent habitat loss within solar plant footprint	Moderate	Medium	Long-term / Irreversible	**Moderate**
Habitats (62A0, 91M0)	Habitat fragmentation due to access roads and OHL corridor	Low	Medium	Long-term / Partly reversible	**Minor**
Habitats (62A0, 91M0)	Edge effects and microclimatic changes	Low	Medium	Medium-term / Reversible	**Minor**
Flora (general)	Direct loss of plant individuals	Moderate (local)	Low	Long-term / Irreversible	**Minor to Moderate**
Protected flora (orchids)	Localised loss of protected plant individuals	Low	Medium	Long-term / Irreversible	**Minor**

Flora (OHL towers)	Vegetation removal at tower foundation sites	Low	Low	Short-term / Irreversible	**Minor**
Flora (access tracks)	Linear vegetation clearance and local degradation	Low–Moderate	Low	Medium-term / Partly reversible	**Minor**
Habitats & flora	Indirect impacts (dust, soil compaction)	Low	Low	Short-term / Reversible	**Minor**

Mitigation measures

Mitigation measures represent a set of planned actions designed to avoid, minimise or compensate for adverse environmental impacts associated with project development. They are defined on the basis of identified impact pathways and are tailored to the sensitivity of affected environmental receptors. The primary purpose of mitigation measures is to ensure that predicted impacts remain within acceptable levels and do not result in significant adverse effects on biodiversity, habitats or other environmental components. Mitigation measures form an integral part of project design and implementation and are applied throughout all project phases.

Mitigation measures are prescribed in order to ensure compliance with national legislation and international environmental standards, as well as to reflect good international practice. Their definition allows potential impacts to be addressed proactively, rather than reactively, thereby reducing environmental risks during project implementation. In addition, clearly defined mitigation measures provide a transparent framework for environmental management and facilitate effective supervision and monitoring of project activities. This ensures that environmental commitments made during the assessment process are translated into practical actions on site.

The construction phase is considered particularly sensitive, as it involves direct physical interaction with natural habitats and species, as well as increased human presence and machinery use. During this phase, mitigation measures play a critical role in preventing unnecessary habitat loss, limiting disturbance and reducing the risk of irreversible damage. The timely and effective implementation of mitigation measures during construction is therefore essential to minimise short-term impacts and to ensure that longer-term environmental objectives are achieved.

The following mitigation measures are proposed to minimise the predicted negative impacts on habitats and flora associated with the implementation of the project in construction phase.

Table 7-29 Mitigation measures for impacts on habitats and flora (construction phase)

Impact	Mitigation measures
Permanent habitat loss	• Optimisation of project layout to minimise land take • Restrict construction activities strictly to the defined project footprint • Avoid unnecessary vegetation clearance
Habitat fragmentation	• Minimise the width and number of access roads • Use existing tracks where feasible • Restore temporarily disturbed areas immediately after works
Edge effects	• Maintain buffer zones between construction areas and adjacent habitats where feasible • Avoid abrupt habitat boundaries
Loss of plant individuals	• Clear vegetation only where strictly necessary • Progressive (phased) vegetation clearance
Impacts on protected orchid species	• Pre-construction botanical survey of 62A0 habitats • Micro-siting of infrastructure to avoid orchid-rich patches where feasible

	• Translocation of individuals only if unavoidable and in line with national regulations
Vegetation removal for OHL towers	• Minimise foundation footprint • Restore vegetation around tower bases after construction
Vegetation clearance for access tracks	• Use temporary access tracks where possible • Re-profile, decompact and re-vegetate tracks after construction
Soil compaction and dust impacts	• Limit machinery movement to designated routes • Apply dust suppression measures during dry periods
Indirect habitat degradation	• Proper storage of materials and fuels • Immediate clean-up of accidental spills

7.9.2.3 Impacts on Invertebrate fauna

The project area supports a diverse assemblage of invertebrate fauna, including gastropods, spiders, butterflies, beetles, orthopterans, hymenopterans and odonates, associated primarily with semi-natural grasslands, forest habitats and ecotonal areas. The majority of recorded species are widespread and common, with favourable conservation status, while only a limited number of taxa are of conservation relevance, either due to national legal protection or international conservation status.

During the construction phase, impacts on invertebrate fauna are expected to arise mainly from direct habitat loss and disturbance, associated with vegetation clearance, soil stripping, earthworks, construction of access roads and installation of infrastructure. These activities will result in the direct removal of microhabitats used by ground-dwelling and vegetation-dependent invertebrates, leading to localised mortality of less mobile species, particularly gastropods, larvae of Lepidoptera and soil-associated beetles. Habitat fragmentation and degradation caused by the creation of access routes and construction platforms may further affect invertebrate communities by reducing habitat continuity and altering microclimatic conditions. Changes in shading, soil moisture and vegetation structure may negatively influence species composition, especially for taxa with specific habitat requirements. However, given the widespread distribution of affected habitat types and the generally high dispersal ability of many invertebrate groups, these impacts are expected to remain localised.

Species of conservation importance, including protected gastropods (e.g. *Limax wohlberedti*, *Helix vladika*), selected Lepidoptera (*Papilio machaon*, *Iphiclides podalirius*, *Euphydryas aurinia*) and Coleoptera (*Oryctes nasicornis*, *Cerambyx cerdo*), may be locally affected where construction activities overlap with suitable habitats. Nevertheless, no key breeding sites or population strongholds for these species have been identified within the project footprint, and their regional populations are not expected to be significantly affected by the proposed works.

Overall, construction-related impacts on invertebrate fauna are expected to be temporary and localised, with the most pronounced effects occurring during the period of active construction. Given the dominance of common and widely distributed species and the limited spatial extent of direct impacts, the significance of impacts on invertebrate fauna is assessed as low to moderate at the local scale, with no anticipated significant adverse effects at the regional or national level.

Key impact on Invertebrate fauna during construction phase:

- Direct loss of individuals due to vegetation clearance, soil stripping and earthworks, particularly affecting ground-dwelling and low-mobility species;
- Localised habitat loss and degradation, resulting in the removal of microhabitats used for feeding, breeding and shelter;
- Temporary increase in mortality risk for larvae, pupae and soil-associated life stages during construction activities;

- Habitat fragmentation and altered microclimatic conditions, especially along access roads and working areas;
- Disturbance of invertebrate communities due to noise, vibration, dust and human presence;
- Localised impacts on protected and conservation-relevant species, without expected effects on their regional conservation status;
- Potential for post-construction recovery, driven by recolonisation from surrounding habitats and the resilience of common species.

Table 7-30 Summary of construction-phase impacts on Invertebrate fauna

Receptor	Impact type	Description of impact
Invertebrate fauna (general)	Direct mortality	Direct loss of individuals due to vegetation clearance, soil stripping, excavation and earthworks, particularly affecting ground-dwelling and low-mobility species
Invertebrate fauna (general)	Habitat loss	Localised loss of habitats and microhabitats used for feeding, shelter and reproduction within the construction footprint
Invertebrate fauna (general)	Microhabitat destruction	Removal of leaf litter, stones, dead wood and soil layers essential for many invertebrate groups
Invertebrate fauna (general)	Habitat fragmentation	Fragmentation of suitable habitats caused by access roads, construction tracks and working platforms
Invertebrate fauna (general)	Alteration of microclimatic conditions	Changes in temperature, humidity and light conditions due to vegetation removal and soil exposure
Invertebrate fauna (general)	Disturbance	Disturbance from noise, vibration, dust and increased human presence during construction activities
Invertebrate fauna (general)	Reduced habitat quality	Soil compaction and dust deposition leading to degradation of habitat conditions
Invertebrate fauna (general)	Temporary displacement	Temporary avoidance of construction areas by mobile invertebrate species
Protected invertebrate species	Localised loss of individuals	Localised loss of legally protected gastropod, Lepidoptera and Coleoptera species where construction overlaps with suitable habitats
Lepidoptera (larval stages)	Loss of host plants	Removal of larval host plants and nectar sources during vegetation clearance
Soil-associated invertebrates	Soil disturbance	Disruption of soil structure affecting soil-dwelling taxa (beetles, larvae, gastropods)
Aquatic and semi-aquatic invertebrates	Indirect impacts	Potential indirect impacts due to sediment runoff or local changes in moisture conditions
Invertebrate communities	Community structure alteration	Short-term changes in species composition due to differential sensitivity and recolonisation ability
Invertebrate fauna (general)	Recovery potential	Natural recolonisation of disturbed areas from surrounding habitats following completion of construction

In order to provide a structured assessment of potential impacts on invertebrate fauna during the construction phase, an impact significance matrix has been developed. The matrix allows for a systematic evaluation of identified impact pathways by considering the expected magnitude of impacts, the sensitivity of affected receptors, and the duration and reversibility of predicted changes. This approach ensures a consistent and transparent assessment of impacts across different invertebrate groups.

The use of an impact significance matrix supports the prioritisation of impacts based on their potential ecological relevance. By summarising complex interactions between construction activities and invertebrate

fauna in a structured format, the matrix facilitates comparison between different types of impacts and helps identify those requiring targeted mitigation measures. This enables a clear distinction between temporary, localised effects and impacts that may have longer-term implications.

The outcomes of the impact significance matrix form a key input for the definition of appropriate mitigation and management measures aimed at minimising adverse effects on invertebrate fauna. The matrix also provides a basis for evaluating residual impacts following the implementation of mitigation measures and supports informed decision-making throughout the project lifecycle.

Table 7-31 Impact significance matrix – invertebrate fauna (construction phase)

Receptor	Impact	Magnitude of impact	Sensitivity of receptor	Duration / Reversibility	Overall significance
Invertebrate fauna (general)	Direct mortality due to construction activities	Moderate (local)	Low	Short-term / Irreversible (individuals)	**Minor to Moderate**
Invertebrate fauna (general)	Habitat and microhabitat loss	Moderate (local)	Low to Medium	Long-term / Partly irreversible	**Minor to Moderate**
Invertebrate fauna (general)	Microhabitat destruction (soil, litter, dead wood)	Moderate	Medium	Medium-term / Reversible	**Minor to Moderate**
Invertebrate fauna (general)	Habitat fragmentation	Low to Moderate	Low	Long-term / Partly reversible	**Minor**
Invertebrate fauna (general)	Alteration of microclimatic conditions	Low	Low	Medium-term / Reversible	**Minor**
Invertebrate fauna (general)	Disturbance (noise, vibration, dust)	Low	Low	Short-term / Reversible	**Minor**
Protected invertebrate species	Localised loss of protected species	Low	Medium	Long-term / Irreversible (individuals)	**Minor**
Lepidoptera (larval stages)	Loss of larval host plants	Low to Moderate	Medium	Medium-term / Reversible	**Minor to Moderate**
Soil-associated invertebrates	Soil disturbance and compaction	Moderate	Medium	Medium-term / Reversible	**Minor to Moderate**
Invertebrate communities	Temporary changes in community structure	Low	Low	Short-term / Reversible	**Minor**

Mitigation measures

The mitigation measures proposed for the construction phase are designed to avoid, minimise and control potential adverse impacts on invertebrate fauna arising from vegetation clearance, soil disturbance and construction activities. These measures are based on the identified impact pathways and take into account the ecological characteristics and sensitivity of invertebrate communities present within the project area. Their implementation aims to reduce the extent and intensity of impacts during the period of active construction works.

The proposed mitigation measures focus primarily on limiting habitat and microhabitat loss, reducing direct mortality of less mobile species and facilitating post-construction recovery of disturbed areas. Particular attention is given to the protection of soil structure, retention of key microhabitat features and avoidance of unnecessary disturbance beyond the defined construction footprint. Where impacts on protected or

conservation-relevant species may occur, mitigation measures emphasise impact avoidance and micro-siting of infrastructure.

The consistent application of the proposed mitigation measures during the construction phase is essential to ensure that impacts on invertebrate fauna remain localised, temporary and of low to moderate significance. These measures also provide the basis for effective site management and support the natural recolonisation of disturbed areas following the completion of construction activities.

Table 7-32: Mitigation measures for impacts on Invertebrate fauna (construction phase)

Impact	Mitigation measures
Direct mortality of invertebrates	• Limit vegetation clearance and soil works strictly to the defined construction footprint • Apply phased construction where feasible to allow gradual displacement of mobile species
Habitat and microhabitat loss	• Retain leaf litter, stones and dead wood outside construction areas • Avoid unnecessary removal of natural substrates where technically feasible
Microhabitat destruction (soil, litter, dead wood)	• Store stripped topsoil separately and reuse it for site restoration • Restore disturbed surfaces immediately after completion of works
Habitat fragmentation	• Minimise the width and number of access roads • Use existing tracks and disturbed areas where possible
Alteration of microclimatic conditions	• Avoid excessive vegetation clearance beyond operational needs • Maintain buffer vegetation strips adjacent to construction zones
Disturbance from noise, vibration and dust	• Apply dust suppression measures during dry periods • Restrict construction activities to daytime hours
Impacts on protected invertebrate species	• Conduct pre-construction checks in suitable habitats for protected gastropods and Lepidoptera • Micro-site infrastructure to avoid areas with higher concentrations of protected species where feasible
Loss of Lepidoptera larval host plants	• Avoid vegetation clearance during peak breeding and larval development periods where possible • Retain patches of host plants and nectar sources outside the construction footprint
Soil disturbance and compaction	• Limit heavy machinery movement to designated routes • Avoid unnecessary soil compaction outside working areas
Temporary habitat degradation	• Implement site restoration and re-vegetation using native plant species • Allow natural recolonisation from surrounding habitats

7.9.2.4 Impacts on Amphibian and Reptile fauna

The project area supports a diverse assemblage of amphibian and reptile species, including taxa of national and European conservation importance. Amphibians are strongly dependent on the availability of aquatic habitats for reproduction, while reptiles primarily occupy dry grasslands, karst habitats, forest edges and mosaic landscapes. Within the solar power plant area, a small permanent water captation represents a key habitat feature, providing essential breeding and refuge conditions for amphibian species.

During the construction phase, impacts on amphibian and reptile fauna are expected to result primarily from habitat loss, disturbance and physical alteration of terrestrial and aquatic environments. Vegetation clearance, soil stripping, excavation works and construction of access roads may lead to the removal of

shelter sites, hibernation areas and basking habitats, particularly affecting reptiles. Amphibians may be affected both during their terrestrial life stages and during seasonal migrations between terrestrial habitats and breeding sites.

The most sensitive impact pathway for amphibians is associated with the potential disturbance, degradation or accidental damage to the permanent water captation and its surrounding terrestrial zone. Any alteration of water quality, hydrological regime or physical structure of this water body could negatively affect breeding success and larval development. In addition, disturbance of terrestrial habitats surrounding the water body may disrupt migration routes and increase mortality during movements.

Reptile species may be affected through direct mortality risk, habitat fragmentation and displacement caused by construction activities and increased machinery movement. Species associated with open karst habitats and forest edges may experience temporary avoidance of construction areas, while less mobile individuals may be exposed to a higher risk of injury or mortality during earthworks.

Although several recorded species are protected under national legislation and listed under the EU Habitats Directive, the majority are widespread at the regional scale, and no critical breeding or population strongholds have been identified within the construction footprint. Consequently, construction-phase impacts on amphibian and reptile fauna are expected to be localised and temporary, with the highest sensitivity related to the water captation and its immediate surroundings.

Key construction-phase impacts on amphibians and reptiles:

- Direct loss and degradation of terrestrial habitats due to vegetation clearance and earthworks
- Disturbance of amphibian breeding habitats, particularly the permanent water captation
- Increased mortality risk during construction activities and machinery movement
- Disruption of migration routes between terrestrial habitats and breeding sites
- Habitat fragmentation and edge effects, especially along access roads
- Temporary displacement and avoidance behaviour, particularly for reptiles
- Localised impacts on protected and conservation-relevant species, without regional population effects

Table 7-33 Summary of construction-phase impacts on amphibian and reptile fauna

Receptor	Impact type	Description of impact
Amphibians	Disturbance of breeding habitat	Potential disturbance or degradation of the permanent water captation used for reproduction
Amphibians	Loss of terrestrial habitat	Removal of terrestrial habitats used for foraging, shelter and migration
Amphibians	Increased mortality risk	Higher mortality during seasonal movements due to construction activities
Reptiles	Habitat loss	Loss of shelter, basking and foraging habitats due to vegetation clearance
Reptiles	Direct mortality	Risk of injury or mortality during earthworks and machinery operation
Amphibians & reptiles	Habitat fragmentation	Fragmentation caused by access roads and construction platforms
Amphibians & reptiles	Disturbance	Disturbance from noise, vibration and human presence
Protected species	Localised impact	Localised effects on legally protected and Annex II species
Amphibian populations	Reproductive success reduction	Potential reduction in breeding success if aquatic habitats are disturbed

in order to systematically assess potential impacts on amphibian and reptile fauna during the construction phase, an impact significance matrix has been prepared. The matrix enables evaluation of identified impact pathways by considering the magnitude of impacts, sensitivity of affected species and habitats, and the duration and reversibility of predicted changes. This approach supports a consistent and transparent assessment of construction-related impacts.

The impact significance matrix indicates that construction-phase impacts on amphibian and reptile fauna are predominantly of **low to moderate significance at the local scale**. The most sensitive impact pathway relates to potential disturbance of amphibian breeding habitats, particularly the permanent water captation. With appropriate avoidance and mitigation measures in place, no significant adverse effects on amphibian and reptile populations at the regional or national level are anticipated.

Table 7-34 Impact significance matrix – amphibian and reptile fauna (construction phase)

Receptor	Impact	Magnitude	Sensitivity	Duration / Reversibility	Overall significance
Amphibians	Disturbance of breeding habitats	Moderate	High	Medium-term / Partly reversible	**Moderate**
Amphibians	Loss of terrestrial habitat	Moderate	Medium	Medium-term / Reversible	**Minor to Moderate**
Reptiles	Habitat loss and disturbance	Moderate	Medium	Medium-term / Reversible	**Minor to Moderate**
Amphibians & reptiles	Direct mortality	Low to Moderate	Medium	Short-term / Irreversible (individuals)	**Minor to Moderate**
Amphibians & reptiles	Habitat fragmentation	Low	Medium	Long-term / Partly reversible	**Minor**
Protected species	Localised impacts	Low	Medium to High	Long-term / Irreversible (individuals)	**Minor**

Mitigation measures

The mitigation measures proposed for the construction phase are aimed at avoiding, minimising and controlling potential adverse impacts on amphibian and reptile fauna, with particular emphasis on the protection of sensitive habitats and species of conservation importance. These measures are based on the identified impact pathways associated with vegetation clearance, earthworks, construction traffic and disturbance of aquatic and terrestrial habitats.

Special attention is given to the protection of the permanent water captation, which represents a key breeding and refuge habitat for amphibians within the project area. Measures targeting this habitat are essential to prevent disturbance, maintain water quality and ensure the continued functionality of the site for amphibian reproduction during and after construction works.

Mitigation measures also focus on reducing direct mortality, limiting habitat fragmentation and maintaining connectivity between terrestrial habitats and breeding sites. By restricting construction activities to defined areas, controlling machinery movement and applying appropriate timing of works, impacts on amphibians and reptiles can be significantly reduced.

The consistent implementation of mitigation measures throughout the construction phase is critical to ensure that impacts on amphibian and reptile fauna remain localised, temporary and of low to moderate significance, and that no long-term adverse effects on local populations occur.

Table 7-35 Mitigation measures – construction phase (amphibians and reptiles)

Impact	Mitigation measures
Disturbance of amphibian breeding habitats	• Establish a no-go buffer zone around the permanent water captation • Prohibit storage of materials, refuelling and machinery operation near the water body
Degradation of water quality	• Prevent sediment runoff into the captation
Loss of terrestrial habitats	• Restrict vegetation clearance to the defined construction footprint • Avoid unnecessary removal of shelter and refuge areas
Disruption of migration routes	• Avoid blocking natural movement corridors between terrestrial habitats and the water captation • Install temporary wildlife passages where feasible and if necessary
Direct mortality during construction	• Conduct pre-construction site checks for amphibians and reptiles • Apply reduced vehicle speeds and restrict night-time works where feasible
Habitat fragmentation	• Minimise the width and number of access roads • Use existing tracks wherever possible
Disturbance from machinery and human presence	• Restrict construction activities to daylight hours
Impacts on protected and Annex II species	• Apply micro-siting of infrastructure to avoid sensitive habitats • Ensure compliance with national species protection regulations
Temporary habitat degradation	• Restore disturbed terrestrial habitats immediately after completion of works • Use native vegetation for site restoration

7.9.2.5 Impacts on Birds

Although the majority of recorded species are classified as Least Concern at the global level, the presence of the Vulnerable European turtle dove (*Streptopelia decaocto*) increases the conservation sensitivity of the area. Nevertheless, no critical breeding colonies or population strongholds have been identified within the construction footprint. Therefore, construction-phase impacts on bird fauna are expected to be localised and temporary, provided that appropriate mitigation measures are implemented. The project area supports a diverse assemblage of bird species, with a total of 38 species recorded during ornithological surveys conducted between April and September. The recorded avifauna includes species associated with forests, open and semi-open habitats, agricultural landscapes, as well as synanthropic and migratory species, reflecting a heterogeneous landscape typical of the wider region. All recorded species are legally protected under Montenegrin legislation and fall within the scope of the Natura 2000 framework.

During the construction phase, impacts on bird fauna are expected to arise primarily from habitat loss and disturbance, associated with vegetation clearance, earthworks, construction of access roads, installation of solar panels and construction of the overhead transmission line (OHL). These activities may lead to the removal of nesting, foraging and resting habitats, as well as increased disturbance from noise, vibration and human presence, particularly during sensitive periods such as breeding and migration.

Bird species associated with open habitats and forest edges may experience temporary displacement and avoidance behaviour in response to construction activities. Ground-nesting and shrub-nesting species are particularly sensitive to vegetation clearance, while raptors and other large birds may be affected by disturbance in foraging areas. The construction of the OHL may result in temporary disturbance along the

corridor and increased collision risk during the construction phase, although this risk is generally lower than during operation.

Although the majority of recorded species are classified as Least Concern at the global level, the presence of the Vulnerable European turtle dove (*Streptopelia decaocto*) increases the conservation sensitivity of the area. Nevertheless, no critical breeding colonies or population strongholds have been identified within the construction footprint. Therefore, construction-phase impacts on bird fauna are expected to be localised and temporary, provided that appropriate mitigation measures are implemented.

Key construction-phase impacts on birds:

- Loss of nesting and foraging habitats due to vegetation clearance
- Disturbance during breeding season from noise, vibration and human activity
- Temporary displacement and avoidance behaviour
- Increased mortality risk during construction works (ground disturbance, machinery)
- Disturbance along the OHL corridor during installation works
- Localised impacts on protected and Natura 2000-listed species
- Potential disturbance to Vulnerable species (European turtle dove)

Table 7-36 Summary of construction-phase impacts on birds

Receptor	Impact type	Description of impact
Bird fauna (general)	Habitat loss	Removal of nesting, roosting and foraging habitats due to vegetation clearance
Bird fauna (general)	Disturbance	Disturbance from noise, vibration and human presence during construction
Breeding birds	Breeding disturbance	Reduced breeding success due to disturbance during nesting period
Ground- and shrub-nesting birds	Nest destruction	Direct destruction of nests during vegetation clearance
Raptors and large birds	Foraging disturbance	Temporary loss or disturbance of hunting areas
Bird fauna (general)	Temporary displacement	Avoidance of construction areas
Bird fauna (general)	Mortality risk	Risk of injury or mortality from machinery and earthworks
Bird fauna (general)	OHL-related disturbance	Disturbance along transmission line corridor during construction
Protected species	Localised impacts	Localised effects on nationally protected and Natura 2000 species

To systematically evaluate potential impacts on bird fauna during the construction phase, an impact significance matrix has been prepared. The matrix enables assessment of the magnitude, sensitivity and duration of identified impacts, allowing differentiation between minor, temporary effects and impacts requiring targeted mitigation. This structured approach supports transparent and consistent impact evaluation.

The impact significance matrix indicates that construction-phase impacts on bird fauna are predominantly of **low to moderate significance at the local scale**. The most sensitive impacts relate to disturbance during the breeding period and temporary loss of nesting habitats. With appropriate mitigation measures in place, no significant adverse effects on bird populations at the regional or national level are anticipated.

Table 7-37 Impact significance matrix – birds (construction phase)

Receptor	Impact	Magnitude	Sensitivity	Duration / Reversibility	Overall significance
Bird fauna (general)	Habitat loss	Moderate	Medium	Medium-term / Reversible	**Minor to Moderate**
Breeding birds	Breeding disturbance	Moderate	High	Short-term / Reversible	**Moderate**
Ground-nesting birds	Nest destruction	Low to Moderate	High	Short-term / Irreversible (nests)	**Moderate**
Bird fauna (general)	Disturbance	Low to Moderate	Medium	Short-term / Reversible	**Minor**
Bird fauna (general)	Temporary displacement	Low	Medium	Short-term / Reversible	**Minor**
Bird fauna (general)	Mortality risk	Low	Medium	Short-term / Irreversible (individuals)	**Minor**
Protected / Vulnerable species	Localised impacts	Low	High	Medium-term / Reversible	**Minor to Moderate**

Mitigation measures

The mitigation measures proposed for the construction phase aim to avoid, minimise and manage potential adverse impacts on bird fauna, particularly during sensitive periods such as breeding and migration. These measures are based on the identified impact pathways and take into account the legal protection status of all recorded species.

Special attention is given to timing of works, habitat retention and reduction of disturbance, as these represent the most effective means of minimising impacts on birds during construction. Measures addressing the construction of the overhead transmission line are also included to reduce disturbance and mortality risk.

The consistent application of mitigation measures during construction will ensure that impacts on bird fauna remain localised, temporary and manageable, in line with national and European conservation requirements.

Table 7-38 Mitigation measures – construction phase (birds)

Impact	Mitigation measures
Disturbance during breeding season	• Avoid vegetation clearance during peak breeding period (March–July) where feasible • Conduct pre-construction nesting checks
Nest destruction	• Clearly mark and protect active nests • Establish temporary exclusion zones
Habitat loss	• Restrict clearance to defined construction footprint • Retain trees and shrubs where possible
Disturbance from noise and activity	• Limit construction to daylight hours • Avoid simultaneous high-disturbance activities
OHL construction impacts	• Minimise duration of works along OHL corridor • Avoid construction during peak migration where feasible
Mortality risk from machinery	• Apply reduced vehicle speeds • Raise worker awareness

Impacts on Vulnerable species	• Apply site-specific measures where turtle dove presence is confirmed
Temporary displacement	• Restore disturbed areas promptly • Encourage natural recolonisation

7.9.2.6 Impacts on Mammal fauna

The study area supports a moderately diverse mammal assemblage, with a total of sixteen (16) species recorded, belonging to six taxonomic orders. The recorded mammal fauna includes small terrestrial mammals, medium-sized carnivores, large mammals and bats. Most non-volant mammal species recorded within the project area are widespread and ecologically adaptable, commonly occurring in agricultural landscapes, forest edges and mosaic habitats across the wider region.

During the construction phase, impacts on terrestrial mammals are expected to arise mainly from habitat disturbance, temporary displacement and increased human activity. Vegetation clearance, earthworks and construction traffic may lead to short-term avoidance of the construction area by mobile species such as foxes and martens, while smaller mammals may experience localised habitat loss and disturbance. However, given the availability of suitable habitats in the surrounding area, these impacts are expected to be localised and temporary, with rapid recolonisation following completion of construction works.

From a conservation perspective, the most sensitive mammal group recorded within the study area is bats (Order Chiroptera), with eight species detected, all of which are strictly protected under national and international legislation. Bats are highly sensitive to habitat loss, disturbance, artificial lighting and linear infrastructure, and their presence within the project area represents a key consideration for the impact assessment.

During the construction phase, bats may be affected through disturbance of foraging habitats and commuting routes, removal of potential roosting features (such as trees with cavities or buildings), increased noise and vibration, and the introduction of artificial lighting. In addition, construction of the overhead transmission line (OHL) may temporarily affect bat movement corridors, particularly for species that rely on linear landscape features for navigation. Species such as *Rhinolophus hipposideros* and *Myotis blythii*, which are listed under Annex II and/or IV of the EU Habitats Directive, are considered particularly sensitive receptors.

Although no confirmed maternity roosts or major bat colonies have been identified within the construction footprint, the presence of multiple protected bat species indicates a high sensitivity of the receptor, and construction-phase impacts on bats require careful management. With appropriate mitigation measures in place, impacts on bat populations are expected to remain localised and of low to moderate significance, without adverse effects at the regional or national level.

Key construction-phase impacts on mammals:

- Temporary habitat disturbance and loss affecting terrestrial mammals
- Displacement and avoidance behaviour due to construction activity
- Increased mortality risk for small mammals during earthworks
- Disturbance of bat foraging habitats and commuting routes
- Loss of potential bat roosting features due to vegetation clearance
- Sensitivity of bats to noise, vibration and artificial lighting
- Temporary disturbance along OHL corridor affecting bat movement
- Localised impacts on strictly protected bat species

Table 7-39: Summary of construction-phase impacts on mammal fauna

Receptor	Impact type	Description of impact
Terrestrial mammals	Habitat disturbance	Disturbance and temporary loss of habitats due to vegetation clearance and earthworks
Terrestrial mammals	Displacement	Temporary avoidance of construction areas
Small mammals	Mortality risk	Risk of injury or mortality during soil stripping and earthworks
Bats	Disturbance of foraging habitats	Reduced foraging efficiency due to habitat alteration and disturbance
Bats	Loss of roosting features	Removal of trees or structures with potential roosting value
Bats	Disturbance from noise and vibration	Reduced activity levels during construction works
Bats	Artificial light disturbance	Disruption of flight paths and feeding behaviour
Bats	OHL-related disturbance	Temporary disruption of commuting routes during construction
Protected species	Localised impacts	Impacts on strictly protected bat species

To evaluate potential impacts on mammal fauna during the construction phase, an impact significance matrix has been prepared. The matrix allows systematic assessment of different impact pathways by considering magnitude, sensitivity and duration of impacts, with particular emphasis on highly sensitive receptors such as bats. This structured approach supports transparent identification of impacts requiring targeted mitigation.

The impact significance matrix indicates that construction-phase impacts on terrestrial mammals are predominantly of **low significance**, reflecting their adaptability and mobility. In contrast, bats represent a **highly sensitive ecological receptor**, with potential impacts assessed as **low to moderate significance at the local scale**, particularly in relation to disturbance, lighting and potential loss of roosting features. With appropriate mitigation measures in place, no significant adverse effects on mammal populations at the regional or national level are anticipated.

Table 7-40: Impact significance matrix – mammal fauna (construction phase)

Receptor	Impact	Magnitude	Sensitivity	Duration / Reversibility	Overall significance
Terrestrial mammals	Habitat disturbance	Low to Moderate	Low	Short-term / Reversible	**Minor**
Terrestrial mammals	Displacement	Low	Low	Short-term / Reversible	**Minor**
Small mammals	Mortality risk	Low	Medium	Short-term / Irreversible (individuals)	**Minor**
Bats	Disturbance of foraging habitats	Moderate	High	Medium-term / Reversible	**Moderate**
Bats	Loss of roosting features	Low to Moderate	High	Long-term / Irreversible	**Moderate**
Bats	Artificial light disturbance	Moderate	High	Medium-term / Reversible	**Moderate**
Bats	OHL-related disturbance	Low	Medium	Short-term / Reversible	**Minor**

Protected bat species	Localised impacts	Moderate	High	Medium-term / Reversible	**Moderate**

Mitigation measures

The mitigation measures proposed for the construction phase are designed to avoid, minimise and manage potential adverse impacts on mammal fauna, with particular emphasis on bats, which represent the most sensitive and conservation-relevant mammal group recorded within the project area. These measures are based on the identified impact pathways associated with vegetation clearance, earthworks, construction traffic, noise, vibration, artificial lighting and the installation of linear infrastructure.

Given the strict legal protection status of all recorded bat species under Montenegrin national legislation and relevant international frameworks, mitigation measures for bats focus on **preventing disturbance to roosting sites, maintaining functional foraging habitats and preserving commuting routes**. Special attention is given to activities that may result in the loss of potential roosting features, changes in landscape connectivity or increased light pollution, as these factors can significantly affect bat behaviour and population viability.

Mitigation measures addressing terrestrial mammals aim to reduce **temporary habitat disturbance, displacement and direct mortality risk**, particularly for small mammals during earthworks. By restricting construction activities to defined areas, controlling vehicle movement and applying phased vegetation clearance, impacts on non-volant mammals can be effectively minimised. The consistent and effective implementation of mitigation measures throughout the construction phase is essential to ensure that impacts on mammal fauna remain **localised, temporary and of low to moderate significance**. These measures also support compliance with applicable legal requirements and contribute to the long-term conservation of sensitive mammal species within the wider project area.

Table 7-41: Mitigation measures – construction phase (mammals)

Impact	Mitigation measures
Habitat disturbance (terrestrial mammals)	• Restrict works to defined construction footprint • Restore disturbed areas promptly
Small mammal mortality	• Apply phased vegetation clearance • Conduct pre-clearance checks
Bat roost loss	• Inspect trees and structures for bat roost potential prior to removal • Avoid removal of confirmed roosts
Disturbance to bat foraging habitats	• Retain linear landscape features where feasible
Artificial lighting impacts on bats	• Use downward-facing, low-intensity lighting • Avoid lighting near known bat activity areas
Noise and vibration disturbance	• Restrict construction to daylight hours
OHL construction impacts on bats	• Minimise duration of works along OHL corridor
Impacts on protected bat species	• Apply species protection requirements under national legislation
Temporary habitat degradation	• Implement habitat restoration using native vegetation

7.9.3 Operation and Maintenance phase

7.9.3.1 Overall impacts

During the operation and maintenance phase, the proposed solar power plant and associated overhead transmission line will represent a permanent element within the landscape, resulting in long-term but generally low-intensity pressures on biodiversity. Compared to the construction phase, human presence and mechanical activity will be limited and intermittent, reducing the frequency and intensity of direct

disturbance to wildlife. As a result, operational impacts are expected to be more stable and predictable, allowing many species to adapt to the presence of infrastructure over time.

The main biodiversity-related impacts during this phase are associated with long-term habitat modification and management, as well as the presence of linear infrastructure. Routine vegetation management within the solar plant area and along access routes may influence habitat structure and availability for certain species groups, while the overhead transmission line may contribute to barrier effects and collision risk for birds and bats. These impacts are expected to remain localised, particularly given the widespread distribution of affected habitat types and the absence of species with highly restricted ranges within the project area.

Additional operational pressures may include chronic low-level disturbance, such as noise from maintenance activities and, where applicable, artificial lighting, which may affect sensitive fauna, particularly nocturnal species. However, provided that appropriate mitigation and monitoring measures are implemented, these effects are expected to be manageable and of low to moderate significance at the local scale. Overall, the operation and maintenance phase is not anticipated to result in significant adverse effects on biodiversity at the regional or national level.

7.9.3.2 *Impacts on habitats and flora*

During the operation and maintenance phase, habitats and flora within the project area will already reflect the residual effects of construction activities, including permanent habitat conversion, vegetation removal and localised fragmentation. The ecological baseline for this phase therefore represents a modified landscape, where parts of the original habitats have been replaced by solar infrastructure and associated facilities, while remaining habitat patches persist under altered conditions influenced by edge effects and management practices.

Within the footprint of the solar power plant and associated infrastructure, habitats affected during construction will remain under long-term altered conditions. Natural vegetation will not be able to fully re-establish due to the permanent presence of solar panels, foundations, internal access routes and the substation. As a result, habitats 62A0, 91M0 and locally 6510 will experience a permanent reduction in spatial extent, accompanied by sustained changes in vegetation structure and floristic composition.

Operational impacts will be driven primarily by routine maintenance activities, including regular vegetation management such as mowing, clearance and prevention of woody encroachment. These practices will suppress natural succession and maintain simplified vegetation communities within managed areas, potentially reducing local habitat complexity and plant diversity. However, these impacts are expected to remain stable over time, without progressive degradation beyond that already caused during the construction phase.

In areas outside the permanent infrastructure footprint, including parts of the overhead transmission line corridor and adjacent zones, partial recovery of habitats and flora is expected following construction. Recolonisation by common and widespread plant species is likely, given the ecological resilience of the affected habitat types and the absence of plant species with narrow distribution ranges. Consequently, impacts on habitats and flora during the operational phase are assessed as low to moderate at the local scale, with no anticipated significant adverse effects on habitat conservation status or floristic diversity at the regional or national level.

Key impact on habitats and flora operation and maintenance phase:

- Permanent loss of habitat area within the solar power plant footprint, reflecting residual impacts from construction;
- Long-term modification of habitat structure, due to the presence of solar panels, foundations and associated infrastructure;

- Alteration of vegetation composition, caused by regular maintenance and suppression of natural succession;
- Reduced habitat complexity within managed areas, particularly affecting grassland and forest-edge habitats;
- Persistence of edge effects in remaining habitat patches adjacent to infrastructure;

Table 7-42: Summary of the operational and maintenance-phase impacts on habitats and flora

Receptor	Impact type	Description of impact
Habitats	Permanent habitat loss	Long-term loss of habitat area within the solar power plant footprint resulting from permanent infrastructure
Habitats	Habitat modification	Sustained alteration of habitat structure due to presence of solar panels, foundations and internal access routes
Habitats	Edge effects	Persistence of edge effects in remaining habitat patches adjacent to infrastructure
Habitats	Fragmentation effects	Continued local fragmentation associated with project layout and fencing
Flora	Altered vegetation composition	Changes in plant species composition due to routine mowing and vegetation management
Flora	Suppression of natural succession	Prevention of woody encroachment and natural regeneration within managed areas
Flora	Reduced habitat complexity	Simplification of vegetation structure within maintained areas

In order to systematically assess the potential impacts of the project on habitats and flora during the operation and maintenance phase, a structured impact significance matrix has been developed. The matrix enables a consistent evaluation of identified impact pathways by considering the expected magnitude of impacts, the sensitivity of affected receptors, and the anticipated duration and reversibility of changes. This approach supports a transparent comparison of different impacts and provides a clear basis for determining their overall significance.

The application of the impact significance matrix allows potential impacts to be prioritised and facilitates the identification of those requiring mitigation measures. By summarising the assessment results in a structured format, the matrix supports informed decision-making and ensures that impacts of differing nature and scale are assessed in a consistent manner. The outcomes of the matrix therefore represent a key input for the definition of mitigation and management measures aimed at minimising long-term effects on habitats and flora.

The results of the impact significance matrix indicate that potential impacts on habitats and flora during the operation and maintenance phase are predominantly of **low significance**, reflecting the limited intensity and spatial extent of operational activities. Permanent habitat loss within the solar power plant footprint represents the most relevant long-term impact; however, its significance remains limited to the local scale due to the widespread distribution and favourable conservation status of the affected habitat types and plant species. Other identified impacts, including habitat modification, fragmentation and changes in vegetation structure, are expected to remain stable over time and not to result in progressive environmental degradation. Overall, the matrix confirms that, with appropriate management measures in place, the project is not expected to cause significant adverse effects on habitats and flora at the regional or national level.

Table 7-43: Impact significance matrix – habitats and flora (Operation & Maintenance phase)

Receptor	Impact	Magnitude of impact	Sensitivity of receptor	Duration / Reversibility	Overall significance
Habitats (62A0, 91M0, 6510)	Permanent habitat loss within the solar plant footprint	Low	Medium	Long-term / Irreversible	**Minor to Moderate**
Habitats (62A0, 91M0)	Long-term habitat modification	Low	Medium	Long-term / Irreversible	**Minor**
Habitats (62A0, 91M0)	Edge effects	Low	Medium	Long-term / Partly reversible	**Minor**
Habitats (62A0, 91M0)	Fragmentation effects	Low	Medium	Long-term / Partly reversible	**Minor**
Flora (general)	Altered vegetation composition due to maintenance	Low	Low	Long-term / Reversible	**Minor**
Flora (general)	Suppression of natural succession	Low	Low	Long-term / Reversible	**Minor**
Flora	Reduced habitat complexity	Low	Low	Long-term / Reversible	**Minor**

Mitigation measures

Mitigation measures during the operation and maintenance phase are primarily aimed at controlling long-term and cumulative impacts resulting from the permanent presence of project infrastructure. These measures focus on limiting disturbance to habitats and flora to the defined project footprint, preventing further habitat degradation, and ensuring that operational activities do not expand beyond the areas already affected during construction. By applying clear operational rules and good environmental management practices, potential impacts can be maintained at a low and stable level throughout the lifetime of the project.

Particular emphasis is placed on appropriate vegetation management, including controlled mowing regimes, avoidance of chemical herbicides, and minimisation of unnecessary ground disturbance. Such measures help preserve semi-natural vegetation characteristics in managed areas and reduce secondary impacts on adjacent habitats. The consistent implementation of mitigation measures during the operation and maintenance phase is essential to ensure that residual impacts on habitats and flora remain localised, predictable and of low significance, and that no additional long-term pressures on biodiversity are introduced.

The following mitigation measures are proposed to minimise the predicted negative impacts on habitats and flora associated with the implementation of the project in operation and maintenance phase.

Table 7-44: Mitigation measures – Operation and Maintenance phase (habitats and flora)

Impact	Mitigation measures
Permanent habitat loss within the solar plant footprint	• Restrict operational activities strictly to the defined project footprint • Prohibit any expansion of infrastructure outside approved boundaries
Long-term habitat modification	• Apply low-intensity vegetation management practices • Avoid use of herbicides and chemicals for vegetation control
Edge effects on adjacent habitats	• Maintain buffer strips between infrastructure and adjacent habitats where feasible • Avoid unnecessary disturbance beyond fenced areas
Habitat fragmentation	• Keep internal access routes to a minimum • Prevent creation of new informal tracks during maintenance
Altered vegetation composition	• Implement controlled mowing regimes • Adjust mowing frequency to allow flowering and seed setting of native species
Suppression of natural succession	• Apply selective vegetation management rather than complete clearance • Retain patches of unmanaged vegetation where operationally feasible
Reduced habitat complexity	• Allow development of structurally diverse vegetation in non-critical areas • Retain shrubs and low vegetation where they do not interfere with operations
Limited recovery potential within permanent footprint	• Prohibit storage of materials and waste outside designated areas • Prevent soil compaction beyond existing infrastructure
Potential indirect impacts (soil disturbance, trampling)	• Limit vehicle movement to designated access routes • Apply good housekeeping practices during maintenance activities
Cumulative operational impacts	• Implement regular environmental inspections • Apply adaptive management based on monitoring results

7.9.3.3 Impacts on Invertebrate fauna

During the operation and maintenance phase, invertebrate fauna within the project area will be exposed primarily to long-term but low-intensity pressures, resulting from the permanent presence of the solar power plant and associated overhead transmission line. Compared to the construction phase, this stage is characterised by limited human activity, mainly related to periodic inspections, vegetation management and routine maintenance works.

Habitats and microhabitats available to invertebrate fauna during this phase will already reflect the residual effects of construction, including permanent habitat conversion and altered vegetation structure. As a result, the baseline conditions for the operational phase represent a modified environment, where certain habitat features have been lost, while remaining areas persist under managed conditions.

Operational impacts on invertebrate fauna are expected to be associated mainly with vegetation management practices, such as mowing and clearance beneath solar panels and along access routes. These activities may influence vegetation composition, reduce habitat complexity and temporarily affect

invertebrate abundance, particularly for taxa dependent on flowering plants, tall grass structure or leaf litter. However, such impacts are expected to remain stable over time and confined to the managed areas.

Given that the recorded invertebrate fauna is dominated by widespread and common species, and that no key breeding or population strongholds have been identified within the operational footprint, impacts during the operation and maintenance phase are assessed as low at the local scale. No significant adverse effects on invertebrate populations at the regional or national level are anticipated.

During the operation and maintenance phase, impacts on invertebrate fauna are expected to be less intensive than during construction, but of longer duration. The most relevant effects are associated with habitat management and long-term alteration of vegetation structure, rather than direct disturbance or mortality. Overall, operational impacts are expected to be **localised, predictable and manageable**, with invertebrate communities adapting to stable site conditions over time.

Table 7-45: Summary of Operation and Maintenance-phase impacts on invertebrate fauna

Receptor	Impact type	Description of impact
Invertebrate fauna (general)	Long-term habitat modification	Permanent alteration of habitat structure within the solar power plant footprint
Invertebrate fauna (general)	Reduced habitat complexity	Simplification of vegetation structure due to regular mowing and maintenance
Invertebrate fauna (general)	Altered vegetation composition	Changes in plant species composition affecting food and shelter availability
Invertebrate fauna (general)	Disturbance from maintenance activities	Temporary disturbance caused by vehicle movement and human presence
Pollinating invertebrates	Reduced floral resources	Reduced availability of flowering plants due to vegetation management
Soil-dwelling invertebrates	Soil compaction	Localised soil compaction along access routes
Invertebrate fauna (general)	Barrier effects	Limited movement restriction caused by fencing and infrastructure
Invertebrate communities	Community adaptation	Gradual adaptation of communities to stable operational conditions

In order to evaluate potential impacts on invertebrate fauna during the operation and maintenance phase, an impact significance matrix has been developed. The matrix enables a structured assessment of long-term effects associated with habitat management, infrastructure presence and routine maintenance activities. This approach supports consistent evaluation of impacts and provides a basis for defining appropriate mitigation measures. The matrix results allow differentiation between minor operational effects and impacts that may require specific management actions. It also supports the assessment of residual impacts and long-term environmental performance of the project.

The impact significance matrix indicates that impacts on invertebrate fauna during the operation and maintenance phase are predominantly of **low significance at the local scale**. Identified effects are mainly related to long-term habitat management and vegetation maintenance, rather than direct disturbance or mortality. No significant adverse effects on invertebrate populations at the regional or national level are anticipated.

Table 7-46: Impact significance matrix – invertebrate fauna (Operation and Maintenance phase)

Receptor	Impact	Magnitude	Sensitivity	Duration / Reversibility	Overall significance
Invertebrate fauna (general)	Long-term habitat modification	Low	Low	Long-term / Irreversible	**Minor**
Invertebrate fauna (general)	Reduced habitat complexity	Low	Low	Long-term / Reversible	**Minor**
Invertebrate fauna (general)	Altered vegetation composition	Low	Low	Long-term / Reversible	**Minor**
Pollinating invertebrates	Reduced floral resources	Low	Medium	Long-term / Reversible	**Minor**
Soil-dwelling invertebrates	Soil compaction along access routes	Low	Low	Medium-term / Reversible	**Minor**
Invertebrate fauna (general)	Disturbance from maintenance	Low	Low	Short-term / Reversible	**Minor**

Mitigation measures

The mitigation measures proposed for the operation and maintenance phase are aimed at controlling long-term and cumulative impacts on invertebrate fauna resulting from habitat management and routine maintenance activities. These measures focus on maintaining habitat quality within managed areas and preventing additional pressures beyond those already introduced during construction. Consistent implementation of mitigation measures will ensure that operational impacts on invertebrate fauna remain localised, stable and of low significance throughout the lifetime of the project.

Table 7-47: Mitigation measures – Operation and Maintenance phase (invertebrate fauna)

Impact	Mitigation measures
Long-term habitat modification	• Restrict operational activities to defined areas • Prevent expansion of managed zones
Reduced habitat complexity	• Apply low-intensity mowing regimes • Retain patches of taller vegetation where feasible
Altered vegetation composition	• Avoid use of herbicides • Encourage native plant regeneration
Reduced floral resources	• Schedule mowing outside peak flowering periods • Retain flowering strips where possible
Soil compaction	• Limit vehicle movement to designated access routes
Disturbance from maintenance	• Restrict maintenance works to daylight hours
Barrier effects	• Avoid unnecessary fencing or remove redundant barriers

7.9.3.4 Impacts on Amphibian and Reptile fauna

During the operation and maintenance phase, amphibian and reptile fauna within the project area will be exposed to long-term but low-intensity pressures, resulting from the permanent presence of the solar power plant, associated infrastructure and routine maintenance activities. Compared to the construction phase, this phase is characterised by significantly reduced levels of disturbance, with human activity limited to periodic inspections, vegetation management and maintenance works.

Habitats available to amphibians and reptiles during this phase will already reflect the residual impacts of construction, including permanent habitat loss, fragmentation and altered habitat structure. Within the solar power plant area, the permanent water captation remains a key habitat element, particularly for amphibians, providing essential breeding and refuge conditions. The long-term ecological functionality of this water body

and its surrounding terrestrial habitats is therefore critical for maintaining amphibian populations during project operation.

Operational impacts on amphibians are expected to be mainly related to chronic low-level disturbance, vegetation management and potential changes in habitat quality in the terrestrial zone surrounding the breeding site. Reptile species may be affected by habitat simplification, reduced availability of shelter and basking sites, and occasional disturbance associated with maintenance activities. However, these impacts are expected to be spatially limited and stable over time.

Given that the majority of recorded amphibian and reptile species are widespread at the regional scale, and that no critical population strongholds have been identified within the operational footprint, impacts during the operation and maintenance phase are assessed as low at the local scale. With appropriate management measures in place, no significant adverse effects on amphibian or reptile populations at the regional or national level are anticipated.

Key operational-phase impacts on amphibians and reptiles:

- Long-term modification of terrestrial habitats within the solar power plant footprint
- Chronic low-level disturbance from routine maintenance activities
- Alteration of habitat structure due to regular vegetation management
- Reduced availability of shelter and basking sites for reptiles
- Potential disturbance of amphibian breeding habitat if water captation and buffer zone are not adequately protected
- Barrier effects and limited habitat connectivity caused by fencing and infrastructure
- Occasional mortality risk associated with vehicle movement during maintenance

Table 7-48: Summary of operational-phase impacts on amphibian and reptile fauna

Receptor	Impact type	Description of impact
Amphibians	Disturbance of breeding habitat	Long-term disturbance risk to the permanent water captation and surrounding terrestrial zone
Amphibians	Reduced terrestrial habitat quality	Alteration of terrestrial habitats used outside the breeding season
Reptiles	Habitat modification	Simplification of habitat structure due to vegetation management
Reptiles	Loss of shelter and basking sites	Reduced availability of stones, vegetation cover and refuges
Amphibians & reptiles	Disturbance	Low-level disturbance from routine maintenance activities
Amphibians & reptiles	Barrier effects	Reduced local connectivity caused by fencing and infrastructure
Amphibians & reptiles	Mortality risk	Occasional risk of injury or mortality from maintenance vehicles
Protected species	Long-term exposure	Continuous exposure of protected species to altered habitat conditions

In order to evaluate potential impacts on amphibian and reptile fauna during the operation and maintenance phase, an impact significance matrix has been developed. The matrix enables systematic assessment of long-term and cumulative effects associated with habitat modification, infrastructure presence and routine maintenance activities. This structured approach supports consistent evaluation of operational impacts.

The impact significance matrix indicates that impacts on amphibian and reptile fauna during the operation and maintenance phase are predominantly of **low significance and at the local scale**. The most sensitive receptor remains the amphibian breeding habitat associated with the permanent water captation; however, provided that this feature is adequately protected, no significant adverse effects are anticipated. Overall,

the project is not expected to adversely affect amphibian or reptile populations at the regional or national level during operation.

Table 7-49 Impact significance matrix – amphibian and reptile fauna (Operation and Maintenance phase)

Receptor	Impact	Magnitude	Sensitivity	Duration / Reversibility	Overall significance
Amphibians	Disturbance of breeding habitat	Low	High	Long-term / Partly reversible	**Minor to Moderate**
Amphibians	Reduced terrestrial habitat quality	Low	Medium	Long-term / Reversible	**Minor**
Reptiles	Habitat modification	Low	Medium	Long-term / Reversible	**Minor**
Amphibians & reptiles	Disturbance from maintenance	Low	Low	Short-term / Reversible	**Minor**
Amphibians & reptiles	Barrier effects	Low	Medium	Long-term / Partly reversible	**Minor**
Amphibians & reptiles	Mortality risk	Low	Medium	Short-term / Irreversible (individuals)	**Minor**

Mitigation measures

The mitigation measures proposed for the operation and maintenance phase are aimed at controlling long-term and cumulative impacts on amphibian and reptile fauna resulting from the permanent presence of the solar power plant, associated infrastructure and routine maintenance activities. During this phase, impacts are expected to be of lower intensity than during construction; however, their long-term nature requires consistent application of appropriate management measures.

Particular emphasis is placed on the continued protection of the permanent water captation, which represents a key breeding and refuge habitat for amphibians within the project area. Ensuring the preservation of water quality, hydrological stability and undisturbed surrounding terrestrial habitats is essential for maintaining amphibian populations throughout the operational lifetime of the project.

Mitigation measures during operation and maintenance also focus on reducing disturbance, preventing further habitat degradation and maintaining habitat connectivity, especially between terrestrial habitats and aquatic breeding sites. Controlled vegetation management, restricted access and careful planning of maintenance activities are key elements in minimising operational impacts on amphibians and reptiles.The effective implementation of these mitigation measures will ensure that operational impacts on amphibian and reptile fauna remain localised, stable over time and of low significance, with no anticipated adverse effects on species populations at the regional or national level.

Table 7-50 Mitigation measures – Operation and Maintenance phase (amphibians and reptiles)

Impact	Mitigation measures
Long-term disturbance of amphibian breeding habitat	• Maintain a permanent buffer zone around the water captation • Prohibit maintenance activities within the buffer zone during breeding periods
Degradation of water quality	• Regular inspection of the water captation for signs of pollution • Prohibit use of chemicals, herbicides or pollutants near the water body
Loss of terrestrial habitat quality	• Apply low-intensity vegetation management in surrounding areas

	• Avoid complete removal of ground cover and shelter features
Disturbance from maintenance activities	• Schedule maintenance works outside peak amphibian breeding and migration periods where feasible • Restrict maintenance activities to daylight hours
Barrier effects and reduced connectivity	• Ensure that fencing allows passage of small fauna where feasible • Avoid creation of new barriers during operational phase
Increased mortality risk on access routes	• Apply low vehicle speeds during maintenance activities • Limit vehicle movement to designated access routes
Impacts on protected and Annex II species	• Implement species protection requirements under national legislation • Avoid disturbance of known resting or shelter sites
Vegetation management impacts	• Adjust mowing regimes to avoid sensitive periods • Retain patches of unmanaged vegetation where operationally feasible
Cumulative long-term impacts	• Conduct periodic ecological inspections • Apply adaptive management measures based on monitoring results

7.9.3.5 Impacts on Birds

During the operation and maintenance phase, bird fauna within the project area will be exposed to long-term but generally low-intensity pressures associated with the permanent presence of the solar power plant, overhead transmission line (OHL) and routine maintenance activities. Compared to the construction phase, this stage is characterised by a significantly reduced level of disturbance, limited primarily to periodic inspections, vegetation management and maintenance works.

Habitats available to birds during this phase will already reflect the residual effects of construction, including permanent habitat loss, modified vegetation structure and the presence of infrastructure. Operational impacts are therefore mainly related to habitat modification and chronic low-level disturbance, rather than direct habitat destruction. Species associated with open habitats, forest edges and agricultural mosaics are expected to continue using the wider area, while some species may permanently avoid the most intensively managed parts of the site.

The presence of the overhead transmission line represents a potential long-term impact factor during the operational phase, particularly in terms of collision risk for certain bird species. Although no major migration bottlenecks or concentrations have been identified within the project area, occasional collision risk may exist for larger birds and species with low manoeuvrability, especially during adverse weather conditions or low visibility.

Given that the recorded avifauna is dominated by widespread and ecologically adaptable species, and that no critical breeding sites or population strongholds have been identified within the operational footprint, impacts during the operation and maintenance phase are assessed as low at the local scale. With appropriate mitigation and management measures in place, no significant adverse effects on bird populations at the regional or national level are anticipated.

Key operational-phase impacts on birds:

- Long-term modification of habitats within the solar power plant footprint
- Chronic low-level disturbance from routine maintenance activities
- Reduced habitat suitability in intensively managed areas
- Collision risk with overhead transmission line (OHL)
- Barrier and avoidance effects caused by permanent infrastructure
- Occasional disturbance during sensitive periods (breeding or migration)

Table 7-51: Summary of operational-phase impacts on Birds

Receptor	Impact type	Description of impact
Bird fauna (general)	Habitat modification	Long-term alteration of habitat structure within the solar plant area
Bird fauna (general)	Disturbance	Low-level disturbance from maintenance activities
Breeding birds	Reduced habitat suitability	Reduced nesting suitability in managed areas
Bird fauna (general)	Avoidance behaviour	Permanent or semi-permanent avoidance of infrastructure areas
Bird fauna (general)	Collision risk (OHL)	Risk of collision with overhead transmission line
Bird fauna (general)	Barrier effects	Reduced local connectivity due to infrastructure
Protected species	Long-term exposure	Continuous exposure of protected species to modified habitats
Vulnerable species	Sensitivity to disturbance	Increased sensitivity of *Streptopelia decaocto* to habitat changes

To assess potential impacts on bird fauna during the operation and maintenance phase, an impact significance matrix has been developed. The matrix allows systematic evaluation of long-term and cumulative effects associated with infrastructure presence, habitat modification and routine operational activities. This structured approach supports consistent interpretation of impact relevance and informs mitigation planning.

The impact significance matrix indicates that impacts on bird fauna during the operation and maintenance phase are predominantly of **low significance and at the local scale**, with the most relevant long-term risk related to potential collisions with the overhead transmission line. With appropriate mitigation and management measures in place, no significant adverse effects on bird populations at the regional or national level are anticipated.

Table 7-52: Impact significance matrix – Birds (Operation and Maintenance phase)

Receptor	Impact	Magnitude	Sensitivity	Duration / Reversibility	Overall significance
Bird fauna (general)	Habitat modification	Low	Medium	Long-term / Irreversible	**Minor**
Bird fauna (general)	Disturbance from maintenance	Low	Low	Short-term / Reversible	**Minor**
Breeding birds	Reduced habitat suitability	Low	Medium	Long-term / Reversible	**Minor**
Bird fauna (general)	Avoidance behaviour	Low	Medium	Long-term / Reversible	**Minor**
Bird fauna (general)	Collision risk (OHL)	Low	Medium	Long-term / Irreversible (individuals)	**Minor to Moderate**
Protected / Vulnerable species	Long-term exposure	Low	High	Long-term / Reversible	**Minor to Moderate**

Mitigation measures

The mitigation measures proposed for the operation and maintenance phase are designed to control long-term and cumulative impacts on bird fauna arising from the permanent presence of project infrastructure

and routine operational activities. Although impacts during this phase are generally less intensive than during construction, their continuous nature requires the application of targeted and consistent management measures throughout the lifetime of the project.

Particular attention is given to collision risk associated with the overhead transmission line, which represents the most relevant long-term impact pathway for birds during operation. Measures aimed at improving line visibility and reducing collision probability are therefore a key component of the mitigation strategy. In addition, vegetation management and maintenance activities are addressed to minimise disturbance and preserve habitat suitability for breeding and foraging birds.

The proposed mitigation measures also ensure compliance with national legislation and Natura 2000 requirements, recognising that all recorded bird species are legally protected and of conservation relevance. By integrating these measures into routine operational procedures, the project will minimise its long-term footprint on avifauna and maintain impacts at an acceptable level.

Table 7-53: Mitigation measures – Operation and Maintenance phase (birds)

Impact	Mitigation measures
Collision risk with OHL	• Install bird flight diverters on the overhead transmission line • Regularly inspect and maintain visibility markers
Habitat modification	• Apply low-intensity vegetation management • Retain structural diversity where operationally feasible
Disturbance from maintenance	• Schedule maintenance outside peak breeding periods where feasible • Restrict works to daylight hours
Reduced nesting suitability	• Retain suitable nesting features outside core operational zones
Avoidance behaviour	• Minimise expansion of managed areas beyond approved footprint
Impacts on Vulnerable species	• Apply site-specific measures where Streptopelia decaocto presence is confirmed
Cumulative long-term impacts	• Implement periodic ornithological monitoring • Adjust mitigation measures based on monitoring results

7.9.3.6 Impact on Mammal fauna

During the operation and maintenance phase, mammal fauna within the project area will be exposed to long-term but generally low-intensity pressures, resulting from the permanent presence of the solar power plant, associated infrastructure and routine maintenance activities. Compared to the construction phase, this period is characterised by significantly reduced levels of disturbance, limited primarily to periodic inspections, vegetation management and occasional maintenance works.

For terrestrial mammals, operational impacts are expected to be limited and largely related to habitat modification and avoidance behaviour within the most intensively managed areas of the site. Species such as fox (*Vulpes vulpes*), stone marten (*Martes foina*), wild boar (*Sus scrofa*) and small mammals are expected to continue using the wider project area, with temporary or permanent avoidance of core operational zones. Given the availability of suitable habitats in the surrounding landscape, these impacts are expected to remain localised and of low significance.

From a conservation perspective, bats (Order Chiroptera) remain the most sensitive mammal group during the operation and maintenance phase. Operational impacts on bats may arise from long-term habitat modification, artificial lighting, disturbance of foraging habitats and potential disruption of commuting routes, particularly in relation to the overhead transmission line (OHL) and permanent site infrastructure. Bats rely heavily on landscape features for navigation and feeding, and even low-level, chronic disturbances can influence their activity patterns.

Although no known maternity roosts or major roosting sites have been identified within the operational footprint, the presence of eight strictly protected bat species, including Annex II and IV species such as *Rhinolophus hipposideros* and *Myotis blythii*, indicates a high sensitivity of the receptor. With appropriate

operational management and mitigation measures in place, impacts on bat populations during the operation and maintenance phase are expected to remain of low significance at the local scale, with no adverse effects anticipated at the regional or national level.

Key operational-phase impacts on mammals:

- Long-term habitat modification within the solar power plant footprint
- Avoidance of intensively managed areas by terrestrial mammals
- Reduced habitat suitability in core operational zones
- Disturbance of bat foraging habitats due to habitat modification
- Artificial lighting effects on bats, altering activity and flight behaviour
- Potential disruption of bat commuting routes, including near OHL
- Low-level mortality risk from vehicle movement during maintenance
- Long-term exposure of strictly protected bat species to altered conditions

Table 7-54: Summary of operational-phase impacts on mammal fauna

Receptor	Impact type	Description of impact
Terrestrial mammals	Habitat modification	Long-term alteration of habitat conditions within operational areas
Terrestrial mammals	Avoidance behaviour	Reduced use of core operational zones
Small mammals	Mortality risk	Occasional risk of injury from maintenance vehicle movement
Bats	Disturbance of foraging habitats	Reduced foraging efficiency due to habitat and vegetation management
Bats	Artificial light disturbance	Disruption of flight paths and feeding behaviour
Bats	Commuting route disruption	Alteration of movement corridors due to infrastructure and OHL
Bats	Barrier effects	Reduced landscape permeability for certain species
Protected species (bats)	Long-term exposure	Continuous exposure to modified habitat conditions

To evaluate potential impacts on mammal fauna during the operation and maintenance phase, an impact significance matrix has been prepared. The matrix enables systematic assessment of long-term and cumulative effects associated with permanent infrastructure, habitat modification and routine operational activities. Particular attention is given to bats as highly sensitive and legally protected species.

The impact significance matrix indicates that impacts on terrestrial mammals during the operation and maintenance phase are predominantly of **low significance**, reflecting their adaptability and mobility. In contrast, bats remain the most sensitive receptor group, with potential impacts assessed as **low to moderate at the local scale**, mainly related to artificial lighting and long-term habitat modification. With appropriate mitigation measures in place, no significant adverse effects on mammal populations at the regional or national level are anticipated.

Table 7-55 Impact significance matrix – mammal fauna (Operation and Maintenance phase)

Receptor	Impact	Magnitude	Sensitivity	Duration / Reversibility	Overall significance
Terrestrial mammals	Habitat modification	Low	Low	Long-term / Reversible	**Minor**
Terrestrial mammals	Avoidance behaviour	Low	Low	Long-term / Reversible	**Minor**

Small mammals	Mortality risk	Low	Medium	Short-term / Irreversible (individuals)	**Minor**
Bats	Disturbance of foraging habitats	Low	High	Long-term / Reversible	**Minor to Moderate**
Bats	Artificial lighting effects	Moderate	High	Long-term / Reversible	**Moderate**
Bats	Commuting route disruption	Low	High	Long-term / Partly reversible	**Minor to Moderate**
Protected bat species	Long-term exposure	Low	High	Long-term / Reversible	**Minor to Moderate**

Mitigation measures

The mitigation measures proposed for the operation and maintenance phase are aimed at controlling long-term and cumulative impacts on mammal fauna, with particular emphasis on bats as strictly protected and highly sensitive species. Although operational impacts are generally less intensive than those occurring during construction, their continuous nature requires consistent application of appropriate management measures throughout the lifetime of the project.

For bats, mitigation measures focus on reducing artificial light disturbance, maintaining functional foraging habitats and preserving commuting routes within the landscape. Special attention is given to lighting design and vegetation management, as these factors strongly influence bat activity and movement patterns. Measures addressing the overhead transmission line are also included to minimise long-term disruption of bat commuting routes.

Mitigation measures for terrestrial mammals aim to maintain habitat permeability, reduce disturbance from maintenance activities and minimise mortality risk associated with vehicle movement. The implementation of these measures will ensure that operational impacts on mammal fauna remain localised, stable over time and of low significance, while ensuring compliance with national and international conservation requirements.

Table 7-56: Mitigation measures – Operation and Maintenance phase (mammals)

Impact	Mitigation measures
Habitat modification	• Limit operational activities to approved footprint • Prevent expansion of managed areas
Avoidance behaviour (terrestrial mammals)	• Retain natural vegetation corridors where feasible
Small mammal mortality	• Apply low vehicle speeds during maintenance activities
Bat foraging disturbance	• Maintain semi-natural vegetation structure • Avoid excessive vegetation clearance
Artificial lighting impacts on bats	• Use downward-facing, low-intensity lighting • Avoid illumination of key bat activity areas
Bat commuting route disruption	• Avoid additional linear barriers • Maintain vegetation features guiding bat movement
OHL-related impacts on bats	• Monitor bat activity near OHL where feasible
Cumulative impacts	• Periodic ecological inspections • Adjust management measures if required

7.9.4 Decommissioning phase

The **decommissioning phase** of the project will involve the removal of solar panels, supporting structures, electrical equipment, the overhead transmission line and associated infrastructure, followed by site restoration activities. Compared to the construction phase, decommissioning activities are expected to be **shorter in duration and spatially limited**, and will largely take place within areas that have already been modified during earlier phases of the project.

Potential impacts on biodiversity during the decommissioning phase are primarily related to **temporary disturbance, soil disturbance and habitat recovery processes**, rather than additional permanent habitat loss. As most natural habitats within the project area will already have been affected during the construction phase, decommissioning activities are not expected to introduce new significant pressures, provided that removal works are carefully planned and implemented.

For **habitats and flora**, decommissioning activities may result in short-term disturbance due to the removal of infrastructure and associated ground works. However, this phase also presents an opportunity for **habitat restoration and ecological recovery**, particularly through soil rehabilitation and re-establishment of native vegetation. Given the dominance of widespread habitat types within the project area and the broad ecological tolerance of recorded plant species, natural regeneration and recovery are expected to occur relatively quickly following site restoration.

Invertebrate fauna may be temporarily affected by soil disturbance and vegetation removal during decommissioning; however, impacts are expected to be localised and reversible. Invertebrate communities are anticipated to recolonise restored areas from surrounding habitats, particularly where native vegetation is re-established and microhabitat features such as soil structure and ground cover are restored.

For **amphibians and reptiles**, potential impacts during decommissioning are mainly related to disturbance of terrestrial habitats and, for amphibians, the potential indirect effects on aquatic breeding sites. Provided that the permanent water captation is protected during decommissioning works, no significant adverse effects on amphibian populations are anticipated. Reptile species are expected to recolonise restored habitats following completion of works, particularly where structural habitat features are reinstated.

Birds may experience temporary disturbance from increased human presence, noise and machinery during infrastructure removal. However, as decommissioning activities are expected to be of limited duration, impacts on avifauna are likely to be short-term and reversible. The removal of overhead transmission lines may result in a **long-term positive effect**, through the elimination of collision risk and barrier effects for birds.

For **mammals**, including bats, impacts during the decommissioning phase are expected to be limited. Terrestrial mammals may temporarily avoid areas where decommissioning works are taking place but are expected to rapidly recolonise restored habitats. For bats, the removal of artificial lighting and linear infrastructure may lead to **long-term beneficial effects**, provided that decommissioning activities avoid disturbance to roosting sites and are conducted outside sensitive periods where feasible.

Overall, impacts on biodiversity during the decommissioning phase are assessed as **temporary, localised and largely reversible**, with a high potential for positive outcomes through habitat restoration and removal of permanent infrastructure. With appropriate planning and implementation of good environmental practice, decommissioning activities are not expected to result in significant adverse effects on biodiversity at the local, regional or national level.

The decommissioning phase represents the final stage of the project lifecycle and involves the removal of solar panels, supporting structures, electrical equipment and associated infrastructure. Activities during this phase will largely take place within areas that have already been modified during construction and

operation, thereby limiting the potential for new or additional impacts on biodiversity. As a result, impacts during decommissioning are expected to differ in nature from those occurring during earlier project phases.

Potential impacts on biodiversity during the decommissioning phase are primarily associated with **temporary disturbance and habitat recovery processes**, rather than permanent habitat loss. While short-term effects may occur due to increased human activity, machinery use and soil disturbance, these impacts are generally localised and reversible. In parallel, the removal of infrastructure provides opportunities for ecological restoration and the re-establishment of natural habitat conditions.

The table below summarises the **key potential impacts of the decommissioning phase on different biodiversity receptors**, reflecting both short-term disturbances and longer-term positive effects. The summary provides an integrated overview across habitats, flora and fauna groups, supporting a comprehensive assessment of biodiversity responses during the decommissioning phase.

Table 7-57: Summary of decommissioning-phase impacts by biodiversity group

Biodiversity receptor	Impact type	Description of impact
Habitats	Temporary disturbance	Short-term disturbance due to removal of infrastructure and soil works within previously modified areas
Habitats	Habitat recovery	Opportunity for restoration and natural regeneration following infrastructure removal
Flora	Temporary vegetation disturbance	Removal of remaining managed vegetation and soil disturbance during dismantling
Flora	Recolonisation potential	Re-establishment of native plant species through natural regeneration or active restoration
Invertebrate fauna	Temporary habitat disturbance	Short-term impacts from soil disturbance and vegetation removal
Invertebrate fauna	Recolonisation	Rapid recolonisation from surrounding habitats following restoration
Amphibians	Disturbance of terrestrial habitats	Temporary disturbance of terrestrial habitats used outside breeding period
Amphibians	Indirect aquatic impacts	Potential indirect effects if water captation is not adequately protected
Reptiles	Temporary displacement	Short-term avoidance of decommissioning areas
Birds	Disturbance	Temporary disturbance from noise, machinery and human presence
Birds	Positive long-term effect	Removal of overhead transmission line eliminates collision risk
Terrestrial mammals	Temporary displacement	Avoidance of active work areas during dismantling
Bats	Disturbance	Short-term disturbance during infrastructure removal
Bats	Positive long-term effect	Removal of artificial lighting and linear infrastructure improves habitat conditions

Mitigation and restoration measures

The mitigation and restoration measures proposed for the decommissioning phase are intended to avoid unnecessary disturbance, minimise temporary impacts and support ecological recovery following the removal of project infrastructure. Although decommissioning activities are expected to be of limited duration and largely confined to previously disturbed areas, the application of appropriate measures is essential to ensure that biodiversity impacts remain controlled and reversible.

A key objective of the proposed measures is to facilitate the restoration of habitats and ecological functions affected during earlier project phases. This includes the rehabilitation of soil structure, re-establishment of native vegetation and the preservation of important habitat features for flora and fauna. Where feasible, natural regeneration processes will be encouraged, supported by targeted restoration actions where required.

The proposed measures also aim to protect sensitive species and habitats during decommissioning activities, particularly amphibians, bats and other legally protected species. Measures addressing the timing of works, buffer zones around sensitive habitats and control of human activity are essential to reduce disturbance during critical periods and to prevent accidental damage to key ecological receptors.

Overall, the mitigation and restoration measures outlined below provide a framework for achieving long-term ecological recovery and potential net biodiversity benefits following project decommissioning. Their consistent implementation will ensure that the site is returned to a condition compatible with surrounding natural habitats and landscape functions, in line with good environmental practice and conservation objectives.

Table 7-58: Mitigation and restoration measures – decommissioning phase

Impact	Objective	Mitigation / restoration measures
Habitat disturbance	Minimise additional degradation	• Restrict decommissioning works to previously disturbed areas • Avoid unnecessary soil disturbance
Soil degradation	Restore soil structure	• Remove compacted layers where feasible • Re-spread stored topsoil
Loss of vegetation cover	Facilitate habitat recovery	• Re-vegetate disturbed areas using native species • Allow natural regeneration where appropriate
Impacts on flora	Preserve native plant communities	• Avoid introduction of non-native species • Monitor vegetation recovery
Invertebrate disturbance	Support recolonisation	• Restore microhabitats (soil structure, ground cover) • Avoid excessive soil sealing
Amphibian habitat disturbance	Protect breeding sites	• Maintain buffer zones around water captation • Avoid works near aquatic habitats during breeding periods
Reptile disturbance	Reduce displacement	• Conduct works outside peak activity periods where feasible • Restore shelter features (stones, vegetation)
Bird disturbance	Minimise disturbance intensity	• Schedule works outside breeding season where feasible
Bat disturbance	Protect sensitive species	• Avoid decommissioning works near potential roosts • Minimise night-time works and lighting
OHL removal impacts	Ensure safe dismantling	• Remove transmission line components in a controlled manner
Long-term ecological recovery	Achieve post-project restoration	• Implement site restoration plan • Conduct post-decommissioning ecological monitoring

7.10 Economy and employment

7.10.1 Overview

This section assesses the potential impacts on economy and employment that may arise during the construction, operation and decommissioning phases of the Project. Key potential impacts are considered as follows:

Table 7-59: Key potential impacts on economy and employment

Construction phase	Operation phase	Decommissioning phase
• **Temporary direct and indirect employment opportunities** • **Temporary economic impact from procurement of goods and services, and worker spending**	• Economic impact of PV Power Plant operation to national economy	• Temporary direct and indirect employment opportunities • Temporary economic impact from worker spending in the local area

7.10.2 Construction phase

7.10.2.1 Potential impacts

Project construction works will cause a number of impacts to the local and regional economy. These will be positive, temporary and restricted to the construction period.

The impacts will be related to project spending for the purchase of materials and services as well as to creating employment opportunities for skilled and (mostly) unskilled personnel, which can be recruited from the local population along the transmission line route. The Project can help in maximising these positive impacts for the benefit of the local communities affected by the Project construction.

7.10.2.2 Employment opportunities

Most of the economic and employment impacts from the Project can be expected during the construction phase. The Project will need to hire and accommodate workers and purchase goods and services, potentially resulting in positive impacts on the local communities.

Temporary employment during the construction phase includes people directly employed by the primary contractor for the construction and upgrading of roads and infrastructure (preconstruction) and construction of the transmission lines and the substation. It also includes jobs supplying the goods and services needed to support the construction process and the staff, including food and transport services.

The number of workers likely to be needed for construction activities will largely depend on the contractor. Many of these workers will be specialised. However, there will be a need for unskilled personnel to support construction activities, i.e. for clearing vegetation, transportation of staff and materials, reinstatement, etc. Preference will be given to local staff for these positions, provided that this does not contradict with local and international regulations on competition and procurement.

The purchase of goods and services during construction may also generate some local employment opportunities, mainly in nearby cities of Nikšić and in settlements close to the construction sites.

It is expected that the employment opportunities generated by the Project will provide more employment options to local population, and therefore the relevant impacts are considered positive.

7.10.2.3 Economic impacts

Economic impacts during the Rudine PV construction will stem from procurement of goods and services by the Project and induced economic effects of spending by project employees.

Detailed information on the procurement needs for the construction phase is not yet available. In general, the types of goods and services required will include:

- Transport, catering, laundry, food supply, security services for construction sites;
- Supply of vehicles, machinery and equipment;
- Provision of construction materials including aggregates/sand, concrete, and building materials.

It is assumed that the most services (including transport, laundry, catering, etc.) can be sourced from local or regional companies. This will be specifically targeted by the Project so that the economic impact from purchase of goods and services will primarily accrue at a local or regional level.

The economic impact of spending in the local economy by project employees is expected to be relatively small, due to the relatively short duration of the construction period in each specific location. However, benefits are expected to accrue for local population centres, local tradesmen, café owners and others with existing formal businesses from Project employees' spending for subsistence and recreation.

The relevant impacts to local and regional economy are therefore considered positive.

7.10.2.4 Mitigation measures

In order to further enhance the positive impacts to local economy and employment, Qair d.o.o. and its contractors are committed to recruit and source locally, work with local businesses and give preference to both. Specific mitigation measures in line with this concept include the following:

- The Project shall work with local authorities and employment organisations to ensure that all positions are advertised in a manner that is accessible to the settlements and communities crossed by the transmission line route.
- The Project shall ensure that the recruitment process is fair and transparent, public and open to all regardless of ethnicity, religion or gender.
- The Project shall stipulate that the contractors provide clear contracts prior to mobilisation stipulating working hours, pay, and other terms of employment.
- As part of the tendering process, the contractors are required to develop a purchasing strategy that stipulates how purchase of goods will be optimised at the regional and local level.
- Immediately upon opening a tender, the Project shall make information on tendering opportunities available to local businesses through trade and industry chambers and local business organisations along the transmission line route.

7.10.2.5 Residual impacts

The following table presents a summary of the residual impacts associated with the impacts identified.

Table 7-60: Residual impacts to economy, employment and income during construction

Impact / Risk	**Measures to Address the Impact / Risk**	**Significance of Residual Impact / Risk** (green shading denotes a 'positive' residual impact)
Construction Phase		
Temporary employment opportunities – regional and local level	• The Project shall work with local authorities and employment organisations to ensure that all positions are advertised in a manner that is	**MINOR** • Approximately 70-80% of labour positions will be filled by skilled workers.

Impact / Risk	Measures to Address the Impact / Risk	Significance of Residual Impact / Risk (green shading denotes a 'positive' residual impact)
	accessible to the settlements and communities crossed by the transmission line route. ● The Project shall ensure that the recruitment process is fair and transparent, public and open to all regardless of ethnicity, religion or gender. ● The Project shall stipulate that the Contractors provide clear contracts prior to mobilisation stipulating working hours, pay, and other terms of employment.	● Most construction and service jobs on the Project will be short-term ● Transparent hiring practices and clear information on employment opportunities will help to manage stakeholder expectations.
Temporary economic impact – regional and local level	● Immediately upon opening a tender, the Project shall make information on tendering opportunities available to local businesses through trade and industry chambers and local business organisations along the transmission line route. ● As part of the tendering process, the contractors are required to develop a purchasing strategy that stipulates how purchase of goods will be optimised at the regional and local level.	**MINOR** ● Temporary impact ● Local purchasing by employees expected to be relatively larger in small cities along the route, where more goods and services are available for purchase ● Impacts will be more significant in the settlements near the substation due to the larger duration of work.

7.10.3 Operation and maintenance phase

During operation, the primary economic impact is related with the benefits of the PV plant to Qair d.o.o. Such benefits have been presented in more detail in Chapter 3 of this ESIA. They are expected to be positive, permanent and of major significance.

The necessary manpower for maintenance purposes is expected to be provided by Qair d.o.o., in which case potential local employment opportunities will be minimal. However, employment opportunities may arise at local level for the maintenance of access roads, PV plant and the trimming of vegetation at the RoW.

7.10.4 Decommissioning phase

The workforce required for the decommissioning of the PV power plant with associated components will depend on the approach taken but is likely to be much smaller than the construction workforce. At this stage, it is thought that the decommissioning will require all permanent aboveground elements to be taken down and the sites reinstated (subject to the relevant legislation prevailing at the time of decommissioning).

Economic impacts during the decommissioning phase will be relatively minimal. There will be a small amount of procurement of goods and services associated with the construction sites and some induced economic impact from employees' spending.

7.11 Land

7.11.1 Overview

This section assesses the potential impacts to lands and livelihoods of the affected population that may arise from the construction, operation and decommissioning of the Project. Key potential impacts are considered as follows:

Table 7-61: Key potential impacts to land and livelihoods

Construction Phase	Operation Phase	Decommissioning Phase
• **Loss of livelihood due to permanent land acquisition** • **Loss of livelihoods due to temporary land acquisition** • **Nuisance to businesses due to the construction activities**	• Loss of livelihoods due to the establishment of easement	• Temporary use of land due to decommissioning activities • Restoration of land use

7.11.2 Construction phase

7.11.2.1 Potential impacts

A number of potential impacts to lands and livelihoods are associated with the project construction period. Key impacts are the following:

- Loss of livelihoods from temporary land acquisition, i.e. properties that will be occupied during project construction but reinstated and returned to their owners when construction ends.
- Loss of livelihoods from permanent land acquisition
- Nuisance to businesses due to the construction activities.

The project will not require any physical displacement. The location of the PV power plant area and the OHLs have been selected so that no residential properties are affected.

7.11.2.2 Loss of Livelihoods from Temporary Land Acquisition

Temporary land acquisition associated with the Project will occur primarily during the construction phase and will be limited to working areas for the construction of the solar power plant, access roads, temporary storage and laydown areas, as well as the overhead transmission line working corridor. The affected land is predominantly pastureland or marginal agricultural land used in an extensive manner, with no intensive or commercial-scale agricultural production identified within the Project area.

Temporary occupation of land may result in short-term restriction of access for grazing or seasonal cultivation, as well as potential loss of one agricultural season in isolated locations. However, construction works will be implemented in a phased manner, and temporary land occupation will be limited in duration and spatial extent. Following completion of construction works, all temporarily affected areas will be reinstated to their original condition and land use.

In accordance with national practice, compensation for temporary land use will be based on the assessment of actual damage and loss of income, taking into account crop type, expected yields, applicable market prices and production costs. Given the limited duration of land occupation, the extensive nature of agricultural activities and the availability of alternative land in the wider area, the sensitivity of affected livelihoods is considered medium.

Taking into account the temporary and reversible nature of impacts, together with the application of timely

compensation and land reinstatement measures, the residual impact on livelihoods arising from temporary land acquisition is assessed as **minor**.

7.11.2.3 Loss of Livelihoods from Permanent Land Acquisition

Permanent land acquisition associated with the Project is limited in extent and relates primarily to the footprint of permanent Project components, including the solar power plant infrastructure, the 110/35 kV substation and the foundations of the overhead transmission line towers.

The total permanent land envisaged for expropriation required for overhead transmission line tower foundations amounts to approximately **3,214 m²**. Permanent land take for the solar power plant is associated with the installation of photovoltaic tables and auxiliary infrastructure. Although the total number of planned photovoltaic panels is 79,800 and the panels will cover approximately **202,777 m²**, the actual permanent land take is lower due to spacing between panel rows and the retention of permeable ground between structures. The land occupied by permanent installations represents a limited proportion of available land in the Project area.

The affected land is predominantly used for extensive grazing and small-scale agricultural activities and does not generally represent the sole or primary source of household income. While permanent land acquisition results in irreversible changes in land use within the Project footprint, its overall scale remains limited.

Compensation for permanently acquired land will be determined in accordance with national expropriation legislation, based on the market value of land calculated using recent comparable transactions and adjusted for land category, quality and location. Where applicable, compensation for perennial crops or other assets will be provided in line with national valuation practice.

Given the limited extent of permanent land take, the supplementary nature of land-based livelihoods in the Project area and the application of fair and timely compensation measures, the residual impact on livelihoods resulting from permanent land acquisition is assessed as **minor**.

Table 7-62: Overview of Land Acquisition Types and Livelihood Impacts by Project Component

Type of land acquisition	Project component	Estimated affected area	Type of impact on livelihoods	Duration
Temporary land acquisition	Construction areas of SPP Rudine, access roads, laydown and storage areas	Localised, short-term; within construction footprint	Temporary restriction of access to grazing land and small agricultural plots; possible loss of one agricultural season at isolated locations	Short-term (construction phase only)
Temporary land acquisition	OHL working corridor and access to tower locations	Localised along the line corridor, phased by section	Temporary limitation of grazing and seasonal land use along the OHL route; impacts fully reversible after construction	Short-term, phased
Permanent land acquisition	OHL tower foundations	Approx. **3,214 m²**	Permanent loss of small land parcels used for extensive grazing or marginal agriculture; negligible effect on overall livelihoods	Long-term (permanent)
Permanent land acquisition	Solar Power Plant Rudine (PV structures and auxiliary infrastructure)	Panels cover approx. **202,777 m²** (partial permanent occupation of land)	Permanent change of land use; land outside panel footprint remains available for traditional extensive use	Long-term (operational phase)
Permanent	**110/35 kV Substation**	Approx. **4,000 m²**	Permanent occupation of a	Long-term

land acquisition			limited land parcel; no significant loss of productive land or primary income sources anticipated	(permanent)

It needs to be emphasised that the permanent acquisition of land for the needs of the construction of the PV plant and substation – most of the acquisition has been completed by now – has been done on the basis of willing buyer – willing seller principle, i.e. based on free negotiations. The majority of the land has been acquired by private individuals.

The land required for the construction of the overhead transmission line includes:

I. land needed for the construction of transmission line towers, and
II. a temporary working corridor with an average width of approximately 3 m to enable vegetation clearance and conductor stringing activities.

The corridor required for conductor stringing and related works represents temporary land occupation only and does not result in permanent land take or long-term loss of land use.

Compensation and land use arrangements for the overhead transmission line

Owners of land (excluding forest land) crossed by the overhead transmission line (OHL) will be compensated for any actual damage incurred during construction activities. In such cases, the establishment of an easement agreement is not required, as the transaction is not registered in the cadastral records. The level of compensation will be determined on the basis of an assessment carried out by a licensed valuation expert engaged for this purpose.

For forest land, the minimum level of compensation foreseen under easement agreements is based on the assessment of a licensed valuation expert. This assessment takes into account not only the value of trees removed, but also any reduction in the market value of the land caused by the presence of the OHL. In practice, compensation actually paid to landowners often exceeds the minimum amount determined by the valuation.

For land directly affected by tower foundations or access roads, the amount of compensation foreseen under easement or access agreements is negotiated directly with landowners, in accordance with applicable legislation and accepted practice.

Upon completion of construction works, all temporarily occupied land will be reinstated, and landowners will be able to continue using their land in the same manner as prior to construction, with the exception of certain restricted activities required for safety reasons (e.g. cultivation of tall trees beneath the OHL). The Project owner will retain the right of access to the transmission line corridor for operation and maintenance purposes.

7.11.2.4 Nuisance to businesses due to the construction activities

There are not businesses in the vicinity of the project area nor along the access roads.

7.11.2.5 Mitigation measures

The project has committed to comply with the land acquisition and compensation principles of the EBRD (i.e. PR5), with the following objectives:

- Providing compensation for loss of assets at replacement cost;
- Ensuring that displacement of economic activities is implemented with appropriate disclosure of information, consultation, and the informed participation of those affected;

- Improving or, at a minimum, restoring the livelihoods and standards of living of displaced persons to pre-project levels, so as to facilitate sustainable improvements to socioeconomic status; and
- Paying particular attention to the needs of vulnerable groups.

The following mitigation measures are foreseen and will be further detailed in the Land Acquisition and Livelihood Restoration framework/plan (LARPF/LARP), as applicable:

- **Project-affected persons (PAPs) affected by permanent land acquisition**, including land required for the construction of the solar power plant, the 110/35 kV substation and overhead transmission line tower foundations, will be provided with compensation calculated by licensed valuation experts. Compensation will be based on prevailing market values and will include all applicable transaction costs, in accordance with national legislation and lender requirements.
- **PAPs affected by temporary land acquisition**, including land used for construction activities, access roads, working areas and the overhead transmission line working corridor, will receive compensation for:
    - loss of crops, trees or other agricultural assets on the affected land;
    - temporary loss of income or disruption of land use during the construction period.

- **PAPs affected by long-term restrictions on land use**, where applicable (e.g. safety restrictions related to overhead transmission line corridors), will receive appropriate compensation reflecting the permanent limitation on land use, in line with national legislation and accepted practice.
- **Access to land and properties will be maintained as far as practicable** throughout construction activities. Where temporary access restrictions are unavoidable, they will be communicated in advance to affected land users and alternative access arrangements will be provided where feasible.
- **All temporarily occupied land will be reinstated** to its original condition or to a condition agreed with landowners and land users following completion of construction works.

7.11.2.6 Residual impacts

The following table presents a summary of the residual impacts associated with the impacts identified.

Table 7-63: Residual impacts to land and livelihoods during construction

Impact / Risk	Measures to Address the Impact / Risk	Significance of Residual Impact / Risk
Construction Phase		
Loss of livelihoods from temporary land acquisition	• Monetary compensation for the loss of crops or trees on the affected land; • Monetary compensation (equal to 15% of the value of the land) for the restrictions to the land due to the presence of the OHL	**MINOR**
Loss of livelihoods from permanent land acquisition	• Monetary compensation equal to the market price of the land plus all transaction costs	**MINOR**
Physical displacement (not anticipated)		**NOT APPLICABLE**

7.11.3 Operation and maintenance phase

No impacts related to land and livelihoods are anticipated during the operation and maintenance phase of the project.

7.11.4 Decommissioning phase

During decommissioning of the PV plant, a large amount of land will be released for agricultural and other uses, which is a positive impact. The decommissioning phase for the OHLs will require the temporary use of land around the towers and along the transmission lines. This will result in temporary impacts on land-based activities and respective livelihoods. However, this will be short-term and compensated under the same principles as construction activities. After decommissioning, all land (i.e. PV power plant, towers) will be reinstated and returned to former use without any restrictions.

7.12 Labour and Working Conditions

7.12.1 Overview

Labor and working conditions is a cross-disciplinary area concerned with protecting the safety, health and welfare of people engaged in work or employment. The goal of all occupational health and safety programs is to foster a safe work environment. As a secondary effect, it must also protect co-workers, family members, employers, customers, suppliers, nearby communities, and other members of the public who are impacted by the workplace environment. Furthermore, it must involve interactions among many subject areas, including occupational medicine, occupational (or industrial) hygiene, public health, safety engineering, chemistry, health physics.

Both the national legislation and EBRD ESR2 are influenced and compliant with key ILO Conventions, such as:

Freedom of Association and Protection of the Right to Organise Convention, 1948 (No. 87)
Right to Organise and Collective Bargaining Convention, 1949 (No. 98)
Forced Labour Convention, 1930 (No. 29 and its 2014 Protocol)
Abolition of Forced Labour Convention, 1957 (No. 105)
Minimum Age Convention, 1973 (No. 138)
Worst Forms of Child Labour Convention, 1999 (No. 182)
Equal Remuneration Convention, 1951 (No. 100)
Discrimination (Employment and Occupation) Convention, 1958 (No. 111)
Occupational Safety and Health Convention, 1981 (No. 155)
Promotional Framework for Occupational Safety and Health Convention, 2006 (No. 187).
All of mentioned eleven conventions are ratified by Montenegro, except Protocol of 2014 to the Forced Labour Convention, 1930.

The goal is:

- To establish, maintain and improve the worker-management relationship;
- To promote the fair treatment, non-discrimination and equal opportunity of workers, and compliance with national labour and employment laws;
- To protect the workforce by addressing child labour and forced labour;
- To promote safe and healthy working conditions, and to protect and promote the health of workers.

Projects are required to comply with whichever of the above mentioned provides the greater degree of protection.

7.12.2 Potential impacts

All phases of the Project will require workforce engagement. The construction phase is expected to generate the highest demand for labour and will involve a temporary increase in the number of workers present in the Project area. Potential impacts are therefore primarily associated with labour conditions, occupational health and safety risks, and workers' interaction with local communities.

7.12.2.1 Labour conditions

In general, according to the Montenegrin labour legislation, the employment may be on permanent and temporary basis. Depending on the specific needs and project activities, the manner of engagement of the work force will be a decision of the employer. In any case, both the employers and employees will be obligated to follow the stipulations outlined in various legal acts related to labour and social protection legislation, which include the Law on Labour (Official Gazette of MN No. 074/19 of 30.12.2019) and the Law on Occupational Safety and Health (Official Gazette of MN No. 34/2014 and 44/2018), among others. The competent body for supervision of implementation of the above legislation is the State Labour Inspectorate within the Ministry of Labour and Social Policy.

In accordance with national legislation and EBRD ESR2, the Contractor shall provide employees with information regarding their rights under national labour and employment law, including their rights related to wages and benefits. This information shall be clear and understandable to employees and shall be explained or made accessible to each employee upon taking employment. The Contractor shall also refrain from any activities against workers organisation and collective bargaining.

The Contractor shall base the employment relationship on the principle of equal opportunity and fair treatment, and shall not discriminate with respect to aspects of the employment relationship, including recruitment and hiring, compensation (including wages and benefits), working conditions and terms of employment, access to training, promotion, termination of employment or retirement, and discipline.

No construction camps are envisaged for the construction of the project components. Whatever the choice is, the Contractor shall ensure that the construction workforce required for the Project has suitable accommodation throughout the entire construction period, including space requirements, food and water provision, adequate heating or air-conditioning to cater with weather conditions.[27] They will also take measures to ensure that the construction workforce has minimal impact on the local communities, respects local culture and traditions, conforms to social rules and legal frameworks, and meets all international standards for working, living and welfare within the workers' accommodation facility.

7.12.2.2 Occupational Health & Safety

Occupational health and safety (OHS) represents a key consideration during the construction, operation, maintenance and decommissioning phases of the Project, including the solar power plant, overhead transmission line and 110/35 kV substation. Project workers may be exposed to a range of occupational hazards associated with civil works, electrical installations and mechanical activities typical for power generation and transmission projects.

During the construction phase, the main OHS risks are related to the operation of heavy machinery and vehicles, earthworks and excavations, lifting and assembly of equipment, work at height and electrical installation activities. During the operation and maintenance phase, risks are primarily associated with electrical safety, maintenance works at height (OHL and PV structures), inspection activities and occasional use of machinery and vehicles. Decommissioning activities may present similar risks to those encountered during construction, although of shorter duration and lower intensity.

Table 7-28 presents the typical OHS risks associated with the construction and operation of the solar power plant, overhead transmission line and substation, together with an assessment of impact significance before and after the application of mitigation measures. Key occupational health and safety risks identified for the Project include:

- operation of heavy construction equipment and machinery (excavators, cranes, lifting equipment, trucks);
- excavation and levelling works for PV foundations, cable trenches and substation construction;

[27] Useful guidance can be found in "Worker's Accommodation: processes and standards" A guidance notes by IFC and EBRD

- transportation of construction materials, PV components, transmission line elements and heavy equipment along access roads and near tower locations;
- work at height during erection of transmission line towers, stringing of conductors and installation of PV mounting structures;
- lifting and assembly of heavy electrical and mechanical equipment at the solar power plant and the 110/35 kV substation;
- exposure to elevated noise levels and dust during earthworks and construction activities;
- risk of slips, trips and falls within construction sites and along uneven karst terrain;
- electrical hazards, including electric shock, arc flash and short-circuit risks during installation, testing and commissioning works;
- thermal hazards, including burns associated with electrical faults or malfunction of equipment;
- risks to community health and safety related to construction traffic and temporary access restrictions;
- security-related risks affecting workers, equipment and materials.

The Contractor shall prepare and implement a Job Hazard Analysis (JHA) and task-specific risk assessments for all high-risk activities. The list of OHS risks will be verified, updated and refined based on site-specific conditions prior to the commencement of works.

7.12.3 Mitigation measures

A Labour Management Plan (LMP) and associated procedures shall be prepared and implemented by the Contractor to describe how labour and working conditions will be managed in compliance with applicable national legislation and EBRD Environment and Social Requirement 2 (ESR2). The LMP will apply to all project workers, including those employed directly by the Contractor and its subcontractors.

As a minimum, the following measures shall be implemented:

- The Contractor shall adopt and implement transparent and non-discriminatory recruitment and hiring procedures, ensuring that no employee or job applicant is discriminated against on the basis of gender, marital status, nationality, age, religion, ethnicity, disability or sexual orientation.
- Where worker accommodation is required, it shall be provided in accordance with EBRD and IFC good practice requirements and applicable national standards, including provisions related to space, hygiene, water supply, sanitation, heating/cooling, safety and privacy.
- All contracts signed with contractors and subcontractors shall include explicit provisions requiring compliance with Montenegrin labour legislation, international labour standards and the Project owner’s policies related to labour, welfare and occupational health and safety.
- The Contractor shall ensure that induction training is provided to all workers, including clear information on workers’ rights, terms and conditions of employment, grievance mechanisms and occupational health and safety requirements. Subcontractors shall be required to provide equivalent training to their employees.
- All workers shall be engaged under written employment contracts that clearly define their terms and conditions of employment, wages, working hours, benefits and legal rights, in accordance with national legislation.
- All workers, including those employed by contractors and subcontractors, shall have the right to freedom of association and to join workers’ organisations of their choice, as well as the right to collective bargaining, in accordance with national law and international standards.

Worker Grievance Redress Mechanism (GRM)

A grievance redress mechanism (GRM) shall be established for all project workers and staff. Workers shall be informed about the GRM at the time of recruitment and induction, including information on how to submit grievances and the measures in place to protect them against retaliation or reprisal.

The GRM shall be designed to:

- be easily accessible to all workers;
- address grievances promptly and fairly;
- operate in a transparent, independent and objective manner;
- provide timely feedback to complainants in a language they understand;
- not impede access to judicial or administrative remedies available under national law.

Occupational Health and Safety

The Contractor shall prepare and implement a Project-specific Occupational Health and Safety (OHS) Plan, covering all construction, operation and decommissioning activities related to the solar power plant, overhead transmission line and substation.

The OHS Plan shall:

- identify and assess all potential OHS risks associated with project activities;
- define preventive and protective measures in accordance with national legislation and international good practice;
- include task-specific risk assessments, method statements and permit-to-work procedures for high-risk activities.

Table 7-30 provides a preliminary list of typical OHS risks associated with power generation and transmission projects, together with indicative preventive measures. The Contractor shall review, update and refine this list based on the specific characteristics of the Project and shall integrate the identified OHS measures into all construction methodologies and work procedures.

Table 7-64: Summary of OHS risks and prevention measures

Impact of various activities	Severity	Probability	Significance before Preventive Action	Preventive Measures	Significance of Residual Risks
During Construction					
Impact of drilling at PV site and tower locations	Critical	Probable	High	Training and education will be provided to all workers involved in drilling and other related works. Effective PPE's will be provided and ensured to be used during all works. Machines will be checked and maintained to an efficient level to ensure risk free operations.	Low
Operation of heavy equipment and machinery	Critical	Occasional	Medium	Developing safe working procedures, training of the operators and workers and maintaining a safe zone, ensuring visibility and stationing flagman.	Low
Excavation for solar panels and tower installations and construction of substation	Major	Occasional	Medium	Excavation for tower foundation for a depth of 3-6 m will be required. In addition, cut and fill will also be required at the PV plant and the substation. The Contractor will be responsible for sloping by cutting back the trench wall at an angle inclined away from the excavation. Shoring will require installing aluminum hydraulic or other types of supports to prevent soil movement and cave-ins. Shielding will be required to protect workers by using trench boxes or other types of supports to prevent soil cave-ins. Contractor will design a protective system that can be complex because consideration should be	Low

				given to many factors: soil and rock classification, depth of cut, water content of soil, changes due to weather or climate, surcharge loads (e.g., spoil, other materials to be used in the trench) and other operations in the vicinity.	
Transportation of construction materials, heavy equipment by road close to substation	Major	Occasional	Medium	The contractor will develop a traffic management plan by considering the heavy load, control of traffic on main and other local roads, pavement condition and stability, radius of curvature of the local roads to take turns on sharp curves, etc.	Low
Working at height for substation and towers assembly	Critical	Frequent	High	Use of fall prevention devices, including safety belt and lanyard, travel limiting devices to prevent access to fall hazard area, or fall protection devices such as full body harnesses used in conjunction with shock absorbing lanyards or self-retracting inertial fall arrest devices attached to fixed anchor point or horizontal life-lines.	Low
Transportation of oversized equipment to PV plant, OHL and substation	Major	Occasional	Medium	Ensure that the vehicle route is surveyed and that its geometric design and condition is appropriate for the transportation of the big and heavy load. Ensure that turning curves are appropriate for the special vehicles.	Low
Lifting and Assembly of Heavy Equipment at substation and PV plant	Major	Occasional	Medium	Lifting equipment selection shall be based on a risk assessment and shall be suitable for the task for which it will be used.	Low
Frequent accidents and injuries due to various construction activities without the use of PPE	Critical	Probable	Serious	The contractors will be responsible for supplying effective PPE to all workforces and staff of consultants and PIU visiting the worksites. Contractors must ensure that all workers and staff are trained how to use PPE prior to entering the construction sites. Any violation of the supply of PPE	Low

				by the contractor and use of PPE by workers will lead to severe penalties.	
Community health and safety from construction activities and traffic	Major	Occasional	Medium	Construction areas will be secured using fences in close proximity to residential development.	Low
Security of workers and assets	Major	Occasional	Medium	The contractor shall: • Provide appropriate security personnel (i.e. security guards) to prevent unauthorised entry into the construction area. • Employ a night watchman for periods of significant on-site storage or when the area necessitates. • Ensure there is proper fencing around the construction site perimeter. • Ensure the construction site has controlled access points (one or two entry points at most), allowing for close monitoring of entry and exit.	Low
During Operation and Maintenance					
Workers health and safety during maintenance	Critical	Occasional	Medium	Implementation of Standard operating procedures (SOPs) of Qair.	Low
Handling of faulted SF6 in circuit breakers and transformers maintenance	Critical	Probable	Serious	Evacuate the faulted SF6 gas from the circuit breaker and flush with fresh air before working on the circuit breaker. Arc products which do not recombine, or which combine with any oxygen or moisture present, are normally removed by the molecular sieve filter material within the circuit breaker.	Low
Electrical risks during maintenance addressing working near exposed energised overhead lines or	Catastrophic	Occasional	Serious	Conduct a job hazard analysis to identify the hazard risks. Follow Qair's standard operating procedure for repair and maintenance. Only qualified persons using proper test equipment and	Low

substations; working on electrical equipment and systems				personal protective equipment must adhere to limited approach boundary with a distance of 7.25 m for 110 kV voltage. Must comply with the working space requirement for the equipment.	
Exposure to electric and magnetic fields (EMF) from operation of the PV Power Plant.	Severe	Minimal	Negligible	Exposure to EMF has been considered during the design of the transmission line conductors and right of way to ensure compliance with the internationally recognised standards. The electric and magnetic fields will be regularly monitored during O&M phase to ensure compliance with national limit values and ICNIRP standards, and if required additional mitigation measures will be pro-posed during O&M phase. .	Low
Thermal risks (e.g. Burns due to short circuit caused by insulation breaks…)	Critical	Probable	Serious	Conduct a job hazard analysis to identify the hazard risks. Follow Qair's standard operating procedure for repair and maintenance. Only qualified persons using proper test equipment and personal protective equipment must approach live electrical equipment	Low

7.13 Community Health, Safety and Security

7.13.1 Construction phase

7.13.1.1 Potential impacts

Community health and safety impacts during construction include, among others, dust, noise and vibration from the works in the worksites as well as construction vehicle traffic, risks to people due to the circulation of heavy trucks and other project vehicles in the wider project area, accident risks to people and especially children in case access to worksites is not restricted, and risks to the local population from interaction with construction labour.

The construction activities will bring limited changes to the way of life that local residents are experiencing prior to the project. Emissions of dust, noise and vibrations have already been dealt with in former sections. Formerly free and unlimited movement of people and children on the roads and localities around the worksites will be somewhat constrained due to the presence of trucks and various machinery on the local roads. The same applies for the livestock since it can also become a safety problem for the traffic. This is further analysed in the next section on Traffic and Transport.

Accidents in the worksites (such as fire, explosions, major spills) may also affect the neighboring communities, depending on the type of accident, scale and environmental conditions. Taking into account the major consequences of relevant accidents but the low likelihood, such risks are considered of moderate significance.

7.13.1.2 Mitigation measures

The Contractor shall be obliged to develop and implement procedures to protect public health and safety. In accordance with **ESR 4 – Health, Safety and Security**, the Contractor shall design, construct, operate, and decommission the structural elements of the Project taking into consideration safety risks to third parties and affected communities.

This shall include the introduction and enforcement of a Code of Conduct for workers, as well as the implementation of adequate site security measures to prevent unauthorised access to active construction sites, workers' camps, transport vehicles, construction machinery, and equipment storage areas.

The Contractor shall prepare and implement an Emergency Response Plan (ERP) to respond to accidental and emergency situations in a manner appropriate to the construction risks. The ERP shall be based on the prior identification of major-accident hazards and shall include measures necessary to prevent major accidents and to limit their consequences for local communities, with particular consideration given to vulnerable groups, including children, elderly persons and persons with disabilities.

The Contractor shall identify and implement measures to address emergency events. These measures shall be designed to address emergency situations in a coordinated and expeditious manner, to prevent injury to the health and safety of the community, and to minimize, mitigate and compensate for any impacts that may occur.

The ERP shall be consistent with national and local emergency response and civil protection plans and coordinated with relevant municipal and state authorities.

An ERP shall include, as appropriate:

1. engineering controls (such as containment systems, automatic alarms, and shut-off systems) proportionate to the nature and scale of the hazard;
2. identification of and secure access to emergency equipment available on-site and nearby;
3. notification procedures for designated emergency responders;
4. use of diverse media channels for notification of affected communities and other stakeholders;
5. a training program for emergency responders, including drills conducted at regular intervals;
6. public evacuation procedures, where applicable;
7. designation of a responsible coordinator for ERP implementation, with clearly defined roles, responsibilities, and reporting lines; and
8. measures for environmental restoration and clean-up following any major accident.

The ERP shall be subject to periodic review and testing, and shall be updated as necessary based on lessons learned from drills or actual emergency events. The ERP shall be approved by **CGES** and communicated to neighbouring communities as well as to relevant civil protection and emergency response authorities.

Transport safety practices shall be adopted and implemented in accordance with the Traffic Management Plan to prevent traffic incidents and nuisance to local residents. The Contractor shall evaluate and monitor potential traffic and road safety risks to workers, affected communities and other road users and shall implement appropriate road safety measures to prevent and mitigate such risks.

The Contractor shall undertake a road safety assessment for each phase of the Project, monitor traffic-related incidents and accidents, and prepare regular reports on such monitoring. These reports shall be used to identify safety-related issues and to establish and implement corrective measures.
For vehicles or fleets of vehicles, the Contractor shall implement appropriate procedures, including driver training, vehicle safety checks, and monitoring and enforcement systems. Regular maintenance of all project vehicles shall be ensured.

Where the use of project equipment could affect public roads, the Contractor shall take all appropriate safety measures to avoid incidents and injuries to members of the public.

7.13.2 Operation and maintenance phase

7.13.2.1 Potential impact

During the operational phase the substation and the OHLs will release electrical and magnetic fields and operational noise (discussed under Chapter 7.5.3), which may be considered as a community health risk.

7.13.2.2 Electric and Magnetic fields

Electric and magnetic fields (often referred to as EMF) and the electromagnetic forces they represent are an essential part of the physical world. Their sources are the charged fundamental particles of matter (principally electrons and protons). Electromagnetic forces are partly responsible for the cohesion of material substances and they mediate all the processes of chemistry, including those of life itself. People experience the natural magnetic field of the Earth (to which a magnetic compass responds) and natural electric fields in the atmosphere. Electric fields are measured in volts per meter (V/m) or kilovolts per meter (kV/m). Magnetic fields are measured in microteslas (μT) or nanoteslas (nT).

High-voltage power transmission line and substations are a source of extremely-low-frequency (ELF) that modulates the Earth's steady natural electric and magnetic fields.

The amplitude of the electric field modulation depends on the voltage of the TL equipment, which remains more or less constant as long as the TL equipment is under operation. The strength of the magnetic field modulation depends on the electrical current (the load) carried by the TL equipment, which varies according to the demand for power at any given time.

Legal Framework

In 1998, the International Commission on Non-Ionizing Radiation Protection (ICNIRP) issued recommendations for low-frequency fields exposure limits, listed in the "Guidelines for Limiting Exposure to Time-Varying Electric, Magnetic, and Electromagnetic Fields (up to 300 GHz)". ICNIRP recommendations are applicable both to the long-term exposure of the general public and the short-term exposure at the industrial sites. The exposure limits established in the recommendations are widely accepted all over the world. They were adopted in:

(i) the Recommendation of EU Council 1999/519/EC of 12 July 1999 Limiting the Public Exposure to Electromagnetic Fields (0 Hz to 300 GHz), and
(ii) the Directive 2004/40/EC of the European Parliament and EU Council of 29 April 2004 on the Minimum Health and Safety Requirements regarding the Exposure of Workers to the Risks Arising from Physical Agents (Electromagnetic Fields).

Table 7-65: Limit values for exposure to EMF (ICNIRP / EU)

Exposure of public		Industrial exposure	
Electric field	Magnetic field	Electric field	Magnetic field
5 kV/m	100 μT	10 kV/m	500 μT

The main Montenegrin legislation related to the non-ionizing radiation, which refers to the exposure limits, includes:

- The Law on Protection against Non-Ionizing Radiation (Official Gazette of the MN, no. 35/13) of 1 July 2015, and
- The associated sub-law document: Ordinance on Exposure Limits to Non-Ionizing Radiation (Official Gazette of the MN, no. 6/15) of 10 February 2015.

This legal instrument determines exposure limits and referent limit levels of exposure of the population to electrical, magnetic and electro-magnetic fields with different frequencies.

The limit values of the relevant physical quantities for general public exposure of the population to electromagnetic fields for certain frequency

Table below provides the limit values for the exposure to time variant electric and magnetic fields of frequency between 1 Hz and 10 MHz. The limit values are defined for the following relevant physical quantities:

- Electric field strength (*E*);
- Magnetic field strength (*H*);
- Magnetic induction (*B*).

Limit values for electric field strength, magnetic field strength, and magnetic induction are the same as per National legislation and ICNIRP / EU framework.

Table 7-66: Limit values for electric field strength, magnetic field strength, and magnetic induction

Frequency range	Electric field strength E [V/m]	Magnetic field strength H [A/m]	Magnetic induction B [μT]
1-8 Hz	5000	$3{,}2\times10^4/f^2$	$4\times10^4/f^2$
8-25 Hz	5000	$4\times10^3/f$	$5\times10^3/f$
25-50 Hz	5000	160	200
0,05-0,4 kHz	250/f	160	200
0,4-3 kHz	250/f	64/f	80/f
0,003-10 MHz	83	21	27

The limit values for time variant contact current (I_c) and induced current in the extremities (I_L) are defined for the electromagnetic fields of frequency up to 110 MHz are given in Table 7-30.

Table 7-67: Limit values for contact current and current in extremities

Frequency range	Maximum contact current, I_c [mA]	Maximum current in extremities, I_L [mA]
<2,5 kHz	0,5	-
2,5-100 kHz	0,2xf	-
0,1-10 MHz	20	-
10-110 MHz	20	45

Calculation of Electromagnetic Radiation for the 110/35 kV Substation

The calculation of the electric and magnetic field of substations is very complicated due to the complex structure and the large number of elements and equipment (transformers, switches, disconnectors, cables,

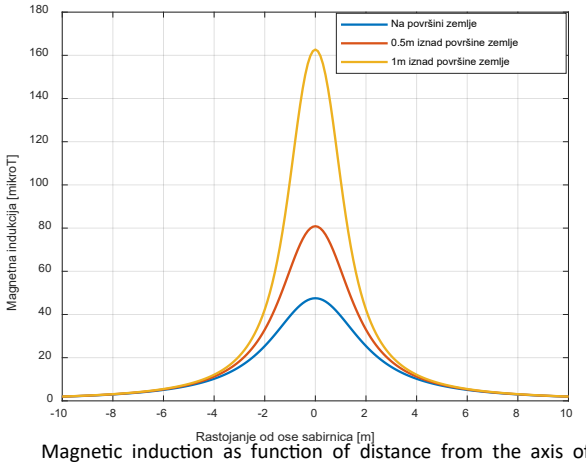
busbars, measuring devices, etc.), which have certain specifics but must be respected. All of these devices affect the magnitude and distribution of electromagnetic fields inside and outside the substation. Also, each substation is characterised by a different position of the elements in the overall layout of the equipment (individual elements are placed at right angles, the busbars can stand one above the other or next to each other, individual elements can be more or less raised in relation to others).

In order to estimate the expected values of electric field strength, magnetic induction and magnetic field strength, the given design data on TS, as well as data on a similar SF6 transformer plant, taken from the Siemens literature, were used.

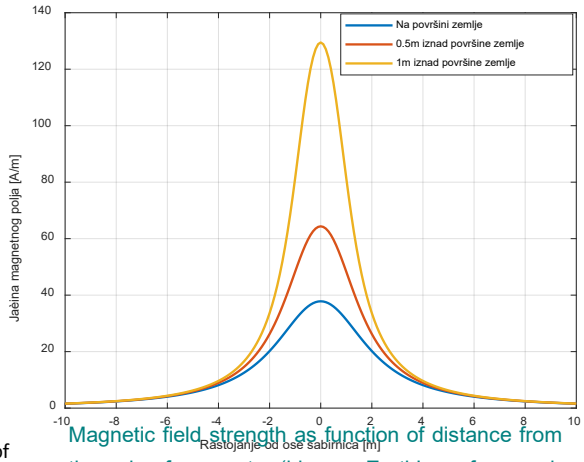
Of all the parts of electrical equipment, busbars are the longest elements through which current flows (switches are specially "shielded", disconnectors are short, measuring transformers are separated from other parts and the like). Therefore, in this study, a brief analysis of the distribution of electric and magnetic fields around the busbars was performed.

On the 35 kV side of the substation, copper busbars with a cross section of 60x10 mm are used, for which the maximum allowed current is 1060 A. The calculation was performed for busbar heights of 2 m above the ground, as well as 3 m above the ground, while the distance between the phases is 0.55 m. Values for the relevant physical quantities of the electromagnetic fields were calculated for points on the ground, as well as for points at a height of 0.5 m and 1 m above the ground. Also, it is accepted that the busbars are placed in a horizontal plane. Regarding the 110 kV side, it is emphasized that it is made in the building, which means that it is shielded in such a way that there is no electromagnetic field outside the building.

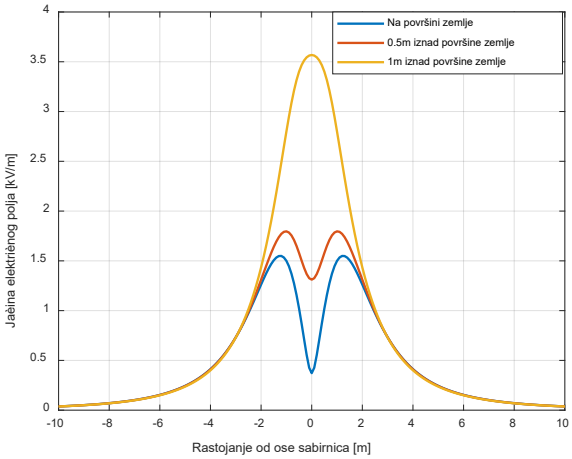
The spatial distribution of the magnetic induction, magnetic field strength, and the electric field strength, respectively, is presented in the following figures, when the height of the busbars is 2 m. The magnetic induction [μT], magnetic field strength [A/m], and electric field strength [kV/m] are drawn on the y-axis, while the horizontal distance from the axis of symmetry of three-phase busbars is given on the x-axis. The spatial distribution of the field is calculated for Earth’s surface (blue colour graph), for 0.5 m above the ground (red colour graph), and for 1 m above the ground (yellow colour graph).



Magnetic induction as function of distance from the axis of symmetry (blue-on Earth's surface; red-0.5 m above surface; yellow-1m above surface)



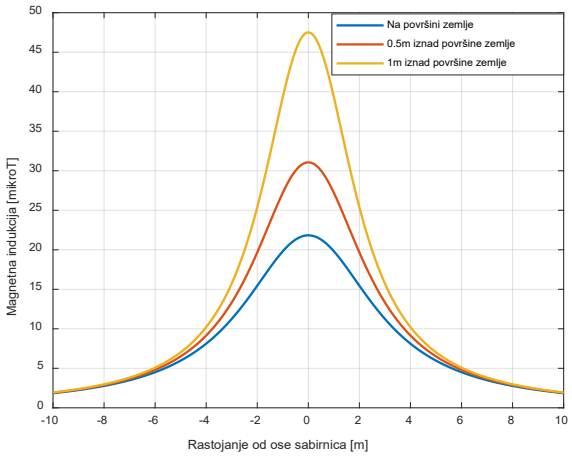
Magnetic field strength as function of distance from the axis of symmetry (blue-on Earth's surface; red-0.5 m above surface; yellow-1m above surface)



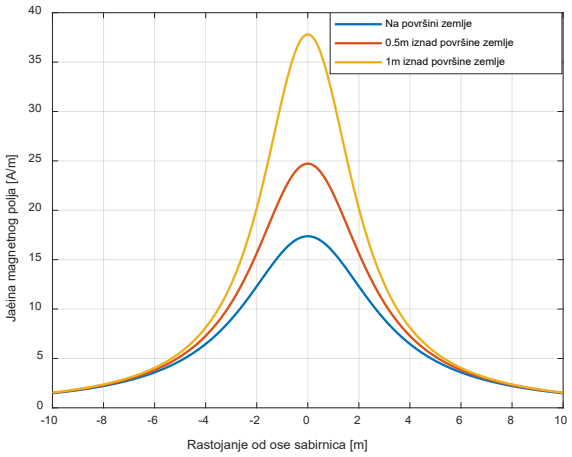
Electric field strength as function of distance from the axis of symmetry (blue-on Earth's surface; red-0.5 m above surface; yellow-1m above surface)

Figure 7-6: Spatial distribution of the magnetic induction, magnetic field strength, and the electric field strength

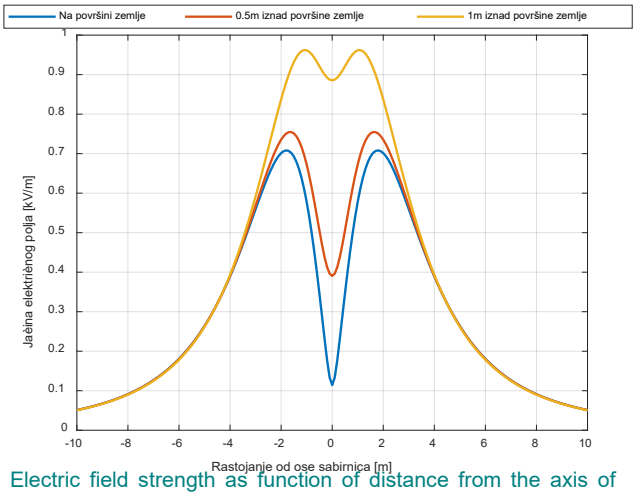
The same calculation, but in the case when the busbars are placed 3 m above the ground, is demonstrated in the following figures (blue colour graph - field on the ground, red colour graph - field at the height of 0.5 m above the ground, yellow colour graph -field at the height of 1 m above the ground:



Magnetic induction as function of distance from the axis of symmetry (blue-on Earth's surface; red-0.5 m above surface; yellow-1m above surface)



Magnetic field strength as function of distance from the axis of symmetry (blue-on Earth's surface; red-0.5 m above surface; yellow-1m above surface)



Electric field strength as function of distance from the axis of symmetry (blue-on Earth's surface; red-0.5 m above surface; yellow-1m above surface)

Figure 7-7: Spatial distribution of the magnetic induction, magnetic field strength, and the electric field strength with busbars 3 m above the ground

The short analysis of the magnetic field of the busbars indicates that the estimated maximum value of the magnetic induction (when the busbars are placed 2 m above the ground) is around **160 μT**, while the maximum value of the magnetic field strength is **130 A/m**. For the height of the busbars of 3 m above the ground, the amplitude of the magnetic induction is around **48 μT**, while the amplitude of the magnetic field strength is around **38 A/m**. It indicates that, in any case, the amplitude of the magnetic induction is not higher than the limit value for the **general public exposure of the population to electromagnetic fields,** which is **200 μT**; also the magnetic field strength is under the limit value of **160 A/m**. It is important to note that the previous analysis of the substation field is rough, because the housing in which the substation will be located is not taken into account, which creates the Faraday cage effect, which further means that the magnetic field will be significantly weaker than previously calculated. However, by conducting such an approximate calculation, an analysis of the worst possible case was performed, which puts us in the so-called "safe side". As for the electric field, for a bus height of 2 m the maximum value of the electric field strength is **3.5 kV/m**, while for a bus height of 3 m the amplitude of the electric field strength is almost **1 kV/m**. These values are significantly **less** than the limit value of electric field strength for the general public exposure of the population to electromagnetic fields, which is **5 kV/m**.

Electromagnetic Radiation for the OHLs

During the operation of the 110 kV overhead transmission lines, the main environmental and health concern relates to the generation of low-frequency electric and magnetic fields (EMF). These fields are produced as a result of the voltage and current flow in the conductors. The intensity of EMF decreases rapidly with distance from the line and depends on technical parameters such as conductor height, spacing, current load, and grounding design.

Reference calculations conducted for the 110 kV Lastva–Kotor transmission line, using comparable technical characteristics and loading conditions, indicate that maximum field values under worst-case scenarios are well below internationally and nationally prescribed exposure limits. For magnetic induction, calculated values typically range between 1–9 μT (maximum ~11 μT), compared with the general public limit of 100 μT under ICNIRP guidelines and 50 μT under Montenegrin law.

Similarly, electric field strength under the line does not exceed 1.2 kV/m, which is significantly below the EU/ICNIRP threshold of 5 kV/m, and remains in compliance with the stricter national limit of 1.25 kV/m.

Given that the new towers represents standard 110 kV structures, with spans and design parameters comparable to the existing line sections for which calculations were carried out, the EMF levels at this location can reasonably be expected to remain within the same range. Importantly, no residential or sensitive receptors are located directly beneath the conductors, and the nearest inhabited areas are at sufficient distance to ensure that exposure levels remain far below any regulatory thresholds.

As a result, **the installation of the new OHLs is not expected to create any additional EMF-related risks for the local population or environment**. Monitoring and control of EMF along transmission lines is part of the standard operational practice of CGES, ensuring continued compliance with both Montenegrin legislation and international standards (ICNIRP, EU Council Recommendation 1999/519/EC).

7.13.2.3 Mitigation measures

No further mitigation measures are provided.

7.14 Construction Traffic and Transport

7.14.1 Overview

Construction works, heavy machinery and large transport vehicles and increased intensity and volume of the traffic will affect the normal traffic regime in the project area.

The construction traffic of the proposed transmission infrastructure implies a need for adequate attention because of (1) likely increase in the intensity and volume of the traffic on the roads with (at an average) lower traffic load, and (2) use of bulky and heavy vehicles for construction and dismantling purposes. The key traffic aspects can generally be grouped in:

- off-site aspects, and
- in-site aspects

The off-site aspects concern conditions outside the construction sites of the proposed transmission line:

- Selection of routes of access roads and travelling time;
- The ability of local roads to accept the planned volume and intensity of the traffic during the construction; phase, taking into account technical and operational requirements of large and heavy vehicles;
- Safety of the roads;
- Plan for the transport and traffic.

The in-site aspects concern the conditions within the construction sites:

- Standards for access roads, including possible need for upgrading of the existing ones.

7.14.2 Means of transport

The principal means of transport proposed to service project construction is by road. This is primarily due to the already existing road network in the project area, flexibility required in delivering machinery and materials to locations in remote areas over difficult terrain and across a corridor, which is dispersed.

Transportation and delivery of the transformers to the proposed substations will be made using specialised vehicles, which will have non-standard dimensions. Some advance works along public roads used for access to substations may be required, including eventual strengthening of bridges and minor improvements to alignments and road geometry. This will be addressed by the Contractor depending on the actual needs.

7.14.3 Key Transport Routes

The table below identifies the main construction routes, which will be used for import of machinery and equipment, materials and labour for construction of the proposed key Project components.

Table 7-68: Key construction transport routes

Transmission section	Principal routes	Local access routes
The Rudine PV Power Plant and OHLs	M7 (Nikšić - Vilusi – Bileća)	• M7 – Rudine • M7, M8 and M9 – Vilusi

7.14.4 Types of Vehicles

The Table below presents information on the assumed types of light and heavy vehicles, which will be used to satisfy construction requirements.

Table 7-69: Construction traffic inventory

Light vehicles	Heavy vehicles
Cars	Ready mix concrete
Vans	Trucks
Light tractors	Cranes
4-wheel drive vehicles	Heavy tractors

7.14.5 Traffic Impacts

It is clear that the project construction traffic will increase traffic flows on some roads, particularly the local road network and unclassified roads, where the levels of traffic are typically low. The effects of construction traffic on such roads will cause significant increases over baseline traffic flows, however these effects would be short-term, limited to the duration of the works in each location, and would be controlled through traffic management measures where necessary.

The following type of impacts is anticipated to arise from the above-described construction traffic:

- Road use delays: the amount of traffic close to a construction site would increase overall traffic in the surrounding area and may affect daily road users, including public transport.

- Impacts on road safety: due to the increase in the amount of traffic, there is a potential for increase of road accidents.
- Degradation of roads: the use of the local road network by heavy trucks and other machinery may lead to wear and damage of the road surface.
- Increase of noise, vibration and air pollution: the traffic of heavy machinery on unpaved roads would increase noise and vibration levels as well as the emissions of dust.

Overall, the construction traffic will have major impacts to the pre-project traffic patterns of the project area. However, such impacts will be short in duration and fully reversible once the construction ends. As a consequence, the impact significance is considered medium.

The impact on other communal infrastructure (electricity, water and telecommunications network) will be negligible. When it comes to the operation of the Rudine PV Power Plant, there will be no impact on the communal infrastructure.

7.14.6 Mitigation measures

Standard mitigation measures apply to project construction in order to minimise traffic impacts. The Contractor shall prepare a Traffic Management Plan in consultation with the local authorities and the traffic police, detailing such measures. A non-exhaustive list of measures includes the following:

- Restrict speed limits of construction traffic to 20 km/h in inhabited areas;
- Advance warning shall be given of any proposed road diversions and blockages;
- Drivers of project vehicles shall be trained/briefed about safe driving with respect to other drivers, non-motorised traffic such as pedestrians, cyclists, and livestock;
- Clear signs and signals shall be set up where necessary;
- Systematic presence of flagmen in the work areas close to traffic lanes;
- Assignment of heavy vehicle construction traffic to suitable routes to and from the working area;
- Information on traffic safety shall be provided to communities not normally subjected to high traffic loads;
- Raising awareness and training of drivers of light vehicles and trucks in elementary safety rules and risks: driving under the influence of alcohol, drugs, speed, tire control, loading (stability);
- Access and site roads will be maintained in good condition.

7.14.7 Residual impacts

Project-related traffic on local roads along the line route is inevitable and may lead to delays for local traffic during the construction period. The key safety risk is over-taking of slow-moving construction vehicles, which may become a safety hazard to non-motorised road users on these roads, where they are used to low levels of baseline traffic. However, impacts on the local road network will be temporary and short-term, and will be managed through the application of a Traffic Management Plan. The overall residual impacts will be expected to be minor.

7.15 Cultural Heritage

The Project area is located at a sufficient distance from settlements, cultural heritage sites, and protected areas.

With regard to known cultural heritage sites, the impact significance of the project is minor, as the distance from existing sites and the type of project activities do not pose any threat to cultural heritage. However, as the area is rich in history, chance finds are not unlikely.

7.15.1 Mitigation measures

Chance Finds

During the construction works, the Contractor shall be obliged to develop and implement a “chance-find” procedure for accidental findings and to comply with national legislation on the protection of cultural heritage. Workers need to be trained in the use of these procedures.

If an archaeological site or items of archaeological significance are found during execution of construction works, the Contractor is obliged to:

(i) inform immediately the competent public institution for protection of cultural heritage about the discovery
(ii) cease operations and to secure the site against any damaging and against unauthorized access, and
(iii) maintain the discovered items in the location and in condition they were found.

According to EBRD ESR 8 the client will ensure that provisions for managing chance finds – defined as tangible cultural heritage encountered unexpectedly during project implementation – are in place and included in contracts, as appropriate. Such provisions will include notifying relevant competent bodies of found objects or sites; delivering training to project personnel, including contractor and sub-contractor employees, on the procedures to follow in the case of chance finds; and securing the area of finds to avoid any further disturbance or destruction. The client will not disturb any chance finds until an assessment is made by a cultural heritage expert(s) and actions are identified consistent with national law and this ESR.

8 Cumulative Impact Assessment

This section identifies and assesses the potentially significant environmental and social impacts of the Rudine Solar Power Plant (SPP) when considered in combination with other existing or reasonably foreseeable developments and activities within the wider project area. The assessment focuses on inter-project cumulative impacts, i.e. combined effects arising from the interaction of the Project with other projects, activities or natural processes over time, which may be additive or interactive in nature.

Intra-project cumulative impacts, defined as combined impacts from different project components affecting the same receptors within the Project Area, have been assessed and addressed in the relevant thematic sections of this ESIA.

8.1 Overview

The identification of existing and planned projects and activities in the wider Rudine area was based on consultations with Project representatives, review of available planning and permitting documentation, and discussions with key informants from local communities and the Municipality of Nikšić.

The wider project area is characterized by open karst terrain with shallow and rocky soils, which limits its suitability for intensive agricultural production. Land use for agriculture is sporadic and of low intensity, mainly related to seasonal grazing and occasional use of open land, without established agricultural holdings. Population density in the wider project area is low.

In recent years, however, the area has experienced increasing interest in renewable energy development, particularly solar power plants and associated grid infrastructure. While individual projects may result in

limited impacts when assessed on a stand-alone basis, their combined effects may lead to cumulative environmental and social impacts if not adequately managed.

8.2 Assessment Methodology

The assessment methodology used in this chapter is adapted from the IFC's Cumulative Impact Assessment (CIA) approach[28]. One of the key principles of cumulative impact assessment is to focus on Valued Environmental Components (VECs), both for setting context of temporal and spatial boundaries to be considered and in assessing the significance of cumulative impacts. The IFC good practice handbook outlines the following six steps (Figure 8-1) to undertaking CIA:

- Determine spatial and temporal boundaries.
- Identify VECs in consultation with effected communities and stakeholders.
- Identify all developments and external natural stressors affecting VECs.
- Determine present condition of VECs.
- Assess cumulative impacts and evaluate their significance over predicted future
- conditions.
- Design and implement (a) adequate strategies, plans, and procedures to manage cumulative impacts, (b) appropriate monitoring indicators and (c) effective supervision mechanisms.

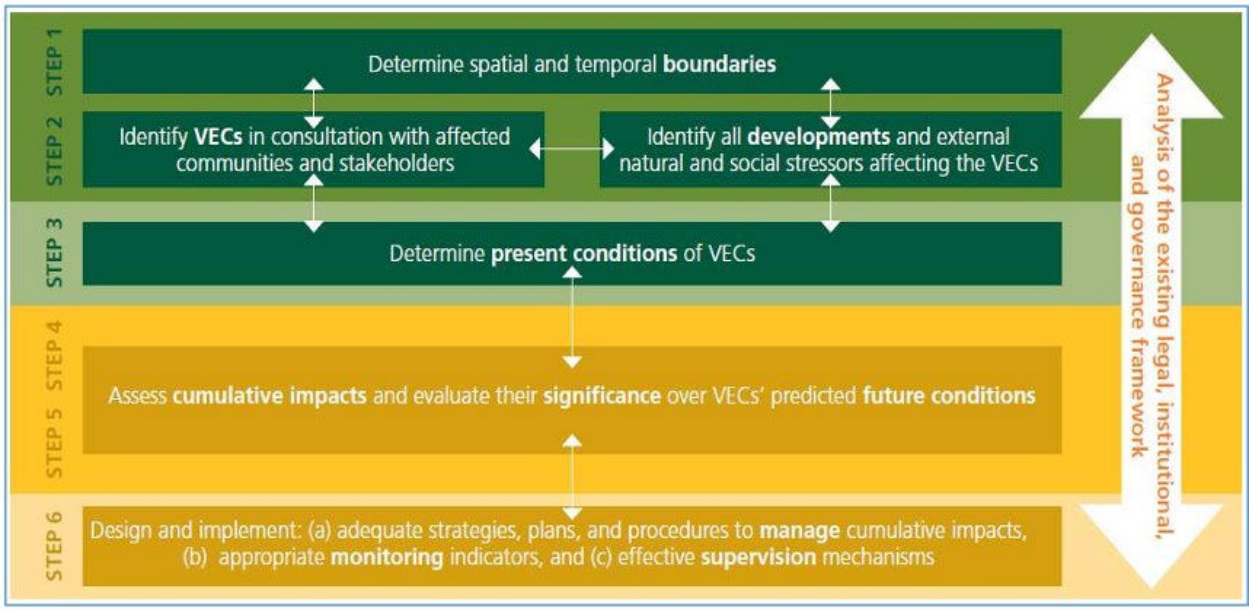


Figure 8-1: Six-Step Approach for Rapid Cumulative Impact Assessment (Source: IFC, 2013)

VECs refer to sensitive or valued receptors of cumulative impacts. In this chapter, VECs have been identified based on assessments undertaken in each of the chapters within the ESIA, drawing on identification of critical receptors as defined by IFC Performance Standards (e.g. critical habitat values). The assessment of cumulative impacts is not intended to provide a detailed assessment of the effects of future developments in the project area. In many instances the layout, design and location of developmental initiatives are not finalized or not known. As such, assessments have been undertaken at a high level in the

[28] International Finance Corporation (IFC) 2013. Good Practice Handbook: Cumulative Impact Assessment and Management.

context of broad development parameters sufficient to provide an understanding of the likely E&S effects of future developments and to enable adequate consideration of cumulative effects.

8.3 Area of influence/Spatial and Temporal Boundaries for CIA

The study area for the consideration of cumulative impacts incorporates the project area for the Quair Rudine PV project, as defined in this ESIA, but it is expanded to take into account a wider area of several decades of km around the project. The CIA focuses on projects likely to be implemented or in progress in the next 2-3 years, when the Rudine PV project will be implemented.

8.4 Basis of Assessment

This section presents results of steps two to four of the RCIA approach to identify VECs and their baseline conditions and to identify relevant development and natural process within the cumulative impact zone. Baseline data presented in this section has been obtained from a review of information/literature, whereas, more recent and detailed information has been obtained through the development of the ESIA. For assessment of cumulative impacts, all major existing and proposed development projects in the area of influence have been identified. These are presented in the following paragraphs.

Within the defined cumulative impact assessment area, a number of existing, approved or planned solar power projects have been identified, based on available planning documentation, consultations with the Municipality of Nikšić, and information obtained during the ESIA process.

Although detailed technical layouts for some of these projects are not yet finalized, they are considered reasonably foreseeable developments due to their advanced planning or permitting status. Given the similar nature of such projects, their concurrent or sequential implementation could result in cumulative impacts, particularly during the construction phase.

The identified solar power developments are broadly characterized by:

- land take and fencing of open karst terrain;
- construction-related traffic and transport of materials;
- presence of construction workforce for limited periods;
- installation of photovoltaic panels, inverter stations and internal access tracks;
- connection to the electricity grid through overhead or underground infrastructure.

Power plants for which a request for connection has been received and an analysis performed connection possibilities in Municipality of Niksic.

Table 8-1: Solar Power Plants in the Municipality of Nikšić

No.	Power Plant Name	Type	Municipality	Installed Capacity (MW)
1	Vraćenovići	Solar	Nikšić	87.5
2	QAIR Montenegro – Rudine	Solar	Nikšić	50.13
3	Bogetići	Solar	Nikšić	18
4	Rudine Energy Park	Solar	Nikšić	140
5	Šipčno II	Solar	Nikšić	164
6	Velestovo	Solar	Nikšić	50
7	Krupac (Stuba)	Solar	Nikšić	49.96
8	New Age Energy III	Solar	Nikšić	68
9	Krstac (Muževice)	Solar	Nikšić	80

10	Petrovići	Solar	Nikšić	50
11	Somina (Samsol)	Solar	Nikšić	180
12	Tupan	Solar	Nikšić	70

The Municipality of Nikšić covers the largest administrative territory in Montenegro, encompassing a wide and heterogeneous spatial context. As a result, renewable energy projects planned within the municipal boundaries are geographically dispersed and vary significantly in terms of proximity, scale, and potential interaction.

The identified solar power projects in the Municipality of Nikšić are currently at different stages of development, ranging from early planning and grid connection analyses to more advanced permitting stages. Based on the available information, it is not expected that the majority of these projects will enter the construction phase within the next two to three years. Consequently, the likelihood of extensive overlapping construction activities among most projects is considered limited.

Among the identified developments, the Tupan Solar Power Plant is the geographically closest project to the Rudine SPP, located at an approximate distance of 6 km from the Rudine project area. Due to this relative proximity and the potential for spatial interaction, the cumulative impact assessment places particular focus on the combined effects of the Rudine SPP and the Tupan SPP, while other solar developments within the Municipality are considered at a broader screening level.

The cumulative impact assessment therefore evaluates potential combined impacts primarily in relation to land use and open space, landscape and visual character, access routes and construction-related traffic, and temporary socio-economic effects. Given the dispersed nature and phased development of solar projects within the Municipality of Nikšić, cumulative impacts are expected to remain localized and manageable, provided that appropriate mitigation and coordination measures are implemented.

8.4.1 "Tupan" solar power plant

The Tupan Solar Power Plant (SPP) is a planned utility-scale photovoltaic project located in KO Tupan, Municipality of Nikšić, with a total installed DC capacity of approximately 95.8 MWp and an expected AC capacity of approximately 75–78 MW.

The project is based on the installation of bifacial photovoltaic modules with a rated power of 740 Wp, mounted on prefabricated steel structures. The modules are installed in a configuration of two rows with six modules per row (portrait orientation). In total, approximately 129,408 photovoltaic modules are planned, arranged in 10,784 mounting blocks.

The overall site layout is divided into 13 spatial units, each equipped with a prefabricated 0.8/35 kV transformer station. Electricity generated by the photovoltaic modules is converted using string inverters with a nominal output of 300 kW, operating at a nominal voltage of 800 V AC. Low-voltage cables connect the inverters to the containerized transformer stations, which step up the voltage to 35 kV.

From the individual transformer stations, medium-voltage underground cable lines transmit electricity to a central 35/110 kV substation. The main substation is planned to be equipped with two 35/110 kV transformers, each with a rated capacity of 40 MVA. Grid connection is planned through the construction of a new 110 kV overhead transmission line, linking the new Tupan 35/110 kV substation to the planned 220/110 kV Vilusi substation.

The photovoltaic modules are mounted on steel structures fixed either by IBO ground anchors or, where anchoring is not feasible, by concrete foundation blocks. The total area directly covered by photovoltaic modules is approximately 876,770 m², excluding internal access roads and the main 35/110 kV substation.

Internal access roads within the photovoltaic plant cover a total area of approximately 27,035 m². The project includes the implementation of a SCADA system, enabling centralized monitoring and control of the power plant during operation.

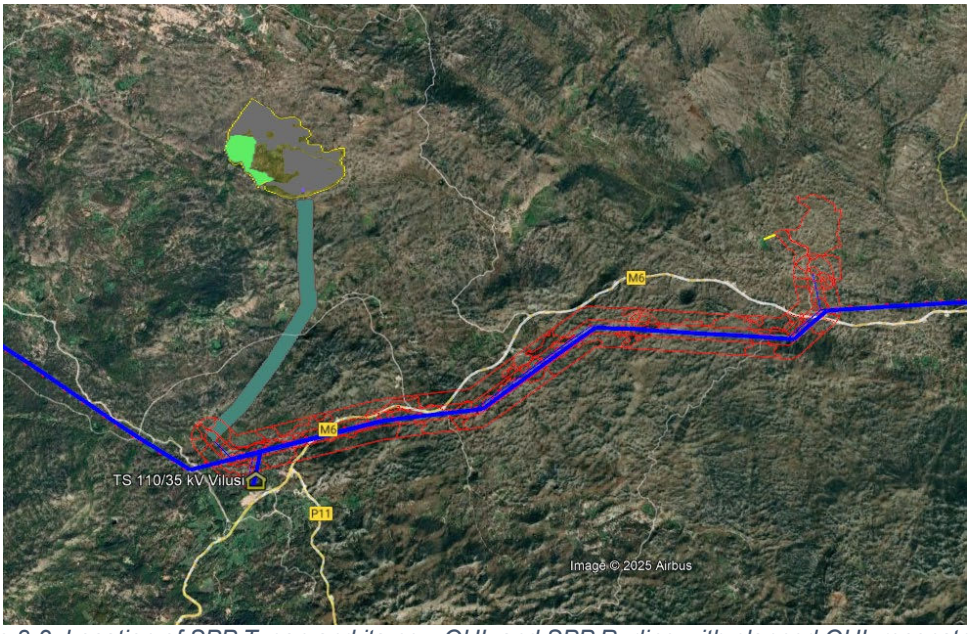


Figure 8-2: Location of SPP Tupan and its new OHL and SPP Rudine with planned OHL reconstruction

8.4.2 Vilusi Solar Power Plant

The Vilusi I Solar Power Plant (SPP) is an approved solar energy project with an installed capacity of 5 MW, located in KO Vilusi, Municipality of Nikšić. The project is developed by R-Solar d.o.o., Nikšić, and its environmental impacts have been assessed through a completed national Environmental Impact Assessment procedure. Development of this project is under construction phase.

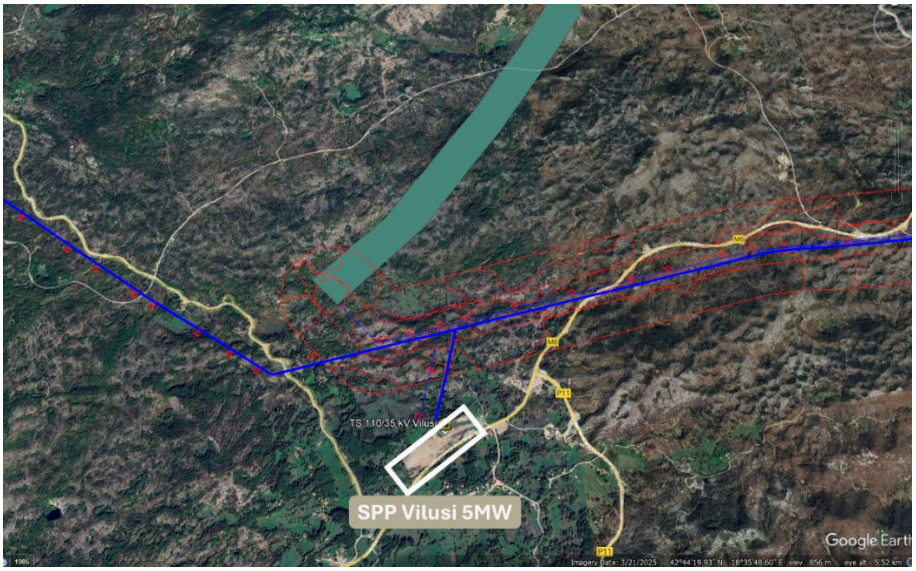


Figure 8-3: Location of SPP Vilusi in the vicinity of new OHL Tupan and existing OHL Niksic-Bileca

The project is situated in a rural settlement of Vilusi, adjacent to the Nikšić–Trebinje magistral road, within a zone that already contains transport and minor industrial infrastructure. The total project area is approximately 57,000 m². Land cover at the site consists of undeveloped land, grasslands and degraded low-density woodland, with no protected natural areas, cultural heritage sites or Natura 2000 / Emerald sites located within or in the immediate vicinity of the project area.

According to the approved EIA documentation, the surrounding environment is characterized by low population density, limited land productivity, and absence of sensitive ecological receptors at the project site. Construction and operation-related impacts of the Vilusi I SPP were assessed as localised, low to moderate, and manageable through standard mitigation measures.

For the purposes of cumulative impact assessment of the Rudine Solar Power Plant, the Vilusi I SPP is considered a small-scale and spatially limited solar development within the Municipality of Nikšić. Given its relatively small installed capacity, limited land footprint and advanced permitting status, Vilusi I is screened at a high level in the CIA. It is not expected to contribute materially to cumulative impacts in combination with the Rudine SPP, particularly when compared to other large-scale planned solar projects in the municipality.

8.4.3 Reconstruction and Potential Expansion of TS 110/35 kV Vilusi

The Vilusi area is currently supplied with electricity through the 110/35 kV Vilusi substation, equipped with a 10 MVA transformer and connected to the transmission network via a single 110 kV overhead line in a “T” connection to the Nikšić–Bileća 110 kV transmission line.

According to the CGES Development Plan, the reconstruction of TS 110/35 kV Vilusi at the existing voltage level is planned in order to improve reliability and accommodate increased power flows. The increased interest in the development of solar power plants in the wider Vilusi area is expected to require enhanced connection and transmission capacity to enable electricity evacuation without network congestion.

Figure 8-4: Photograph of SS Vilusi entrance (Source: Enova)

Spatial and planning conditions have therefore been identified for the potential future expansion of the Vilusi substation, including the possible construction of 220 kV and/or 400 kV installations, with corresponding

transformation capacities and connection to the 220 kV Perućica–Trebinje transmission line and/or the 400 kV Lastva–Trebinje transmission line, based on a line-in–line-out configuration.

At this stage, the exact scope, technical configuration and timing of the reconstruction and any potential voltage level upgrades have not yet been defined and will be subject to further technical analyses, system studies and permitting procedures.

For the purposes of the Cumulative Impact Assessment, the planned reconstruction of TS Vilusi and its potential future expansion are considered as reasonably foreseeable energy infrastructure developments, driven by the cumulative increase in renewable energy generation in the area. Potential cumulative impacts are therefore assessed at a strategic level, focusing on:

- concentration of energy infrastructure within the Vilusi area;
- additional land take related to future substation expansion;
- increased construction activity and traffic in the event of concurrent implementation;
- cumulative landscape and visual effects associated with substations and transmission lines.

8.4.4 Planned Road Upgrades and Reconstruction

According to the Spatial and Urban Plan of the Municipality of Nikšić, several local, non-categorised and regional roads within the wider project area are planned for reconstruction and upgrading during the forthcoming planning period. These projects are intended to improve connectivity, traffic safety and accessibility in the rural areas of the municipality.

Planned local and non-categorised road upgrades, relevant in the broader Rudine–Vilusi area, include:

- L-36 Rudine – Gomilice – Jabuke – Trešnjevo;
- N-53 Podbožur – Smrduša – Cerovica – Velimlje.

In addition, the following regional roads within the Municipality of Nikšić are planned for reconstruction:

- Vilusi – Deleuša (border with Bosnia and Herzegovina);
- M-9 Vilusi 2 (junction with M-7) – Petrovići – Deleuša (border with Bosnia and Herzegovina);
- M-7 Nikšić (junction with M-3) – Riđani (junction with R-17) – Vilusi 1 (junction with M-8) – Vilusi 2 (junction with M-9) – Ilino Brdo (border with Bosnia and Herzegovina).

These road projects are considered reasonably foreseeable infrastructure developments under approved spatial and planning documentation.

For the purposes of cumulative impact assessment, the planned road reconstruction works may interact with the construction phases of the Rudine SPP and other energy developments in the area, potentially resulting in:

- temporary cumulative traffic disruptions;
- increased heavy vehicle movements on shared road segments;
- localized noise, dust and safety risks during overlapping construction periods.

At the same time, the planned road upgrades are expected to improve long-term access and traffic safety in the wider project area. Given that the timing and phasing of road works have not been fully defined, cumulative impacts are assessed at a strategic level, and potential impacts are expected to be temporary,

localized and manageable through implementation of Traffic Management Plans and coordination with relevant road authorities.

8.5 Identification of Valued Environmental Components (VECs)

Based on the projects and infrastructure developments identified in the previous section, the cumulative impact assessment focuses on those environmental and social receptors that may be affected through interaction of multiple developments over time and space.

The majority of the identified solar power projects within the Municipality of Nikšić are currently at different stages of development, with only a limited number expected to enter the construction phase within the same 2–3-year timeframe. In particular, the Tupan Solar Power Plant, located approximately 6 km from the Rudine SPP, represents the most relevant reasonably foreseeable project with potential for spatial interaction. Other solar developments, as well as planned road and grid infrastructure upgrades, are considered at a screening or strategic level.

Valued Environmental Components (VECs) were identified based on:

- findings of the ESIA baseline studies;
- professional experience from similar large-scale renewable energy projects;
- review of available planning and project documentation for nearby developments;
- sensitivity of receptors and their potential exposure to cumulative effects.

The following three VECs were identified as relevant for the cumulative impact assessment:

Traffic and Road Safety

The construction of the Rudine SPP, in combination with other planned or ongoing developments in the wider Rudine–Vilusi area (including the Tupan SPP, road reconstruction projects and potential energy infrastructure upgrades), is expected to result in **temporary increases in traffic volumes** on regional, local and non-categorised roads leading to the project area.

While the exact transport routes will depend on contractor-specific logistics planning, cumulative impacts may arise from **simultaneous use of shared road sections** for the transportation of construction materials, photovoltaic panels, equipment and workforce. These impacts are expected to be **temporary and localized**, primarily affecting road safety, dust generation and noise levels during peak construction periods.

Labour Influx and Pressure on Local Infrastructure

The construction phase of the Rudine SPP will require a temporary workforce, a portion of which is expected to be sourced from outside the immediate project area. Although the construction phases of major nearby solar developments are not expected to fully overlap, the cumulative presence of construction workers associated with multiple projects may result in temporary labour influx.

The affected area is characterized by low population density and limited accommodation and service capacity, meaning that cumulative labour influx could place temporary pressure on local infrastructure and services, particularly accommodation, local roads and utilities. These impacts are expected to be short-term and manageable through appropriate workforce management and coordination measures.

Land Use, Habitat Loss and Biodiversity Pressure

The development of multiple energy projects within the wider area may result in cumulative land take and incremental loss or fragmentation of open karst habitats and disturbed natural vegetation. While individual projects, including the Rudine SPP, are designed to avoid sensitive habitats, the combined footprint of multiple developments may reduce the availability of undeveloped open land.

In addition, improved access resulting from new roads, internal access tracks and grid infrastructure may lead to increased human presence in previously less accessible areas, potentially causing secondary pressure on biodiversity through disturbance.

Given the spacing of projects and the absence of critical habitats within the immediate project area, cumulative biodiversity impacts are expected to be localized and low to moderate, provided that mitigation and access control measures are consistently applied.

8.6 Mitigation and Enhancement Measures

8.6.1 Mitigation Measures for Traffic Issues

The following mitigation measures will need to be adopted by the implementing agencies to minimize the impacts related to the increase in traffic.

Coordination among the agencies and contractors will be required to manage the traffic on the roads available in the area of influence and among the main road axes anticipated to be used for the transport of major loads. In addition, axel load regulations must be followed/enforced, and overloading of trucks should be permitted to ensure that roads are not damaged because of the projects.

With the initiative of the Traffic Authorities, a Traffic Management Plan has to be developed to identify and assess the combined impacts of all projects, once the details for each one are made available. This overall TMP will be informed by the traffic management plans of the individual projects.

8.6.2 Mitigation Measures for Cumulative Impacts on Biotic Environment

During construction phase, the camps and other temporary facilities by the contractors of all the projects in area of influence will be established in a manner that minimizes loss of natural vegetation including trees. Borrow material will be obtained without causing any damage to the natural vegetation.

Every project should develop and implement tree plantation plans in coordination with the competent regional and national authorities. The above recommendations are found to be adequate to address the cumulative impacts of the project.

8.6.3 Further recommendations

Due to the high unemployment rate in the country, communities who are affected due to these projects may come to the Contractors and the implementing agencies with the demand to be employed in the Project. In most cases, they are unskilled and have no experience in infrastructure projects. Therefore, Contractors are reluctant to employ them at the beginning in the construction activities. This causes protest and agitations in the project area and often leads to Contractors' work stoppages and delay in project implementation. It is proposed that skill development by the Contractor be considered in the project. One-week job specific skill development training can be provided with pay to the affected persons and their

relatives prior to their employment. Certificates will be provided to the participants after completion of the training. The training should be hands-on and specific to the job, e.g., masonry work for panels installation, machine operation with proper license for land clearance, etc. The skill development costs can be included in the Contractor's contracts.

9 Environmental and Social Management Plan

9.1 Objectives of the ESMP

The basic objective of the ESMP is to manage adverse impacts and hazards of proposed project interventions in a way that minimizes the adverse impact and risk on the environment, workers, and community during construction and operation stages of project. The specific objectives of the ESMP are to:

- Facilitate the implementation of the mitigation measures discussed earlier in the document.
- Maximize potential project benefits and control negative impacts;
- Address occupational health and safety (OHS) hazards and corresponding preventive measures during construction and operation stages;
- Draw responsibilities for Qair Rudine doo, contractors, consultants, and other members of the project team for the environmental, health, safety, and social management of the Project;
- Define a monitoring and supervision mechanism and identify monitoring and inspection parameters in order to:
    - Ensure the complete implementation of all mitigation measures and preventive actions,
    - Ensure the effectiveness of the mitigation measures and preventive actions;
- Assess environmental, health, safety training requirements for different stakeholders at various levels.

9.2 Obligations of the Contractor

9.2.1 Construction Environmental and Social Management Plan (C-ESMP)

The Project Environmental and Social Management Plan (ESMP) will form an integral part of the bidding and contractual documentation for the selection of the Contractor. The technical specifications will clearly state that the Contractor shall comply with all mitigation measures and preventive actions defined in the ESMP and this ESIA, as well as with the applicable EBRD Environmental and Social Requirements (ESRs), the EBRD Environmental, Health and Safety (EHS) Guidelines, and national environmental, labour, occupational health and safety legislation and standards of Montenegro.

The selected Contractor shall be required to prepare and implement a Contractor's Construction Environmental and Social Management Plan (C-ESMP), demonstrating how the requirements set out in the ESMP and the ESIA will be implemented during the construction phase of the Rudine Solar Power Plant. The C-ESMP shall be aligned with the Project description, construction methodology and scheduling, and shall reflect site-specific risks and mitigation measures.

The Contractor shall also prepare and implement all subsidiary management plans requested under the ESMP (such as Traffic Management Plan, Waste Management Plan, Labour Management Procedures, Occupational Health and Safety Plan, Emergency Response Plan and other relevant sub-plans), which together shall form part of the C-ESMP.

The C-ESMP shall be submitted for review and approval within 30 days of Contractor mobilisation, and shall be approved by Qair Montenegro d.o.o. (or the Project Company) prior to the commencement of any

construction activities. The approved C-ESMP shall be treated as a binding project document and shall serve as the primary tool for monitoring the Contractor's environmental and social performance during construction.

Non-compliance with the approved C-ESMP and related environmental and social requirements shall be considered a contractual non-compliance and shall be subject to corrective actions, sanctions and/or penalties in accordance with the terms of the Contract and the Project's environmental and social management framework.

9.2.2 Occupational Health and Safety Plan (OHS Plan)

The Contractor shall prepare and implement an Occupational Health and Safety Plan (OHS Plan) as an integral part of the Contractor's Environmental and Social Management Plan (C-ESMP). The OHS Plan shall be developed in line with the identified occupational hazards and preventive measures outlined in the ESIA, including site-specific risks associated with the construction of the Rudine Solar Power Plant.

The applicable regulatory framework for occupational health and safety shall include:

- EBRD Environmental and Social Requirements (ESRs), in particular ESR 2 – Labour and Working Conditions;
- EBRD Environmental, Health and Safety (EHS) Guidelines;
- national legislation on occupational health and safety of Montenegro.

Where the above requirements do not adequately address specific occupational health and safety risks associated with the Project, the Contractor shall apply international good practice, including relevant standards and guidance issued by the International Labour Organization (ILO), Occupational Safety and Health Administration (OSHA), and other internationally recognised bodies.

The OHS Plan shall be reviewed and updated as necessary:

a. when there are changes in the scope or schedule of the Project;
b. when construction methods or techniques are modified based on site conditions;
c. following the identification of a significant OHS hazard, incident or accident; and
d. at the completion of the construction phase, in order to incorporate lessons learned and improve future project performance.

The OHS Plan shall provide clear guidance for all identified occupational hazards associated with construction activities. For each work activity, hazards and mitigation measures shall be presented under the following headings:

a. Contractor's OHS standards and procedures relevant to the identified hazards;
b. Site-specific OHS hazards and risks anticipated during construction; and
c. Control, mitigation and preventive measures to be implemented by the Contractor.

In accordance with Montenegrin occupational health and safety legislation, the Contractor shall prepare all mandatory documentation related to the organisation and safety of the construction site, including the Construction Site Safety Plan / Construction Site Organisation Study, and submit it to the competent labour inspection authority prior to the commencement of construction works, within the legally prescribed deadlines.

The implementation of the OHS Plan shall be monitored throughout the construction phase, and compliance with its requirements shall be a contractual obligation of the Contractor.

9.2.3 Job Hazard Analysis

Job hazard analysis (JHA) will be conducted for each construction component focusing on job tasks as a way to identify hazards before they occur. It will focus on the relationship between the worker, the task, the tools, and the work environment. In principle, after identifying uncontrolled hazards, steps should be taken to eliminate or reduce them to an acceptable risk level.

The JHA should be one of the major components of the larger commitment of the Contractor's health and safety management system. The JHA should be conducted on many jobs in the worksite. Priority should be given to the following types of jobs:

- Jobs with the highest injury or illness rates;
- Jobs with the potential to cause severe or disabling injuries or illness, even if there is no history of previous accidents;
- Jobs in which one simple human error could lead to a severe accident or injury;
- Jobs that are new or complex to the construction or have undergone changes in construction processes and procedures; and
- Jobs complex enough to require written instructions.

9.2.4 Integration of ESHS Requirements into Method Statements

The Contractor shall incorporate a dedicated Environmental, Social, Health and Safety (ESHS) section into all Method Statements prepared for construction activities.

The ESHS section of each Method Statement shall be:

- based on the Job Hazard Analysis (JHA) relevant to the specific activity;
- informed by the environmental and social baseline and risks identified for the Project site;
- tailored to the specific construction methods and sequencing proposed by the Contractor.
- The ESHS section shall clearly identify:
- applicable ESHS risks and hazards;
- mitigation and control measures to be implemented;
- roles and responsibilities for ESHS implementation;
- required monitoring and supervision measures.

Each Method Statement, including its ESHS section, shall be submitted to the Construction Supervision Consultant (CSC) for review. The ESHS aspects of the Method Statements shall be reviewed by the CSC ESHS Specialists, while the technical and engineering aspects shall be reviewed by the relevant engineering experts of the CSC.

Approval of Method Statements shall only be granted once both the technical review and the ESHS review have been completed satisfactorily. Any revision to an approved Method Statement shall be subject to the same review and approval process, and the concurrence of the CSC ESHS Specialists shall be required prior to implementation on site.

9.3 Institutional Arrangements

9.3.1 Project Management Unit

Project implementation will be led by the Project Management Unit (PMU) established by the Project Company (Qair Montenegro d.o.o.). The PMU will be responsible for overall coordination, implementation and supervision of the Project during construction and operation phases.

The PMU will be responsible for:

- procurement of construction contractors;
- procurement and management of consulting services, including the Construction Supervision Consultant (CSC) and, where applicable, third-party monitoring and evaluation (M&E) consultants;
- coordination of land acquisition and compensation processes, ensuring that compensation to Project Affected Persons (PAPs) is completed in accordance with the approved LARPF and prior to contractor mobilisation;
- coordination and oversight of Project implementation in line with contractual, environmental and social requirements.

The PMU will be headed by a Project Director (PD) and will include qualified Environmental, Social and Health and Safety (ESHS) Specialists.

9.3.2 Environmental, Social and Health and Safety (ESHS) Specialists

The ESHS Specialists within the PMU will be responsible for ensuring that the Project is implemented in compliance with:

- applicable national environmental, social and occupational health and safety legislation of Montenegro; and
- the EBRD Environmental and Social Requirements (ESRs), including requirements related to labour, community health and safety, land acquisition and environmental protection.

The ESHS Specialists' responsibilities will include, but not be limited to, the following:

- supporting the Project Director in the preparation and review of bidding and contractual documentation to ensure inclusion of all relevant ESMP, OHS and LARPF requirements, including appropriate budget allocation and Bill of Quantities (BoQ);
- reviewing and approving Contractor documentation related to environmental and social management, including the Contractor's Environmental and Social Management Plan (C-ESMP) and its subsidiary plans;
- overseeing and monitoring construction activities from an ESHS perspective, through close coordination with the Construction Supervision Consultant (CSC);
- reviewing and endorsing periodic environmental and social monitoring reports prepared by the CSC and/or Contractor;
- providing guidance and advice on ESMP implementation to the CSC and Contractors, and contributing to ESHS training and capacity building activities as required;
- coordinating with relevant authorities, local governments and affected communities to support effective Project implementation and stakeholder engagement;
- coordinating the development, implementation and monitoring of emergency response procedures, including investigation and reporting of environmental incidents, occupational accidents and community health and safety events;
- preparing or consolidating periodic progress reports on ESMP and LARP/F implementation for internal use and reporting to financiers, as required.

9.3.3 Field-level Construction Camp Offices (CO)

For the duration of the construction phase, the Contractor shall establish one or more field-level Construction Camp Offices (CCO) at or near the construction site. These offices shall serve as the primary on-site interface for the implementation and monitoring of the C-ESMP and Occupational Health and Safety (OHS) Plan, under the oversight of the PMU and the Construction Supervision Consultant (CSC).

The Construction Camp Offices shall be responsible for the following:

- maintaining regular liaison and communication with Project Affected Persons (PAPs) and local communities to address site-related concerns;
- providing information and guidance to PAPs regarding the submission of compensation-related requests in accordance with the approved Land Acquisition and Livelihood Restoration Framework (LARP/F);
- assisting local community members in submitting complaints or grievances through the Grievance Redress Mechanism (GRM);
- maintaining close coordination with the PMU, ESHS Specialists, the CSC, the Contractor's site management, and relevant governmental authorities, particularly with regard to traffic management and site access control.

9.3.4 Construction Supervision Consultant

The Construction Supervision Consultant (CSC) shall be responsible for supervising construction activities and ensuring compliance with contractual, technical, environmental, social and health and safety requirements of the Project.

The CSC's responsibilities shall include, but not be limited to, the following:

- supervision and verification of the implementation of ESMP and C-ESMP requirements;
- supervision of civil and electromechanical works to ensure compliance with approved designs, technical specifications and quality standards;
- review and verification that Contractors incorporate ESHS measures, including those derived from Job Hazard Analyses (JHA), into their Method Statements;
- supervision of Contractor performance with respect to ESMP implementation, including the identification, documentation and follow-up of non-compliance notices;
- delivery of ESHS training and capacity-building activities to Contractor personnel and, where requested by the PMU, to relevant PMU staff;
- review, provision of technical input and endorsement of activity-specific Method Statements, including their ESHS sections;
- preparation and submission of monthly construction supervision reports to the PMU, including dedicated sections on ESHS performance.

9.3.5 Contractor

The Contractor shall have primary responsibility for the day-to-day implementation of environmental, social and health and safety measures during construction, in accordance with contractual obligations, the ESMP and the approved C-ESMP.

The Contractor's responsibilities shall include:

- preparation and submission of a Contractor's Environmental and Social Management Plan (C-ESMP), including all site-specific subsidiary management plans, for review and approval by the CSC prior to mobilisation;
- preparation and implementation of a site-specific Occupational Health and Safety Plan (OHS Plan) based on construction methods and identified site hazards, and its revision:
  a) when the scope of works changes;
  b) when construction methodologies or techniques are modified due to site conditions; and
  c) following the occurrence of a significant OHS hazard, incident or accident;
- implementation of all mitigation, monitoring and preventive measures defined in the ESMP, C-ESMP and associated Method Statements;
- preparation and submission of monthly environmental, social and OHS monitoring reports to the CSC and PMU, addressing compliance status, incidents, corrective actions and improvement measures.

9.4 Site-specific Management Plans

Prior to mobilisation and commencement of construction works, the Contractor shall prepare and submit for review and approval a set of site-specific environmental, social and health and safety management plans, forming an integral part of the Contractor's Environmental and Social Management Plan (C-ESMP).

All site-specific management plans shall be:

- consistent with the Project ESMP and the findings of the ESIA;
- aligned with applicable EBRD Environmental and Social Requirements (ESRs);
- compliant with national legislation of Montenegro; and
- reviewed and approved by the Construction Supervision Consultant (CSC) and the PMU prior to implementation.

Table 9-1: Site-Specific Management Plans

Plan	Description
Waste Management Plan (WMP)	The Waste Management Plan shall establish procedures for the minimisation, segregation, storage, collection, transport and disposal of all waste streams generated by the Project. The Plan shall cover both **hazardous and non-hazardous waste**, including solid and liquid waste, and shall aim to prevent soil and water contamination.
Emergency Response Plan (ERP)	The Emergency Response Plan shall define site-specific procedures, roles and responsibilities for responding to emergency and accidental situations during **construction, operation and decommissioning**. The ERP shall address risks such as accidents, spills, fire, extreme weather events and other foreseeable emergencies, and shall ensure coordination with local emergency services and authorities.
Traffic Management Plan (TMP)	The Traffic Management Plan shall be developed to manage project-related traffic during construction, minimise traffic disruption and delays, and ensure the safety of road users, including pedestrians and cyclists. The Plan shall identify access routes, traffic control measures, signage, scheduling of deliveries and coordination with relevant road authorities.
Pollution Prevention Plan (PPP)	The Pollution Prevention Plan shall identify measures to prevent pollution of **soil, surface water and groundwater** resulting from project-related activities. The Plan shall include best construction practices, spill prevention and response measures, product-specific handling procedures (e.g. fuels, lubricants, chemicals), safe storage requirements, dust suppression measures and a list of prohibited materials.
Hazardous Materials	The Hazardous Materials Management Plan shall define procedures for the selection, handling, storage, transport and disposal of hazardous materials used on site, in order to prevent risks to workers, the public and the environment. The Plan shall include inventory

Management Plan (HMMP)	management, labelling, Safety Data Sheets (SDS), storage requirements and emergency response measures.
Stakeholder Engagement Plan (SEP)	The Stakeholder Engagement Plan shall define procedures for proactive and continuous engagement with affected communities and other stakeholders. The SEP shall include information disclosure, consultation mechanisms and operation of the **Grievance Redress Mechanism (GRM)**, supporting effective risk management, transparency and performance improvement throughout the Project lifecycle.

9.5 Mitigation Plan

The Mitigation Plan presents a structured summary of the environmental, social and health and safety impacts identified for the Project and defines the corresponding mitigation and management measures, monitoring requirements and institutional responsibilities for their implementation.

The Plan identifies:

- key impacts and risks associated with the construction, operation and maintenance phases of the Project;
- mitigation and preventive measures designed to avoid, minimise, mitigate or compensate for identified impacts, in accordance with the mitigation hierarchy;
- monitoring measures and indicators to assess the effectiveness of mitigation measures;
- roles and responsibilities of the PMU, ESHS Specialists, Construction Supervision Consultant (CSC) and Contractors in implementing and monitoring these measures.

The Mitigation Plan is presented in a series of tables covering the construction, operation and decommissioning/maintenance phases of the Project.

Where appropriate, references are made to the detailed impact assessment presented in Section 6 of this ESIA, allowing the reader to access more comprehensive explanations of the impacts, risks and corresponding mitigation measures.

The mitigation and monitoring measures defined in this Plan shall be incorporated into the Project ESMP and, where relevant, translated into contractual obligations and Contractor-specific management measures through the Contractor’s Environmental and Social Management Plan (C-ESMP).

Table 9-2: Mitigation Plan for the Construction phase

Issue / Risk	Preventive / Mitigation measures	Responsibility	Performance Indicators	Timing of Implementation
ESHS Management				
Implementation of ESMP measures	• Setting-up of Environmental, Social and Health & Safety Management organisation, in compliance with ISO14001 and 45001 standards and Montenegro's national Health & Safety and environmental legislation and standards	Contractor	• Management organisation set-up including relevant staff. • Management reporting systems in place • Regular inspection and monitoring of ESHS performance	Management organization and relevant staff in place before start of construction
Ambient Air Quality and Climate - Section (6.4)				
Vehicle emissions	• Maintenance of equipment and vehicles. • Training of operators and drivers • Restrict vehicle speeds on construction sites and access roads	Contractor	• Maintenance records of vehicles • Training records • CSC and Qair Montenegro d.o.o. audit reports	• Implementation throughout construction
Dust emissions to sensitive receptors when precipitation is adequate and wind speed < 3 m/s	• Locate construction activity away from sensitive land areas and receptors where possible • Minimize open excavation areas • Minimize stockpiling by proper coordination of earthworks and excavation activities • Reduce fugitive dust emissions by water sprinkling measures • Temporary terminate or restrict construction works if intensive fugitive dust emission occurs • Design earthworks to allow future successful re-vegetation. • Inspect local roads regularly and clean if necessary	Contractor	• Site surveys by CSC and Qair Montenegro d.o.o. • CSC and Qair Montenegro d.o.o. audit reports • Grievances by local population	• Implementation throughout construction

Issue / Risk	Preventive / Mitigation measures	Responsibility	Performance Indicators	Timing of Implementation
	• Maintain all construction machinery and equipment in good working order and do not left running when not in use. • No burning of any material anywhere on construction sites			
Dust emissions to sensitive receptors when precipitation is low and wind speed >3 m/s blowing towards receptor	• Same mitigation measures as above		• Site surveys by CSC and Qair Montenegro d.o.o. • CSC and Qair Montenegro d.o.o. audit reports • Grievances by local population	• Implementation throughout construction
Noise – Section 6.5				
Earthworks, steelworks, towers assembly, HV equipment, and installation	• All construction activity to occur between 06:00 and 22:00 hours • Noise-reduction technologies in the equipment and machinery (i.e. silencer) • Use of the lowest noise work practices and equipment. • Good maintenance of machinery and vehicles • Turn off equipment and vehicles when not in use. • All vehicular movements to and from the site to only occur during the scheduled normal working hours • Provision of a grievance mechanism • Liaison with local authorities	Contractor	• Results of audits (application of mitigation measures). • Project activity restrictions schedule • Grievances from local population • Monitoring results	Before and throughout construction phase.
Geology and Soils – Section 6.7				
Soil erosion	• Top soil will be removed prior to construction, properly stored and reinstated after construction • Original surface contours will be reinstated	Contractor	• Monitoring and reporting of soil handling and storage measures (height of topsoil mounds, volumes of topsoil	• Before and during construction

Issue / Risk	Preventive / Mitigation measures	Responsibility	Performance Indicators	Timing of Implementation
	after construction where practical. • Storage of the original surface soil resources along the PV plant, at the Substation and HV transmission line (to be re-used)		handled) • Monitoring and reporting of restoration and erosion control measures	
Soil compaction	• Topsoil stockpiles will be approximately 2-3 m in height • Soil stockpiles will be protected from heavy rainfall (covering). • Access areas to heavy machinery will be restricted to the construction corridor and access roads. • Deep ploughing will be applied following construction all along the construction corridor and construction sites.	Contractor	• Events where machinery has been identified outside the designated working areas. • Monitoring and reporting	• Before and during construction
Soil Pollution and accidental spills	• Fuel and other hydrocarbons handling, especially bulk storage, will take place in secure bunded areas • Implementation of the Pollution Prevention Plan to avoid accidental spills • Implementation of the Emergency Response Plan in case accidental spills occur • Segregation of the excavated contaminated soil and management as hazardous waste	Contractor	• Periodic monitoring of Hazardous Materials Management Procedure, Pollution Prevention Plan and Emergency Response Plan • Reporting and addressing non conformities to the mentioned plan	• Before and during construction • Reinstatement phase
Hydrology – Section 6.6				
Earthworks for tower installations and construction of solar panels and substation	• Minimal modification of channel morphology • Careful management and control of the groundwater table via monitoring holes • Interception of run-off from the working corridor • Full reinstatement of land drainage features • Vehicles will be prohibited from driving through	Contractor	• Periodic monitoring of application of mitigation measures and results reporting • Take action when sediment runoff is detected and report actions taken	• During construction

Issue / Risk	Preventive / Mitigation measures	Responsibility	Performance Indicators	Timing of Implementation
	watercourses. • Header drains and cut off ditches		• Monitoring logs for water table	
Construction sites	• All areas for which there is a risk of leaks or spills will be bunded • Sound engineering practices at the construction sites • Prompt installation of erosion control and reinstatement. • Special attention on the slopes above the lake/river where the OHL line is planned	Contractor	• Report on the initial monitoring of subcontractors and list of materials.	• During construction
Accidental pollution of water resources by solid and liquid wastes	• Waste Management Plan • Hazardous Materials Management Procedure • Pollution Prevention Plan and Emergency Response Plan		• Monitoring and reporting on application of Waste Management Plan, Hazardous Materials Management Procedure, Pollution Prevention Plan and Emergency Response Plan	• Preparation of Plans before construction • During construction
Landscape – Section 6.8				
PV plant subsites and substation				
Landscape homogenization: the removal of existing matrix of agricultural lands and woodlands/shrublands	• Construction footprint and the extent of land disturbance will be minimized. • Disturbed areas will be reseeded and reclaimed. • A comprehensive landscape strategy that includes the replacement planting of native vegetation will be developed.	Contractor	• Supervision during construction by appropriate landscape/ecological site supervisor	• Before and during construction • Reinstatement phase
Changes in the aesthetic value to residents and visitors	• Upon completion of the construction, all temporary structures, surplus materials, and waste will be thoroughly removed from the site. • The design of building structures (Qair Montenegro	Contractor	• Supervision during construction by appropriate landscape site supervisor	• Before and during construction • Reinstatement phase

Issue / Risk	Preventive / Mitigation measures	Responsibility	Performance Indicators	Timing of Implementation
	substation) will be developed in order to harmonize with the existing topography, and the natural landscape.		• Compliance with related regulation on waste management • Appropriate design of substation	
PV plant and OHL				
Landscape fragmentation	• Construction activities that occur outside the designated construction corridor will be kept to the shortest feasible duration. • All areas utilized for construction purposes will be restored to their pre-construction state as closely as practically possible once the construction is completed. • Materials and machinery will be stored in an organized and tidy manner throughout the construction process to maintain a clean and efficient work environment. • Building structures will be thoughtfully designed to harmonize with the existing topography, ensuring they seamlessly integrate into the natural landscape.	Contractor	• Supervision during construction by appropriate landscape/ecological site supervisor • Verification of compliance of construction corridor widths	• Before and during construction • Reinstatement phase
Fragmentation of landscape habitats features	• Trees will be protected before construction begins, and whenever possible, tree trimming will be conducted instead of complete tree removal to preserve their presence in the landscape. • When replanting is necessary, appropriate tree species that are characteristic of the specific landscape area will be selected, ensuring they align with the natural surroundings and contribute to the overall ecosystem. • Lighting will be limited to working hours, with the exception of security lighting, to minimize	Qair Montenegro d.o.o. to engage expert botanist in order to select species for reinstatement Contractor for the rest	• Supervision during construction by appropriate landscape/ecological site supervisor • Construction monitoring reports • Reinstatement monitoring report	• Before and during construction • Reinstatement phase

Issue / Risk	Preventive / Mitigation measures	Responsibility	Performance Indicators	Timing of Implementation
	light pollution and ensure it does not adversely impact the natural environment during nighttime.			
	•			•
Biodiversity – Section 6.9				
General biodiversity loss or degradation	• Production of the Biodiversity Management Plan (BMP) • Optimization of project layout to minimize land take • Use of existing access roads wherever possible • Re-profile, decompact and re-vegetate unnecessary tracks after construction • Restrict construction activities strictly to the defined project footprint • Maintain buffer zones between construction areas and adjacent habitats where feasible • Proper storage of materials and fuels • After construction, disturbed areas are to be re-integrated with the environment • Prevention of oil, fuel and chemical spill, and planning of emergency response. • Prohibition, prevention and control of illegal actions that would destroy or disturb the autochthonous flora and fauna, particularly (i) collection of medicinal plants, mushrooms and fruits, (ii) collecting snails, (iii) poaching of game, birds, etc., (iv) collection of bird eggs, hunting and other. • Removal of invasive alien plant species and prevention of their introduction	Contractor	• Pre / During / Post Construction Surveys, reporting results and comparisons. • Records of verifying implementation of mitigation and compensation measures. • Monitoring of illegal access for logging on project roads • Monitoring of biodiversity	• Before and during construction • Operation and Maintenance phase

Prevention of Habitat and plant loss	• Pre-construction botanical survey of 62A0 habitats in order to protect orchids species • Translocation of orchids individuals only if unavoidable and in line with national regulations • Avoid unnecessary vegetation clearance • Progressive (phased) vegetation clearance • Minimise foundation tower footprint • Restore vegetation around tower bases after construction • Avoid, as far as possible, the construction of new access roads • Minimise the width and number of access roads • Permanent expert supervision (ecologist or biologist) will be provided when clearing these habitats • Waste material (concrete, iron, soil, etc.) will not be stored/deposited on these habitats • No temporary deposits for construction material, setting up of work camps and machinery yards on these habitats	Contractor	• Baseline, construction and post-construction habitat and flora surveys • Verification of implementation of mitigation measures related to vegetation clearance, habitat retention, buffer zones and limitation of disturbance. • Monitoring of habitat disturbance and reinstatement, including temporary and permanent habitat loss. • Monitoring of restoration activities, including use of native plant species and natural recolonisation.	• Before and during construction phase

Issue / Risk	Preventive / Mitigation measures	Responsibility	Performance Indicators	Timing of Implementation
Impact on invertebrate fauna	• Limit vegetation clearance and soil works strictly to the defined construction footprint • Apply phased construction where feasible to allow gradual displacement of mobile species • Retain leaf litter, stones and dead wood outside construction areas • Avoid unnecessary removal of natural substrates where technically feasible • Store stripped topsoil separately and reuse it for site restoration • Restore disturbed surfaces immediately after completion of works • Restrict construction activities to daytime hours • Conduct pre-construction checks in suitable habitats for protected gastropods and Lepidoptera • Micro-site infrastructure to avoid areas with higher concentrations of protected species where feasible • Avoid vegetation clearance during peak breeding and larval development periods where possible	Contractor	• Baseline, construction and post-construction biodiversity surveys, with reporting and comparison to baseline conditions. • Verification of implementation of mitigation measures related to limitation of disturbance, habitat retention and reinstatement. • Monitoring of habitat condition, reinstatement and recolonisation trends.	• Before and during construction • During operation and maintenance phase
Loss of Amphibian and Reptile fauna	• Establish a no-go buffer zone around the permanent water captation • Prohibit storage of materials, refuelling and machinery operation near the water body • Prevent sediment runoff into the captation • Avoid unnecessary removal of shelter and refuge areas • Avoid blocking natural movement corridors between terrestrial habitats and the water captation • Install temporary wildlife passages where feasible and if necessary • Conduct pre-construction site checks for amphibians and reptiles • Apply reduced vehicle speeds and restrict night-time works where feasible	Contractor	• Pre-, during- and post-construction surveys and monitoring of amphibians and reptiles, including reporting • Verification of implementation of mitigation measures related to protection of water bodies, habitat retention, movement corridors and site reinstatement. • Monitoring of habitat condition, connectivity and restoration success, including terrestrial habitats and vegetated	• Before and during construction • During operation and maintenance phase

	• Apply micro-siting of infrastructure to avoid sensitive habitats • Ensure compliance with national species protection regulations • Restore disturbed terrestrial habitats immediately after completion of works		buffers.	
Disturbance of Bird fauna	• Avoid vegetation clearance during peak breeding period (March–July) where feasible • Conduct pre-construction nesting checks • Clearly mark and protect active nests • Establish temporary exclusion zones • Retain trees and shrubs wherever possible • Limit construction to daylight hours • Minimise duration of works along OHL corridor • Avoid construction during peak migration where feasible • Apply site-specific measures where turtle dove presence is confirmed • Restore disturbed areas promptly	Contractor	• Pre-, during- and post-construction bird surveys and monitoring. • Verification of implementation of bird-related mitigation measures, including timing restrictions and nest protection. • Monitoring of collision risk and effectiveness of overhead line mitigation measures. • Monitoring of habitat condition, recolonisation and adaptive management measures.	• Before and during construction • During operation and maintenance phase
Disturbance / Displacement of bat and other mammal species	• Apply phased vegetation clearance • Conduct pre-clearance checks • Inspect trees and structures for bat roost potential prior to removal • Avoid removal of confirmed roosts • Retain linear landscape features where feasible • Use downward-facing, low-intensity lighting • Avoid lighting near known bat activity areas • Restrict construction to daylight hours • Minimise duration of works along OHL corridor •	Contractor	• Baseline, construction and post-construction bat surveys and activity monitoring, including roost and pre-clearance checks. • Verification of implementation of mitigation measures related to roost protection, lighting control, habitat retention and connectivity. • Monitoring of bat activity	• Before and during construction • During operation and maintenance phase

			and habitat condition, including adaptive management based on monitoring results.	

Issue / Risk	Preventive / Mitigation measures	Responsibility	Performance Indicators	Timing of Implementation
Economy and Employment – Section 6.10				
Employment opportunities	• Work with local authorities and employment organisations to ensure that all positions are advertised in a manner that is accessible to the settlements and communities crossed by the PV plant and HV transmission line route. • Ensure that the recruitment process is fair and transparent, public and open to all regardless of ethnicity, religion or gender, • Ensure that the Contractors provide clear contracts prior to mobilisation stipulating working hours, pay, and other terms of employment.	Qair Montenegro d.o.o. / Contractor	• Evidence of employment advertisements • Evidence of recruitment process • Evidence of meetings with Authorities	• Before and after start of construction
Economic impacts	• Immediately upon opening a tender, make information on tendering opportunities available to local businesses through trade and industry chambers and local business organisations along the HV transmission line route and PV Plant settlements area • As part of the tendering process, develop a purchasing strategy that stipulates how purchase of goods will be optimised at regional and local level.	Contractor	• Purchasing strategy for local goods and services	• During contractor tendering process
Land and Livelihoods – Section 6.11				
Impacts on livelihoods from permanent land acquisition	• Affected landowners are provided compensation above replacement value.	Qair Montenegro d.o.o.	• Evidence of compensation payments • Evidence of public consultation events	• Prior to start of construction

Issue / Risk	Preventive / Mitigation measures	Responsibility	Performance Indicators	Timing of Implementation
	• Landowners will receive timely and clear information on project activities and the timing of construction works			
Impacts on livelihoods from temporary land acquisition	• Affected landowners are compensated for of damage to crops, trees or other assets. • Land will be reinstated and returned to the owners after construction • Landowners will receive timely and clear information on timing of construction works and of the duration of interruption of agricultural activities.	Qair Montenegro d.o.o.	• Compensation assessment by expert valuer • Evidence of compensation payments • Evidence of public consultation events	• Prior to start of construction
Labour and Working Conditions – Section 6.12				
Worker rights	• Qair Montenegro d.o.o. will put in place hiring mechanism to ensure no employee or job applicant is discriminated against on the basis of his or her gender, marital status, nationality, age, religion or sexual orientation • Qair Montenegro d.o.o. will undertake socioeconomic compliance monitoring. KPIs will be developed around worker rights, discrimination and management, workforce grievance mechanism and monitoring of outcomes. • Worker accommodation will conform to international best practice • In all contractor contracts explicit reference will be made to the need to abide by Serbian law, international standards and Qair Montenegro d.o.o. policies in relation to labour and welfare standards.	Qair Montenegro d.o.o./ Contractor	• Socioeconomic compliance monitoring results • Inspections and audit results • Contracts • Grievance mechanism in place	• Before start of construction • Throughout construction

Issue / Risk	Preventive / Mitigation measures	Responsibility	Performance Indicators	Timing of Implementation
	• Qair Montenegro d.o.o. will provide as part of their induction, training on worker rights and will also require contractors and subcontractors to provide training on workers rights to their employees. • Qair Montenegro d.o.o. will ensure that all its employees have contracts which clearly state the terms and conditions of their employment and their legal rights. Qair Montenegro d.o.o. will also require contractors and subcontractors to include the terms and conditions of employment and legal rights in all contracts. • All workers (including those of contractors and subcontractors) will be able to join unions of their choice and have the right to collective bargaining. • Qair Montenegro d.o.o. will require all contractors and subcontractors to put in place a worker grievance mechanism that will be accessible to all workers.			
Occupational Health and Safety				
Impact of drilling at PV site and tower locations	• Training and education will be provided to all workers involves in drilling and other related works. • Effective PPE's will be provided and ensured to use during all works. • Machines will be checked and maintained to efficient level to ensure risk free operations.	Contractor	• Evidence of training / training records • Inspections to ensure use of PPE • Compliance checks for machinery	• Before and during construction
Operation of heavy equipment and machinery	• Develop safe working procedures, training of the operators and workers and maintain a safe zone, ensuring visibility and stationing flagman.	Contractor	• Evidence of training / training records • CSC and Qair Montenegro D.o.o. audits	• During construction

Issue / Risk	Preventive / Mitigation measures	Responsibility	Performance Indicators	Timing of Implementation
Excavation and leveling for PV site development, tower foundation and substation construction	• Excavation for tower foundation for a depth of 3-6 m will be required. In addition, cut and fill will also be required at the substation. For PV plant cable trenches the required depth will be 1.5m. • The Contractor will be responsible for sloping by cutting back the trench wall at an angle inclined away from the excavation. • Shoring will require installing aluminum hydraulic or other types of supports to prevent soil movement and cave-ins. • Shielding will be required to protect workers by using trench boxes or other types of supports to prevent soil cave-ins. • Contractor will design a protective system that can be complex because consideration should be given to many factors: soil and rock classification, depth of cut, water content of soil, changes due to weather or climate, surcharge loads (e.g., spoil, other materials to be used in the trench) and other operations in the vicinity. • Access to excavations must be secured and safe. • Emergency response plan must cover trenching and excavation.	Contractor	• CSC and Qair Montenegro d.o.o. audits	• During construction
Transportation of tower materials, heavy equipment by road close to construction sites	• The Contractor will develop a traffic management plan by considering the heavy load, control of traffic in main and other local roads, pavement condition and stability, radius of curvature of the local roads to take turns on sharp curve, etc.	Contractor	• Traffic Management Plan	• Before Construction

Issue / Risk	Preventive / Mitigation measures	Responsibility	Performance Indicators	Timing of Implementation
Working at height along the slope, for tower erection and substation assembly	• Installation of guardrails with mid-rails and toe boards at the edge of any fall hazard area. • Use of fall prevention devices, including safety belt and lanyard, travel limiting devices to prevent access to fall hazard area, or fall protection devices such as full body harnesses used in conjunction with shock absorbing lanyards or self-retracting inertial fall arrest devices attached to fixed anchor point or horizontal lifelines.	Contractor	• Work Instructions • CSC and Qair Montenegro d.o.o. audits	• During construction
Stringing conductors at road, river, and existing transmission line crossings	• Prepare and submit a traffic management plan to Qair Montenegro D.o.o. for an approval at least 30 days before commencing work on any project component involved in traffic diversion and management. • Coordinate with the PMU staff to plan the work. Take necessary shutdown on the live transmission lines/switchyard field, in coordination with the TSO. Provide training and appropriate personal protective equipment to workers.	Contractor	• Traffic Management Plan • Inspections to ensure use of PPE • CSC and Qair Montenegro d.o.o. audits	• During construction
Transportation of oversized equipment to PV plant and substation	• Ensure that the vehicle route is surveyed and that its geometric design and condition is appropriate for the transportation of the big and heavy load. Ensure that turning curves are appropriate for the special vehicles.	Contractor	• Traffic Management Plan • Route survey reports	• Before construction
Lifting and Assembly of Heavy Equipment at Substation and PV plant	• Lifting equipment selection shall be based on a risk assessment and shall be suitable for the task for which it will be used.	Contractor	• Work Instruction	• Before construction
Frequent accidents and injuries due to various construction	• Contractors will be responsible for supplying effective PPEs to all workforces and staff of consultants and PMU visiting the worksites.	Contractor	• Evidence of training / training records	• During construction

Issue / Risk	Preventive / Mitigation measures	Responsibility	Performance Indicators	Timing of Implementation
activities without the use of PPE	• Contractors must ensure that all workers and staff are trained how to use them prior to station and visit to construction sites. • Any violation of the supply of PPEs by Contractor and use of PPEs by workers will lead to severe penalties.		• Inspections to ensure use of PPE	
Community health and safety from construction activities and traffic	• Construction areas will be secured using fences in close proximity to residential development. Together with appropriate info boards and signage.	Contractor	• Fences installed • Signage	• During construction
Security of workers and assets	• Provide appropriate security personnel (i.e. security guards) to prevent unauthorized entry into the construction area. • Employ night watchman for periods of significant on-site storage or when the area necessitates. • Ensure there is proper fencing around construction site perimeter, or mobile patrol where fence is not applicable. • Ensure construction site has controlled access points (one or two entry points at most), allowing for close monitoring of entry and exit.	Contractor	• Construction site layout • CSC and Qair Montenegro d.o.o audits	• During construction
Community Health, Safety and Security – Section 6.13				
• Risks form road accidents • Risks for kids and adults trespassing the construction sites	• Introduction of a Code of Contact for workers • Install site security to avoid unauthorised access • Prepare an Emergency Response Plan • Develop a Traffic Management Plan (see Section 7.14)	Contractor	• Code of Conduct in place and understood by the workers • Traffic Management Plan in place • Emergency Response Plan in place	• Before start of construction • Throughout construction
Traffic and Transport – Section 6.14				
• Road Use Delays	• Develop a Traffic Management Plan • Strict speed limits;	Contractor	• Traffic Management Plan in place	• Before start of construction

Issue / Risk	Preventive / Mitigation measures	Responsibility	Performance Indicators	Timing of Implementation
• Impacts on Safety of Road Users • Road Infrastructure Degradation • Increase of noise, vibration and air pollution	• Advance warning will be given of any proposed road diversions and closures; • Drivers of project vehicles will be trained/briefed about safe driving with respect to other drivers, non-motorised traffic such as pedestrians, cyclists, and livestock; • Clear signs and signals will be set up where necessary; • All project vehicles will be regularly maintained; • Assignment of heavy vehicle construction traffic to suitable routes to and from the working area; • Information on traffic safety will be provided to communities not normally subjected to high traffic loads; • Access and site roads will be maintained in good condition		• Minutes of meeting from consultations and agreements with stakeholders (municipalities) and authorities incl. traffic police	• Throughout construction
Cultural Heritage – Section 6.15				
Chance Finds	• Develop and implement a Chance Finds Procedure • Inform immediately the competent public institution for protection of cultural heritage about the discovery • Cease the operations and secure the site against eventual damaging or destroying, as well as against unauthorized access, and • Maintain the discovered items in the location and in the condition, they were found	Contractor	• Chance Finds Procedure in place • Chance Finds Record Forms	• Before start of construction • Throughout construction

Table 9-3: Mitigation plan for the operation and maintenance phase

Issue / Risk	Preventive / Mitigation measures	Responsibility	Performance Indicators	Timing of Implementation
Hydrology – Section 6.6				
Contamination of Freshwater Resources	• Waste Management Plan • Chemical Substances Management Plan • Pollution Prevention Plan • Emergency Response Plan	Qair Montenegro D.o.o.	• Periodic Monitoring of application of the Waste Management Plan and Hazardous Materials Management Plan, Pollution Prevention Plan and Emergency Response Plan. • Records of monitoring	• Throughout operation
Geology and soils – Section 6.7				
Soil erosion	• The maintenance crew will periodically check for evidence of surface erosion • Periodical check of erosion mitigation systems, drainage canals, retaining walls, etc.	Contractor	Records of periodic monitoring of soil conservation status, especially regarding erosion	• Throughout operation
Landscape – Section 6.8				
Changes in the viewshed and aesthetic value by the permanent presence of project structures	• Integration of access roads: Access roads will be carefully designed and constructed to blend harmoniously with the local landscape. Sensitive earthworks will be employed to minimize their visibility and ensure a seamless integration. • Vegetation reinstatement: In areas where the construction corridor passes through forests or areas with significant vegetation, efforts will be made to reinstate vegetation. Lower-growing vegetation will be preferred to restore the natural appearance of the landscape while ensuring adequate access for maintenance and operation.	Contractor	• Records of establishment and growth of vegetation planting as part of the mitigation landscape design	• During the first years of operation

Issue / Risk	Preventive / Mitigation measures	Responsibility	Performance Indicators	Timing of Implementation
	• Substation design: Substations will be designed in a manner that allows them to blend into the landscape. The architecture and aesthetics of the substations will be carefully considered to minimize their visual impact and maintain the natural character of the surroundings. • Vegetation screen: Vegetation screens will be established along substation parcels to provide additional visual mitigation. These screens will consist of strategically planted vegetation to create a natural barrier, helping to screen the substation and reduce its visual prominence.			
Biodiversity – Section 6.9				
Prevention of Habitat and plant loss	• Avoid use of herbicides and chemicals for vegetation control • Maintain buffer strips between infrastructure and adjacent habitats where feasible • Retain shrubs and low vegetation where they do not interfere with operations • Apply adaptive management based on monitoring results	Contractor	• Monitoring of habitat disturbance and reinstatement, including temporary and permanent habitat loss. • Monitoring of restoration activities, including use of native plant species and natural recolonisation.	• During operation, first year of finishing of construction phase after that once in 3 year.
Impact on invertebrate fauna	• Retain patches of host plants and nectar sources outside the construction footprint • Implement site restoration and re-vegetation using native plant species • Allow natural recolonisation from surrounding habitats • Restrict maintenance works to daylight hours • Apply adaptive management based on monitoring results	Contractor	• Verification of implementation of mitigation measures related to limitation of disturbance, habitat retention and reinstatement. • Monitoring of habitat condition, reinstatement and recolonisation trends	• During operation, every third year

Loss of Amphibian and Reptile fauna	• Use native vegetation for site restoration • Maintain a permanent buffer zone around the water captation • Prohibit maintenance activities within the buffer zone during breeding periods • Regular inspection of the water captation for signs of pollution • Prohibit use of chemicals, herbicides or pollutants near the water body • Apply adaptive management measures based on monitoring results	Contracotr	• Verification of implementation of mitigation measures related to protection of water bodies, habitat retention, movement corridors and site reinstatement. • Monitoring of habitat condition, connectivity and restoration success, including terrestrial habitats and vegetated buffers.	• During operation, first year of finishing of construction phase after that once in 3 year.
Disturbance of Bird fauna	• Encourage natural recolonisation • Install bird flight diverters on the overhead transmission line • Regularly inspect and maintain visibility markers • Minimise expansion of managed areas beyond approved footprint • Apply site-specific measures where *Streptopelia decaocto* presence is confirmed • Apply adaptive management measures based on monitoring results	Contractor	• Verification of implementation of bird-related mitigation measures, including timing restrictions and nest protection. • Monitoring of collision risk and effectiveness of overhead line mitigation measures. • Monitoring of habitat condition, recolonisation and adaptive management measures.	• During operation, every third year
Disturbance / Displacement of bat and other mammal species	• Apply species protection requirements under national legislation • Implement habitat restoration using native vegetation • Retain natural vegetation corridors where feasible • Use downward-facing, low-intensity lighting • Monitor bat activity near OHL where feasible • Apply adaptive management measures based on monitoring results	Contractor	• Baseline, construction and post-construction bat surveys and activity monitoring, including roost and pre-clearance checks. • Verification of implementation of mitigation measures related to roost protection, lighting control, habitat retention and connectivity. • Monitoring of bat activity and habitat condition, including adaptive management based on monitoring results.	• During operation, first year of finishing of construction phase after that once in 3 year.

Issue / Risk	Preventive / Mitigation measures	Responsibility	Performance Indicators	Timing of Implementation
Lands and Livelihoods – Section 6.11				
Impacts on livelihoods from accessing the OHL	• Damages to crops, trees or structures during O&M will be compensated ad hoc.	Contractor	• Compensation records for O&M activities	• Throughout operation
Occupational Health and Safety – Section 6.12				
Workers' H&S during maintenance	• Implementation of Standard operating procedures (SOPs) of Qair Montenegro d.o.o.	Contractor	• H&S audits • Incident reports	• During operation
Community Health and Safety – Section 6.13				
Electromagnetic fields (EMF)	• Exposure to EMF has been considered during the design of the transmission line conductors and the OHL route to ensure compliance with national and international standards. In specific, for the 110 kV OHL, a minimum conductor height of 9 m shall be maintained along the transmission line with the exception of settlement areas where the minimum conductor height shall be set at 18 m. The electric and magnetic fields will be regularly monitored during O&M phase to ensure compliance with national limit values and ICNIRP standards and if required additional mitigation measures will be proposed during O&M phase.	Qair Montenegro d.o.o.	• EMF measurement results	• During operation

Issue / Risk	Preventive / Mitigation measures	Responsibility	Performance Indicators	Timing of Implementation
	• Qair Montenegro d.o.o. will maintain and clear entire RoW from the establishment of permanent structures. Awareness will be created along the OHL alignment to avoid long exposures under the line.			

9.6 Monitoring Program

As one of the key elements of the ESMP, a two-tier monitoring program is proposed comprising compliance monitoring and effects monitoring. The main purpose of this monitoring program is to ensure that the various tasks detailed in the ESMP, particularly the mitigation measures, are implemented in an effective manner, and also to evaluate program impacts on the key environment and social parameters. Both these types of ESMP monitoring are discussed below.

9.6.1 Compliance Monitoring

The purpose of the compliance monitoring is to ensure that the contractor implements the mitigation measures and preventive actions presented in the ESMP are effectively and timely implemented. This monitoring will generally be carried out by the CSC with the help of checklists prepared on the basis of the mitigation measures and preventive actions given in Chapter 7.

9.6.2 Effects Monitoring

Effects monitoring is a very important aspect of environmental management to safeguard the protection of the environment. The effects monitoring plan proposed for the project is presented in Table 9-4. The monitoring will comprise surveillance to check whether the contractor is meeting the provisions of the contract during construction and operation of the project including the responsible agencies for implementation and supervision. Compliance indicators or threshold limits for the monitoring are also given in Table 9-4. Actual monitoring time and location will be decided by CSC and PMU.

Table 9-4: Effects Monitoring Plan

Parameter/ Activity	Location	Means of Monitoring	Compliance indicator/ threshold limits	Frequency	Responsible Agency	
					Implementation	Supervision
During Construction						
Hydrocarbon and chemical storage and handling	Construction camps and yards	Visual Inspection of storage facilities	No leakages from the containers in the storage. Handling follows procedures to avoid spillages.	Monthly	Contractor	CSC
Spoils	At all construction sites	Visual inspections	Disposal in approved locations	Monthly	Contractor	CSC

Parameter/ Activity	Location	Means of Monitoring	Compliance indicator/ threshold limits	Frequency	Responsible Agency	
					Implementation	Supervision
Traffic Safety	Access Roads	Visual inspection to see whether proper traffic signs are placed and flag-persons for traffic management are engaged	Smooth flowing of traffic; and placement of traffic signs and flag-person	Monthly	Contractor	CSC
Dust	Construction sites	Visual inspection to ensure good standard equipment is in use and dust suppression measures (e.g., spraying of waters) are in place.	No dust generation from the construction activities	Weekly	Contractor	CSC
	Construction Sites	Spot measurements with portable meters	Compliance with national ELVs.	Monthly	Contractor	CSC
Noise	Construction sites	Noise measurement using portable noise meter	Compliance with national ELVs	Monthly	Contractor	CSC
Waste Management	Construction camps and construction sites	Visual inspection that solid waste collection facilities are in place and waste is disposed at designated site	Facilities are clean and waste collection and disposal facilities are in place	Monthly	Contractor	CSC
Air (PM, CO2, SOx, NOx)	At PV plant and Substation	24-hour continuous monitoring with appropriate equipment	Compliance with national ELVs	Quarterly during civil works	Contractor	CSC, Qair Montenegro d.o.o.

Parameter/ Activity	Location	Means of Monitoring	Compliance indicator/ threshold limits	Frequency	Responsible Agency	
					Implementation	Supervision
Noise Level	Villages along OHL and PV Plant	15 minutes continuous monitoring during day and night	Compliance with national ELVs	Once at villages close to tower, Quarterly locations in SS and PV plant during civil works	Contractor	CSC, Qair Montenegro d.o.o.
Cultural and archeological Sites	At all work sties	Visual observation for chance finds	Indication of chance finds	Daily	Contractor	CSC, Qair Montenegro d.o.o.
Restoration of Work Sites	All Work Sites	Visual Inspection	The facilities are clean with no waste at the works sites	After completio n of all works	Contractor	CSC, Qair d.o.o.
Plantation	Designated approved locations	Visual inspection	Number of saplings planted and survival rate	Monthly	Qair Montene gro	CSC/ ESIC
Baseline biodiversity condition	Project area and surroundings	Field surveys, habitat mapping, photo records	Baseline established and documented	Once (pre-constructio n)	Contractor /expert biologist	CSC/ ESIC
Extent of habitat disturbance	Construction footprint	Site inspections, GIS mapping	Disturbance within approved footprint	Once in 6 moths	Contractor /expert biologist	CSC/ ESIC
Vegetation clearance control	Construction areas	Site inspections, work permits	No clearance outside approved areas or sensitive periods	Monthly (constructi on)	Contractor /expert biologist	CSC/ ESIC

Soil stripping and reinstatement	Temporarily disturbed areas	Visual inspection, photo comparison	100% temporary areas reinstated	Monthly (construction)	Contractor	CSC/ ESIC
Fauna presence and activity	Project area and surroundings	Targeted fauna surveys, walkover checks	No significant decline vs. baseline	Pre construction	Contractor /expert biologist	CSC/ ESIC
Protected species management	Sensitive habitats	Pre-construction checks, records	Avoidance measures applied	As required	Contractor /expert biologist	CSC/ ESIC
Disturbance (noise, dust, light)	Construction and OHL areas	Site inspections, incident records	No significant disturbance incidents	Monthly (construction)	Contractor	CSC, Qair Montenegro d.o.o.
Compliance with ESMP measures	Entire project area	CSC inspections, EMS audits	Full compliance / corrective actions applied	Quarterly (construction)	Contractor	CSC/ ESIC
Safety of workers Monitoring and reporting accidents	At work sites	Induction training, Toolbox talk, and worksite-based training	Records of training	Continuous	Contractor	CSC, Qair Montenegro d.o.o.
Walk-through health and safety inspection and audit	At all work sites	Visual inspection and use of audit form	Inspection record with photo evidence	Weekly	CSC, Contractor	Qair Montenegro d.o.o.
PPE usage by workers	At work sites	Usage of PPE vs the number of workers and implementation of contractor ‘s OHS plan	All workers should be provided with, and use necessary PPEs	Monthly	Contractor	CSC, Qair Montenegro d.o.o.

Grievances	In the project area	Number of grievances registered and addressed	Minutes of grievance redress meetings	Monthly	PMU	CSC, EMS
During Operation and Maintenance						
Inspection as per Standard Operating Procedures	Tower locations	Visual Inspection of environmental related issues	Comply with Qair d.o.o. SOPs	Monthly	PMU	Qair d.o.o.

Condition of habitats and vegetation	Project area and adjacent habitats	Field inspection, habitat surveys, photo records	Habitat condition stable or improving	Once every three year	PMU	Qair Montenegro d.o.o.
Vegetation management practices	Entire project site	Review of maintenance practices, site inspections	No use of herbicides; biodiversity-friendly management	Annually	PMU	Qair Montenegro d.o.o.
Biodiversity condition (fauna & flora)	Project area and surroundings	Targeted biodiversity surveys, walkover surveys	No significant decline compared to baseline	Once every three year	PMU	Qair Montenegro d.o.o.
Presence of protected species	Sensitive habitats and buffer zones	Targeted checks, incident records	No harm to protected species	Annually / as required	PMU	Qair Montenegro d.o.o.
Invasive alien species	Project area	Field inspections	No spread of invasive species	Annually / as required	PMU	Qair Montenegro d.o.o.
OHL bird and bat interaction	Overhead line corridor	Visual inspections, targeted monitoring	No significant collision risk	Once in three years	PMU	Qair Montenegro d.o.o.
Effectiveness of OHL mitigation	Overhead line corridor	Inspection of bird diverters and markers	Mitigation measures functional	Once in three years	PMU	Qair Montenegro d.o.o.
Restoration and recolonisation	Restored areas	Habitat condition surveys	Successful recolonisation observed	Once in three years	PMU	Qair Montenegro d.o.o.
ESMP compliance	Entire project area	CSC inspections, EMS audits	Full compliance or corrective actions applied	Annually	PMU	Qair Montenegro d.o.o.

Electromagn etic fields	Near the residential areas along the OHL alignment	Measurement through appropriate equipment	National standards	First time when OHL has been energized	PMU	Environme ntal Protection Agency

9.7 Performance Indicators

For evaluating the performance of the environmental and social management and monitoring plan, performance indicators are identified for efficient and timely implementation of measures/actions proposed in ESMP. The indicators are defined both for implementation phase and for operation phase. CSC will be responsible for compiling the information on these indicators and reporting to Qair Montenegro d.o.o.

To measure the overall environmental performance of the project, a list of performance indicator is given below:

- Number of inspections carried out by CSC per month.
- Number of non-compliances observed by CSC or ESHS Specialists.
- Availability of environmental, social, and OHS specialists in CSC.
- Availability of environmental, social, and OHS specialists with contractors.
- Timely reporting of documents (as defined in ESMP and monitoring plan).
- Number of training imparted to stakeholders/other capacity building initiatives.
- Number of grievances received.
- Number of grievances resolved.
- Number of construction-related accidents, incidents and near misses.

9.8 Grievance Redress Mechanism

9.8.1 Grievance Redress Mechanism for Qair Montenegro d.o.o.

Qair Montenegro d.o.o. has implemented a grievance mechanism to ensure that it is responsive to any concerns, complaints particularly from affected stakeholders and communities. Special care will be focused on training of Qair Montenegro d.o.o. staff involved in the grievance mechanism management regarding functioning of grievance mechanism, particularly the stakeholders' opinions and communication mechanism. The Grievance process outline is presented in the following figure.
The following indicative timeframe will be used:

- Written acknowledgement of receipt of the grievance: within 5 days of receiving the grievance
- Proposed resolution: within 15 days upon the acknowledgement of grievance.

In addition, the active grievance procedure must be enlarged by following actions:

- Link to obtain a grievance form has been published on the website of Qair Montenegro d.o.o.; copies of the document will also be physically available in local municipalities;
- Qair Montenegro d.o.o. will allocate responsibility for dealing with community grievances.

Qair Montenegro d.o.o. may receive complaints about the activities being undertaken by contractors (and their subcontractors). If Qair Montenegro d.o.o. needs to lead the investigation, when assigning the complaint owner consideration should be given to whether the person is senior enough and they should be

afforded the full support of the person who is managing this contractor. Where repeated complaints in a location or on a specific matter are made about a contractor (or their subcontractors) this should be escalated and corrective action be a matter of discussion with the senior management of the contractor.

9.8.2 Grievance Redress Mechanism for Contractor

A separate Grievance Redress Mechanism for Workers will be established by the Contractor and it will include employees of Contractor and sub-contractor companies, as well as the primary supply workers. The Contractor and its sub-contractors on this project will be informed by the Qair Montenegro d.o.o. on the necessity for implementation of Grievance Redress Mechanism for Workers within their organizations, concerning their employees.

Contractors' role and responsibilities for receiving grievances, supporting the investigation and resolution of grievances and abiding by the project grievance mechanism should be clearly set out in the grievance procedure and stipulated in the contractor's contract (and other working documents). All grievances received by contractors should be logged, shared with the project and registered.

Affected communities and stakeholders do not generally differentiate between project activities undertaken by a client team or those undertaken by the contractors. Therefore, it is important that contractors are trained in handling grievances, concerns, requests, and so on in compliance with the project grievance mechanism.

9.8.3 Monitoring and reporting

Monitoring should be undertaken on an agreed periodic basis; for most projects this should be monthly. Periodic monitoring of agreed indicators should be undertaken and a short report prepared.

These periodic monitoring reports should highlight any grievances of a critical nature that have been escalated and should be reviewed by the senior manager responsible for oversight of the grievance mechanism and shared with relevant heads of department.

The senior manager responsible for oversight of the grievance management function should undertake a quarterly or bi-annual review of the monitoring program.

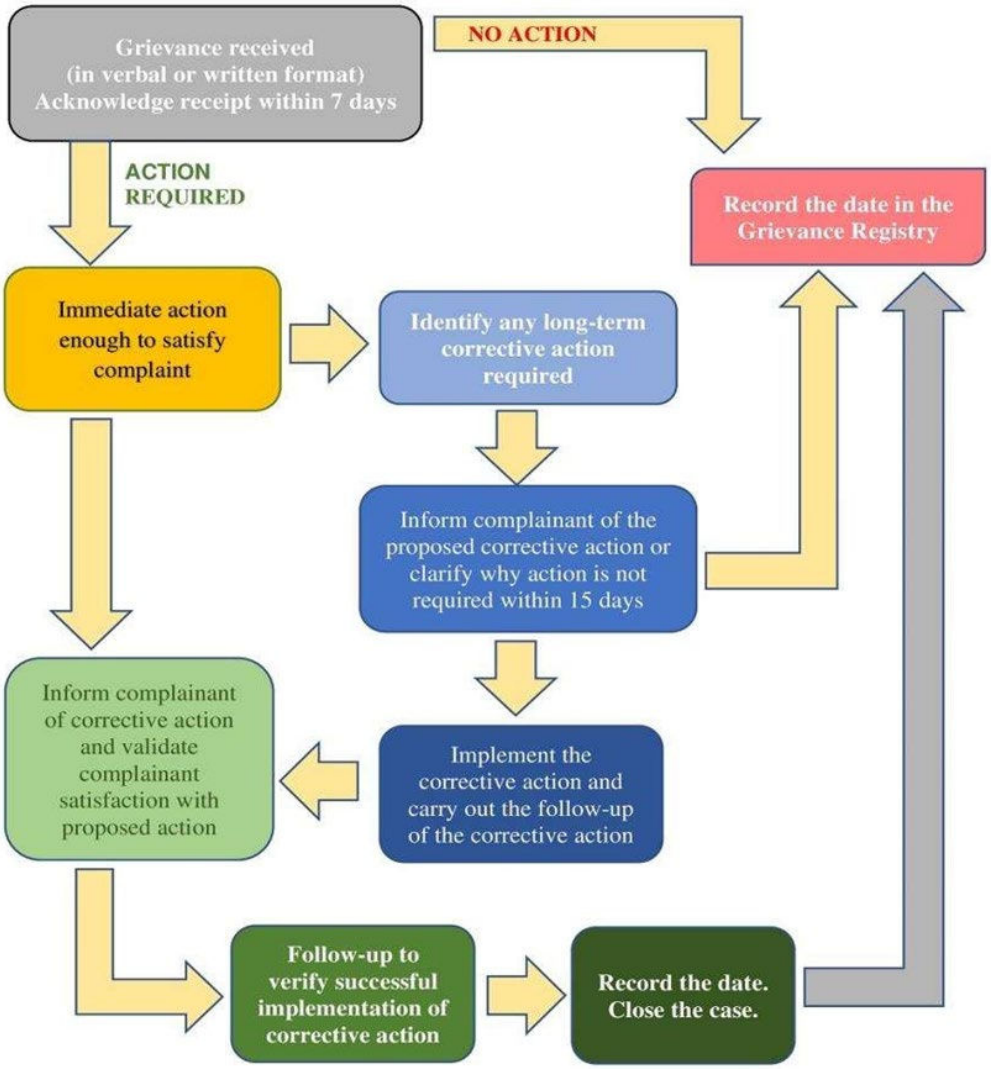


Figure 9-1: Grievance Redress Mechanism

9.9 Capacity Building and Training

Capacity building for effective implementation of the environmental and social safeguard requirements is a key element of the ESMP. Capacity building for environmental and social safeguard management will need to be carried out at all tiers of the Project, including Qair Montenegro d.o.o., PMU, CSC and contractors. At the construction site, the CSC will take the lead in implementing the capacity building plan, though the contractors will also be responsible to conduct trainings for their own staff and workers. The various aspects that are covered under the capacity building will include general environmental and social awareness, key environmental and social sensitivities of the area, key environmental and social impacts of the project, ESMP requirements, OHS aspects and waste disposal.

Table 9-5 provides a summary of various aspects of the environmental, OHS, and social trainings to be conducted at the construction site. The PMU may revise the plan during the project implementation as required.

During the O&M phase of the Project, these trainings will continue to be conducted by Qair Montenegro d.o.o. staff for all relevant O&M personnel.

Table 9-5: Capacity Building Plan

Contents	Participants	Responsibility	Schedule
General environmental and socioeconomic awareness; Environmental and social sensitivity of the project influence area; Mitigation measures; Community issues and workers' code of conduct; Grievance Mechanism; ESMP Awareness of transmissible diseases; Social and cultural values.	PMU; CSC; selected contractors' crew	CSC	Prior to the start of the field activities. (To be repeated as needed.)
OHS Plan; Job Hazard Analysis; Incorporation of ESHS in Method Statement.	Construction crew	Contractors	Prior to the start of the construction activities. (To be repeated as needed.)
Road safety; Defensive driving; Waste disposal; Cultural values and social sensitivity.	Drivers	Contractors	Before and during field operations. (To be repeated as needed.)
Importance and use of PPEs and emergency communication; Excavation; Cranes and Rigging; Working at heights; Scaffolding.	Workers	Contractors	Before and during field operations. (To be repeated as needed.)
Application of Contractual Instruments during OHS violations; Excavation and trenching; OHS in handling and transportation of mechanical equipment.	Contractor, CSC, ESHS Specialists.	CSC	During construction.

9.10 Documentation

Both Contractors and CSC will prepare two separate monthly reports, one for Environmental and Social Management and the second one for OHS Management. The ESHS Specialists with assistance of the CSC and contractors will also produce quarterly reports.

Contractor's and CSC's Monthly Report: Implementation schedule of the mitigation plans and safety inspections and preventive actions suggested in the ESMP should be reported in all monthly reports. The outcome of the field inspections and audits should be reported in all monthly reports. The contractors should present the implementation schedule of mitigation measures and preventive actions in all monthly reports along with monitoring and auditing and the CSC should confirm the status of mitigation and preventives claimed by the contractors.

Quarterly Progress Reports on Environment, Health and Safety: The environmental, Health and Safety monitoring reports will include environmental mitigation measures and preventive actions undertaken, environmental monitoring activities conducted, details of monitoring data collected, analysis of monitoring results particularly the non-compliances, recommended mitigation and corrective measures, ESHS training conducted, and environmental and OHS regulatory violations observed. The environmental monitoring

reports will be submitted quarterly during the construction period and annually for three years after completion of construction.

Quarterly Progress Reports on Social: The quarterly social progress reports will cover the progress on implementation of the LARP (including expropriation and damages) and community development assistance programs.

Project Completion Environmental, Health and Safety Monitoring Report: One year after completion of construction, the ESHS Specialists will submit a Project Completion Environmental Monitoring Report, which will summarize the overall environmental impacts of the Project.

10 Stakeholder Engagement

10.1 Introduction

This Chapter describes the process and outcomes of the consultations carried out with various groups of stakeholders as part of the project work so far. Also provided in this chapter is a framework for the consultations to be carried out during project implementation. Finally, further disclosure requirements for the present ESIA are described at the end of the Chapter.

Details on stakeholder engagement are provided in the Stakeholder Engagement Plan (SEP) under a separate cover.

10.2 Objectives of Consultations

Stakeholder engagement involves building relationships through consultation, information sharing and acknowledgement of national/local conditions and requirements, by building mutual trust, respect and understanding. Engagement serves as a tool to develop relationships, which enable and support achievement of the set goals (organisation/project goals). Furthermore, stakeholder engagement ensures feedback, which results in higher resilience of the project outcomes against potential challenges and critical factors, and shortens the time and resources for their resolving.

Stakeholders have different expectations, and their engagement through an open process and timely sharing of information helps the organisation/project to understand better their needs and manage them accordingly. The stakeholder feedback is beneficial for identifying and mitigating risks that could slow down or interfere with the project implementation.

The national legislation and EBRD performance requirements require consultations to be carried out particularly with the affected communities as part of the environmental and social assessment process.

The specific objectives of the consultation were: (i) obtaining local knowledge about the environment and people living in the nearby areas of project alignment; (ii) interaction with the project affected population and other stakeholders for the collection of primary and secondary data on environment and people; and (iii) engaging stakeholders for maximization of the project benefits.

10.3 Stakeholder Identification

Stakeholders are considered to be individuals or organizations which have an interest in the proposed project or knowledge that would provide insight into issues or affect decision making related to the proposed project. On the basis of interest and role criteria there are two types of stakeholders for the proposed project as described below.

10.3.1 Project-affected parties

Project affected stakeholders are institutions, organizations, local governments, private owners and general public residing in the project area - for example, municipalities in which location the project activities are being implemented, or people having businesses and/or living in the project area. These are groups of actors that are directly impacted by the project, with some having direct benefits from it, while others not experiencing a direct benefit from the project but shall gain it from the project outcomes, and, finally, ones that do not have any direct benefits.

The project specific stakeholders are:

- Qair Montenegro d.o.o.: Company responsible for the project's overall management.
- CGES: Key stakeholder involved in regional renewable energy development projects.
- Municipalities of Nikšić (village of Rudine): Local government bodies directly affected by the project activities.
- Landowners and/or users along the RoW of the OHL (private stakeholders)
- Users of the Roads: Local residents and commuters who use the roads affected by the project.
- Local Communities: Residents living in proximity to the project area who may experience direct or indirect effects.
- Construction Contractors and Supervision Engineers: Parties directly involved in the execution and oversight of the project construction.

10.3.2 Other interested parties

These are typically institutional stakeholders – for instance, related government department/agencies, local government, and organizations that may not be directly affected by the project; however, they may influence the project and its design. They include Qair Montenegro d.o.o., other concerned departments that may have a role during various phases of the project, regulatory agencies such as EPA, other relevant departments such as Ministry of Spatial Planning, Urbanism and State Property, Ministry of Agriculture, Forestry and Water Management, non-governmental organizations (NGOs), the broader interested communities including academia and journalists, and general public.

The project specific interested parties are:

- Environmental Protection Agency (EPA)
- Ministry for Energy and Minning
- Ministry of Spatial Planning, Urbanism and State Property
- Ministry for Agriculture, Forestry and Water Management
- Environmental NGOs (Expeditio, Green Home, CZIP, NGO Ozon, etc.)

10.4 Consultation framework

10.4.1 National framework

Public participation in the environmental protection processes in Montenegro is regulated by:

- Law on the Environmental Impact Assessment (EIA)
- Law on the Strategic Environmental Assessment (SEA)
- Law on Spatial Planning and Construction of Objects
- Law on Free Access to Information

- Convention on Access to Information, Public Participation in Decision-making and Access to Justice in Environmental Matters (Aarhus Convention)

The Law on Free Access to Information obligates government institutions and agencies, public bodies and officials to provide access to documents of public interest, with the exempt of the ones stated by law.

On the level of project implementation, the provisions for stakeholder engagement are included in the Law on EIA (Official Gazette of Montenegro, No. 75/18) (Article 13) stating that the Competent Authority shall inform the authorities, organisations and the public on the need to conduct EIA within three days from the receipt of a complete EIA application. Furthermore, Article 20 of the same law states that the competent authority must organise a public hearing within five working days from the date of receipt of the request for approval of the EIA study. The authority must also inform interested bodies, organisations, and interested public about the manner, term and place of public insight, as well as how to submit comments and opinions. The time and place of the public hearing must also be communicated. The EIA study for which a public hearing is organised shall be published on the web site of both the competent authority and the e-Government portal starting on the date of the public hearing.

The public hearing shall be organised and conducted by the competent authority and shall last at least 30 days from the date of notification.

Taking the above into account, the Montenegrin legislation ensures that public is involved at every stage of the EIA procedure, and their public comments, concerns or raised opinions on the EIA study are collected during the public hearing event(s), organised by the Developer.

Stages of EIA in which stakeholders are included are as follows:

- Notification of the intention for project implementation.
- EIA Screening decision.
- EIA Scoping decision.
- Announcement of the availability of the EIA study.
- Report on the adequacy of the EIA study.
- Decision on granting consent to or rejecting the application for the project implementation.

Montenegro ratified the Aarhus Convention on Access to Information, Public Participation in Decision-making and Access to Justice in Environmental Matters in 2009 (Official Gazette no. 77/09) and has started its implementation since 2 February 2010.

10.4.2 Previous consultation

Qair Montenegro d.o.o. has been proactively approaching the stakeholder engagement on the Project since project inception – engagement with state and local government bodies in the process of project development; and engagement with individual landowners via local authorities and directly during the land acquisition negotiations. A summary of these activities is presented below.

Pre-Scoping phase

During the initial planning stages of the project, stakeholder engagement focused on negotiations undertaken to purchase land and secure the easement and lease agreements. Additionally, meetings were organized with the local community members and local administrative representatives, to present the Project and receive insights from the public.

The consultations and land lease agreements for the project site area with private landowners were held during the 2023-2024. The process involved direct engagement with landowners to define lease conditions, duration, and compensation, ensuring mutual understanding and consent.

The meetings with affected persons were held at the communities of Rudine, during the 2024. No complaints received.

Public hearing on the Environmental Impact Assessment (EIA) for the Rudine PV Power Plant project was held on November 20, 2024, organized by the Environmental Protection Agency at the premises of the Nikšić Municipality Hall, Njegoševa 18. A presentation of the Project followed, together with discussion on potential impacts and mitigation measures.

Scoping phase

Following the approval of the ESIA Scoping Report from the Client, the Scoping Report was disclosed to stakeholders:

- The Scoping Report was published to the web site of the Client https://www.qair.energy/documentation-environmental-social-reports/ ;
- Hard copies of the Scoping Report send to the Urban Planning Dept. of the City of Niksic as well as the Local Municipal offices of Vilusi and Rudine;
- Open hearings/public presentations were held at the communities of Vilusi and Rudine will be held in March 2206.

Data collection and meetings with stakeholders in the preparation phase of the ESIA Report

In the phase of data collection for the preparation of the ESIA Report..

Table 10-1: Summary of stakeholder engagement activities in the planning stage of the Project

Date and Place	Stakeholder	Description
Pre-Scoping phase		
2023–2024 in Rudine	Private Landowners	Consultations and signing of land lease agreements for the project site area. The process involved direct engagement with landowners to define lease conditions, duration, and compensation, ensuring mutual understanding and consent.
2024 in Rudine	Affected persons in Rudine	Consultations were held in PAP household during preparation of EIA. No complaints received.
November 20, 2024 at the premises of the Nikšić Municipality Hall, Njegoševa 18.	General Public Project Affected Persons Other Interested Stakeholders	Public hearing on the Environmental Impact Assessment (EIA) for the Rudine Solar Power Plant project, organized by the Environmental Protection Agency. Presentation of the project and discussion on potential impacts and mitigation measures.
Scoping phase		

To be field after Public consultation organised in March		
Primary and secondary data collection and meeting with Stakeholders for the ESIA		

10.4.3 ESIA Disclosure

Upon EBRD no-objection, the Draft ESIA is planned to be made publicly available in March 2026 on the website of Qair Montenegro d.o.o.

10.4.4 ESIA Public Consultation

Public consultation meetings (open hearings) will be held within one month after publication of the draft ESIA in the municipalities and/or communities affected. Focus group discussions may be also held if the participation at open hearings is not representative. The comments and feedback received during the meetings and through other channels (e.g., webmail, written communications, social media, etc.) will be documented and taken into account during the preparation of the Final ESIA.

The final ESIA will be made publicly available at the same locations as the draft ESIA.

10.4.5 Stakeholders feedback on the ESIA

The final ESIA report will include a section indicating the main concerns raised by stakeholders and how they have been addressed.

10.4.6 Grievance Redress Mechanism

Qair Montenegro d.o.o. Project Management Unit (PMU) will establish a grievance redress mechanism (GRM) to collect and facilitate stakeholders' concerns and/or needs, and thus alleviate potential project adverse impacts for local communities or other stakeholders. Instituting effective grievance redress

mechanism is a crucial mechanism for risk management for the Project while simultaneously enabling effective stakeholder engagement. Addressing stakeholder concerns promptly, using sound and transparent process that is culturally appropriate and clearly accessible to all affected parties at no cost and without retribution ensures Project implementation meeting its galas within specified timeframe and respecting outlined deadlines. Therefore, established Project grievance mechanism receives, evaluate, and address grievances from affected stakeholders and communities to serve achieving successful competition of the Project in accordance with international standards while respecting local policies, culture and conditions.

The set Project grievance mechanism with following principles shall be respected by both the PMU and the contractors/supervision engineers on-site:

a. Different ways in which users can submit their grievances, which may include submissions in person, by phone, text message, mail, e-mail or via a website;
b. Publicly advertised procedures, setting out the length of time users can expect to wait for acknowledgement, response, and resolution of their grievances;
c. A log where grievances are registered in writing and maintained as a database;
d. Transparency about the grievance procedure, governing structure, and decision-makers; and
e. An appeals process (including the national judiciary) to which unsatisfied grievances may be referred when resolution of the grievance has not been achieved

This document outlines grievance redress principles to be respected, while using different means such as the Qair Montenegro d.o.o. company web page and contractors/supervision engineers' on-site camp to inform and guide affected parties about the grievance redress. This chapter includes the following supporting appendices:

- Project Grievance Form
- Template of the Grievance Registry
- Template of the Stakeholder Engagement Registry

1. Submission of Grievances

The available submission methods include:

- **In Person**: Stakeholders can submit grievances directly at Qair Montenegro d.o.o. office or designated local Project office, as well as on contractors/supervision engineers' camp site by filling in the Project Grievance Form.
    - Project Grievance Form submitted directly to the contractor for construction works or the supervision engineer, will forward any such received grievances to Qair Montenegro d.o.o PMU within 24 hours timeframe, to allow PMU to further process the grievance/comment (i.e., record, acknowledge and respond to the grievance in the timeframes defined below).
    - The information boards to be placed at the construction site will clearly display contact information for third-party concerns (contact details of the dedicated contact person designated to address any issues or concerns raised by third parties - their name, position, phone number, and email address).
    - Grievances may also be submitted anonymously or without the use of the form if preferred.
- **Mail**: Grievances can be sent to the Qair Montenegro d.o.o office or Project offices via postal services at no costs to the complaint.
- **E-mail**: A specific email address has been established for receiving grievances.
- **Website**: An online grievance submission form is available on the project's official website.

2. Grievance Log

All grievances received through any channel will be logged in a centralized Qair Montenegro d.o.o Grievance Register, in addition to (but separate form) the Stakeholder Engagement Registry, which details interactions with communities and stakeholders.
The Grievance Register shall include following information:

- Date and time of the grievance submission
- Name and contact information of the complainant (if provided)
- Description of the grievance – such as grievances related to traffic disruptions, inadequate storage of construction materials and equipment, etc. – to enable timely detection of most frequent incidents, ascertain trends and manage risks,
- Channel through which the grievance was submitted
- Steps taken for grievance acknowledgment, investigation, and resolution
- Status of the grievance (acknowledged, under investigation, resolved, pending, etc.)
- Date of resolution and closure/provision of feedback to the complainant, including recording of level of satisfaction with the proposed resolution.

This log will be maintained as an electronic database to ensure efficient tracking and management of grievances.

3. Grievance Processing and Timelines

The grievance processing procedure will be transparent and publicly advertised to ensure stakeholders are aware of the expected timelines:

- **Acknowledgement**: Grievances will be acknowledged within 5 working days of receipt.
- **Response**: A response will be provided to the complainant within 15 working days of grievance acknowledgment, detailing the steps that will be taken to address the issue.
- **Resolution**: The aim is to resolve grievances within 30 working days of receipt. In cases where more time is required, the complainant will be informed about the delay and the reasons for it. The PIU will make all reasonable efforts to address the complaint upon the acknowledgement of grievance. If the PMU is not able to address the issues raised by immediate corrective action, a long-term corrective action will be identified. The complainant will be informed about the proposed corrective action and follow-up of corrective action within 10 working days upon the acknowledgement of grievance. Preventive actions will be identified and implemented with the aim of preventing recurrence of the same issue in the future; these will also be communicated to the complainant.

In addition, during the process of informing the complainant of the proposed action, the PMU will validate complainant satisfaction through providing a grievance close-out form for the resolved grievance to be signed by the complainant (if the complainant agrees) and the PIU to attest to their mutual satisfaction. The PMU will make reasonable efforts to follow-up with the complainant to verify successful implementation of the action.
If the PMU is not able to address the particular issue raised through the grievance mechanism or if action is not required, it will provide a detailed explanation/justification on why the issue was not addressed. The response will also contain an explanation on how the person/ organisation that raised the complaint can proceed with the grievance in case the outcome is not satisfactory.

Note: At all times, complainants may seek other legal remedies in accordance with the local legislation, including formal judicial appeal.

4. Governance transparency

The GRM procedure, including information about the governing structure and decision-makers, will be made publicly available through various channels such as the project website, local newspapers, and community meetings. This will ensure that stakeholders understand how grievances are managed and who is responsible for decision-making.

5. Appeals Process

If a grievance is not resolved to the satisfaction of the complainant, an appeals process will be available. The appeals process includes:

- **Re-Evaluation by Qair Montenegro d.o.o**: The complainant can request a re-evaluation of the grievance by senior Qair Montenegro d.o.o management.
- **Independent Review**: If still unsatisfied, the complainant can seek an independent review by an external mediator appointed by Qair Montenegro d.o.o.
- **Judicial Recourse**: As a final step, unresolved grievances can be referred to the national judiciary for legal adjudication.

6. Communication and Transparency

- **Communication**: Qair Montenegro d.o.o will outline its grievance redress mechanism in writing, publicize it on their website as well as Project dedicated website (if any), and clearly outline to all affected parties deadlines as well as management of the process. Disclosure will be in a format and language readily understandable to the local population, simple enough so that it does not require legal counsel to complete.

- **Transparency**: The process needs to be transparent, fair, readily understandable, accessible, and culturally appropriate for all affected parties, particularly vulnerable populations. Qair Montenegro d.o.o will clarify who is expected to use this procedure and assure potential users that there will be no costs or retribution associated with submitting a grievance, and their personal data will be treated according to local privacy legislation. Anonymous grievances will also be processed, provided a means of communication is available.

7. Timing

- Qair Montenegro d.o.o will publicly communicate and commit to a certain timeframe for responding to recorded complaints and ensure that this response time is enforced. During critical periods, such as construction, immediate responses to time-sensitive complaints are essential.

8. Assisting complainants

If the grievance is vague and not clear enough, the Qair Montenegro d.o.o PMU will assist and provide counsel in formulating/redrafting the submission, in order for the grievance to become clearer, for purposes of an informed decision by the PMU, in the best interests of persons affected by the Project and in consideration of the preferred resolution steps of the complainant.

9. Written Records

Qair Montenegro d.o.o will keep a written record of all complaints, which is critical for effective grievance management. The record will contain the name of the individual or organization, the date and nature of the complaint, any follow-up actions taken, the final result, and how and when this decision was communicated to the complainant.

10. Grievance Reporting

All public comments can be made by email using the publicly available and stated contacts.

11. Monitoring and Evaluation

The effectiveness of the GRM will be monitored and evaluated periodically. Feedback from stakeholders will be used to continuously improve the process. Training will be provided to Qair Montenegro d.o.o staff and local project officers to ensure they are equipped to manage grievances effectively.

By implementing this GRM, Qair Montenegro d.o.o aims to foster a positive relationship with all stakeholders and ensure that their concerns are addressed promptly and fairly

Contact information for inquiries or submitting grievances:

Qair Montenegro d.o.o - Project Menagement Unit
Address: Bulevar Džordža Vašingtona 19, Podgorica
Tel.: +38269480118
E-mail: s.klikovac@qair.energy