



Montenegro: Construction of Bar-Boljare Highway - Environmental and Social Assessment

Gap Analysis & Disclosure Pack section Mateševo – Andrijevica

ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT REPORT

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Appendix IV: Road Safety Audit

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Abbreviations

Abbreviation	Meaning
a.s.l.	above sea level
BBH	Bar – Boljare Highway
Ch.	Chainage
C & C	Cut and Cover
CHS	Community Health and Safety
DD	Detailed Design
DG NEAR	Directorate-General for Neighbourhood and Enlargement Negotiations
EBRD	European Bank for Reconstruction and Development
EC	European Commission
EIA	Environmental Impact Assessment
EIB	European Investment Bank
EMP	Environmental Management Plan
EPA	Environmental Protection Agency of Montenegro
ESAP	Environmental and Social Action Plan
ESIA	Environmental and Social Impact Assessment
ESMP	Environmental and Social Management Plan
EU	European Union
EUD	European Union Delegation
GIP	Good International Practices
GIS	Geographical Information System
GSI	Geological Strength Index
(H)	Horizontal
IBA	Important Bird Area
IC	Interchange
IFI	International Financing Institution
IPA	Instrument for Pre-accession
IPA	Important Plant Area
IPF	Infrastructure Project Facility
IR	Inception Report
km	Kilometre
LARF	Land Acquisition and Resettlement Framework
LARP	Land Acquisition and Resettlement Plan
LTS	Lateral Toll Station
LULUCF	Land Use, Land Use Change and Forestry
MCA	Multicriteria Analysis
MCI	Ministry of Capital Investment
MIS	WBIF Management Information System
MNE/MON	Montenegro
MONTEPUT	State owned road operating company – Project Manager
MoT	Ministry of Transport
MSD	Minimum Stopping Distance
M & B	Man and Biosphere
NIPAC	National IPA Coordinator
NTS	Non-Technical Summary
O & M	Operation and Maintenance

Abbreviation	Meaning
OEM	Orient/East Mediterranean
OfG	Official Gazette of Montenegro
OHS	Occupational Health and Safety
PAP	Project Affected Persons
PCU	Pollution Control Unit
PD	Preliminary Design
PR	Performance Requirements
PUC	Public Utility Company
QA	Quality Assurance
R	Radius
RAE	Roma, Askali, Egyptian ethnic group
SEETO	South East Europe Transport Observatory
SEP	Stakeholders Engagement Plan
SER/SRB	Serbia
SIA	Social Impact Assessment
SRP	State Review Panel
TA	Technical Assistance
TEM	Trans-European Motorway
TEN-T	Trans-European Network-Transport
TIN	Triangulated Irregular Network
ToR	Terms of Reference
TRA	Transport sector
(V)	Vertical
UAA	Total Utilised Agricultural Area
WASH	Water, Sanitation and Hygiene
WB (G)	World Bank (Group)
WBIF	Western Balkans Investment framework

1 Introduction

1.1 Project Background

1.1.1 Project Background

The Bar-Boljare Highway (BBH) in its length of 168 km, which the section Mateševu – Andrijevica is a part of, forms the Trans European Motorway (TEM) branch route through Montenegro. This BBH road is part of the E-80 and E-65 routes, comprising SEETO Route 4 [Romanian border/Vatin – Belgrade (SER) – Podgorica (MNE) – Bar (MNE)]. The Highway connects the Adriatic Coast (Port of Bar) to the border of Serbia (Boljare) and with ports on the Danube (Corridor VII and Corridor X) and, ultimately, with the entire so-called Pan-European corridor network and integrate the TEN-T extension in the Western Balkans.

The development phases for the entire BBH are as follows:

- Section I: Smokovac–Mateševu
- Section II: Mateševu–Andrijevica and the Smokovac–Tološi–Farmaci bypass;
- Section III: Andrijevica–Boljare
- Section IV: Podgorica – Đurmani

The intention of Montenegro to construct the Bar – Boljare Highway was initiated back in 2001 by the Parliamentary decision to proceed with the development of the Spatial Plan (“Official Gazette of MNE” no. 45/01). The Spatial Plan of Montenegro up to 2020 was subsequently adopted in 2008 (“Official Gazette of MNE” no. 24/2008) reserving space by defining a dedicated corridor for the Highway BBH. The objective of defining the corridor was to safeguard the space from other spatial demands and use (Spatial Plan, Pg.133). On October 19, 2023 the Government of MNE has determined the Draft Spatial plan of Montenegro up to the year 2040. After the disclosure, public insight, and consultation period, the final draft of the Spatial Plan was adopted and disclosed on January 29, 2024 by the Ministry of Spatial Planning, Urbanism and State Property. The Strategy of transport development in Montenegro (2019-2035) has included the completion of the Section “Mateševu - Andrijevica” part of the Bar - Boljare Highway into the unified list of priority infrastructure projects.

The section Mateševu–Andrijevica, subject to the present ESIA disclosure dossier, is 23.5 km long (14% of the total length of the Bar - Boljare highway).



Figure 1-1: The Bar-Boljare Highway and Mateševo - Andrijevica section

1.1.2 Project history and efforts to adopt measures to avoid /minimize adverse impacts on affected communities

The development history of section Mateševo- Andrijevica must be observed and understood in the context of the Bar-Boljare Highway as a whole, but also from the perspective of the 41 km long section Smokovac-Mateševo, under operation since July 13, 2022. The construction of Smokovac-Mateševo section was alike Mateševo-Andrijevica constrained the land use and was guided by the principles of defining spatial limits for the highway corridor and the land use principles as defined in the Spatial Plan of Montenegro up to 2020. Hence, the principles of defining the highway corridor, including restriction, limits and land use are in place since 2008 and tackles the entire 168 km stretch of the Highway.

The activities undertaken in preparation of the mandatory documentation for the Mateševo-Andrijevica Section can be observed through **two consecutive development phases**, without overlapping sequences.

The **first phase**, started with the General Design (Louis Berger SAS-Paris, Simm Engineering –Podgorica) in 2008, when three alternative solutions of the alignment were examined. The Design activities continued in 2018 under the Technical assistance services (TA) supported through a Western Balkans Investment Framework (WBIF)¹ Grant. Under the Scope of work of the TA together with earlier efforts financed by the Government of Montenegro, the following studies were developed:

¹ The Western Balkans Investment Framework is an EU initiative, uniting regional beneficiaries, international financial institutions, and bilateral donors to enhance the European perspective of the Western Balkans. Due to its collaborative nature in line with the 'Team Europe' approach, the WBIF has been identified as the main vehicle for the implementation of the ambitious Economic and Investment Plan for the Western Balkans.

- Preliminary Design for the Section Mateševu-Andrijevića adopting Variant 3, approved by the State Review Committee (2022)
- National EIA for the Mateševu – Andrijevića section, (2024) for which the consent of the Environmental Protection Agency was given with the Decision 03-UPJ-652/28 dated May 14th, 2024, based on the above Preliminary Design.
- Preliminary ESIA for the Mateševu – Andrijevića, drafted under the WBIF, based on the approved Preliminary Design, inclusive of a LARF and SEP, submitted in July 2023, which was not disclosed as final nor consulted.
- Preliminary ESIA prepared as a part of the Feasibility Study for the entire Bar-Boljare highway (2021).
- Strategic environmental impact assessment for Detailed spatial plan of Bar-Boljare highway (2008);

The **second phase** started mid-2024, and has been determined by: (1) the intention of the Government of Montenegro to request EBRD to financially support the construction of Section Mateševu Andrijevića, which required assessment of compliance of project activities with, inter alia, the Environmental and Social Policy of EBRD (2019) and the applicable Performance Requirements, and consequently (2) the decision of MONTEPUT to explore viable alternatives in the endeavour to respond to complaints raised by three out of eight settlements.

The underlining concerned argued that the Preliminary design (approved by the SRC) was not adequately consulted with the public and results in detrimental impacts to the functional and spatial integrity, by severance and major physical displacement. By acknowledging the concerns as legitimate and justified, MONTEPUT undertook additional activities in August 2024. MONTEPUT assessed the technical, cost, and other implications from modifying the route from the Preliminary Design in the area from Tunnel Trešnjevik to Andrijevića. This was followed by development of the Schematic Design for the proposed changes, which was presented during September 2024 to all eight local communities impacted by the construction of Mateševu-Andrijevića. Detailed minutes of meetings are being kept and are available in the archive of MONTEPUT d.o.o., while the key findings are summarized in Annex 10 the Project Stakeholder Engagement Plan (SEP) During intensive communication with local communities, majority of participants expressed public affirmation and acceptance of the proposed change. However, occasional individual concerns and criticisms of the route change could have been heard during the consultations which were later put in writing as formal grievances alleging the route was modified disregarding known landslide areas, lacked investigations, violated engineering standards, alleged economic loss resulting from development /construction restrictions on land imposed by the Highway Bar – Boljare Spatial plan. Key takeaways and most significant statements and insights shared by stakeholders from eight local communities during meetings held between July and December 2024 are presented in the Consultation report, 2024.

The route change, spanning from the exit of the Trešnjevik Tunnel to Andrijevića, significantly reduced the number of physical displacement cases, preserved the spatial and functional integrity of three rural settlements, and enabled the sustainable functioning and development of these settlements in the future. The route change respected the interests and request of these local communities to relocate the route defined based on the Preliminary Design driven by their aim to preserve the local communities. The process was guided by combining the expectations and single legitimate interests with the public interest, and shared development goals, and the Government's intention to enhance transport through expanding the network of public roads. The construction of the Bar – Boljare Highway in general, and the Mateševu – Andrijevića section, is an important link to unlocking Montenegro's economic, social, tourism, and cultural development potential.

Local communities have expressed lasting concerns rooted in the past, from disruption and safety risks encountered during construction of the Smokovac-Mateševu Section due to disregard of regulatory requirements and safety standards by contractors engaged in the construction of that section.

Attention should be drawn to the fact that the minutes from the public meetings include statements and claims from participants that either deviate from the topic of engagement or are made with side motives. Finally, it is important to highlight there are still unmet expectations of the Bare Kraljske community regarding the construction of the Mateševu – Andrijevića section. The community consistently demands the inclusion of an interchange in the Bare Kraljske area to connect the highway with the Komovi and Bjelasica nature parks. This discussion goes beyond the direct impacts of the Project and are seen as wider development opportunities beyond the scope of the ESIA.

Following the intensive communication and meaningful cooperation with stakeholders, several open residual concerns, specifically in the settlements of Mateševu and Bare Kraljske have been identified. It is crucial for future activities related to the implementation of the Project, that MONTEPUT continues its engagement with stakeholders, exercising trust building efforts, at the same time ensuring that other institutional and decision making authorities are guided and adhere to the adopted Project social performance standards.

To address ongoing and future concerns which are a consequence of the Project a Grievance Mechanism has been established, and information about its role and functioning will be made available on notice boards in both municipalities and in the impacted local communities. The availability of the Grievance mechanism has been extensively and in details communicated to the local communities.

1.1.3 Summary of engagement with local communities during the Second phase

Between July and September 2024 MONTEPUT held a series of community meetings following the concerns and formal complaints of the settlement of Bare Kraljske, Kralje and Slatina. The community of Bare Kraljske had continuously requested that the Design is supplemented to explore the possibility to include an additional interchange.

On July 23, 2024, the Project team met with around 40 residents of Bare Kraljske. Participants reported that up to the date of this meeting no meaningful consultations nor presentation of the routing of the alignment was made. Allegations of lack of transparency, and failure to publicly disclose appropriate information so to enable meaningful consultation with stakeholders were highlighted. Many concerns, both future and historic relevant to the preceding section Smokovac –Mateševu, were raised, such as: haulage routes and deterioration of local roads, inadequate drainage solutions, severance impacts and restrictions on land imposed after construction of the highway. The administrative steps of the expropriation has begun, and questions and concerns were raised why the process started based on the Preliminary design before. The meeting also raised dissatisfaction with the activities preceding the valuation of assets and lack of advanced communications. No negotiated settlements, nor actual land take or resettlement has occurred thus far. The community emphasized that during 2022 they presented their requests in the form of 7 itemized requests (these are Joint conclusions reached during the community meeting held on September 10, 2022) which were sent to several level of governmental institutions including MONTEPUT and the line Ministry but no feedback was received. The community reported that MONTEPUT provided feedback only to the request for an additional interchange, declining the request with the justification that this is not technically feasible nor required by national design parameters. In addition, such interchange is not foreseen with the spatial plan of Montenegro, which is why the community initiated plan amendments. This initiative was supported by the Municipality Kolašin through a formal decision of the Municipal Assembly. The community welcomed

the meeting and found this to be a good foundation for MONTEPUT and other governmental stakeholders to build on in their future engagement efforts. The community also welcomed the information that a Project specific Grievance mechanism is foreseen and decided during the meeting that it is in the best interest that formal communication and engagement planning is established through their elected representative i.e. the President of the local community.

On July 24, 2024 the PASECO team met with the local community Kralje. In advance of the meeting scheduled on site, an introductory meeting with the President of the local community (Mjesna zajednica) was held in Podgorica, who provided background information on the community's view and perception, which are based on real indicators, of impacts on the communities should the route not be reconsidered. The economic aspects were not the prevailing interest in the self-assessment of the communities' wellbeing. The community reported that they have not been engaged meaningfully in the routing of the alignment, have received no information in advance, not even when it comes to expropriation. These concerns were raised with many institutional stakeholders and appear to have been receiving assurances that these concerns will be considered seriously. The understanding of PASECO team was that MONTEPUT was aware of both of these concerns and their gravity and was ready to consider different routing alternatives with the designer entrusted with the Detailed Design once the selection process is completed. The community suggested that an alternative route possibly bypassing the settlement is explored, and welcomed the information that a Project specific Grievance mechanism is foreseen and decided as in the case of other communities that formal communication and engagement planning is established through their elected representative i.e. the President of the local community.

On July 23, 2024, PASECO team met with the President of the Local Community office of Slatina and several citizens. During the meeting the importance of the highway was not questioned and the President expressed their conviction that the construction of the highway will encourage younger generations to stay in this region and to return and resettle there. Nonetheless, they expressed the need for the route to be reassessed and possibly modified to reduce and, wherever possible, avoid the expropriation of properties and residential structures. The primary goal of changing the alignment route would be to protect property and allow owners (citizens) to remain living and working on their properties. One of opinions expressed was that people who do not reside in the settlement but own land welcome the land acquisition as a form of economic gain. There was a unity in agreement that authorities must change the way they interact and empower citizens and that a more frequent and structured communication with the local population is required.

Following the decision of MONTEPUT to explore viable alternatives and change the route, public meetings with detailed presentations were held on September 4th, 18th, 19th and 27th 2024 respectively, in the communities Andrijevića, Kralje, Slatina, Mateševo and Bare Kraljske. The minutes of meetings were provided to EBRD and are available in the archives of MONTEPUT, while an extensive summary is presented in Annex 10 of the Stakeholder Engagement Plan (SEP). These meetings were scheduled and moderated by MONTEPUT and attracted in Andrijevića over 40 citizens of which very few were openly criticizing and against the route change, mainly because there were in anticipation for their assets to be expropriated based on the alignment based on Preliminary design. The meeting in Kralje on September 18, 2024 was attended by more than 35 citizens from Kralje, Gnji Potok, Sjenozeta and Tresnjevik) who openly supported the modified route, while in Slatina a few from the the 40 attendees of the meeting (September 19, 2024) were opposing the route change.

1.1.4 Project Manager and Implementation Unit

The Project Beneficiary is Government of Montenegro represented by MONTEPUT a State-owned Road operating company who will be the Project Manager.

MONTEPUT will be managing all aspects of the Project and act as the implementing entity, and Employer under the Design and build and two Consultancy Contracts i.e. Supervision of design and works and the Technical Support.

1.1.5 Relation to national strategies, plans and programs

The Bar-Boljare highway is expected to contribute to the regional cooperation for European integration and improvement of the management of the Core Network, and its significance is recognized in the following national strategic documents:

Spatial Plan of Montenegro until 2020 (adopted in 2008): One of the objectives of the 2008 Spatial Plan was the construction of settlements bypasses (particularly urban centres), to minimize negative impacts on the environment caused by pollution from transit traffic. This refers in particular to the urban centres along the main car traffic corridors; highways. The road network concept has been defined having in mind the objectives of the development of Montenegro, as well as the role that the road network has in the realization of the same, and with regards to the existing conditions of the road network and the expected transportation flows until the year 2020. Among the proposed motorways was part of the motorway Beograd – south Adriatic through Crna Gora: Boljare-Andrijevića-Mateševo-Bratonožići-west bypass of Podgorica – Sozina tunnel -Bar (Durmani). The Bar – Boljare motorway is also included in the new **Spatial Plan of Montenegro until 2040** (adopted in October 2023)

Transport development strategy of Montenegro, 2019-2035: This Strategy emphasizes that “Bar-Boljare Highway corridor represents the basic connection in the north-south direction, and it also provides the appropriate connections to Serbia, Bosnia and Herzegovina and Albania through the existing road network system. The connection of Bar with the TEN-T Corridor X (which passes through Serbia), i.e. the Bar-Belgrade Highway, not only is the strategic orientation of Montenegro for connecting with Central Europe, but also represents a direction that has special significance for the Port of Bar and the overall economic development Montenegro. The Bar-Boljare Highway should contribute to opening of many development opportunities and of further realization of Northern region potential, better and faster connectivity with central and southern parts of the country when it comes to internal integrated character of connecting, while providing safer and more efficient transport”.

The Bar-Boljare highway is planned to be constructed in four phases: i. Smokovac-Mateševo, ii: Mateševo-Andrijevića and bypass Smokovac - Tološi – Farmaci, iii: Andrijevića – Boljare, and iv: Podgorica – Durmani. The construction of the Smokovac-Uvač-Mateševo section (41 km) is completed and the section is currently operating.

The construction of new motorways is considered a national priority due to the role they play in the uniform regional economic development and the development of Montenegro as an attractive tourist destination. Although Montenegro has an extensive road network, no roads meet the standards of full motorways.

The Bar-Boljare Highway is expected to provide significant improvements in the following fields:

- Integrating the Montenegrin roads to the Core Transport Network and in the South-East Europe Transport Observatory (SEETO);
- Accommodating the increasing traffic growth and minimizing congestion;
- Improving local environmental and social conditions;
- Fostering economic development of Montenegro and Western Balkans through improved connections;

- Improving traffic safety and achieving cost efficiency for environmental protection, accidents and congestions at border crossings and urban area;
- Improving mobility of citizens and reduction of travel times;
- Reducing the road infrastructure maintenance costs.

1.2 ESIA methodology

1.2.1 Scope of the ESIA

The current ESIA report provides an in-depth analysis of potential environmental and social impacts, according to EU practice and the requirements of the EBRD Environmental & Social Policy (2019) and considering the stakeholders' feedback. Thereby, any negative foreseeable impact of the motorway section on environment, social and/or on climate change factors has been identified and appropriate mitigation measures have been developed. In addition, the ESIA identifies, monitors and manages any residual risks.

This ESIA is accompanied by a Non-Technical Summary (NTS), Stakeholder Engagement Plan (SEP), Environmental and Social Management Plan (ESMP), Environmental and Social Action Plan (ESAP), Critical Habitat Assessment and Land Acquisition and Resettlement Framework (LARF), which form a disclosure package for purposes of public consultation.

1.2.2 Field studies

For the purposes of establishing the environmental and social baseline and impact assessment the following were performed:

- Environmental measurements:
 - Ambient air quality monitoring at 4 locations for two twenty-four-hour periods, according to European standards and legislation provisions. Parameters monitored include PM10, PM2.5, SO2, NO2, CO.
 - Noise levels measured in 5 locations and in two 24-hour measurement cycles at each location (the same as for the air quality measurements). The indices assessed are according to the requirements of the Directive 2002/49/EC (Environmental Noise Directive - END), i.e. Lday, Levening, Lnight and Lden and Leq.
 - Water sampling, physical, and chemical analyses. Two sampling campaigns at 5 locations in the project area (three surface water and 2 water wells) were performed. The water chemical and microbiological analysis package included the following parameters: Heavy Metals, PAHs, Total Petroleum Hydrocarbons C10-C40, PCBs, Nitrate (NO3), Nitrite (NO2), Phosphate (PO4), BOD, Ntot, Ptot, NO3-N, Xylene (BTEX), Total Coliform, E.coli and Intestinal enterococci, as well as pH.
- Field research and biodiversity surveys were executed in the framework of the preliminary ESIA (2019-2021). The surveys covered:
 - biodiversity of fish fauna and biodiversity of benthic fauna in Drcka River and Lim River.
 - Amphibians and Reptiles
 - Birds

- Mammals (including Bats)
- flora and habitats
- Additional biodiversity surveys for the new alternative (conducted in October 2024), covering:
 - Flora and Habitats Amphibians and reptiles
 - Aquatic macroinvertebrates
 - Terrestrial invertebrates
 - Bats
 - Mammals
 - Ichthyofauna and benthic fauna
 - Ornithofauna: Darko Saveljic

Primary data collection through field work:

- Field visits of the project area during July 2024 (Bare Kraljske, Kralje and Slatina, meetings with citizens and key informants i.e. Presidents of local community offices), September 2024 (Meetings with 8 local communities during 4 meetings) and December 2024 (Bare Kraljske, Mateševu – citizens and owners of physical structures fronting the highway up to 100m, Kralje, Slatina and Gnjili potok with Presidents of Local community offices) and meetings with local communities of Bare Kraljske and Mateševu.
- Site visits and visual observation using tools such as google maps, google earth and similar overlapped with the Preliminary design and the proposed modifications for identification of land acquisition and physical displacement impacts.
- Two day walk over survey from Mateševu to Andrijevića along the alignment for a detailed understanding of the spatial baseline conditions, human receptors, social interactions etc, and identification and verification of data from the route change with the site conditions.
- Perception survey on expectations, risks and the importance of the the Highway for the economic development of North Montenegro region. (2022)

1.2.3 Methodology for impact assessment

1.2.3.1 Types of impacts

Impacts may occur as positive, negative, direct, indirect and cumulative. Determination of the type of impact is the important step of the assessment process. The determination of the impact type is based on geographical size, sensitivity of receptor, duration, significance and likelihood of the impact.

Table 1-1: Impact types

Impact Type	Definition
Positive	Impacts that make positive changes over the current conditions.
Negative	Impacts that lead to new and undesirable changes over the current conditions.
Direct	Direct impacts occur through direct interaction of an activity with an environmental, social, or economic component.
Indirect	Impacts which are not a direct result of the project, often produced away from or as a result of a complex impact pathway.
Cumulative	Impacts that consist of an impact that is created as a result of the combination of the project evaluated in the current project together with other projects causing related impacts.

1.2.3.2 Impact significance

Impact significance criteria (SC) is determined through the consideration of the Nature (N), Extent (E), Duration (D), Magnitude (M), and receptor sensitivity (R) applicable to the specific impact. For the purpose of this methodology the consequence of the impact is represented by:

$$SC = (E+D+M+R) \times N/4$$

A rating scale as defined in the table below represents each individual aspect in the determination of the consequence.

Table 1-2: Criteria for Determining Impact Significance

Aspect	Score	Definition
Nature (N)	-1	Negative: Impacts that are considered to represent an adverse change from the baseline condition or introduce a new undesirable factor. Impacts are described as “negative” when they: — Reduce the socio-economic welfare (i.e. living quality and result in land acquisition) — Reduce the quality of existing environment and habitat
	+1	Positive: Impacts that are considered to represent an improvement on the baseline condition or introduces a new desirable factor. Impacts are described as “positive” when they; — Enhance socio-economic welfare (i.e. health, employment). — Enhance the quality of existing environment and habitat.
Extent (E)	1	Project Site: (i.e. limited to the area applicable to the specific activity)
	2	Municipality (i.e. the area within 5 km of the site),
	3	District (i.e. extends between 5 and 15 km from the site)
	4	Regional: (i.e. extends beyond 50 km from the site)
	5	National: potential impacts that expected to create changes at national level.
Duration (D)	1	Immediate (≤1year)
	2	Short term (1-5 years),
	3	Medium term (6-15 years),
	4	Long term (the impact will cease after the operational life span of the project)
	5	Permanent (no mitigation measure of natural process will reduce the impact after construction)

Aspect	Score	Definition
Magnitude (M)	1	Minor: where the impact affects the social and physical environment in such a way that cultural, social and environmental functions and processes are not affected.
	2	Low: where the impact affects cultural, social and environmental functions and processes are slightly affected.
	3	Moderate: where the affected cultural, social and environmental functions are altered and processes continue in a modified way.
	4	High: where cultural, social or environmental functions or processes are altered to the extent that it will temporarily cease.
	5	Very high: where natural, cultural, social or environmental functions or processes are altered to the extent that it will permanently cease.
Receptor Sensitivity (R) ²	1	Low: Local community and/or environment is fully equipped/has the tools to manage changes of life quality. • Species and/or population has high capacity to absorb or adapt to change (i.e. has capacity to move away from or adapt to the project impact), and is potentially unaffected or marginally affected • People being least vulnerable to change or disturbance (i.e. ambient conditions such as air quality are well below applicable legislation and international guidance) • Individuals who are able to quickly adapt to temporary disruption in their living conditions, livelihood status or a change in the status of public infrastructure
	3	Medium: Local community and/or environment is partially equipped/has the tools to manage changes of life quality. For example: • Internationally threatened species /protected area within the area impacted by the project activities outside of period of high sensitivity or during routine or reliably predictable peak presence • Species and/or population which has moderate capacity to absorb or adapt to change (i.e. has capacity to move away from or adapt to the project impact), leading to potential temporary but sustainable effect which does not substantially alter character or result in significant loss of ecological functionality • People being vulnerable to change or disturbance (i.e. ambient conditions such as air quality are below adopted standards • Negative change in livelihood status, household assets/income or living conditions. Temporary disruption to businesses resulting in a small drop in business revenue. • Increased risk to public health that can be controlled using detailed mitigation measures. • Disruption to public infrastructure that results in an inconvenience to other users
	5	High: Sensitive local community and/or environment not equipped or prepared to cope with social and environmental impacts such as changes of life quality. For example: • Internationally threatened species /protected area within the area impacted by the project activities during period of high sensitivity (e.g. during breeding, spawning or nesting) and during routine or reliably predictable peak presence • Species and/or population which has little or no capacity to absorb or adapt to change (i.e. little or no capacity to move away from or adapt to the project impact), leading to potential for substantial change of character and/or loss of ecological functionality • Most vulnerable groups (i.e. ambient

² Receptors may be humans, ecological and physical components of the environment. Receptor sensitivity considers how a particular receptor may be more or less susceptible to a given impact. More sensitive receptors may experience a greater degree of change, or have less ability to deal with the change, compared with less sensitive receptors that may be more resilient or adaptable.

Aspect	Score	Definition
		conditions such as air quality are at or above adopted standards • Individuals with a marginal livelihood, low socio-economic income or poor quality living conditions • Individuals who are vulnerable due to their age, disability or other reason and who may require special assistance during engagement activities • Businesses with a marginal economic existence which are not able to easily adapt to change

1.2.3.3 Impact likelihood

The likelihood of an impact is scored according to the following table:

Table 1-3: Likelihood Scoring

Likelihood	1	Improbable (the possibility of the impact materializing is very low because of design, historic experience, or implementation of adequate corrective actions; <25%)
	2	Low probability ((there is a possibility that the impact will occur; >25% and <50%)
	3	Medium probability (the impact may occur; >50% and <75%)
	4	High probability (it is most likely that the impact will occur- > 75% probability), or
	5	Certain (the impact will occur)

1.2.3.4 Determination of the Overall Impact

The overall impact is categorized as low, medium or high. Environmental and social IA is therefore calculated as follows

$$IA = SC \times L$$

Table 1-4: Determination of the Overall Impact – Negative impacts

Significance	5	5	10	15	20	25
	4	4	8	12	16	20
	3	3	6	9	12	15
	2	2	4	6	8	10
	1	1	2	3	4	5
		1	2	3	4	5
		Likelihood				

The outcome of the IA will result in a range of scores, ranging from 1 through to 25. These scores are then grouped into respective classes as described in Table.

Table 1-5: Description of the Overall Impact Scores

Value *	Score	Definition
1-8	Low	Impacts with a “Low” significance are expected to be noticeable changes to baseline conditions, beyond natural variation, but are not expected to cause hardship, degradation, or impair the function and value of the receptor. However, these impacts warrant the attention of the Project parties, and should be avoided or mitigated where practicable
9-16	Moderate	Impacts with a “Moderate” significance are likely to be noticeable and result in lasting changes to baseline conditions, which may cause hardship to or degradation of the receptor, although the overall function and value of the receptor is not disrupted.

Value *	Score	Definition
		These impacts are a priority for mitigation in order to avoid or reduce the significance of the impact.
17+	High	Impacts with a “High” significance are likely to disrupt the function and value of the receptor, and may have broader systemic consequences (e.g. environment, ecosystem or social well-being). These impacts are a priority for mitigation in order to avoid or reduce the significance of the impact

*In case the value of the overall impact is a fractional number, the value is rounded as 0.5 to round up

Table 1-6: Determination of the Overall Impact – Positive impacts

Significance	5	5	10	15	20	25
	4	4	8	12	16	20
	3	3	6	9	12	15
	2	2	4	6	8	10
	1	1	2	3	4	5
		1	2	3	4	5
		Likelihood				

The impact will be determined for each impact without relevant management and mitigation measures (pre-mitigation), as well as post implementation of relevant management and mitigation measures (post-mitigation).

The same methodology and quantification applies to assessment of residual impacts.

One of the aims of an ESIA consists of suggesting mitigation measures in order to limit any potential negative impacts affecting all physical, biological and socioeconomic resources as well as receptors due to Project activities. Mitigation measures are defined against each significant adverse impact by making use of avoidance, minimization, restoration and remediation as appropriate. The calculation is presented for each risk area in a summary risk assessment table and no narrative repetition of the quantification will be included in the specific risk chapters.

1.2.1 Limitations and constraints

While relevant secondary data from official and reliable sources were available for most of the baseline conditions, comprehensive data and records from public consultations, stakeholder engagement, information sharing and feedback on spatial plans from the year 2001 onwards are not available. The Environmental and Social Impact Assessment (ESIA) has been informed in that area to the extent available and accessible data were available.

1.2.2 ESIA team

The study team of the present ESIA disclosure package consists of:

- Demetres Economides, Project Manager
- Anastasia Sitara, Environmental expert
- Vuko Strugar, Environmental expert
- Ksenija Petovar, Social expert
- Ioannis Koutras, Civil Engineer, Traffic safety expert
- Vassilis Papanikolaou, Environmental expert
- Eleni Triantafyllou, Environmental expert

The biodiversity studies of October 2024 were conducted by E3Consulting and the following experts:

- Amphibians and reptiles: Katarina Ljubisavljivic
- Aquatic macroinvertebrates: Miloje Sundic and Vladimir Pesic
- Terrestrial invertebrates: Suzana Malidzan
- Bats: Belma Sestovic, Stefan Ralevic
- Flora and Habitats: Snezana Vuksanovic, Sead Hadziablahovic
- Ichthyofauna and benthic fauna: Danilo Mrdak, Dusanka Berak, Vukica Despotovic
- Mammals: Belma Sestovic, Stefan Ralevic
- Ornithofauna: Darko Saveljic

The following experts were involved in the preliminary ESIA:

- Senior non-key ESIA Expert: Demetres Economides
- International Social Expert: Nina Valcic
- Local environmental expert: Misko Buric
- Local environmental assistant: Predrag Bulajic
- Local landscape expert: Sanja Mitrovic
- Local biodiversity expert: Jelena Rakosevic
- Fish expert: Drago Maric
- Amphibians and reptiles: Katarina Ljubisavljivic
- Habitat and flora: Snezana Vuksanovic
- Birds expert: Darko Saveljic
- Mammals expert: Marina Radonjić

2 Legal and Policy framework

This section aims to provide brief overview of the EBRD Policy and Performance Requirements, other international regulatory framework and international good practices in comparison to Montenegro national legislation framework (laws and secondary laws) and domestic practices. Furthermore, it aims to identify gaps between EBRD Policies and national legislation with the potential to lead to Project non-compliance to the EBRD PRs and by that, to provide measures to be included in the following Project environmental and social performance documents, specifically the ESIA and ESMP, and others to improve the environmental and social performance of the Project in general, and secure compliance with EBRD PRs.

The Project is expected to be designed, constructed and operated in full accordance with the EBRD's Environmental and Social Policy (2019). The Project is also expected to meet all relevant Montenegrin as well as EU laws and Directives.

2.1 Overview of the Main Relevant National Legislation

The Environmental Protection Agency (EPA) was established in 2008 and became operational in 2009. Its mandate includes implementation of strategies, programmes, laws and regulations in the field of environment, implementation of international treaties within its jurisdiction, environmental permitting, EIA, Strategic Environmental Assessment (SEA), IPPC licensing, environmental monitoring, keeping relevant registers and databases, and reporting and coordination of reporting on the state of the environment. The EPA is also responsible for the provision of information to national and international organizations and to the public.

The Law on Environment (OfG. 48/08, 40/10, 40/11, 27/14, 52/16) is a key legal act on the management and protection of the environment. It establishes principles, mechanisms and the institutional framework for environmental protection in line with the requirements stemming from Montenegro's international commitments.

The table below presents the main legislative acts from the legal framework.

Table 2-1: Main national legislation regarding environmental and social parameters

Laws and regulations	Official gazette of Montenegro	Relevance
The Constitution of Montenegro	1/07 adopted on 25.10.2007, with sixteen amendments	The Constitution of Montenegro defines Montenegro as a state of civil, democratic, ecological and of social justice, based on the rule of law. Montenegro is by Article 1. of the Constitution proclaimed as a "green" and ecological state, adding that the state is responsible for the preservation of nature and sound environment, adding the right to sound environment a list of basic human rights.
Law on Environment	55/16	The Law on Environment establishes principles, mechanisms and the institutional framework for environmental protection in line with the requirements stemming from Montenegro's international commitments. The Law describes such principles as an integrated approach to environmental protection, cooperation among governmental authorities at different levels and between governmental authorities and stakeholders, access to information

Laws and regulations	Official gazette of Montenegro	Relevance
		and public participation, and the polluter pays, and user pays principles
The Law on Environmental Impact Assessment	80/05, 40/10, 40/11, 27/13 and 52/16, 75/18	This Law regulates the procedure for assessing the impact of the study on projects that can have a significant impact on the environment, the content of the impact assessment study, the participation of stakeholders and organizations and the public, the assessment and approval process, notification of projects that can have a significant impact on the environment other countries, supervision and other issues of importance for the assessment of environmental impacts.
Rulebook regulating documentation submitted with request for EIA	19/19	It regulates in more detail the documentation submitted together with request to decide on the need for preparation of the environmental impact assessment study.
Law on Integrated Prevention and Control of Environmental Pollution	80/05	The Law indicates the conditions and the procedure for issuance of integrated permits for installations and activities. A number of implementing regulations have been adopted, including the Regulation on the types of activities and facilities that require integrated permits (OfG. 7/08).
Law on Air Protection	25/10, 40/11 and 43/15	The Law clarifies the competencies of the EPA and defines a strategic framework for air protection, as well as strengthens the harmonization with obligations resulting from Montenegro's international commitments and relevant EU directives. The Law envisages a range of measures for the prevention and reduction of air pollution such as setting limit values for emissions from stationary and mobile pollution sources and setting national emission ceilings for specific pollutants, as well as phasing out ozone-depleting substances
Law on nature protection	76/06, 51/08, 21/09, 40/11, 54/16	The Law describes the classification of protected natural assets. These include: (i) protected areas – strict nature reserve, national parks, special nature reserves, nature parks, nature monuments, protected habitats and landscapes with outstanding features; (ii) areas of ecological network This Law also predicts the preparation of a by-law in the form of List of wild species of plants, animals and fungi that are endangered or can become endangered, rare and endemic, and which have a special importance in terms of the genetic, ecological, ecosystem, scientific, health and economic aspects. This List is not yet prepared, but there is Decision on putting under protection some plant and animal species (OfG. 76/06). There is also in place the Rulebook on the conditions for transport and method of processing with protected wild species during the transportation). (iii) protected speleological, geological and paleontological sites.

Laws and regulations	Official gazette of Montenegro	Relevance
Law on National Parks	56/09, 40/11, 28/14 and 39/16	The Law defines the borders, level of protection, development limitations within natural parks, permitted resource uses and how the national parks should be managed. This Law ensures the protection and improvement of the National Parks by defining conditions for protection; rational use of the national parks resources; sustainability and development of flora, fauna and fungi species and their communities; protection and improvement of special natural values; research and usage of national parks for the needs of developing science, education, tourism, culture and recreation; prevention of actions that can disturb the basic characteristics and properties of national parks; and for environmental protection.
Law on Municipal Wastewater Management	2/17	The Law stipulates the obligation to treat municipal wastewater, WWTP construction deadlines, monitoring and method of monitoring discharged municipal wastewater. The owner of a building must connect his or her building to a collector system connection within a period of not more than 12 months from setting the collector system into operation and the wastewater which is discharged into the recipient must be previously treated in accordance with the standard.
Law on Waste Management	64/11 and 39/16	The Law requires the waste producer to make all efforts to prevent and reduce the generation of waste. It also provides for extended producer responsibility. Holders of waste are obliged to ensure the treatment of waste. If the treatment is impossible or unjustified from the point of view of cost efficiency or environmental protection, the holder of waste should ensure the disposal of that waste. Separate collection is mandatory for paper, metal, plastic, glass and bio-waste. Separate collection, and collection of municipal waste for treatment, are the responsibility of local self-government authorities.
Law on Chemicals	51/17	The Law regulates the classification, packaging and labelling of chemicals, and transport, import and export of dangerous chemicals. The Law stipulates the obligation of the exporter or supplier to provide a Safety Data Sheet to each distributor or future user of the dangerous chemical, as well as to present to the competent authorities a Chemical Safety Report prepared on the basis of a chemical safety assessment, together with measures to reduce and control the risks.
Law on Water	27/07, 32/11, 47/11, 48/15, 52/16, 55/16, 2/17, 80/17 and 84/18	The Law stipulates the principles of water management. The basic units of water management are two river basin districts. The Law envisages the development of a water master plan for the whole country and of water management plans for each river basin district or for parts of a river basin district. Following the adoption of the water management plans, the Government should adopt a programme of measures for each river basin district.

Laws and regulations	Official gazette of Montenegro	Relevance
Law on the Protection against Environmental Noise	28/11, 28/12, 62/13, 1/14, 9/15 and 2/18	A number of responsibilities for implementation of measures prescribed by the Law are vested with local self-government authorities. They are responsible for their own acoustic zoning. In all municipalities, acoustic zoning has already been done, on the basis of the Rulebook on the limitation of noise in the environment, the methods of determining the noise indicators and acoustic zones and methods of assessment of adverse effects of noise
Law on Roads	42/04, 21/09, 54/09, 40/10, 36/11, 40/11 92/17 and 82/2020	This Law regulates the legal position, development, maintenance, protection, management and financing of public roads. Construction and reconstruction of public roads is carried out in accordance with the law (concerns issues related to traffic on state roads, temporary closing of state roads (for construction of facilities), authority for licensing and supervision on state roads, safety measures during construction works).
The Law on Spatial Planning and Construction	64/17, 44/18, 63/18, 11/19, 82/20	This Law regulates the system of arrangement of the territory of Montenegro, the manner and conditions for the construction of structures, as well as other issues of importance for landscaping and construction of structures. It defines the process of adoption of the planning documents for construction of facilities (spatial plans) including defining the public interest for the expropriation of properties, in order to build the planned facilities. It envisages the disclosure, consultations and institutional appeals mechanism, in lieu with recourses available under other laws, prior to adoption of general spatial plans, detailed spatial plans and urbanistic plans. This Law centralized spatial planning and construction at the central government level, thus abolishing the right of local authorities to adopt and issues spatial plans and permits.
Expropriation Law	55/00 12/02, 28/06, 21/08, 30/17 75/18, 33/24	This Law regulates the process of involuntary resettlement when public interest is established by separate Law or by the Government of Montenegro. It recognises the expropriation as deprivation or limitation of proprietary rights to immovable property, when this is of public interest and differs cases of expropriation that changes the owner of expropriated immovable property (complete expropriation), the determination of easement rights on immovable property and lease on the land for maximum of three years.
Law on Local Self Government	2/2018; 34/2019; 30/2020.	The Law regulates the functioning of municipalities
Law on Local Self Government Financing	2010, amended 2018	The Law lays out the financial autonomy of municipalities as well as fiscal regulation. The Ministry of Public Administration is in charge of the supervision of local governments.
Labour Law	49/08, 074/19, 006/21, 059/21	Regulates rights and obligations of employees, the methods and procedures regarding those rights, the way of encouraging employment, facilitating flexibility in the labour market, branch and

Laws and regulations	Official gazette of Montenegro	Relevance
		individual collective agreements and labour contracts etc. Montenegro ratified 75 ILO conventions, including all eight fundamental conventions.
Law on work safety and health	34/14 and 44/18	Law on work safety and health defines that occupational health and safety is provided and implemented by applying modern technical and technological, organizational, health, social and other measures and means of protection in accordance with that Law, other regulations, ratified and published international treaties. In developing design plans for new, reconstructed or adapted facilities, design, management system and conducted work by the employees must include and establish the prescribed occupational safety measures in accordance with this Law and technological project assignment.
Law on Road Traffic Safety	33/12 and 58/14	Regulates traffic signalization, security provisions for temporary closure or changes of traffic on roads (horizontal and vertical signalling, light signalling, telecommunication devices, etc.), driver permits for all sort of vehicles, technical review for vehicles in traffic etc. It also regulates traffic signalization on parts of road where obstacles or damage occur or where the works are carried out.
Law on the protection of cultural heritage	49/10, 44/17 and 18/19	The Law aims at protection of cultural heritage as preservation and improvement, ensuring the sustainable use of cultural heritage, according to their traditional and appropriate uses, for human development and quality of life, spreading knowledge about the values and importance of cultural heritage, providing for the conditions of cultural heritage, in accordance with their purpose, to serve for cultural, scientific and educational needs of individuals and society. It also defines procedure for chance finds cultural heritage encountered unexpectedly during projects.
Law on the Prohibition of Discrimination	46/10, 18/14 and 42/17	The Law prohibits discrimination as any form of unjustified, legal or factual, direct or indirect difference, or unequal treatment as well as priority to a person in relation to other persons, based on race, skin colour, nationality, social or ethnic origin language, religion or belief, political or other opinion, gender, gender identity, sexual orientation, health status, disability, age, financial status, marital status, or family status, assumption of belonging to a group, a political party or another organization, and other personal qualities.
Law on Minority Rights and Freedoms	31/06, 38/27, 2/11 and 31/17	The Law protects the rights of the autochthonous and ethnic minorities and their members including general human and civil rights and freedoms guaranteed to all citizens, as well as protection special minority rights and freedoms.
Law on agricultural land	15/92 and 32/11	The Law regulates use of agricultural land, including planning, development, commasation, change in use and property etc.
Law on forests	74/10 and 47/15	The Law regulates the rights and obligations of forest owners, forests in state ownership and concessions, planning documents for the regulation and protection of forests, public discussion of plans etc.

Laws and regulations	Official gazette of Montenegro	Relevance
Law on public procurement	42/11, 57/14, 28/15 and 42/17	The Law defines the process of public procurement, additionally, that evidence of professional technical and personnel training can be acquired, including established quality management system, protection of the environment, work safety etc. which is essential for implementing EBRD Performance Requirements regarding obligations of contractors, sub-contractors and third parties.
Law on the peaceful resolution of labour disputes	16/07, 53/11, 42/15 and 55/16	The Law provides with internal grievance mechanism for labour disputes of employees, and defines the settlement procedure, holding arguments, providing relevant documentation, expert opinions, closing arguments and deadline for arbitrate decision.
Law on property and property relations	19/09	The Law regulates property rights, ownership and easement rights over immovable property. The provisions of this law are essential in determining displaced persons legal rights over property that are being under the Project impact, including which owners of property are considered to be with legally recognizable rights or claims to the property and, owners with customary claims to the property.
State Survey and Real Estate Cadastre Law	29/07, 32/11, 43/15, 37/17 and 17/18	The Law regulates the state survey, real estate cadastre and registration of immovable property rights and other issues of importance to the state survey and cadastre.
The Family law	01/07 and 53/16	The Law defines shared spouses' assets that constitutes the property that the spouses acquire in the course of work the duration of the marital community, as well as income from that property. There is a legal presumption (under the Family law) that the title to property acquired during the life of marriage is equally divided amongst spouses as marital shared assets if they haven't agreed otherwise, which is important legal provision for gender equality and EBRD Policy Requirement.
Law on Social Housing	35/13	The Law proclaims the right to social housing that can be realized by natural persons. It also provides with definition of beneficiaries to social protection which is compatible with the vulnerable groups reference as made to the purpose of the EBRD PR. This law can influence the impact on displaced persons with no legal rights to the property they are occupying in the resettlement process
Law on State Administration	78/18	The Law regulates actions and organization of the state administration, entrusting public administration authority, as well as other issues of relevance to state administration affairs.
Law on extra-judicial proceedings Law on Civil Procedure Law on Administrative Procedure Law on administrative disputes	27/06 and 20/15. 22/04, 76/06, 48/15 and 51/17. 56/14, 20/15, 40/16 37/17, 54/16.	The Laws provide all stakeholders regular court process and appeal mechanism in various parts of the Project phases.

Laws and regulations	Official gazette of Montenegro	Relevance
Law on protection of population from infectious diseases	12/18	The Law defines facilities that includes mandatory health and sanitary supervision, and it includes collective accommodation of children or adults (including worker accommodation) etc.
Law on protection and rescue	13/07, 32/11 and 54/16	The Law provides with provisions on obligation, including legal entities, employers etc. on discovery and prevention of natural hazards, fire, technical and technological accidents, and other disasters, as well as rescue of citizens and material goods endangered.
Rulebook on property value assessment methodology	64/18	The Law defines rules of value property assessment including assessment made in process of expropriation.

In order to facilitate the Bar - Boljare Highway project, on December 8, 2014 Montenegro adopted a Law on Bar - Boljare Highway, in a form of Lex specialis. Brief overview of this Law is presented below. It regulates some issues that are of importance for the ESIA and Project general environmental and social performance and compliance with the EBRD Policy and PRs.

Table 2-2: Law on Bar - Boljare Highway

Montenegro law	Brief description
Law on Bar - Boljare Highway (OfG.52/14)	For the purposes of implementation of the Bar-Boljare Highway, this Law regulates a special expropriation procedure, the process of preparation and review of main design, the building permit requirements, the requirements for execution of preparatory works, taxes, customs duties and other levies. This means this Law derogated some provisions of the Expropriation law, The Law on Spatial Planning and Construction, several import and tax laws and by-laws etc. Asked to summarize those changes in few words, we would say it made some of the processes more expeditious to the investor/contractor, dividing the Project into phases, allowing phased design and construction, which is beneficial to the Highway project. However, some changes in the expropriation process can be prejudicial to the social performance of the Project, as it opens minor additional gaps to the EBRD PRs, which will be further analysed in this Report.

2.2 Montenegrin Legal Framework on ESIA procedure

2.2.1 Montenegrin Legal Framework on EIA procedure

The Environmental Impact Assessment (EIA) process is regulated by the Law on Environmental Impact Assessment (Official Gazette of the Republic of Montenegro, No. 80/05, 40/10, 40/11, 27/13, 52/16, 75/18) and other regulations adopted on the basis of this Law.

The scope of EIA was harmonized with the Convention on Environmental Impact Assessment in a Transboundary Context (Espoo Convention) and EIA Guidelines have been issued. Secondary legislation (Decree on projects for which the environmental impact assessment is carried out (OfG. 47/13, 53/14 and 37/18), Rulebook on the close content of the documentation submitted with the

request for deciding on the need for elaboration of the Study (OfG. 19/19), Rulebook on detailed content of an Environmental Impact Assessment Study (OfG. 19/19)) was amended in 2019. As a result, the legal framework for EIA is well aligned with the EIA Directive 2011/92/EU and the Espoo Convention.

Concerning the criteria for projects requiring an EIA, Montenegro has chosen for some activities to apply stricter thresholds as compared with the EU mandatory list of EIA installations. For instance, the Law on Nature Protection (OfG. 51/08, 21/09, 40/11, 62/13, 6/14) takes into consideration the need for an “appropriate assessment” that is required for projects that could have significant effect on the conservation and integrity of ecologically significant areas, i.e. the future Natura 2000 sites. For projects that need both an EIA and appropriate assessment, the latter should be done as part of the EIA procedure. If an EIA is not necessary but appropriate assessment is needed, a separate procedure has to be carried out by the EPA.

The Environmental Impact Assessment is defined by the Law as a preventive environmental protection measure, where:

- public and stakeholder consultation is conducted,
- analysis of alternative measures in order to collect data is carried out,
- prediction of the harmful effects of certain projects on the life and health of people, flora and fauna, land, water, air, climate and landscape, material and cultural goods and the interaction of these factors is made
- proposal of certain measures that can prevent, reduce or eliminate adverse effects is carried out.

The impact assessment includes projects in the fields of: industry, mining, energy, transport, tourism, forestry, agriculture, water management, waste management, utilities and projects planned in a protected natural asset or special purpose area defined by the Decree on the Establishment of the List of Projects for which is a mandatory impact assessment and List of projects for which an environmental impact assessment may be required ("Official Gazette of the Republic of Montenegro", No. 20/07).

The competent authority responsible for the implementation of the impact assessment procedure is:

- the authority responsible for environmental affairs - for projects for which consents, approvals and licenses are issued by another state administration body;
- local government body competent for environmental protection activities - for other projects for which approvals, approvals and licenses are issued by other local government bodies.

Starting the process of impact assessment:

- Phase I - Decision-making process on the need for environmental impact assessment of the project
- Phase II - Procedure for determining the scope and content of the Environmental Impact Assessment Study

The Rulebook on the content of the Environmental Impact Assessment Study defines a detailed content of the study, including a qualitative and quantitative presentation of possible changes in the environment during the project, regular work, in the event of an accident, and assessing whether the changes are temporary or permanent.

The Law explicitly stipulates that the implementation of the project cannot be undertaken without the implementation of the environmental impact assessment procedure and obtained consent to the Environmental Impact Assessment Study, or decision that there is no need for the EIA Study.

- Phase III - Procedure for giving approval to the Environmental Impact Assessment Study

Since the Environmental Impact Assessment Study is an integral part of the technical documentation needed to obtain a building approval, as a rule, it is developed at a very early design stage at the level of the conceptual or main design. More specifically:

1. At the request of the project holder, the competent authority shall issue a decision on granting approval to the EIA Study or on rejecting the request for granting approval to the EIA Study, based on the conducted procedure and the report of the Technical Commission.
2. The Competent Authority establishes a technical commission for the evaluation of the Environmental Impact Assessment Study. The Technical Commission evaluates the EIA Study in accordance with the Law and the Rules of Procedure of the Technical Commission for evaluation of the Environmental Impact Assessment Study.
3. Public participation is ensured at all stages of the environmental impact assessment process: the decision-making process on the need for impact assessment, the procedure for determining the scope and content of the EIA Study and the procedure for giving approval to the Environmental Impact Assessment Study. The competent authority is obliged to inform the interested authorities and organizations and the public about the submitted request, provide insight in submitting the request and documentation that is attached to the request and provide public insight, organize the presentation and conduct a public discussion on the Environmental Impact Assessment Study.

The following figure presents the national EIA approval procedure.

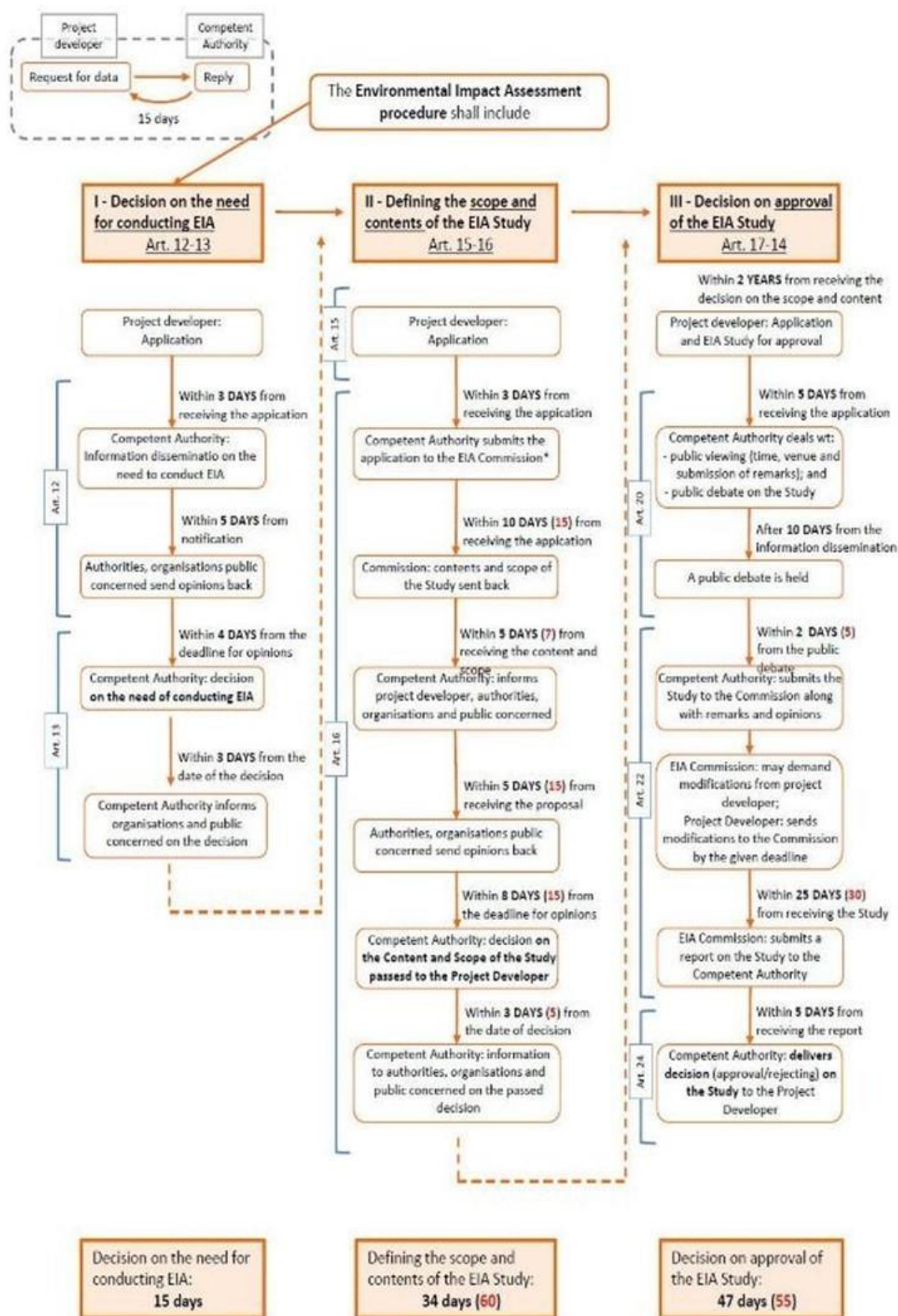


Figure 2-1: EIA approval national procedure

The Environmental Protection Agency is in charge for the Environmental Impact Assessment procedure and elaborate approval, in accordance with the EIA law and the Ministry of Agriculture and Rural Development (Directorate for Water Management) is in charge for the Water Permit.

According to the Decree on projects for which the environmental impact assessment is carried out (OfG. 47/13, 53/14 and 37/18), the proposed Project is on the List I, article 10 (d) "*Construction of a new road of four or more lanes, or realignment and/or widening of an existing road of two lanes or less so as to provide four or more lanes, where such new road or realigned and/or widened section of road would be 10 km or more in continuous length*".

An overview of the relevant laws governing the permitting process is provided in the table below.

Table 2-3 Relevant laws related to permitting process

Law	OfG.	Relevance for this ESIA
Law on Spatial Planning and Construction of Structures	64/17, 44/18, 63/18, 11/19, 82/20	Art. 55 - defines the contents of urban and technical conditions for projects Art. 73 – Technical documentation is prepared in accordance with the urban-technical conditions The issuance of urban-technical conditions is defined in Article 74 Art. 181 defines the issuance of a Building Permit for a Complex Engineering Facility Art. 190 defines the issuance of a Use Permit for a Complex Engineering Facility
Law on Environmental Impact Assessment	80/05, 40/10, 40/11, 27/13 52/16 75/18	Article 6 - The obligation to obtain an approval for the impact assessment Art. 17-26 - Deciding on approval of the Impact Assessment
Rulebook on the contents of requests and documents for the issuance of Water Acts, way and conditions for mandatory advertising in the procedure for establishing Water Conditions and Water Acts Contents	27/07	A Water Permit, according to the Water Law, Art. 115 is required for: • River diversion • Construction of highways, motorways and bridges larger than 15m; • Exploitation of river deposits; • Geological and Hydro-geological investigations; • Opening new non-hazardous waste disposal sites. Art. 3 and 4 - Content of the documentation for the issue of water conditions Art 5 and 6 - Content of the documentation for the issue of water consent Art. 7, 8 and 9 - Content of the documentation for the issue of water permit

2.2.2 Legal framework for SIA and expropriation procedure

EIA Law does not require a Social Impact assessment to be undertaken in the meaning assigned under EBRD PR1.

The only legal requirement is preparation of and elaborate for expropriation, which has been prepared based on the Adopted Preliminary Design which is considered as a plain inventory of persons and assets affected by land acquisition and tackles only formal title holders. There are no requirements to conduct an integrated and comprehensive assessment of social impacts as envisaged in the EBRD PR 1,2,4,5 and 10. Furthermore, social impact is overlooked, and planning documents are intended for

obtaining permits and licenses, and less demanding on social performance throughout the life of any project.

Several plans and documents of importance are required by laws of Montenegro to be developed that are in correlation with the project and partially include assessment of social impacts: Spatial plan of Montenegro, Urban project, concept and main design - regulated by Law on Spatial Planning and Construction (OfG.64/17 (..) 82/20). In this adoption process, there is a procedure of public inquiry. It envisages disclosure, consultations and grievance mechanism prior to adoption of National spatial plan, detailed spatial plans and urbanistic plans. However, these processes don't consider tangible social impacts of the projects outside the planning phase as defined in the EBRD PR 5.

The most important aspect of SIA at the Project level is the impact stemming from involuntary resettlement impact. The Expropriation Law (55/00, 33/24) regulates the process of involuntary resettlement when public interest is established by separate Law or by the Government of Montenegro.

The Law on Expropriation (Official Gazette No. 055/00, changes 012/02, 028/06, 021/08, 030/17, 75/18, and 33/24) focuses on the process of acquiring and providing compensation, or in specific circumstances replacement property, for any affected property needing to be expropriated in the public interest. It addresses physical and economic displacement for those stakeholders who have legal rights according to the law. The Law on Expropriation does not use the term "involuntary resettlement", but instead uses the term "expropriation" which is based on the governments eminent domain power. The Law on Expropriation also defines the requirements and agreements related to expropriation and compensation issues.

The main provisions of the Law are as follows³:

- Outright purchases of immovable property (land, residential and other structures) are defined as full (complete) expropriation. Partial (incomplete) expropriation includes the instigation of an easement over the immovable property or a lease of land for up to 3 years. Temporary occupation of land is also possible when needed for construction or other works (accommodation of workers, materials, machines, etc.).
- The expropriation proposal may be submitted by the Beneficiary of expropriation only after public interest has been declared (by law or by the Government of Montenegro). The proposal is submitted to the authority competent for property affairs – the regional unit of the municipality on whose territory the property proposed for expropriation is located.
- The expropriation proposal has to include: (i) information on the properties to be expropriated, (ii) proof that public interest has been declared, and (iii) proof that the expropriation beneficiary has paid the entire amount of compensation to the account of the Finance Ministry in advance.
- The Law allows for negotiated settlements on the amount and type of compensation between the expropriation beneficiary and property owners, until the Decision on Expropriation becomes valid. In that case, the expropriation procedure is terminated.

- If a negotiated settlement has not been reached, the competent authority issues a Decision on Expropriation but is required to enable property owners to raise their concerns before issuing the Decision. The amount of compensation is specified in the Decision.
- Affected persons are entitled to lodge an appeal against the Decision with the Finance Ministry. However, the appeal does not hold up the enforcement of the Decision. Any decisions of the Finance Ministry may further be challenged by affected persons by initiating an administrative dispute with the Administrative court. The expropriation beneficiary may acquire possession of the affected property when the Decision on Expropriation becomes valid, provided that compensation has already been provided to the property owner. Exceptions are allowed for urgent cases. If it is determined that the expropriation of a part of the owner's property would result in the owner having no economic interest in using or not being able to use the remainder of the property, that remaining part of the property will also be expropriated at his/her request. All persons who have formal legal rights on land and structures, as registered by the Cadastre, are entitled to compensation. Compensation provided to formal owners of property is defined as fair compensation in cash or in kind (replacement property). When compensation is provided in cash, it is determined "in the amount of the market value of similar properties in the area, plus any losses of income during the resettlement period). When compensation is provided in kind, the owner is provided with replacement property at the same value as the previous property, plus any losses of income during the resettlement period.
- The Law regulates in detail the types of compensation for different assets (agricultural land, construction land, residential facility, commercial premises, forests, crops, etc.)
- The Law stipulates that land can be accessed only after the Decision of Expropriation is legally binding given that the compensation has been paid or replacement property provided or if the owner has refused to receive the compensation amount (which needs to be evidenced). The Law allows the land to be accessed also in cases of urgency to construct a specific structure, or complete works or to prevent significant damages to the public on a case-by-case basis which is decided by the Administration for property. Before such a request is upheld, the Beneficiary of expropriation must have enumerated the land and assets and assessed their values. Payment of the set compensation is not required as per Article 29a.
- Article 35 requires compensation to be paid at market value, increased for moving and transitional costs.
- Article 46 requires that the socio-economic conditions and specific vulnerabilities must be taken into consideration which can lead to an increased compensation if these are "of significance to the livelihood of the owner" (large number of household members, number of household members earning income, the health status of the household members, monthly income of the household, and other socio-economic features, etc.).
- The amount of compensation is determined by a committee established by the competent authority and approved by the competent authority. The committee consists of five members, of which at least three members must be court accredited experts for valuation of property. The methodology for valuation is defined by the *Ordinance on Methodology for Assessing Property Value*⁴ adopted by the Finance Ministry. The Ordinance refers to the International Valuation Standards and European Valuation Standards as the basis for valuation.

- Property rights on the new property are formally transferred based on the final Decision on Expropriation and proof that compensation has been provided/paid.
- The Law foresees rights of PAPs (those with formal legal rights) to appeal at many stages of the expropriation procedure, beginning with administrative and judicial appeals (i.e. against the decision on public interest and the decision on expropriation).
- Those who have formal legal rights are informed throughout the expropriation process (i.e. passing of the decision on public interest; before the decision on expropriation is passed, the municipal office in charge of expropriation has to invite the affected person with formal legal rights to a meeting to present any facts which may be relevant for expropriation).
- The Law on Spatial Planning and Construction defines cases of removal of an informally built structure of primary residence (constructed prior to the Cut-off date), when the local municipality is obliged to provide alternative accommodation to the household – this coupled with some Court decisions in the past enables the BoE to pay at replacement cost structures constructed without a building permit.

2.3 Overview of the Main Relevant International Regulatory Framework

2.3.1 The EU EIA Directive

The Environmental Impact Assessment (EIA) was introduced for the first time in Europe in 1985 by the EIA Directive (85/337/EEC) and represents a key instrument for European Union environmental policy. The EIA Directive of 1985 has been amended three times:

- Directive 97/11/EC brought the EIA Directive in line with the UN ECE Espoo Convention on EIAs in a Transboundary Context. The 1997 Directive widened the scope of the EIA Directive by increasing the types of projects covered and the number of projects requiring mandatory environmental impact assessment (Annex I). It also provided for new screening arrangements, including new screening criteria (included in Annex III) for Annex II projects, and established minimum information requirements;
- Directive 2003/35/EC sought to align EIA Directive provisions with the Aarhus Convention on public participation in decision-making and access to justice in environmental matters; and
- Directive 2009/31/EC amended Annexes I and II of the EIA Directive, adding projects related to the transport, capture and storage of carbon dioxide (CO₂).

On 28 January 2012, Directive 2011/92/EU on the effects of public and private projects on the environment was published in the Official Journal. Directive 2011/92/EU codifies Council Directive 85/337/EEC on the assessment of the effects of certain public and private projects on the environment (EIA Directive) and its associated amendments. Directive 2011/92/EU fully preserves the content of the acts being codified and does no more than bring them together with only such formal amendments as are required by the codification exercise itself.

The scope of this Directive is to ensure that plans, programmes and projects likely to have significant effects on the environment undergo an Environmental Assessment prior to their approval or authorisation. While Annex I contain a list of projects for which the EIA is mandatory, Annex II defines those categories of projects whose ESIA is optional and at the discretion of the community member states.

According to the Directive 97/11 EC, the proposed Project falls into Annex I, Category 7 (c) "Construction of a new road of four or more lanes, or realignment and/or widening of an existing road of two lanes or less so as to provide four or more lanes, where such new road or realigned and/or widened section of road would be 10 km or more in continuous length".

The EU Directive on Environmental Impact Assessment (EIA Directive⁴ 2014/52/EU) defines the requirements for assessment of potential adverse effects on the environment of some public and private projects that are expected to have significant impact on the environment. The EIA is conducted prior to the issue of the construction permit and approval for project implementation. The environmental impact may be the impact on human beings or on biological diversity, on the quality of soil, water, air or other natural resources, on the climate, or on the historical and cultural heritage, as well as on the interaction between these elements. The public and other parties are to be consulted on the EIA as consultation with the public is a key feature of environmental assessment procedures.

2.3.2 Other Most Relevant EU Directives

Other relevant EU Directives considered are the following:

- Water Framework Directive establishing a framework for Community action in the field of water policy (2000/60/EC)
- Directive on the assessment and management of flood risks (2007/60/EC) - Floods Directive
- Directive 2008/105/EC on environmental quality standards in the field of water policy (amending and subsequently repealing Council Directives 82/176/EEC, 83/513/EEC, 84/156/EEC, 84/491/EEC, 86/280/EEC and amending Directive 2000/60/EC) establishes, among others: (1) limits on concentrations in surface waters of 33 priority substances and 8 other pollutants (Annex I); (2) the possibility of applying Environmental Quality Standards (EQS) for sediment and biota, instead of those for water; (3) the possibility of designating mixing zones adjacent to discharge points where concentrations of the substances in Annex I might be expected to exceed their EQS; and (4) a requirement for Member States to establish an inventory of emissions, discharges and losses of the substances in Annex I.
- Directive 2006/11/EC on Dangerous Substances lays down rules for protection against, and prevention of, pollution resulting from the discharge of certain substances into the aquatic environment of the Community.
- Groundwater Directive 2006/118/EC established a regime which sets groundwater quality standards and introduces measures to prevent or limit inputs of pollutants into groundwater.
- Directive 2012/18/EU on the control of major-accident hazards involving dangerous substances (amending and subsequently repealing Council Directive 96/82/EC), obliges Member States to ensure that operators have a policy in place to prevent major accidents.
- Environmental Noise Directive 2002/49/EC defines a common approach intended to avoid, prevent or reduce on a prioritized basis the harmful effects, including annoyance, due to exposure to environmental noise, including, among other, assessment methods for the noise indicators.
- Directive 2000/14/EC on the approximation of laws of the Member States relating to noise applies to equipment for use outdoors listed in Articles 12 and 13 and defined in Annex I of this Directive.
- Directive 2008/50/EC 16 on ambient air quality and cleaner air for Europe;

⁴Directive 2014/52/EU of the European Parliament and of the Council of 16 April 2014 amending Directive 2011/92/EU on the assessment of the effects of certain public and private projects on the environment

- Directive 2008/98/EC 18 on waste (Waste Framework Directive)
- Habitats Directive 92/43/EEC aims to contribute towards ensuring biodiversity through the conservation of natural habitats and of wild fauna and flora in the territory of the Member States.
- Birds Directive 2009/147/EC relates to the conservation of all species of naturally occurring birds in the wild state in the territory of the Member States.
- Directive 2008/96/EC on road infrastructure safety management
- Directive 89/391/EEC – Occupational Health and Safety
- EC Directive 98/59/EC of 20 July 1998 on the approximation of the laws of the Member States relating to collective redundancies and collective dismissals

The European Commission's Directive on improving the safety of the European road network⁵ was to be implemented by EU Member States by the end of 2010, representing a first step towards common quality management in infrastructure safety in Europe.

The Directive currently only applies to the Trans-European road network (TEN) and thus only to the highest-ranking roads, mostly motorways and expressways which already have a relatively high road safety level. The European Commission encourages all Member States also to apply the directive correspondingly to all other roads in their own responsibility. In this sense the Directive should also be implemented into the road safety standards of Montenegro as it is one of the best capacity building measures for road safety in the field of infrastructure.

The procedures covered by the Directive include:

- Road Safety Impact assessment (RSIA) to introduce the factor road safety into the impact assessment procedures for bigger road projects at a very early planning stage
- Road Safety Audits (RSA) for new road at the construction planning stage
- Road Safety Inspection (RSI) for existing roads
- Network Safety Management (NSM) and Black Spot Management (BSM) to identify and remediate dangerous sections and locations
- Education, training and certification of Road Safety Auditors

2.3.3 Relevant International Multilateral Agreements

Conventions and international agreements that Montenegro has adhered related to this project are presented in the following table:

⁵Directive 2008/96/EC of the European Parliament and of The Council of 19 November 2008 on road infrastructure safety management

Table 2-4: International agreements relevant to the project

Subject	Title	Date	Summary
Hydrometeorology	Convention of the World Meteorological Organization	2007	WMO provides world leadership and expertise in international cooperation in the delivery and use of high-quality, authoritative weather, climate, hydrological and related environmental services by its Members, for the improvement of the well-being of societies of all nations.
Climate change	UN Framework Convention on Climate Change	2006	Aims to reduce greenhouse gas emissions to combat global warming.
	Paris Agreement	2016	It is a legally binding international treaty on climate change. Its goal is to limit global warming. Implementation of the Paris Agreement requires economic and social transformation, based on the best available science.
Protection of ozone layer	Montreal Protocol on Substances that Deplete the Ozone Layer	2006	Aims to protect the ozone layer by phasing out ozone depleting substances.
Waste	Convention on the Control of Transboundary Movements and Disposal of Hazardous Wastes (Basel Convention)	2006	To reduce the transboundary movements and amounts of hazardous wastes and non-hazardous wastes to a minimum, and to manage and dispose of these wastes in an environmentally sound manner.
Biological diversity	UNESCO Convention Concerning the Protection of the World Cultural and Natural Heritage	2006	Aims to identify protect and preserve cultural and natural heritage worldwide. The General Conference of the United Nations Educational, Scientific and Cultural Organization (UNESCO) meeting in Paris in 1972 adopted the World Heritage Convention. It proclaims that each State Party to this Convention recognizes that the duty of ensuring the identification, protection, conservation, presentation and transmission to future generations of the cultural and natural heritage and situated on its territory. Montenegro became member State of UNESCO in June 2006, and principles of the Convention are enshrined in its legislation.
	Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES Convention)	2006	Ensures that international trade in specimens of wild animals and plants does not threaten their survival.
	European Convention for the Protection of European Wildlife and the Natural Habitats (Bern Convention)	2009	Aims to ensure conservation and protection of wild plant and animal species and their natural habitats (listed in convention Appendices I and II), to increase cooperation between contracting parties, and to regulate the exploitation of those species (including migratory species) listed in convention Appendix III.
	UN Convention on Biological Diversity (Rio Convention)	2006	Commitment to conserve biological diversity, to use biological resources sustainably and to share equitably the benefits arising from the use of genetic resources.
	Cartagena Protocol on Biosafety to the Convention on Biological Diversity	2006	

Subject	Title	Date	Summary
	Convention on Wetlands of International Importance, Mainly Waterfowl Habitat (Ramsar Convention)	1996	Aims to halt the world-wide loss of wetlands and promote the conservation of wetlands through wise use and management.
	European Landscape Convention	2008	Promotes the protection, management and planning of the landscapes and organises international co-operation on landscape issues.
	Convention on the Conservation of Migratory Species of Wild Animals (Bonn Convention)	2009	Seeks to conserve terrestrial, marine and avian migratory species (those that regularly cross international boundaries, including international waters). Concluded under the aegis of the United Nations Environment Program.
Water resources	UN Economic Commission for Europe Convention on the Protection and Use of Transboundary Watercourses and International Lakes	2014	Aims to prevent, control and reduce transboundary impact, use transboundary waters in a reasonable and equitable way and ensure their sustainable management.
	Protocol on Water and Health of the United Nations Economic Commission for Europe Convention on the Protection and Use of Transboundary Watercourses and International Lakes	2019	Aims to protect human health by better water management and by reducing water-related diseases.
Chemicals	Stockholm Convention on Persistent Organic Pollutants	2006	Aims at the protection of human health from persistent organic pollutants
Atmospheric air	Convention on Long-Range Transboundary Air Pollution	2006	The aim of the Convention is that Parties shall endeavour to limit and, as far as possible, gradually reduce and prevent air pollution including long-range transboundary air pollution. Parties develop policies and strategies to combat the discharge of air pollutants through exchanges of information, consultation, research and monitoring.
Environmental security	Convention on Environmental Impact Assessment in a Transboundary Context (Espo Convention)	2009	Requires signatories to assess the environmental impact of certain activities at an early stage of planning and states to notify and consult each other on all major projects under consideration that are likely to have a significant adverse environmental impact across boundaries.
Environmental information	UN Economic Commission for Europe Convention on Access to Information, Public Participation in Decision-Making and Open Justice (Aarhus Convention)	2009	Grants the public rights to access information, public participation and access to justice, in governmental decision-making processes on matters concerning the local, national and trans-boundary environment. Focuses on interactions between the public and public authorities.
Human Rights	The International Bill of Human Rights		It consists of the Universal Declaration of Human Rights (adopted in 1948), the International Covenant on Civil and Political Rights (ICCPR, 1966) with its two Optional Protocols and the International Covenant on Economic, Social and Cultural Rights (ICESCR, 1966). The Universal Declaration of Human Rights with all its covenants and optional protocol was

Subject	Title	Date	Summary
			ratified by former Socialist Federal Republic of Yugoslavia which Montenegro was part of. The Constitution of Montenegro proclaims protection and guarantees of human rights embodied in the International Bill of Human Rights.
	The European Convention on Human Rights (ECHR)	2007	Formally the Convention for the Protection of Human Rights and Fundamental Freedoms, it is an international convention to protect human rights and political freedoms in Europe. The convention entered into force in 1953. All Council of Europe member states are party to the Convention. The Convention established the European Court of Human Rights (ECtHR). Human right promoted by the ECHR includes, amongst others: freedom of expression, gender equality, rights of persons with disabilities, Roma rights, migrant rights, national minorities rights, LGBT rights etc. It also promotes ensuring social rights: social security, public health, bioethics etc. On May 11, 2007, Montenegro became a full member of the Council of Europe and ratified all its conventions
	Convention on the Elimination of all Forms of Discrimination Against Women (CEDAW)	2006	It is an international treaty adopted in 1979 by the United Nations General Assembly, and it forbids any distinction, exclusion or restriction made on the basis of gender of human rights and fundamental freedoms in the political, economic, social, cultural, civil or any other field. Montenegro ratified CEDAW on 23rd October 2006 and embodied its provisions in national legislation.
Labour conditions	ILO Conventions	2006	With eight core conventions of the International Labour Organization, which are: Forced Labour Convention, 1930; Freedom of Association and Protection of the Right to Organize Convention, 1948; Right to Organize and Collective Bargaining Convention, 1949; Equal Remuneration Convention, 1951; Abolition of Forced Labour Convention, 1957; Discrimination (Employment and Occupation) Convention, 1958; Minimum Age Convention, 1973; Worst Forms of Child Labour Convention, 1999. Montenegro became ILO member state in 2006. Since then, the country ratified 75 International Labour Standards (conventions), including all eight fundamental conventions.
Workers' and community's Health & Safety	International Labour Organization Convention on Construction Safety and Health No. 167	2006	Adopted at Geneva on 20 June 1988, which Montenegro ratified and embodied its provisions into national legislations, proclaims applying modern technical and technological, organizational, health, social and other measures and means of protection.
	World Health Organisation (WHO)		WHO's standards and guidelines process regulation issues on protection of population from infectious diseases, workers accommodation, influx of workers in a local community, and standards on disease community and workers' safety related to large construction or technological projects and protection from communicable diseases in connection of workplace.

2.4 EBRD Performance Requirements

The European Bank for Reconstruction and Development is committed to promoting “environmentally sound and sustainable development” in the full range of its investment and technical cooperation activities. The ESP outlines how the Bank will address the environmental and social impacts of its projects by defining the respective roles and responsibilities of both EBRD and its clients in designing, implementing and operating projects in line with this Policy.

In order to translate this objective into successful practical outcomes, the EBRD has adopted a comprehensive set of specific Performance Requirements (PR) that clients are expected to meet, covering key areas of environmental and social impacts and issues. EBRD’s document “Environment and Social Policy” (the Policy) and related Performance Requirements (PRs) detail the commitments of the Bank to promote environmentally sound and sustainable development across the full range of its activities.

EBRD categorizes proposed projects as A / B / C based on environmental and social criteria to reflect the level of potential environmental and social impacts and issues associated with the proposed project and to) determine the nature and level of environmental and social investigations, information disclosure and stakeholder engagement required for each project, taking into account the nature, location, sensitivity and scale of the project, and the nature and magnitude of its possible environmental and social impacts and issues.

EBRD’s Environmental and Social Policy (ESP 2019) identifies those projects that require an ESIA. According to ESP Annex 2 – item 6: “Construction of motorways, express roads..... new roads of four or more lanes, or realignment and/or widening of existing roads to provide four or more lanes, where such new roads, or realigned and/or widened sections of road would be 10 kilometres or more in a continuous length” are assigned to Category A projects. A project is categorized A when it could result in potentially significant adverse future environmental and/or social impacts.

The Project has been categorized as **Category A** for EBRD requirements and is subject to a comprehensive ESIA process.

In general, a project funded by the EBRD is obligated to meet following EBRD’s Policy Requirements that are in short presented in the Table below:

Table 2-5: EBRD’s Performance Requirements

No	Name	Brief description of requirements
PR 1	Assessment and Management of Environmental and Social Risks and Impacts	This section establishes the importance of integrated assessment to identify the environmental and social impacts and issues associated with projects, defines Environmental and Social Management System (ESMS), obligation to carry out a comprehensive Environmental and Social Impact Assessment (ESIA) (for projects type A), and Environmental and Social Management Plan (ESMP), obligation of the client to identify social and environmental risks associated with its supply chain, and the obligation of Monitoring, Reporting and Review during the complete Project cycle.
PR 2	Labour and working conditions	This section promotes fundamental principles and rights of workers by requirement that the client and third parties (contractors, sub-contractor) comply (in line with ILO Conventions) and promotes Non-Discrimination and Equal Opportunity for workers during the complete Project cycle. It also obligates the client to provide an effective grievance mechanism for workers (and their organizations, where they exist) to raise workplace concerns.

No	Name	Brief description of requirements
PR 3	Resource Efficiency and Pollution Prevention and Control	This section identifies opportunities and alternatives for resource efficiency relating to the project in accordance with GIP, identifies the appropriate pollution prevention and control methods, technologies and practices (“techniques”) to be applied in order to avoid or minimize project-related greenhouse gas (GHG) emissions during the design and operation of the Project. Also it identifies other measures of resource efficiency and pollution prevention and control.
PR 4	Health, Safety and Security	This section identifies the health and safety risks and protection measures appropriate to the stage, size and nature of the project in accordance with relevant substantive EU Occupational Health and Safety (OHS) standards and GIP. It also identifies and assess project-related risks and adverse impacts to the health and safety of the potentially affected communities, develop protection, prevention and mitigation measures proportionate to the impacts and risks in accordance with GIP.
PR 5	Land Acquisition, Restrictions on Land Use and Involuntary Resettlement	This section is aiming to mitigate adverse social and economic impacts from land acquisition or restrictions on affected persons’ use of and access to assets and land, compensation for property acquisition, the obligation to restore or, where possible and improve the livelihoods and standards of living of displaced persons to at least pre-displacement levels.
PR 6	Biodiversity Conservation and Sustainable Management of Living Natural Resources	This section is aiming to the protection and conservation of biodiversity using a precautionary approach. Also, it aims to the adoption of a mitigation hierarchy approach, with the aim of achieving no net loss of biodiversity, and where appropriate, a net gain of biodiversity. Moreover, it promotes good international practice (GIP) in the sustainable management and use of living natural resources, it defines critical habitat as most sensitive biodiversity features, defines legally protected and internationally recognized areas of biodiversity value, and lastly it defines other issues and measures for protection of biodiversity and living natural resources.
PR 7	Indigenous Peoples	These standards are not relevant to the Project as Montenegro does not have distinct social and cultural groups as defined by PR7.
PR 8	Cultural Heritage	This section supports the protection and conservation of cultural heritage, adopts the mitigation hierarchy approach to protecting cultural heritage from adverse impacts arising from the Project, defines studies to be undertaken and consultation to assess potential impacts and, if necessary, the required changes in design. It also defines procedure for chance finds cultural heritage encountered unexpectedly during Project, the obligation to provide information to affected communities and stakeholders in a transparent way on any activities that might involve impacts on cultural heritage and consult with the affected communities.
PR 9	Financial Intermediaries	This standard is not relevant to the Project.

No	Name	Brief description of requirements
PR 10	Information Disclosure and Stakeholder Engagement	This section aims to provide public information disclosure and stakeholder engagement to activities associated with the Project by stakeholder identification and individuals or groups who are affected or likely to be affected, or may have an interest in the Project, to develop and implement a Stakeholder Engagement Plan (SEP) and disclose all relevant Project information and conduct public consultation as a two-way, meaningful process. It also establishes an effective grievance mechanism, process or procedure to receive and facilitate resolution of stakeholders' concerns and grievances.

2.5 Gap analysis

The table below enumerates all significant legal gaps between EBRD Policy, Performance Requirements and GIPs on one side, and Montenegro national legislation and common practices on the other, and proposes gap-filling measures for the Project to comply with EBRD PRs:

Table 2-6: Legal gap analysis

Relevant to PR	EBRD PR provision	Short gap delineation	Gap closing measure
PR 1	In category A projects it will be required of the client ⁶ to carry out a comprehensive Environmental and Social Impact Assessment (ESIA).	Several plans and documents of importance are required by laws of Montenegro to be developed, but those required documents do not represent a comprehensive and integrated assessment of the social and environmental impact.	A comprehensive ESIA package according to the EBRD requirements is prepared and disclosed
PR 1	To develop ESMP, as a programme of actions to address the Project's environmental and social impacts and other measures to meet the PRs. It may consist of a combination of documented operational policies, management systems, procedures, plans, practices and capital investments.	All legally required documents do not represent a comprehensive and integrated plan of assessment, or a programme of operational policies, management systems, procedures, plans, practices and capital investments of the social and environmental impact.	The ESMP includes an integrated set of management plans to be developed for both construction and operation of the project, ensuring the adequate addressing of environmental and social impacts.

⁶ In this section of the Report, in the description of EBRD PR provisions, the "client" is the final beneficiary of the Project (the client to the EBRD - Project Promoter), including all its affiliates and organizational units. In this Project, it refers to MoTMA - State Roads Directorate.

Relevant to PR	EBRD PR provision	Short gap delineation	Gap closing measure
PR 1	A client is required to identify social and environmental risks associated with engagement and actions of employed third parties ⁷ . The management system will include processes on assessment and monitoring of the performance of the third parties.	The national law includes obligation of all to meet legal requirements in all aspects, but there are only few provisions of responsibility of an investor to a social or environmental performance of Project associated third parties.	Environmental and social management procedures, as well as monitoring processes for the Contractor (during construction phase) and the operator (during operation phase) are thoroughly described in the ESIA package
PR 2	The client will document and communicate to all workers their rights under national labour and employment law and any applicable collective agreements, working conditions and terms of employment.	The law defines as an obligation of the employer to inform the employee about the working conditions. However, in practice workers are often left unaware of some of their legal rights and terms of employment.	Labour Management Procedure materially compliant with EBRD PR2 has been developed and applicable to the Engineer-procure-construct (EPC) contractor and any Sub-Contractor and Service Provider employing or engaging labor in relation to execution of the Project
PR 2	Where a client provides accommodation for workers, the accommodation shall in particular meet good international industry practice given in EBRD/IFC Guidance Note "Workers' accommodation: processes and standards", 2009.	The law is silent. There are no corresponding legal provisions in the national legislation.	Labour Management Procedure materially compliant with EBRD PR2 has been developed setting out requirements for accommodation (chapter 9) if accommodation is to be provided by the Engineer-procure-construct (EPC) contractor and any Sub-Contractor and Service Provider employing or engaging labor in relation to execution of the Project
PR 2	The client will provide an effective grievance mechanism for workers (and their organisations, where they exist) to raise workplace concerns. The mechanism should address concerns promptly, using an understandable and transparent process that provides timely feedback to those concerned, without any retribution	Besides the possibility of peaceful resolution of labour disputes, and court process available to employees before regular national courts, employees should be able to raise grievances before the employer. National legislation grievance mechanism provided by Labour law provisions is formal and limited.	Labour Management Procedure materially compliant with EBRD PR2 has been developed setting out requirements for setting up an effective grievance mechanism for workers (chapter 10) by the Engineer-procure-construct (EPC) contractor and any Sub-Contractor and Service Provider employing or engaging labor in relation to execution of the Project

⁷ A third party may be, inter alia, a government agency, a contractor or a sub-contractor, a supplier with whom the project/client has a substantial involvement, or an operator of an associated facility or service.

Relevant to PR	EBRD PR provision	Short gap delineation	Gap closing measure
PR 4	The client will identify the health and safety risks and protection measures appropriate to the stage, size and nature of the project in accordance with relevant substantive EU OHS standards and GIP.	The difference between Montenegro national law framework on OHS and EU OHS standards are not significant. However, the difference can be often significant in practice in typically available and acquired protective equipment, enforcement and discipline of employees in using proper equipment and applying proper measures of safety, training and knowledge of employees in applying measures of OHS.	OHS risks are identified and necessary measures are included in the ESIA package. Construction Occupational Health and Safety Management Plan is foreseen Training on OHS is included as an obligation of the Contractor in the ESMP
PR 4	The client will identify and assess project-related risks and adverse impacts to the health and safety of the potentially affected communities and will develop protection, prevention and mitigation measures proportionate to the impacts and risks. The client will cooperate with the relevant authorities and other stakeholders, as appropriate, on mitigation measures and plans.	Several laws provide provisions regarding community health and safety, considering the impacts and risks appropriate to the stage, size and nature of the project. As a general rule, national legislation provides only superficial and general provisions on stakeholder and community engagement, and disclosure of health and safety plans and provisions.	Community health and safety risks during construction are identified The ESMP foresees a Community Health and Safety Plan as a obligation of the Works Contractor
PR 4	The client will identify, evaluate and monitor the potential traffic and road safety risks to workers and potentially affected communities throughout the project life cycle and, where appropriate, will develop measures and plans to address them.		Road safety Audit has been performed for the highway within the ESIA process The drafting and Implementation of a Construction Traffic Management Plan including identification of road safety risks, relevant mitigation measures and training to the employees is included in the ESMP as a Contractor's requirement

Relevant to PR	EBRD PR provision	Short gap delineation	Gap closing measure
PR 5	The objectives of this PR include the obligation of the client to mitigate adverse social and economic impacts from land acquisition or restrictions on affected persons and to restore or, where possible, improve the livelihoods and standards of living of displaced persons to pre-displacement levels.	National legislation does not envisage overall approach and assessment need of impacts resulting from involuntary resettlements in terms of the objectives of PR5. It is limited to compensate owners for the property loss in the process of expropriation (deprivation or limitation of proprietary rights to immovable property in case there is a public interest).	A Land Acquisition and Resettlement Framework (LARF) has been developed as part of this ESIA setting out mandatory principles to mitigate adverse social and economic impacts from land acquisition or restrictions on affected persons compliant to EBRD PR5.
PR 5	Displaced persons include those who have legally recognisable rights or claims to the property, those with customary claims to the property, those with no legally recognisable rights or claims to the property (they are occupying), people experiencing loss of access to physical assets or natural resources.	The Expropriation Law guides land acquisition by using the Emminent Domain right of the State, and has a “simplified” approach to cover direct economic loss persons who have formal legal rights to the land or holders of recognisable rights resulting from expropriation. In practice, there are no gaps when it comes to persons without formal rights (in particular in cases of physical displacement from structure constructed without a building permit). MONTEPUT has confirmed that its practice is based on the right to adequate housing and the recent Decision of the Court of Human rights in Strasbourg, France.	A Land Acquisition and Resettlement Framework (LARF) has been developed as part of this ESIA setting out mandatory principles to mitigate adverse social and economic impacts from land acquisition or restrictions on affected persons compliant to EBRD PR5
PR 5	Compensation is calculated at replacement cost value of property. Replacement cost is complex due to variety of property, but the value is usually calculated as the market value of the assets plus the transaction costs related to restoring such assets (registration and transfer taxes). Depreciation of structures and assets should not be taken into account.	Expropriation law proclaims that owners of expropriated property have the right to fair compensation. Fair compensation is in cash, which is determined at the level of the market price of the same type of property in the same or similar area of the municipality, increased by conceivable lost profit in the period of relocation depending of the use of property and the cost of moving, according to circumstances. Depreciation is taken into account, and also if the value of the immovable property of the previous owner is significantly increased due to the user's investment on expropriated land fair compensation is determined by the proportionate reduction of the market price in relation to these circumstances.	A Land Acquisition and Resettlement Framework (LARF) has been developed as part of this ESIA setting out mandatory principles to mitigate adverse social and economic impacts from land acquisition or restrictions on affected persons compliant to EBRD PR5.

Relevant to PR	EBRD PR provision	Short gap delineation	Gap closing measure
PR 5	In cases where involuntary resettlement already occurred as part of same project previously financed by other entity or as part of preparation for the project in expectations of financing the project; the client will identify: any gaps and the corrective actions that may be required to ensure compliance with this PR.	There are no corresponding legal provisions in the national legislation.	A Land Acquisition and Resettlement Framework (LARF) has been developed as part of this ESIA setting out mandatory principles to mitigate adverse social and economic impacts from land acquisition or restrictions on affected persons compliant to EBRD PR5. No involuntary resettlement has taken place at the time of development of this ESIA.
PR 5	From the earliest stages and through all resettlement activities, during all phases of the project, the client will involve affected persons by public consultations. This will facilitate their early and informed participation in decision-making processes related to resettlement.	There are no legal provisions for early stakeholder engagement nor their empowerment to participate in the decision-making process in the meaning as assigned by the PR. However the process is very formal from the administrative point of view. During the Social impact assessment process it has been established that the practices of institutions in charge of expropriation are not materially compliant even with the national legal requirements.	Capacity building through early engagement with the Institutions in charge of expropriation to ensure the Land Acquisition and Resettlement Framework (LARF) developed as part of this ESIA is applied to mitigate adverse social and economic impacts from land acquisition or restrictions on affected persons.
PR 5	The client will carry out a socio-economic baseline assessment on people affected by the project, including impacts related to land acquisition and restrictions on land use and detailed census. The client will develop a LARP that covers the applicable requirements set forth in this PR. The plan will be designed to mitigate the negative impacts of displacement, identify potential benefits and establish the entitlements of all categories of affected persons (including host communities), with particular attention paid to the needs of the vulnerable.	Montenegro legislation does not require the development of specific resettlement / livelihood restoration plans, nor the implementation of a census / socio-economic survey, nor a document similar to the LARP. The only document that is being prepared according to Montenegro legislation is the Expropriation study corresponding to a census of persons and assets.	The Land Acquisition and Resettlement Framework (LARF) has warranted development of a LARP covering applicable requirements under EBRD PR5.

Relevant to PR	EBRD PR provision	Short gap delineation	Gap closing measure
PR 5	Regarding timing of compensation payments and clients taking possession of property PR requires that compensation should be paid before displacement or imposition of access restrictions.	Expropriation and Bar - Boljare Highway law includes the possibility for the Beneficiary of expropriation to take possession before payment of compensation in two situation: (i) when owner doesn't agree with the valuation of property and refuse to accept compensation payment and; for (ii) to execute preparatory works for construction (geological examination and geodetic measurements) which were extended by Bar - Boljare Highway law and includes even: construction of new and reconstruction of existing access roads, relocation of existing infrastructure lines, installation of equipment for crushing plants, concrete factories and asphalt base, creation of temporary facilities for the accommodation of workers and supervisory bodies, materials and equipment and preparatory soil and other works on the route.	Taking of land and related assets after payment of compensation shall apply as a rule. If the offer for compensation is rejected by the previous owner, the land and related assets can be taken into possession once the funds equal to the offered amount have been secured and earmarked in a designated account, and with prior approval of EBRD.
PR 5	The PR envisages economic displacement in situation when resettlement causes temporary or permanent loss of income or livelihood through, for example, interruption or elimination of a person's access to his/her employment or productive assets, regardless of whether the affected people are physically displaced.	The law does not recognize economic displacement as a separate category, only expropriation of property used for livelihood.	To close the Gap a Socio-economic survey shall be conducted to inform the LARP and allow a LARP Completion Audit to be undertake in line with the The Land Acquisition and Resettlement Framework (LARF).
PR 5	Where a project involves the loss of public amenities or publicly used resources ⁸ , the client shall undertake meaningful consultation, in accordance with PR 10, with the locally affected community to identify and, where possible, agree upon a suitable alternative.	There are no corresponding legal provisions in the national legislation.	The Land Acquisition and Resettlement Framework (LARF) has warranted meaningful consultations with the locally affected community are undertaken to identify and agree upon a suitable alternative where possible.

⁸ Examples include rangeland and pasture, non-timber forest resources (i.e. medicinal plants, construction and handicraft materials), woodlots for timber and fuel wood; water resources for agriculture, recreation or fishing.

Relevant to PR	EBRD PR provision	Short gap delineation	Gap closing measure
PR 5	Vulnerable groups refer to people who, by virtue of gender identity, ethnicity, age, disability, economic disadvantage or social status may be more adversely affected by project impacts than others and who may be limited in their ability to claim or take advantage of project benefits. The client will take necessary actions to ensure that vulnerable groups are not disadvantaged in the resettlement process, are fully informed and aware of their rights, and are able to benefit equally from the resettlement opportunities and benefits.	The Expropriation law makes no other recognition of vulnerable groups as such, so there are no special requirements in the legislation for organising consultations and relocation assistance for vulnerable groups. However, In process of determining fair compensation, in accordance with the provisions of this Law, compensation can be determined to a higher level from the market price taking into account the financial and other personal and family circumstances of the former owner, provided that those circumstances are essential for livelihood.	The Project will identify any vulnerable persons and/or groups that might be disadvantaged in the resettlement process or that could benefit from the positive effects of the development activities. The Project will liaison with the institutions and authorities administratively operating in the Project area to use existing data and knowledge to identify vulnerable groups and individuals, to provide additional measures for mitigation of impacts in coordination with such institutions and include such authorities in the Project cycle from its offset. Resettlement activities will be vulnerability sensitive.
PR 5	The client will establish an effective and independent grievance mechanism consistent with this PR and with the objectives and principles of PR 10, to receive and address specific concerns about compensation and relocation that are raised by displaced persons and/or members of host communities. It will include a recourse mechanism designed to resolve disputes in an impartial manner. The grievance mechanism will not affect the right of affected or limit persons and communities to resolve disputes using legally established method and court proceedings.	There are no corresponding legal provisions in the national legislation.	Stakeholder Engagement Plan (SEP) and The Land Acquisition and Resettlement Framework (LARF) have included mandatory requirements for the Project to establish an effective and independent grievance mechanism. A grievance manager was already appointed by MONTEPUT d.o.o.

Relevant to PR	EBRD PR provision	Short gap delineation	Gap closing measure
PR 5	Monitoring of the resettlement and livelihood restoration process will be carried out in accordance with PRs and prepared documents and action plans. It should involve the participation of key stakeholders such as affected communities.	There are no corresponding legal provisions in the national legislation.	Chapter 9 of the Land Acquisition and Resettlement Framework (LARF) has included principles for monitoring and evaluation
PR 8	Where a project may affect cultural heritage, the client will consult with affected communities on the scope, location and duration of a project, and any activities that might involve impacts on cultural heritage.	The Law on Spatial Planning and Construction envisage disclosure, consultations and grievance mechanism prior to plan adoption. There are no legal provisions on early-stage mandatory assessment of influence on cultural heritage assets or public consultation during project life cycle.	The Project has received inputs and mandatory measures from institutional stakeholders charged with responsibilities to manage and safeguard Cultural heritage.
PR 10	The process of stakeholder engagement and public consultation should begin at the earliest stage of project planning and continue throughout the life of the project. It is an integral part of the assessment, management and monitoring of environmental and social impacts and issues of the project.	Different laws envisage mandatory or recommended public disclosure, public consultation or consultations with local, scientific or other communities and stakeholders. However, there are no legal obligation envisaged to inform and consult the public, local communities or stakeholders about inclusive project-based information, broad array of adverse impacts from the early stages of the project life to its final stages.	A standalone Stakeholder Engagement Plan (SEP) has been developed identifying gaps in past engagement and information sharing practices. The SEP has set forth a strategy and engagement programme for the entire Project cycle.
PR 10	The client will identify and document the various individuals or groups who are affected or likely to be affected by the project or may have an interest in the project. The client will develop and implement a SEP that will be tailored to take into account the main characteristics and interests of the stakeholders, and the different levels of engagement and consultation.	There are no corresponding legal provisions in the national legislation.	A standalone Stakeholder Engagement Plan (SEP) has been developed identifying gaps in past engagement and information sharing practices. The SEP has set forth a strategy and engagement programme for inclusive engagement practices

Relevant to PR	EBRD PR provision	Short gap delineation	Gap closing measure
PR 10	Disclosure of relevant project information helps stakeholders understand the risks, impacts and opportunities of the project. The client will provide access to information: about the scale and duration, risks to, and potential impacts, proposed mitigation plans, stakeholder engagement process and public consultation meetings, the grievance process of the project. Meaningful consultation is a two-way process. The consultation process with affected parties will be undertaken in a manner that is inclusive and culturally appropriate, and which represents the views and specific needs of various groups as identified in the SEP.	The legal framework of Montenegro does envisage requirements for access to information, public disclosure and public consultations. However the requirements are lacking clear instructions on making these meaningful and beyond the formal requirements. Interaction is mostly constrained to written communication, while planning and spatial documents are subjected to public face to face consultations. The Law does not foresee a structured engagement process for specific development projects, neither private nor public, and the practices differ depending on Project proponents. The grievance mechanism envisaged by Montenegro legislation is more formal, similar to appeal system in administrative or court processes.	A standalone Stakeholder Engagement Plan (SEP) has been developed identifying gaps in past engagement and information sharing practices. The SEP has set forth a strategy and engagement programme for inclusive engagement practices and a grievance mechanism as intermediary tool to close the gaps.
PR 10	The client will establish an effective grievance mechanism, process or procedure to receive and facilitate resolution of stakeholders' concerns and grievances, in particular, about the client's environmental and social performance. The grievance mechanism process or procedures should address concerns promptly and effectively, in a transparent manner, at no cost and without retribution. The mechanism, process or procedure cannot prevent access to judicial or administrative remedies.	Besides the process of grievances during public consultations envisaged by the Law on Spatial Planning and Construction in the urban planning phase, there are no corresponding legal provisions on grievance mechanism provided by the investor to stakeholders and affected communities. However, all process is subject to the possibility to administrative (Law on Administrative Procedure) and regular court proceedings (Law on Civil Procedure).	Stakeholder Engagement Plan (SEP) has included mandatory requirements for the Project to establish an effective and independent grievance mechanism. A grievance manager was already appointed by MONTEPUT d.o.o. with details available in the SEP.

3 Project alternatives

3.1 Do nothing scenario

The “do-nothing scenario” entails that the existing infrastructure on the Mateševu - Andrijevića section of Route 4 will not be upgraded and therefore will not be in line with the TEN-T regulatory requirements. This scenario, however, hinders the meeting of the overall objective of the project which aims at facilitating the development and improvement of road transport infrastructure in Montenegro, thereby hindering the contribution to the overall efficiency and effectiveness of road transport operations in the region. Therefore, the “do-nothing scenario” **is not in line with EU Directives and SEETO strategic plan for the SEETO Road Network**. Given the need for the Project as outlined in previous chapters, it was concluded that the “do-nothing scenario” is not considered as a viable project alternative.

Consequently, the design alternatives examination is focused on identifying the optimal solution and micro location of the highway from the point of view of technical, economic, functional, technological, aesthetic and environmental protection requirements according to the mitigation hierarchy. An overview of the different design alternatives is provided in the following sections and related figures

3.2 General Design alternatives

During General Design (Louis Berger SAS-Paris, Simm Engineering -Podgorica, 2008), three alignment alternative solutions were examined⁹. The main characteristics of these alternatives are described in the following sections.

3.2.1 Alternative 1

Alternative 1 consists of a route with a total length of 23.4 km, designed for a speed of 100 km/h. The minimum radius of the curves is 450 m, and the average curvature is 41.47 grad/km. The most unfavorable longitudinal gradient is 5%, extending over a length of 2,307 m, while 42% of the route (9,804 m) has a longitudinal gradient greater than 4%. The third lane extends for 12,650 m. The maximum climbing level of the route reaches 1,165 m, with sections of the road at elevations between 1,000 and 1,100 m, and over 1,100 m, covering lengths of 8,800 m. The total length of structures on the route includes 2,696 m of bridges and 5,735 m of tunnels. The overall construction cost of the project amounts to €273,888,985.08.

3.2.2 Alternative 2

Alternative 2 involves a 23.56 km long route designed for a maximum speed of 100 km/h. The minimum radius for curves along the route is 450 m, and the average curvature is 45.27 grad/km. The most unfavorable longitudinal gradient is 5% over a length of 2,932 m, while sections with a gradient greater than 4% account for 11,762 m, or 49.90% of the total length. The road features a third lane spanning 12,650 m. The maximal climbing levels include sections ranging from 1,000 to 1,100 m (1,230 m long) and above 1,100 m (8,765 m long). Additionally, the project includes significant structures, with bridges

⁹ In order to avoid confusion among the solutions proposed in the General Design and in the Preliminary Design, the term “alternative” is used for the solutions of the General Design and “variant” for the solution of the Preliminary Design

totaling 2,841 m in length and tunnels extending 5,443 m. The total construction cost for the project is estimated at €274,811,810.40.

3.2.3 Alternative 3

Alternative 3 of the project spans a total length of 23.32 km, with a design speed of 100 km/h. The minimal radius for curves is 450 m, and the average curvature is 38.02 grad/km. The most unfavorable longitudinal gradient is 5% over a distance of 2,408 m, while areas with a gradient greater than 4% cover 4,378 m, or 18.80% of the total length. The road also includes a third lane that extends for 11,749 m. For elevation, the maximal climbing levels include sections ranging from 1,000 to 1,100 m (1,161.53 m long) and those over 1,100 m (9,480 m and 6,790 m in length). The project involves significant infrastructure, with bridges totaling 2,866 m and tunnels extending 6,785 m. The total estimated construction cost for Alternative 3 is €299,849,453.23.

The characteristics of the three alternatives described above are summarized in the following table.

Table 3-1: Main Characteristics of the alternatives of the General Design

Ref. No.	Characteristics	Alternative 1	Alternative 2	Alternative 3
1.	Length (km)	23.40	23.56	23.32
2.	Design speed (Vr- km/h)	100 km/h	100 km/h	100 km/h
3.	Minimal radius (Rmin-m)	450	450	450
4.	Average curvature	41.47 grad/km	45.27 grad/km	38.02 grad/km
5.	The most unfavourable longitudinal gradient and length	5% / 2307m	5% / 2932m	5% / 2408 m
6.	Longitudinal gradient >4% (in percentages of total length)	9804m (42%)	11762m (49.90%)	4378m (18.80%)
7.	Third lane length	12650.00 m	12650.00 m	11749.00 m
8.	Maximal climbing level Route length with levels - 1000 to 1100 m - over 1100 m	1165 m 8800 m 8800 m	1230 m 8765 m 8980 m	1161.53 m 9480 m 6790 m
9.	Length of structures - bridges - tunnels	2696.00 m 5735.00 m	2841.00 m 5443.00 m	2866.00 m 6785.00 m
10.	Total construction cost (Euro)	273,888,985.08	274,811,810.40	299,849,453.23

The General Design concluded to the proposal of Alternative 1 for further elaboration. Nevertheless, according to the Annex 5.1 of the ToR "Guidelines for preparing the preliminary design of the route" page 32, the alternatives 1 and 2 were subject of further elaboration during the Preliminary Design. Alternative 3 was excluded from further elaboration.

3.3 Variants of preliminary design

During preliminary design, two variants of Alternative 1 option and one variant of Alternative 2 option were considered. These are presented in this section.

For developing the variants in the Preliminary Design, the alignment alternatives of the General Design and the technical solutions of the Main Design for Smokovac – Mateševac section were used as a starting point. Elaboration of several variants was carried out under the following considerations:

- The proposed alignments of the variants should respect the corridor defined by the Spatial Planning documents (see following figure).
- The geometric elements should apply to ToR and TEM standards recommendations.
- The proposed cross sections should include all the lining structures.
- A review of all the regions of conflict between the Regional Road R19, the existing local road network, and the future motorway.
- A proposal for the necessary crossings as well as the potential relocation of the existing road network should be carried out.

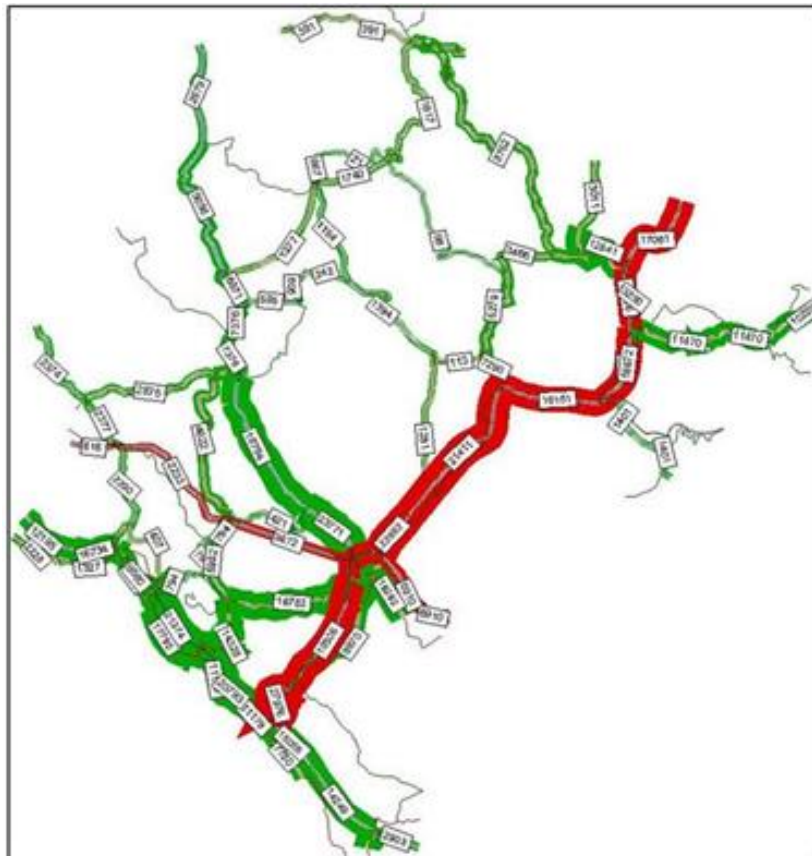


Figure 3-1: Planned level of traffic on existing and planned roads in Montenegro in 2027. (Source: Detailed spatial plan of the highway Bar - Boljare)

The variants' design has been elaborated under the following restrictions and assumptions:

- The proposed corridor of all designed variants has been defined by the spatial planning documents.
- All variant solutions respect the defined corridor.
- The design is based on geodetic base maps of scale 1:1000 which have been provided by the Beneficiary.
- The existing transmission lines have been taken into consideration in order to avoid their relocation.
- Effort has been made to avoid demolitions and conflicts with existing buildings and roads along the whole corridor.

- All the points of conflict between the new highway and the existing road network and structures have been examined and the possible relocation of the existing road network has been proposed.
- The maximum height of cuts is limited to 40m and the maximum height of embankments is limited to 25m according to the ToR.
- Embankments with height over 25m have been replaced by structures.
- Cut slopes and slopes for embankments and the proposed protective measures took into consideration the existing geotechnical surveys results provided by the Beneficiary, the geotechnical results of the additional surveys performed for the PD, experience from the Smokovac – Mateševu section and visual observation of the project area.
- Design speed: $V_e = 100\text{km/h}$
- Due to the very difficult terrain with the features of mountain and river valley, the exploration of alternative design variants for design speed 120km/h was declined. It should be noted that design speed of 120 km/h is adequate for plain to hilly terrain while for mountainous terrain would result in too many structures, significantly increasing the total cost of the project.
- Additionally, the section under examination (Mateševu – Andrijevića) is part of the “Bar – Boljare” Highway, (of a total length of 169km) where design speeds of $V_e=100\text{km/h}$ and (on exceptional occasions) $V_e=80\text{km/h}$ have been applied for mountainous terrain.

Three variants were developed in the Preliminary Design (see Figure 3-2 to Figure 3-6) and are presented below:

3.3.1 Variant 1

Variant 1 is based on Alternative 1 of the General Design and is developed taking into consideration the comments and recommendations of the SR. It foresees a realignment from ch 8+000 to ch 12+000 in such a way that the route could run through the sunlit part of the valley. This realignment results to two cut and covers of $L=95\text{m}$ and $L=160\text{m}$.

Table 3-2: Summary of Variant 1 characteristics

AXIS	CH	CH	Length	Bridges	Tunnel	Cut & Covers/ Lane Covers	Open Road
			KM	KM	KM	KM	KM
RIGHT	0.00	1.30	1.30	0.565	0		0.735
LEFT	0.00	1.30	1.30	0.565	0		0.735
MAIN	1.30	8.92	7.62	2.631	0	0.175	4.814
RIGHT	8.92	14.15	5.23	0.49	3.57	0.386	0.789
LEFT	8.92	14.13	5.21	0.37	3.94	0.553	0.347
MAIN	14.14	20.54	6.40	0.14075		0.290	5.96925
MAIN	20.54	23.51	2.97	0.790		0.200	1.98
		TOTAL	23.51	4.55	3.76	1.13	14.07

3.3.2 Variant 2

Variant 2 is separated from Variant 1 from Ch. 7+550 to Ch. 14+820 according to the respective solution in the General Design and it is based on Alternative 2 of the General Design.

This Variant examines the highway corridor towards northeast in the valley of the Čestogaz River.

The proposed tunnel is about 3150 m. According to this variant, the key tunnel is shorter than in variant 1 for 508m. But due to the difficult spatial conditions in which the motorway was developed, there was a need for several smaller tunnels of 365, 140, 120 and 145m length, which to a great extent reduces the difference between the tunnels in the two Variants.

By applying the same approach as for Variant 1, a lot of modifications have been done for the refinement of the Alternative 2 of the General Design.

3.3.3 Variant 3

Variant 3 is a new variant (based on the Alternative 1 of the General Design), which by-passes the outskirts of Andrijevica and, results in shorter bridges piers and leads to an optimal balance of earth masses.

It was designed taking into consideration the comments and recommendations of the SRP on variants 1 and 2 and in order to provide a different solution (according to the requirements of the ToR) but also feasible in terms of economy, alignment and impacts on population. The differences between variant 1 and 3 are mainly:

- From ch 1+300 to ch 6+000

Horizontal modifications by replacing curves R=700, R=750m by R=500m which leads to adjustment to the mountainous terrain and replacement of cut and covers and lane covers by open cuts.

- From ch 6+000 to ch 14+500

A realignment has been proposed in order to pass to the sunlit part of the valley at around ch 8+500 similarly to variant 1, but with shorter bridges.

- From ch 18+500 to ch 21+000

A realignment, to the north, has been proposed in the outskirts of the residential area of Andrijevica. This results in the replacement of high embankment and Bridge 15 (L=834m) by two Bridges (BR15 250m and BR16 250m), two lane covers of 145 and 90m length respectively and avoidance of the residential area.

3.3.4 Variant 5

Another alternative solution (Variant 5) has been ultimately developed by MONTEPUT in 2024 based on the decision of MONTEPUT to address, at that time already raised and known concerns of three out of eight settlements, through formalizing and enhancing stakeholder engagement activities in exploring viable alternatives to the alignment in the areas of concerns (from the exit portal of Tunnel Trešnjevci to interchange Andrijevica).

The new alternative solution refers to route change from the exit of the Trešnjevci Tunnel to the Andrijevica interchange and it mitigates the potential negative impacts on both the local community and the environment. From the exit of the Trešnjevci Tunnel, the route is being relocated below the regional road and follows the course of the Kraštica River.

Variant 5 has been ultimately selected since the new alignment considers the opinions of the local population during public consultation. During public consultation, concerns were raised by local people on residential and agricultural activities of the area and subsequently, Variant 5 avoids the immediate impacts the former variants have on the natural and anthropogenic environment.

The variants examined are shown in the following figures.



Figure 3-2: Project variants _Part 1

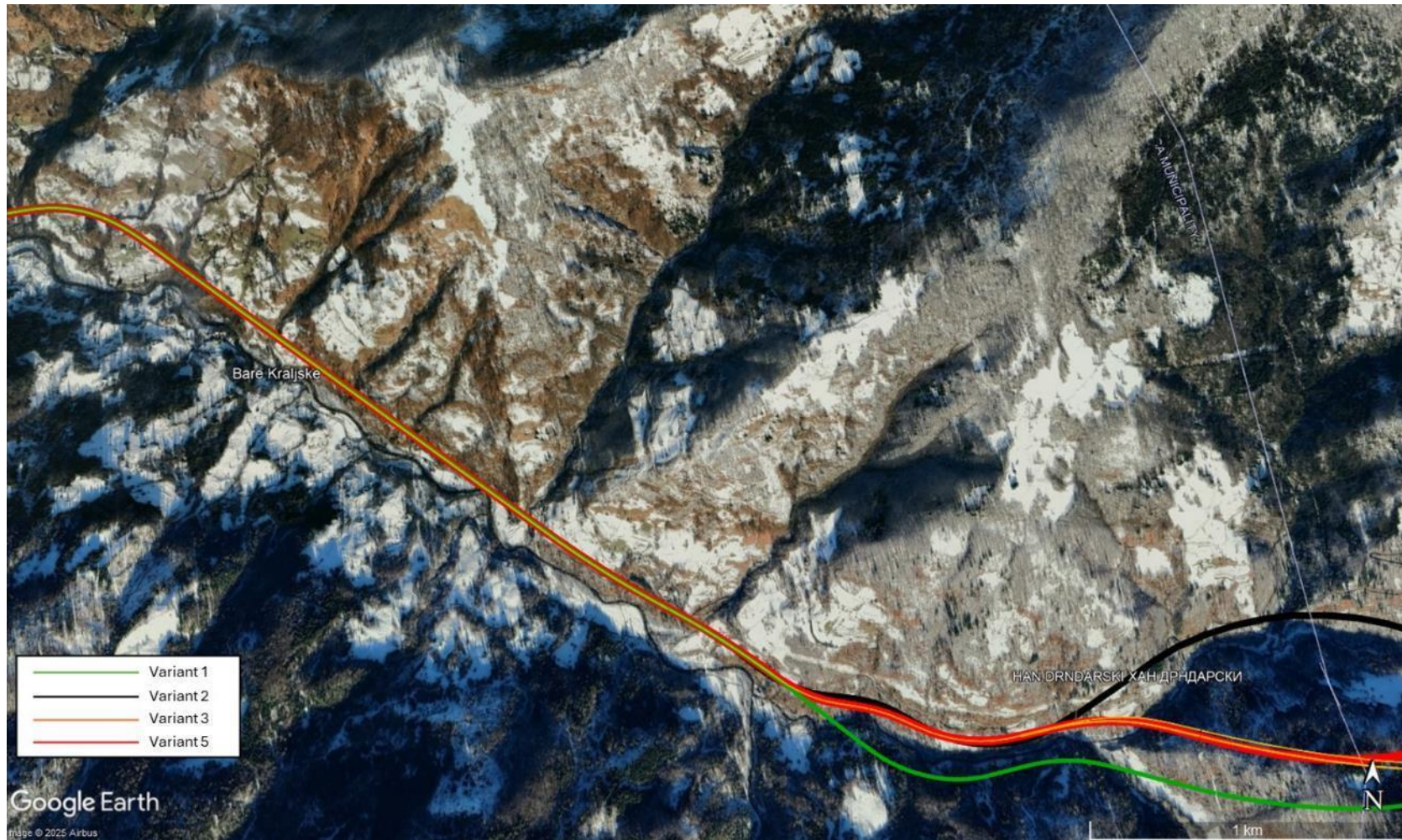


Figure 3-3: Project variants _Part 2



Figure 3-4: Project variants _Part 3



Figure 3-5: Project variants _Part 4

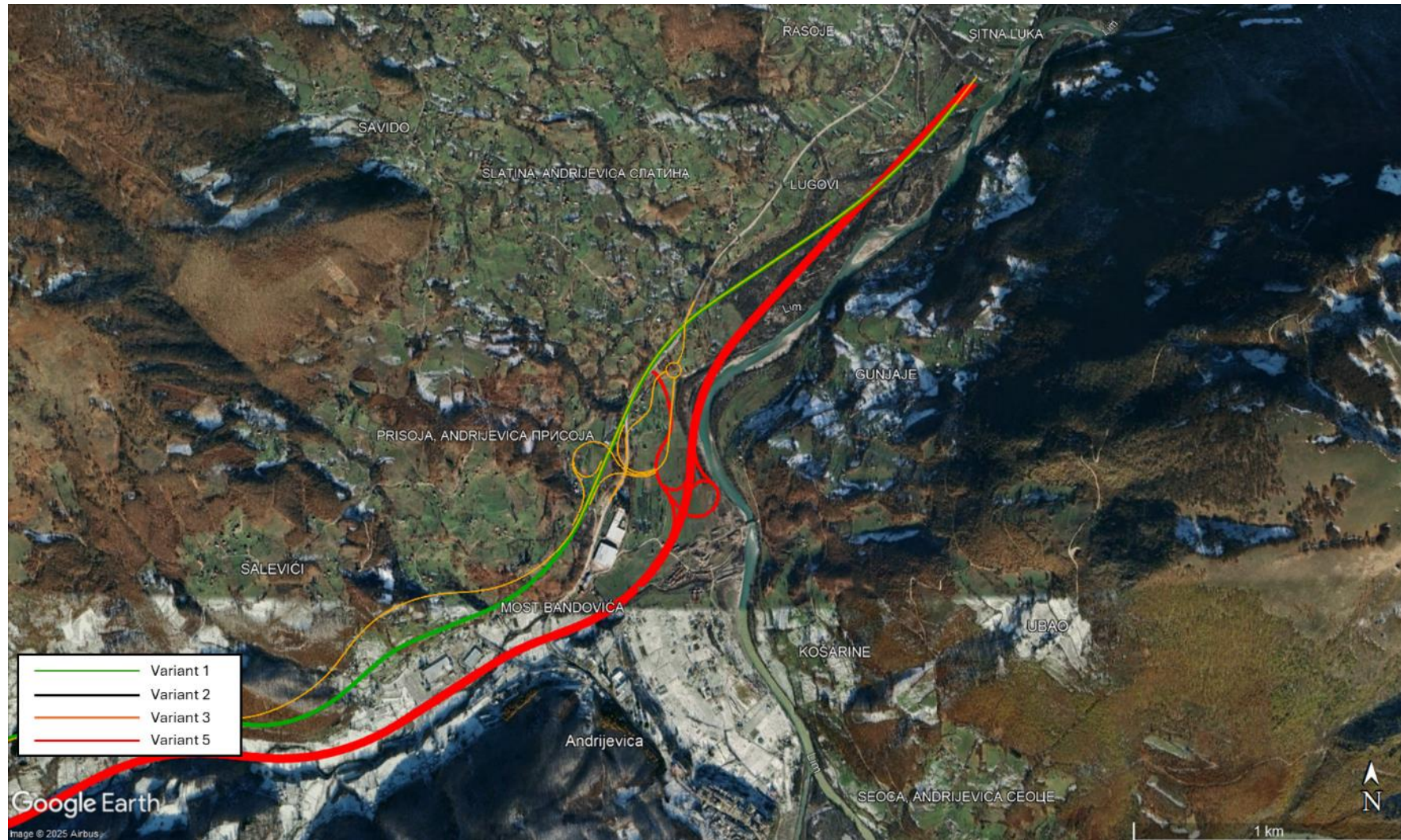


Figure 3-6: Project variants _Part 5

3.3.5 Assessment of Variants 1, 2, 3 and 5

Variants 1, 2, 3 and 5 were assessed with the use of Multi-criteria analysis (MCA). Variant 2 was excluded from further consideration at an early stage of the Preliminary design, after consultation with the SRP, since it requires the implementation of extensive retaining structures – measures. Therefore, Variants 1, 3 and 5 were ultimately assessed.

The alternative solutions were considered from the following points of view:

Production processes or technologies: Production processes and technologies are defined in the project description and in the environmental impact assessment, and there are no significant differences that are specific to any of the considered variants.

Work methods during the construction and operation of the project: The methods of construction and operation are defined in the project description, and there are no significant differences that are specific to any of the considered variants.

Site plans and project drawings: All variants were analysed within the same and narrow corridor, defined by planning documents and the Conceptual design.

Type and selection of materials for project execution: In all considered variants, the same type of materials would be used for the execution of the project.

Time schedule for the implementation and termination of the project: In terms of the of the construction complexity, there is no difference between the variants, it is estimated they would all take the same time for construction.

Date of start and end of execution: None of these dates have been defined.

Size of the Project area: Regarding the size of the site and the time required for construction, there are no major differences between the variants. The length of the highway in variant 1 is 23.51 km, in variant 3 is 23.48 km and in variant 5 is 24 km (the new route from the entrance of the Trešnjevik Tunnel to the Andrijeviča interchange is 12.5 km long, and 222 m longer than the original version).

Pollution control: In terms of pollution control, there are no differences between the considered variants.

Regulation of access to the project and traffic roads: There are minor differences in regulation of access to the project and traffic roads between the considered variants, because all variants are limited to the same narrow corridor.

Responsibility and procedure for environmental management: There are no differences between the considered variants in terms of responsibilities and procedures for environmental management.

Training: There are no differences between the considered variants in terms of training.

Monitoring: There are no differences between the considered variants in terms of monitoring.

Contingency plans: Possible emergency situations are equally applicable to all considered variants.

Project removal and site restoration (for temporary projects): Not applicable, the highway is not a temporary facility.

An overview of the assessment of alignment alternative Variant 1 of the Preliminary Design against Variant 3 of the Preliminary Design and Variant 5 is presented in the following Table.

Table 3-3: Overview of the variants 1,3 and 5

Criterion	Variant 1	Variant 3	Variant 5
Variant route length	23.51 km	23.49 km	24.1 km
Technical elements of the route - radii of circular curves, crossings, etc., with an indication of the applied minimum elements	480 m	480 m	700 m
Heights of cuttings and embankments	40 m for cuts 25 m for embankments	40 m for cuts 25 m for embankments	40 m for cuts 25 m for embankments
Length of bridges	4.55 km	4.67 km	8.48 km
Length of tunnels (L+R)	7.06 km	7.08 km	7.84 km
Length of supporting structures (walls and pile walls, reinforced embankments)	10.6 km	11.4 km	11.64 km
Quantities and imbalance of soil volumes for excavations and embankments	Cuts: 5.15 million m ³ Tunnel: 0.90 million m ³ Embankments: 2.34 million m ³ Estimated imbalance of useful material: 3.00 million m ³ .	Cuts: 6.15 million m ³ Tunnel: 0.96 million m ³ Embankments: 2.32 million m ³ Estimated imbalance of useful material: 4.00 million m ³ .	1.019.034 m ³ total volume of excavations Cuts: 6.15 million m ³ Tunnel: 1.07 million m ³ Embankments: 2.38 million m ³ Estimated imbalance of useful material: 2.6 million m ³
Length of the third lane	4.85 km	4.85 km	4.85 km
Length of the route with a slope greater than 4%	4.70%/7240m	4.90%/6304m	5.50%/4.858,5m
Qualitative assessment of operating and maintenance conditions	Similar operating and maintenance conditions.	Similar working and maintenance conditions. Variant 3 is more favourable on the approach to the western entrance to the tunnel, due to less restrictions on the driver's view (combination of horizontal alignment and vertical curve of the ridge). Moreover, the horizontal alignment of variant 3 in the tunnel is in a longer straight section. As a result, there is a longer unobstructed	Similar operating and maintenance conditions. Due to the terrain which is very suitable for the formation of instability (landslides), it is recommended that the bridges be founded on piles. The slopes should have a gentle geometry with an expected high volume of protection by anchors, as well as with drainage facilities and protection against erosion.

Criterion	Variant 1	Variant 3	Variant 5
		stopping distance in tunnel vision.	
Total construction cost and price per 1 km	373.2 million euro 15.9 M€/km	356.6 million euro 15.2 M€/km	394.6 million euro 16.8 M€/km
Environmental and social aspects	Variant 1 results in less expropriations and demolitions of buildings. On the other hand, the alignment divides, with bridge and high embankments, a community in the outskirts of Andrijevac also producing disadvantageous visual impacts.	Variant 3 has minimal effect bypassing the outskirts of Andrijevac, but it requires more buildings' demolitions along the axis.	Variant 5 holds the following environmental and social benefits: Preservation of existing structures: The previous route envisaged the demolition of a large number of buildings, especially in the village of Kralje. With the new route, this number is significantly reduced, avoiding the displacement of many residents. Environmental preservation: The new route is largely laid on bridges, avoiding the cutting into existing slopes, thereby reducing the environmental impact and preserving the landscape. Social aspect: The new solution has minimized physical displacement and severance impacts which were specific concerns raised by a local community.
	Both variants have similar environmental effects with respect to landscape and biodiversity but, variant 3 is superior with respect to the effect on Emerald site "Lim river valley" (proposed Natura 2000 site, IPA site), since it is further away from the limits of the protected zone.		

Following the above, Variant 5 appears to be preferable against Variants 1 and 3.

Variant 5 has been ultimately selected since the new alignment considers the opinions of the local population during public consultation. During public consultation, concerns were raised by local people on residential and agricultural activities of the area and subsequently, Variant 5 avoids the immediate impacts the former variants have on the natural and anthropogenic environment.

Therefore, Variant 5 is proposed to be adopted for further development in the Preliminary Design stage, as it results in reduced environmental impact and need for demolition, and minimizes physical displacement and severance impacts which were specific concerns raised by a local community.

4 Project Description

4.1 Project location

The Mateševsko - Andrijevića section is approximately 23.5 km long (14% of the total length of the Bar - Boljare highway).

The start point is after the Mateševsko IC and the 555m long tunnel (Smokovac – Mateševsko section). The end is the area of the Kraštica River, tributary of Lim River, near Andrijevića.

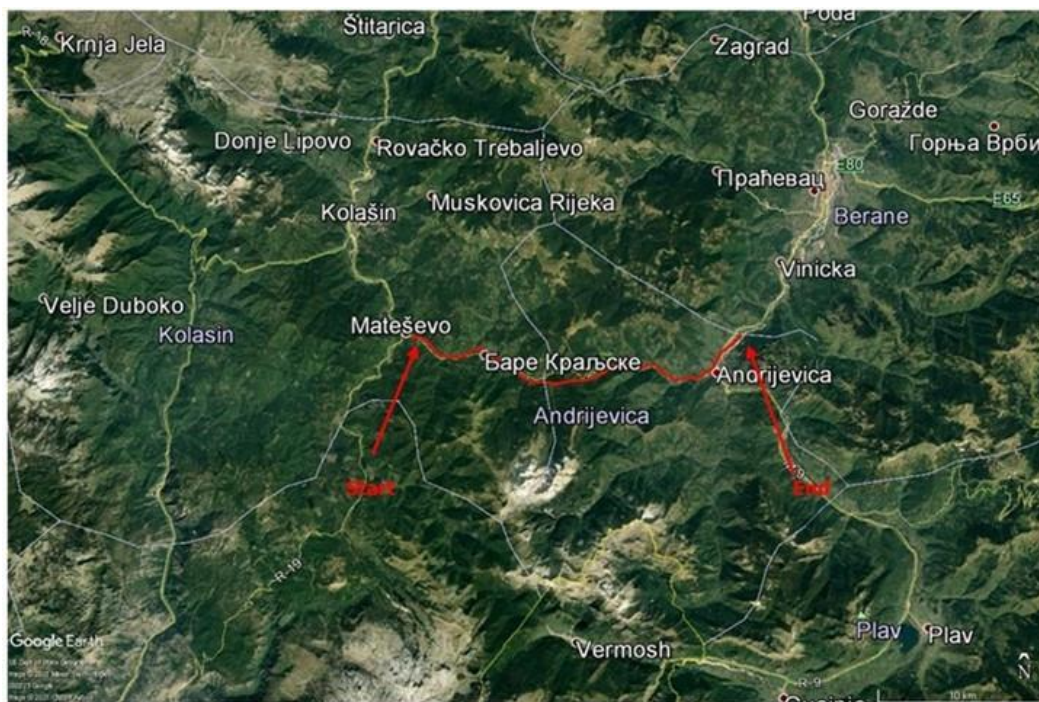


Figure 4-1: Location of future Mateševsko-Andrijevića highway section

Part of the Mateševsko-Andrijevića Highway section is located within the municipality of Kolašin while the rest is located within the municipality of Andrijevića.

The proposed geographical coordinates of the start and the end of the highway section according to the World Geodetic System 1984 (WGS 84) are:

Table 4-1: Coordinates of the highway section

WGS 84	Latitude (ϕ)	Longitude (λ)
Start of the highway section	42.759277°	19.558139°
End of the highway section	42.759824°	19.803302°

4.2 Existing Road Network

A detailed review of all the local network has been done as well as analysis of all the points of conflict with the future highway.

The local road network has been classified in the following three main categories:

- Category 1. Suburban roadway connecting settlements. It is used in the restoration of the Regional road R19. It has a design speed of 50km/h and a typical cross section of 6.5m wide.
- Category 2. Local roads connecting properties. They have a design speed of 40km/h and a typical cross section of 5.9m wide.
- Category 3. Forest – unclassified restoration roads. They have design speeds ≤ 40 km/h and a typical cross section of 4.0m wide. They are further classified in two sub – categories:
 - Sub-category 3.1. Unclassified roads tier 1, which have design speeds of 30km/h and 40km/h and are connecting properties.
 - Sub – category 3.2. Unclassified roads tier 2, which have unfavourable geometrical characteristics and restore forest roads.

The Regional road R19 is the main existing road within the examined corridor. The proposed Highway corridor, almost along its entire length, follows the Regional road R19, therefore crossings and local deviations of this road have been foreseen.

All crossings with local and unclassified roads have also been examined, thus deviations and grade separated crossing (overpass, underpass etc) have been proposed.

4.3 Highway Design Parameters

4.3.1 Design Parameters

The Design speed depends on the characteristics of the terrain crossed by the Highway as specified in the table below:

Table 4-2: Type of terrain and design speed

Type of terrain	Ve (km/h)
Plain and hills	120
Hills and mountains	100

The topography along the alignment - hilly /mountainous - creates the need for extensive retaining structures (piles, lane cover and reinforced embankment and defines the design speed.

It should be noted that the same type of terrain applies to the previous section “Smokovac- Mateševu” which is constructed, where design speed ($V_e=100$ km/h) is selected for the highway.

Taking into consideration:

- technical aspects (type of terrain)
- economical aspects (minimize extensive retaining structures)
- environmental aspects (minimize impacts to the natural environment)
- safety aspects (uniform cross section for Smokovac-Mateševu-Andrijevića motorway)

The proposed design speed is $V_e=100$ km/h.

The design speed ($V=100$ km/h) defines the minimum geometrical elements that have been used according to the standards, as follows:

Table 4-3: Design Parameters for the Preliminary Design

	Parameter	Value
GENERAL	Design speed on the highway	100 – 120 km/h

	Parameter	Value
	Design speed on access roads	min 40 km/h
	Max length of direction	20Vr
	Min stopping sight distance (MSD)	Reference to a table
	Min overtaking sight distance	780 m (100 km/h)
LOCATION PLAN	MinR horizontal curve	450m (100km/h)
	MinR horizontal curve	70m (100-130 km/h)
	MinR horizontal curve on access roads	40 m
	Min length of slow vehicle lane	800 m
PROFILE GRADE	MinR convex change of highway grade	9.000m (100km/h)
	MinR concave change of highway grade	4.000m (100km/h)
	Max gradient	5% (100km/h)
	Min gradient on embankments	0.5%
	Min gradient in cuttings	0.5%
	Min crossfall	2-2.5%
	Max crossfall	7%
	Average value of a relative grade of the edge of the carriageway	0.5-0.75%
	Max gradient in tunnels and facilities	T<500 m same as on the route 500 m <T< 1.000 m 4% 1.000 m<T<3.500 m 3% T>3.500 m 1.5%
	MinR of convex change of grade for access roads	500
HIGHWAY CROSS SECTION	MinR concave change of grade for access roads	700
	Max gradient for access roads	7 % up; 8 % down
	Traffic lanes	3.5-3.75 m 100, >100 km/h
	Slow vehicle lanes	3.5 m for speed ≥ 100 km/h
	Emergency lanes and niches	2.5 m and 4.0 m
	Emergency lanes in tunnels or bridges	Most<150 m & Tunnel <200 m
	Edge strips	0.30-0.5 m
	Edge strips between the traffic lane and emergency lane	0.25-0.5 m
	Median strip	3.0 or 4.0 m
	Shoulder	1-1.5 m
	Vertical clearance	4.70+0.20 m
	The equivalent traffic load calculation shall be made with the reference axis of 115 kN load	115 kN

4.3.2 Typical cross section

The applied typical cross sections for the highway, for design speed $V_r=100$ km/h, is presented in the table below.

Table 4-4: Design parameters for typical cross sections ($V_r=100\text{km/h}$)

	Design speed $V_r=100\text{ Km/h}$
Lane width	4x3.50 m
Emergency lane width	2x2.50 m
Edge strip width along the lanes	2x0.35 m
Edge strip width along the emergency lane	2x0.25 m
Median strip width	4.00m
Total width	24.2 m

The above presented lanes widths and the typical cross section lay-out are in accordance with the ToR requirements and compatible with the cross section of Smokovac – Mateševo section.

Stopping lanes are designed on all open road sections, as well as in tunnels shorter than 200 m and bridges shorter than 150 m.

The side sections of a typical cross section will follow these main principles:

1. The separation of drainage from the roadway and split into separate channels was implemented, by providing separate collection systems. This way, it is possible to collect water from the highway lane and take it to pollution control units (PCU);
2. The EN1317 standards were applied to safety fences, and the necessary width was taken into account for adjusting the width of the shoulders.

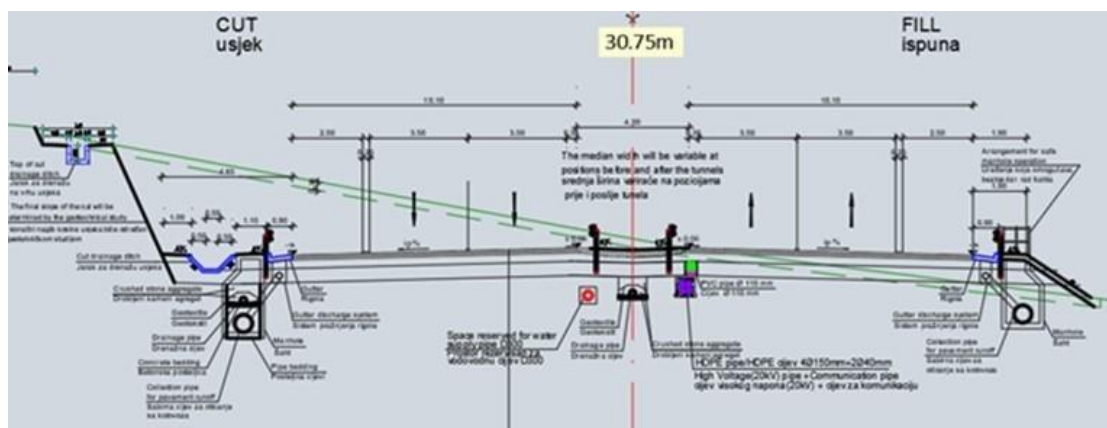


Figure 4-2: Typical cross section on open road

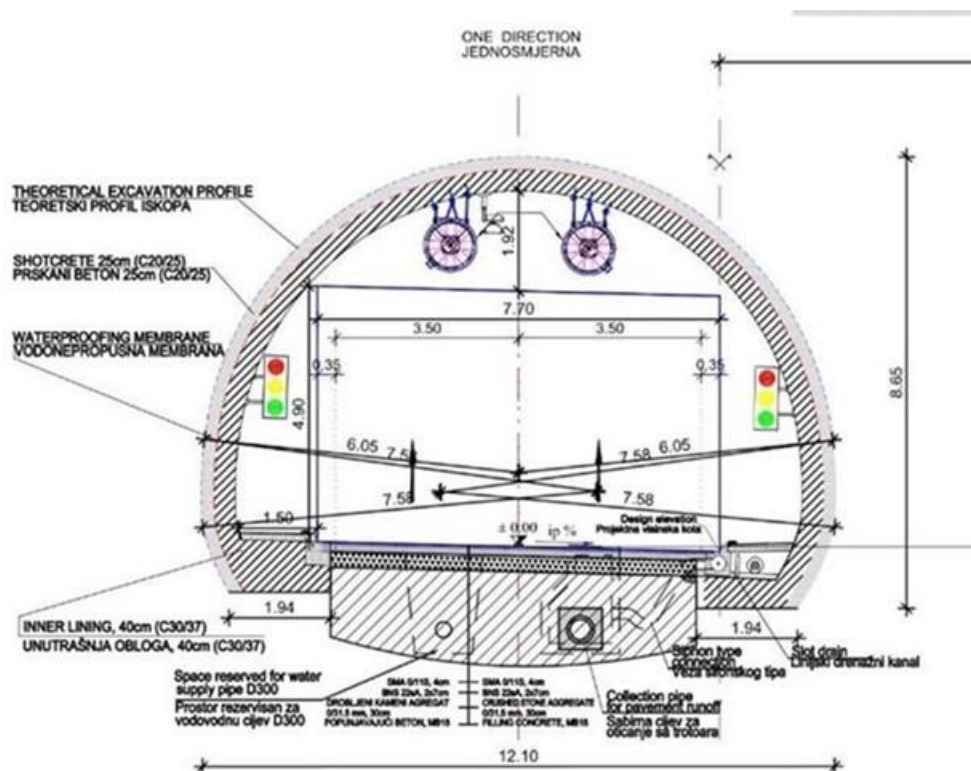


Figure 4-3: Cross-section of the tunnel



Figure 4-4: Cross-section of a retaining wall

4.4 Characteristics of selected variant

The technical characteristics of the alignment Variant 5 are presented in the following table.

The selected Variant 5 was designed taking into account the comments and recommendations of the State Audit Committee for revision of Variants 1, 2, and 3 in order to provide a different solution (according to the requirements of the Project Terms of Reference), but also a feasible solution in terms of economy, route and impact to the population.

Table 4-5: Technical characteristics of Variant 5

Characteristic	
Route length	23.5 km
Computational speed (Vr)	100 km/h
Minimum radius (Rmin)	480 m
Most unfavourable longitudinal slope and length	4.98%/268m
Longitudinal slope >4% (in percentage of the total length)	32%
Length of the third strip	4900 m
Maximum embankment height (m)	25 m
Maximum cutting height (m)	40 m
Length of bridges	4.96 km
Length of the tunnel	3.95 km
Length of supporting structures (walls and piles, reinforced embankments)	11.64 km
Quantities of materials in excavations and embankments	Excavations open route: 6.15 million m ³ Excavations in tunnels: 1.07 million m ³ Embankments: 2.38 million m ³ Estimated amount of excess material: 2.6 million m ³ .
Length of the route with a gradient greater than 4%	5.50%/4858.6 m
Qualitative assessment of working and maintenance conditions	Similar conditions of use and maintenance Tunnels in variant 5 are longer and have higher operating costs, while bridges in variant 1 are longer and cause higher maintenance costs.
Total construction costs and price per 1 km	394.6 million euros 16.8 million €/km

4.5 Andrijevac interchange

Andrijevac interchange is foreseen at the end of the section. Andrijevac interchange is designed to be constructed in three phases as follows:

At the first phase a trumpet interchange is proposed at Ch. 21+220 which connects the designed motorway with the existing network providing space for a maintenance base, control and management facilities and a toll station. In this phase it is assumed that the Bar – Boljare Highway would end at this point.



Figure 4-5: Andrijevac I/C – phase I

At the second phase, it is assumed that the remaining sections of Bar- Boljare Highway will have been constructed, and a trumpet interchange will provide the connection between the Bar Boljare Highway and the existing local network.



Figure 4-6: Andrijevac I/C – phase II

At the final phase, a second interchange is proposed which links the future section (Andrijevac – Berane) of BBH with the (future) branch to Pec. The proposed type of interchange is appropriate for the connection of two Highways. The proposed solution enables the construction of all associated functional facilities at their final position.

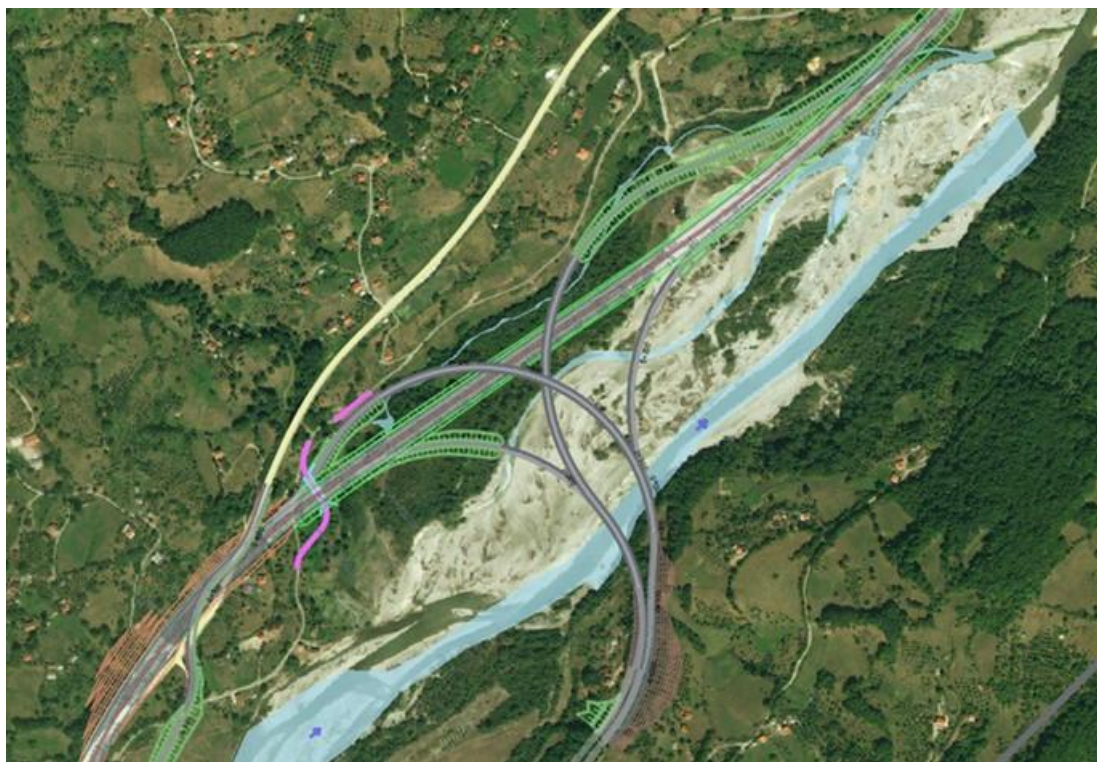


Figure 4-7: Andrijevica I/C – final phase

4.6 Structures Design (bridges, overpasses, interchange facilities, underpasses)

The Mateševu - Andrijevica highway extends across mountainous terrain with many difficulties, such as high slopes in both directions (longitudinal and transversal), steep valleys, approach difficulties and lack of space for construction sites.

The alignment route, for the most part, is alongside with rivers and the existing road network. Hence, the bridges are crossing the rivers and the local roads at many positions. This requires provisions for the temporary/or permanent realignment of the existing roads and minor riverbed arrangements.

From the Geotechnical point of view, the greater area of the corridor of the highway Mateševu – Andrijevica requires particular research and exploration, due to important issues concerning processes of physical-chemical decomposition, of slope wash and of sliding. These issues have been taken into consideration in the design of the Structures, i.e. preference of underpasses/reinforced embankments instead of bridges, use of longer spans (less piers) in dangerous zones etc.

The foreseen structures are presented in the table below

Table 4-6: Bridges along the highway route

Ref. No	Chainage		Branch	Total Length (m)
	From	To		
1L	0+155	0+720	Left	565
1R	0+205	0+770	Right	565
1	1+910	2+295	Axis	385
2	2+587	2+7130	Axis	126

Ref. No	Chainage		Branch	Total Length (m)
	From	To		
3	2+795	2+910	Axis	115
4	3+450	3+655	Axis	205
5L	4+540	4+752	Left	212
5R	4+400	4+752	Right	352
6	06+434	07+044	Axis	610
7	07+375	07+524	Axis	149
8	07+690	07+766	Axis	76
9	08+312	08+461	Axis	149
9AL	9+069	9+135	Left	66
9AR	9+044	9+152		108
10L	09+355	09+415	Left	60
10R	09+334	09+394	Right	60
11L	13+470	13+523	Left	53
11R	13+490	13+695	Right	205
12L	13+605	14+340	Left	735
12R	13+785	15+185	Right	1400
13L	14+440	14+895	Left	455
13R	15+305	16+240	Right	935
14L	15+046	15+132	Left	86
14R	16+262	17+049	Right	787
15L	15+525	15+694	Left	169
15R	17+155	17+340	Right	185
16L	15+855	16+190	Left	335
16R	17+385	17+690	Right	305
17L	16+301	16+365	Left	64
17R	17+769	18+101	Right	332
18L	16+420	17+049	Left	629
18R	18+170	18+485	Right	315
19L	17+155	17+215	Left	60
19R	18+900	19+005	Right	105
20L	17+430	17+505	Left	75
20R	19+517	19+637	Right	120
21L	17+790	17+840	Left	50
21R	19+956	20+036	Right	80
22L	17+910	18+010	Left	100
22R	20+705	20+805	Right	100
23L	18+170	18+485	Left	315
23R	21+230	21+320	Right	90
24	19+517	19+637	Axis	120
25	19+956	20+036	Axis	80
26	20+705	20+805	Axis	100
27	21+230	21+320	Axis	90
BR-VR6.6	6+950.00		Local road	72.00
BR-VR9.5	9+180.00		Local road	44.00
BR-SR14.6	14+520.00		Service road	44.00

Ref. No	Chainage		Branch	Total Length (m)
	From	To		
BR-SR17.0	17+120.00		Service road	72.00
And1_BR1	21+160		I.C. Andrijevića	128.00
UP 1	4+100		Underpass (Local Road VR_3.8)	45.00
UP 2	5+670.00		Underpass (Local Road VR_5.6)	45.00
UP 3	15+720.00		Underpass (Restaurant 2)	30.00
UP4	17+860.00		Underpass (Local Road VR_17.9)	50.00
UP5	21+160.00		Underpass (SR 21.3_R)	55.00

Table 4-7: Crossings and deviations of local network along the Variant 5

Name	Calculated speed	Type of crossing	Length (m)	Note
VR_0.2	50	Underpass	207.18	Regional road M9
SR_2.5	50		231.33	Regional road M9
SR_3.4	50		264.96	Regional road M9
VR_3.8	40	Underpass	465.54	
VR_0.2	50	Underpass	201.03	Regional road M9
SR_2.5	50		231.33	Regional road M9
SR_3.4	50		264.96	Regional road M9
VR_3.8	40	Underpass	465.54	
VR_5.6	40	Underpass	476.75	
VR_6.6	50	Underpass	1131,54	Regional road M9
SR_6.9	No category		64.04	
SR_7.4	No category		73.73	
SR_7.5	No category		129.97	
SR_7.7	No category		178.24	
SR_7.8	50		439.33	Regional Road M9
VR_9.5	No category		577.86	
AR_HM1	No category		210.10	To E/M facilities
AR_HM2	No category		705.32	To E/M facilities
SR_14.6	40		493.43	
SR_14.9	No category		542.81	
SR_15.0	50		320.38	Regional road M9
VR_16.6	No category	Underpass	631.28	
SR_17.0	50		253.50	Regional road M9
VR_17.9	50		492.38	Regional road M9
SR_18.1	No category		199.59	
SR_20.2	No category		180.39	
SR_20.2.1	No category		196.46	

Name	Calculated speed	Type of crossing	Length (m)	Note
SR_20.6	40	Overpass	829.87	
SR_21.2	40		822.88	
SR 21.3R	50		606.44	Regional road M9
VR 21.9	50	Overpass	272.79	Regional road M9

4.7 Tunnels, C&C, lane covers

The cover and cut approach is adopted, along the unstable sections of the alignment as well as at the areas where the shaping of smoother slopes leads to the exceed of the expropriation limit. In that way, not only does the safety of the alignment against any instability is ensured, but also the maximum height of the cutting slopes is reduced.

By reducing the height of the slopes, smoother cutting angles, of the order to 3(V):2(H), with intermediate 4m wide benches, can be applied, without exceeding the expropriation limit, thus minimizing the need for implementing extensive support measures in the direction of ensuring the global stability.

Table 4-8: Tunnels, C&C and lane covers in Variant 5

BRANCH	CHAINAGE		TUNNEL	COVERED EXCAVATION	LANE COVER	SUPPORTING WALLS
	From	To	Length	Length	Length	Length
			(m)	(m)	(m)	(m)
Left	0+798	0+917				119
Left	0+940	1+072				132
Left	1+116	1+199				83
Left	3+699	3+825			126	
Left	3+825	3+860				35
Left	3+920	3+970				50
Left	5+960	6+166				206
Left	6+170	6+334			164	
Left	6+338	6+360				22
Left	8+116	8+230			114	
Left	8+626	9+024				398
Left	9+127	9+350				223
Right	9+545	13+440	3895			
Left	9+520	13+445	3945			
Right	12+940	13+042			102	
Left	13+023	13+200			177	
Left	13+440	13+675			235	
Left	18+800	18+900			100	
Left	19+435	19+580			145	
Left	20+025	20+115			90	
Left	20+555	20+600			45	
Both	20+600	20+680		80		

BRANCH	CHAINAGE		TUNNEL	COVERED EXCAVATION	LANE COVER	SUPPORTING WALLS
	From	To	Length	Length	Length	Length
			(m)	(m)	(m)	(m)
Left	20+680	20+750			70	
Both	21+698	21+900		202		
Right	21+960	23+400				1440
Total (m)			7,112	282	1,352	2,708

4.8 Associated and functional facilities

The supporting highway facilities are divided into:

- Functional facilities serving the traffic on the highway, used for maintenance, control and enabling faster, safer, more comfortable and reliable transportation of goods and passengers on the highway: structures and facilities intended for road maintenance, control and management, and for toll stations; and
- Associated facilities intended for road users: petrol stations, motels, shops, parking lots, rest areas, information centres and others.

4.8.1 Functional facilities

Under the Detailed Spatial Plan of the Bar - Boljare highway and the Urbanistic and Technical Requirements, the ToR of the project, the following facilities are foreseen:

- Base for Road Maintenance.** Their main role is to carry out all the necessary road maintenance works in the winter and summer and are complementary with information technology facilities (telephone connections, regulation and control of traffic, etc.). Road maintenance base is planned at Andrijevića at around Ch. 21+400 - located in the interchange to maintain the highway from Mateševu to Berane.
- Toll stations.** Toll station at Andrijevića interchange around ch. 21+500

4.8.2 Associated facilities

The following associated facilities are foreseen (Figure 4-8):

- Both - sided rest area type II in Mateševu and both-sided petrol and service station type II in Mateševu that are integrated at one location
- Motels type I, both in Mateševu and in Andrijevića;
- Both - sided petrol station type I in Andrijevića;

4.8.2.1 Both-sided rest area type II and petrol and service station type II in Mateševu

Rest Area: 3-5 ha - The role of the rest area, together with the parking lots, is to enable safe and comfortable travel and rest for participants in traffic, and in addition, this type of facility promotes local tourism.

This Rest area is an independent part of the functional unit with a gas station and is organized in such a way that there can be parked 40 passenger cars, 16 trucks, and 4 buses at a time.

Based on precise guidelines from the DSP, the construction of the following facilities is planned on the plateau of the rest areas:

- Public fountain with a separate toilet of 100 m².
- Smaller ethno-catering shop 100 m²
- Multipurpose sports field with a small shop with a cafe
- Covered area with stalls for the sale of local agricultural and traditional handicraft products, dimensioned as a ground floor building of 200m².
- Spaces for rest, recreation and seating for 100 - 200 passengers (paths, benches and tables, trash cans, etc.), area of approximately 2000 m²;
- At the entrance there should be a board with the name of the rest area, its map and information about close surroundings
- At the exit from the rest area, it is planned to set up an information-tourist point of 30 m²) which is in the function of tourism promotion (with the use of telephone and information about the environment and its motives, available from the rest area, about the main traffic turns to cities, spas, tourist destinations), natural and cultural assets, etc.);
- Facility - a place for first aid and roadside assistance for passenger cars (size 30 m²); which is a facility with an information and tourist point
- Facility for emergency accommodation of employees at the rest area and inn for inspection and police (approx. 40 m²)

Petrol and service station: 1.5-3.0 HA - It is also an independent facility within this mixed functional unit.

For the needs of users and visitors, the area around the building is primarily equipped with parking spaces for: 40 passenger cars, 16 trucks, and 4 buses. Within the building there are also refuelling points for all types of fuel dispensing in accordance with the required standards. In addition to the planned number of parking spaces, the gas station contains:

- Temporary place for solid waste disposal from the station (min. 30 m² gross).
- Larger public fountain and public toilet, which will be located within the gas station facility;
- At the entrance to the station there will be a board with the name and map of the gas station;
- At the exit from the gas station there will be an information-tourist point (approx. 30 m²), with the use of telephone and information about the environment and its motives available from the rest area, about the main traffic turns to cities, spas, tourist destinations, natural and cultural assets etc;
- Facility of first aid and information services with official and public telephone (approx. 30 m² gross),
- At the exit of the gas station, there will be special services for the repair of passenger cars and trucks and buses, as well as towing service and sheltered parking for damaged vehicles of approx. 200 m² gross;
- Indoor cafe at the gas station will be with a terrace (150 m² + 100 m²)

- Accommodation for restaurant and pumping station staff (by regulation for ½ shift staff), inn for inspection and police, as well as storage of materials, tools, etc. (120 m² gross).

4.8.2.2 Motels type I, both in Mateševce and in Andrijevica

Two locations are planned. Generally, these are the locations with the richest facilities, in the function of keeping visitors for one or more nights, and for the needs of traffic, rest, recreation and tourism.

The facility or location where the Motel Type I is located, which has an approximate gross area of 2600m² floors P + 3 + Pk, has:

- Entrance and exit lane and green dividing island;
- Parking for passenger cars, trucks and buses with at least 50, 20 or 5 parking spaces,
- Larger public fountain, special public toilet (female and male, 50-100 m² gross) and temporary place for garbage disposal from the checkpoint (30-60 m² gross);
- At the entrance to the checkpoint there will be a board with the name and map of the motel;
- At the exit from the checkpoint there will be an information-tourist facility (min. 30 m²) with the use of telephone and information about the environment and its motives available from the rest area, about the main traffic turns to cities, spas, tourist destinations, natural and cultural assets, etc.);
- Accommodation for motel staff and tourist information facility and checkpoint maintainers (by regulation for ½ shift staff), inspection and police inn (min. 60 m² gross);
- Canopies, landscaped green areas, paths, benches, tables (with a minimum of 60 seats) and trash cans, as well as other facilities for rest and relaxation; total area 2000-4000 m².
- It is also planned to arrange and equip appropriate areas for camping;
- Free, maintained green areas - a landscape for relaxation.

4.8.2.3 Both-sided petrol station type I in Andrijevica

Petrol service station type I - "Andrijevica" is also placed on both sides of the highway corridor, and they are equipped with:

- Entrance and exit lanes and green dividing island;
- 9 refuelling points, for different types of vehicles and with different types of energy sources, as well as other additional services (oil change, window cleaning, sale of spare parts and other consumables);
- Parking for passenger cars, trucks and buses with 40, 16 or 4 parking spaces. With the necessary passing lanes (for a minimum of 224 simultaneous users);
- Temporary place for solid waste disposal from the station (min. 30 m² gross) with a larger public fountain and a public toilet located within the gas station (approximate gross area 30 m²);
- At the entrance to the station there will be a board with the name and map of the gas station;
- At the exit from the gas station there will be an information-tourist point (min. 30 m²) with the use of telephone and information about the environment
- First aid service with a doctor and auxiliary medical staff, as well as the necessary accommodation of 80 m² gross area;

- Indoor restaurant with terrace and min. 120 seats, with ethno kitchen with a capacity of 500 meals a day and a toilet (min. 250 m² gross + 100 m² terrace);
- Grocery store with drinks, food, cigarettes, newspapers, perfumery, jewellery on offer (min 100 m²);
- Accommodation for restaurant and pumping station staff (by regulation for ½ shift staff), inn for inspection and police, as well as storage of materials, tools, etc. (min 100 m² gross).

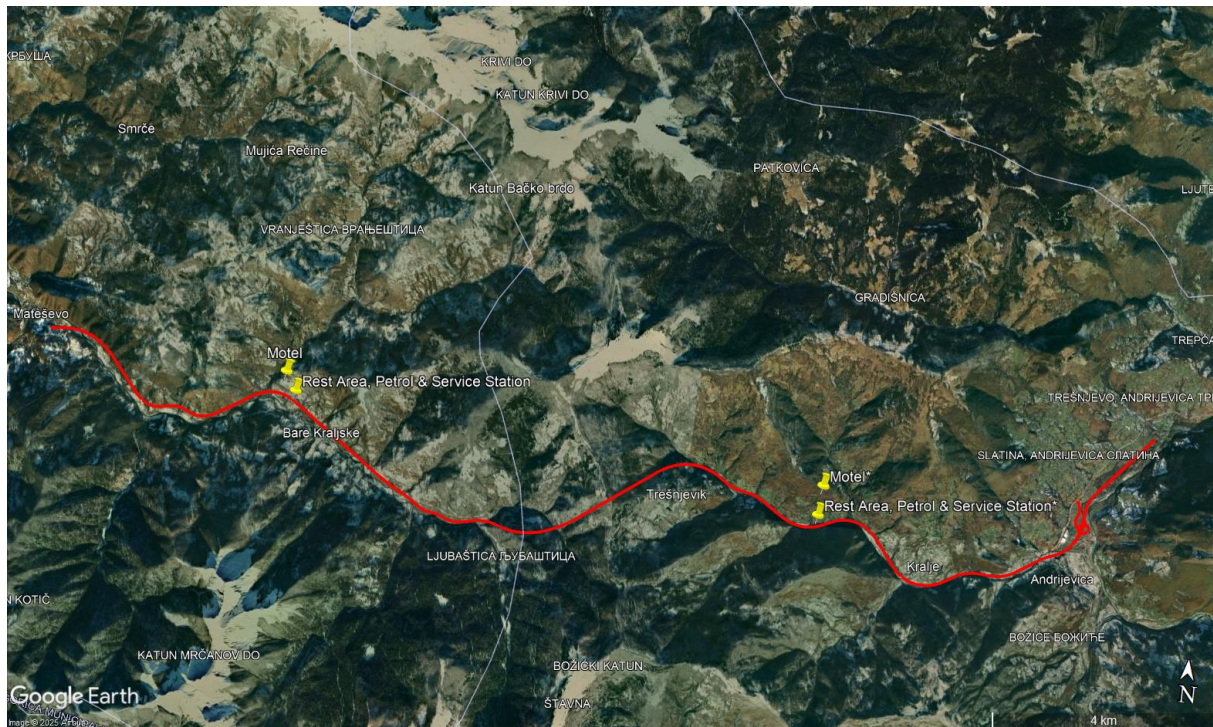


Figure 4-8: Rest Area, Petrol and Services Stations and Motels along the new alignment (* these are based on the former variant)

4.9 Electromechanical installations

4.9.1 Lighting

The lighting requirements of Highway Mateševsko-Andrijevička have been designed and calculated according to the European CEN Standard CEN/TR 13201-1:2014 Road lighting Part 1: Guidelines on selection of lighting classes, and the European CEN Standard EN 13201-2: "Road lighting Part 2: Performance requirements". Guideline on illuminating areas has been followed according to TEM Standards and Recommended Practice: 2002 from United Nations Economic Commission for Europe. Finally, each lighting installation along the Highway Mateševsko-Andrijevička has been designed in accordance with the national regulations of the Republic of Montenegro:

- Law on the Bar-Boljare Highway ("Official Gazette of Montenegro", 52/2014 od 16.12.2014. god),
- Law on Roads ("Official Gazette of the Republic of Montenegro", 42/2004 and "Official Gazette of Montenegro", 54/2009 and 36/2011)

Road lighting installations on the Mateševsko-Andrijevička section also include:

- Lighting of Andrijevičica Interchange (I/C),
- Lighting of Bridges,
- Lighting of Highway Rest Areas,
- Lighting of Toll Station

Apart from the above, the following areas are also proposed to be illuminated:

- 75m before and after each bridge for guidance purposes
- 200m before the start of deceleration lane in interchanges
- 200m after the end of acceleration lane in interchanges

The road lighting is designed to be implemented with luminaries of LED technology that will be placed on masts of 10m or 12m. Regarding toll lighting, the increased lighting requirements in combination with the large road surface (which must be illuminated with 50 lux) require the use of high masts 20 meters per side of the passage.

4.9.2 Power supply and distribution

Power supply & distribution includes:

- The power supply to road lighting circuits
- The power supply to traffic equipment, communication and signals devices.

The section Mateševu-Andrijevičica will be power supplied by two HV/MV substations (referred to as primary substations). At the one end of the section, the existing substation HV/MV (Highway 2 – Mateševu) shall be used, while from the other end (direction from Andrijevičica) a new substation will be provided. The final location of the new substation and the technology that will be used will be determined in cooperation with CGES¹⁰. Each substation shall have a 100% transformation reserve, i.e. two transformers of estimated power, ensuring that each one of them can fully meet the demand on the considered section.

Alongside the highway, fourteen (14) substations MV/LV is proposed to be established. We distinguish four typical buildings (4) where the equipment will be placed. The Building of Substation (external) has dimensions LxWxH 11,7x8,4x3,85m.

The Substation's Building provides for all the necessary electromechanical installations, such as:

- Lighting
- Heating / Air conditioning / Ventilation
- Fire protection system-Security system
- Telecommunication

Appropriate configuration was made for the installation of the main equipment such as:

- Power transformers
- Medium voltage electric equipment
- Low voltage electric equipment

¹⁰ Crnogorski elektroprenosni sistem AD (Montenegrin Electrical Transmission System)

- UPS
- Diesel generator
- Control panels

4.9.3 Traffic & signal equipment

Regarding the surveillance and control of Highway a central system will be installed for surveillance, control, and data collection. The central system will be in the maintenance base at the Andrijeviča Interchange (I/C).

Installations that will be controlled by the system are:

- MV/LV Substation,
- Low Voltage Pillars,
- Emergency call stations,
- VMS,
- Traffic cut barriers,
- Video monitoring (CCTV),
- OHVD system,
- Traffic Data Devices
- Weather stations

The construction of the system, the connections between units of the electrical devices takes place with the use of optical fibered (FO) cables. During their route to the ground, the optical fibers go through pipes PEΦ50. For example, of the cross paths the pipes are boxed but an extra pipe is placed for reserve reasons. The depth of the routing through the pipes to the ground is about 70cm. In the case of the pipes going across with technical works, the imminent route takes place through galvanized metal pipes for bridges, or through the specified mechanical canal for the internal of the Tunnels.

Moreover the system will include:

- Automation Systems, consisting of:
 - PLC - Programmable Logical Controllers, connected to the equipment for collecting signals and sending control commands,
 - Sensors, actuators, switches, (controllers),
 - Power supply and signal transmission wirings.
 - A Video Monitoring System, consisting of cameras, switches, and signal transmission wirings.
 - A Supervisory Operator monitoring and control system which will include SCADA software, 2 Servers, 1 “Client”, database, Video Recorder and Monitors

4.9.4 Tunnel electromechanical equipment

4.9.4.1 Lighting

The design of tunnel lighting is performed according to following standards and guidelines:

- European Standard (Approved by CEN) CR 14380:2003 "Lighting applications - Tunnel lighting"

- Technical Report CIE 88:2004 "Guide for the Lighting of Road Tunnels and Underpasses"
- Technical Report CIE 189:2010 "Calculation of Tunnel Lighting Quality Criteria"
- European Standard EN 16276 "Evacuation Lighting in Road Tunnels"
- Technical Report CIE 193:2010 "Emergency Lighting in Road Tunnels" (only for Lay Bys lighting)

The Daytime road luminance level L (cd/m^2) inside tunnel will be adjusted proportional to external luminance L_{20° by controlling the luminous flux of the LED luminaires, using a dedicated lighting control system. The Night lighting level will be constant with luminance level $\geq 2 \text{ cd}/\text{m}^2$ and will operate continuously on a 24-hour basis. The Night lighting is power supplied by UPS and used also as Emergency Lighting.

The luminaires of Night lighting will operate continuously on a 24-hour basis. The luminaires of Daytime lighting will be controlled by ON/OFF switching and will operate during day. The luminaires of Access Road lighting will be controlled by ON/OFF switching and will operate during night.

Each Lane Cover will have an independent lighting control panel that will include all the necessary switchgear and control equipment (switches, circuit breakers, relays, contactors, PLC, etc.). The lighting control system will be simple ON/OFF switching type and will be implemented by electrical control devices (relays, switches etc.) or by a digital automation system (PLC, controller). The lighting control system will operate automatically with the possibility of manual intervention. The system will control also the access roads lighting system, which will operate in parallel with the night lighting of the tunnel.

The tunnel will be equipped with emergency or safety lighting, so that in case of electrical power interruption from L.V. 3X400/230Vac network, a minimum light level inside the tunnel will be maintained. In case of electrical power interruption, the vehicles speed limit inside tunnel must be reduced by informing the drivers using Variable Speed Limit Signs (VSLS) and/or Variable Message Signs (if any) installed before the entry portal.

Finally, the tunnel will be equipped with evacuation lighting, designed according to EN 16276: 2003 "Evacuation Lighting in Road Tunnels" and Austrian Guidelines RVS.

4.9.4.2 Ventilation and smoke extraction

Regarding ventilation, the tunnel will be equipped with jet fans fully reversible, as well as Measuring Instruments for Pollutants CO, NO_x & Visibility and Measuring Instruments for Air Velocity & Direction.

The jet fans will be installed on the tunnel roof and will be supported on hot dipped galvanized steel base and / or supports provided by the manufacturer. The fixing of the jet fans on the roof will be done according to the manufacturer's instructions. Also, the jet fans will be hanged on especially fire-resistant shock absorbers. The power cables for the jet fan supply will be installed in embedded or visible fire-resistant electrical conduits. The cables will be fire resistant (class F180/E90) with steel armouring for mechanic resistance. The whole construction will be waterproof and fire resistant. The jet fan and motor will be connected to the tunnel grounding system by a bare copper wire of 16-25 mm².

For measuring air quality, three instruments will be installed on the right bore and three on the left bore. The measurements and fault alarms are transmitted to the local PLC and afterwards to the SCADA system through special signal cables.

To supervise the air movement inside the tunnel and to control the ventilation system, instruments for the measurement of the air velocity and air flow direction will be installed inside the tunnel. The instruments will be installed at the same locations as the air pollutant instruments.

Ventilation system management should be enabled from:

- tunnel operational centre - technical room, without permanent manned presence.
- management at the SCADA server level of the control centre
- tunnel control centre with permanent manned presence.

In the control centre, at a video wall, as well in the operational station of the tunnel operational centre, display:

- current measured values of the ventilation system,
- status of the ventilation system elements.

4.9.4.3 Fire protection and safety systems

The tunnel Safety Measures are determined mainly according to European Directive 2004/54/EC and supplementary according to RABT 2006 and specific requirements issued by the Project Owner.

The safety measures include:

Emergency exits (Fire Protection System). The tunnel will be equipped with nine (9) cross passages for pedestrians and two (2) cross passages for emergency vehicles and pedestrians. The cross passages will be used as emergency exits to the other “safe” bore in case of fire incident or emergency case. Also, an additional exit (escape) door to outdoors will be provided at left bore Ch = 13+050 m. The distance between cross passages is approx. 300m which is much shorter than the distance of 500m that allowed by the EU Directive.

Drainage of road pavement (Tunnel Drainage System). Since the transport of dangerous goods is permitted through the tunnel, drainage system for flammable and toxic liquids will be provided through well-designed slot gutters. Additionally, the drainage system will be designed and maintained to prevent fire and flammable and toxic liquids from spreading inside tubes and between tubes.

Lighting system (Lighting & Fire Protection System). As already described, normal light is provided during day and night, while safety lighting and evacuation lighting shall be also provided.

Ventilation system. Mechanical ventilation system as described.

Emergency stations. Emergency stations will be provided near the portals and inside the tunnel at intervals of approx. 150m. The stations will be placed in recessed booths on right sidewall of tunnel and shall be equipped with an emergency (SOS) phone, two portable fire extinguishers and a panic button. The stations will be designed according to RABT 2006 – Sec. 6.4.1 “Emergency call stations”.

Water supply for firefighting (Fire Protection System). Water supply shall be provided for firefighting. Hydrants will be provided near the portals and inside at intervals of approx. 150m (max. allowed distance is 250m). The hydrants will be placed in recessed fire cabinets on left sidewall of tunnel, opposite to emergency stations. The system will be designed according to RABT 2006 – Sec. 6.4.2 “Supply with fire water”.

Road signs (Fire Protection System). Specific signs will be used for all safety facilities provided for tunnel users. The reflective and illuminated signs for use in tunnel (i.e.. signs for evacuation route and exits, parking area, emergency phones, firefighting, traffic signalling etc.) will be designed according to EU Directive - Annex III and/or RABT 2006 Guidelines.

Control centre (Tunnel Control System). A regional control centre will be provided for remote surveillance, traffic management and control of the tunnel and “Mateševu & Andrijevića” highway.

Monitoring systems (Traffic Management & Fire Protection Systems). The following monitoring systems will be provided for tunnel interior and access roads: - Video monitoring system (CCTV) with fixed cameras inside tunnel and PTZ (Pan Tilt Zoom) cameras in tunnel access roads, near tunnel portals. - Traffic monitor system based on road loop detectors inside tunnel which is able to

automatically detect traffic incidents (such as stopping vehicles) - Linear fire detection all along tunnel with fibre optic sensor cable, controllers and main control panel

Tunnel-closing equipment (Traffic Management System). The following equipment will be provided for tunnel-closing in case of an emergency situation: (i) Traffic signals (flashing Amber) at access road, before tunnel entry portals (ii) Traffic closing barriers equipped with warning light, in front of tunnel entry portals (iii) Traffic signals (Amber - Green) and LCS (Lane Control Signs) at entry /exit portals (iv) Additional means like VMS (Variable Message Signs) provided for Traffic Management System along “Mateševo & Andrijeviča” highway

Emergency Power Supply (Electrical Power Supply & Distribution System). The tunnel will be power supplied by two (2) MV (medium Voltage) 20kV lines coming from east and west sides. Each MV 20kV line comes from independent HV (High Voltage 150/400kV) substations and so the tunnel power supply is considered as “uninterruptable”. There is no need for installation of Emergency Diesel Generators in tunnel substations. An electrical MV/LV 20kV/690/400V substation of app. 1,200kVA will be constructed near west tunnel portal, which will supply power to tunnel jet fans, lighting, fire pumps, control systems etc. An electrical MV/LV 20kV/690/400V substation of app. 1,000kVA will be constructed near east tunnel portal, which will supply power to tunnel jet fans, lighting, control systems etc. Furthermore, two (2) internal MV/LV 20kV/690/400V substations of app. 630kVA will be constructed inside the vehicles cross passages, for power supply of nearby equipment (jet fans, lighting, traffic lights, LCS, VMS, control systems, etc.). Each of above substation will be equipped with a UPS (Uninterruptible Power System) capable to supply continuously for 30min the safety lighting system and tunnel monitoring and control systems (CCTV, traffic signs, PLC, SCADA etc.)

Fire resistance of equipment (Fire Protection System). The power supply cabling of safety lighting system will be fire resistant type NHXH F180/E90. The suspension system of various equipment (i.e.. luminaires, cable trays, etc.) in the tunnel roof will be designed and constructed in order to withstand collapse in normal conditions and in case of fire.

4.9.4.4 Service buildings

The tunnel will have four (4) Service Buildings:

- The main Service Building will be built in the east (21,5x10,3m)
- The secondary Service Building will be constructed on the southwestern front of the Tunnel 2 (26,7x10,3m)
- The two (2) Buildings of Internal Substations (17,60x5m)

The buildings provide for all the necessary electromechanical installations, such as:

- Lighting
- Heating / Air conditioning / Ventilation
- Weak stream
- Fire protection systems
- Security systems

Appropriate configuration was made for the installation of the main equipment such as:

- Power transformers
- Medium voltage electric equipment
- Low voltage electric equipment
- UPS
- Diesel generator
- Fire pumps

- Control panels

Manual extinguishers for initial fire extinguishing are placed nearby or in every area of service buildings.

4.9.4.5 Traffic, safety and surveillance equipment

Tunnel shall have the following traffic and safety devices.

- Emergency call stations,
- Traffic Management and Traffic Closing Management System,
- Emergency Services Radio System,
- Broadcast system emergency messages,
- Video monitoring-Closed Circuit Television System (CCTV),
- Traffic Surveillance Facilities,
- Public address system.

4.10 Drainage

The drainage of the catchments upstream of the highway is achieved through the design of hydraulic structures; either bridges or culverts, at the points where the watercourses cross the alignment. Bridges are chosen where the terrain dictates it and where longer spans are required that can convey the peak flows (Hydraulic analysis for bridges is included in separate documentation).

The culverts under the highway are designed for the 50-year return period. At the culvert inlets, headwalls or drop structures are proposed according to what best fits the local arrangement. In cases where discharge through culvert cannot be applied (high cuts), then a cascade structure is installed directing the flow to the cut drainage ditch.

Apart from the highway, culverts are also introduced under the designed ramps, service or local roads, designed with a 10-year return period. When the culvert is in the immediate vicinity of a highway culvert (immediately upstream or downstream), the size and shape of the local road culvert will be kept the same as the size and shape of the highway culvert. This is to avoid obstruction of the flow entering or leaving the highway culvert.

Apart from culverts, protection parallel to the alignment is provided in order to protect the highway from the runoff of the upstream catchments. This is introduced through the following:

- Embankment toe protection is provided at the toe of high embankments (>7.0m) and at the locations where small runoff results from the upstream catchments.
- When the flow at the toe of embankment is significant, a drainage ditch is provided to discharge it to the nearest culvert or bridge.
- A drainage ditch is provided at the top of all cuts to protect the highway.

In addition, in order to collect the runoff from the cuts, cut drainage ditches are provided at the toe of the cuts, on the side of the highway, as well as at the top of the retaining walls and cut and covers. Cut ditches discharge to recipients through culverts and bridges.

Gutters and collection pipes are provided on the side of the pavement to collect the runoff from the highway and ramps. Pavement runoff is then directed to separators for treatment and then to recipients. The size of collection pipes is calculated for uniform flow.

Perforated pipes are used to collect the water that drains through the pavement with a typical arrangement of minimum Ø200.

Gullies are provided at specified intervals to collect the flow in gutters and discharge it into the collection pipes.

Runoff from highway pavement and ramps will be collected and treated in prefabricated separators. The design return period is chosen as 10yrs. The separators will be designed based on the EN Standard 858 for separator systems for light liquids (e.g. oil and petrol).

Separators are installed at the following spots:

- At low points of the alignment.
- At the entrance and exit of tunnels.
- At the start of the bridges so that the size of the collection pipe under the bridge is minimised.
- Apart from the spots above, separators are installed at frequent locations to discharge the pavement runoff and avoid large sizes of collection pipes and separators. Locations are chosen to be accessible for maintenance.

Concentration of pollutants at the outflow of separators will meet class 1 limit (pollutant concentration below 5 mg/l). The number of PCUs required may change in the later stages of the project, but the total treatment capacity will be approximately the same.

4.11 Retaining structures

A detailed geotechnical investigation campaign has taken place during the previous phase of the project (prior to ch 9+800 where the variation between the proposed and the former variant commences) and several potential hazardous zones have been identified, along with retaining structures proposed. These are presented in the tables below.

Table 4-9: Potential hazardous zones identified

Retaining Wall – Ch	Length (m)	Geotechnical Unit	Retaining Structure
Left 0+798 ÷ 0+917	119	Debris of Sandstone and Limestone in a silty / clayey matrix Completely weathered Sandstone	Retaining Wall
Left 0+940 ÷ 1+072	132	Debris of Sandstone and Limestone in a silty / clayey matrix Completely weathered Sandstone Limestone / Marly Limestone	Retaining Wall
Left 1+116 ÷ 1+199	83	Debris of Sandstone and Limestone in a silty / clayey matrix Completely weathered Sandstone Marlstones Limestone / Marly Limestone	Retaining Wall
Left 3+699 ÷ 3+825	126	Alluvial/Elluvial Clay with intercalations of marly limestones Marlstones Limestone/Marly Limestone	Lane Cover
Left 3+825 ÷ 3+860	35	Alluvial / Elluvial Clay with intercalations of marly limestones or calcarenites Marlstones Limestone / Marly Limestone	Retaining Wall
Left 3+920 ÷ 3+970	50	Alluvial / Elluvial Clay with intercalations of marly limestones or calcarenites Marlstones Limestone / Marly Limestone	Retaining Wall
Left 5+960 ÷ 6+166	206	Alluvial / Elluvial Clay with intercalations of marly limestones or calcarenites Sandstone with intercalations of Siltstones	Retaining Wall
Left 6+170 ÷ 6+334	164	Alluvial/Elluvial Clay with intercalations of marly limestones Sandstone with intervals of Siltstones Alevrolites with intercalations of Sandstones	Lane Cover
Left 6+338 ÷ 6+360	22	Alluvial / Elluvial Clay with intercalations of marly limestones or calcarenites Sandstone with intercalations of Siltstones Alevrolites with intercalations of Sandstones	Retaining Wall
Left 8+116 ÷ 8+230	114	Alluvial/Elluvial Clay with intercalations of marly limestones Sandstone with intervals of Siltstones Alevrolites with intercalations of Sandstones	Lane Cover
Left 8+626 ÷ 9+024	398	Alluvial / Elluvial Clay with intercalations of marly limestones or calcarenites Alevrolites with intercalations of Sandstones	Retaining Wall

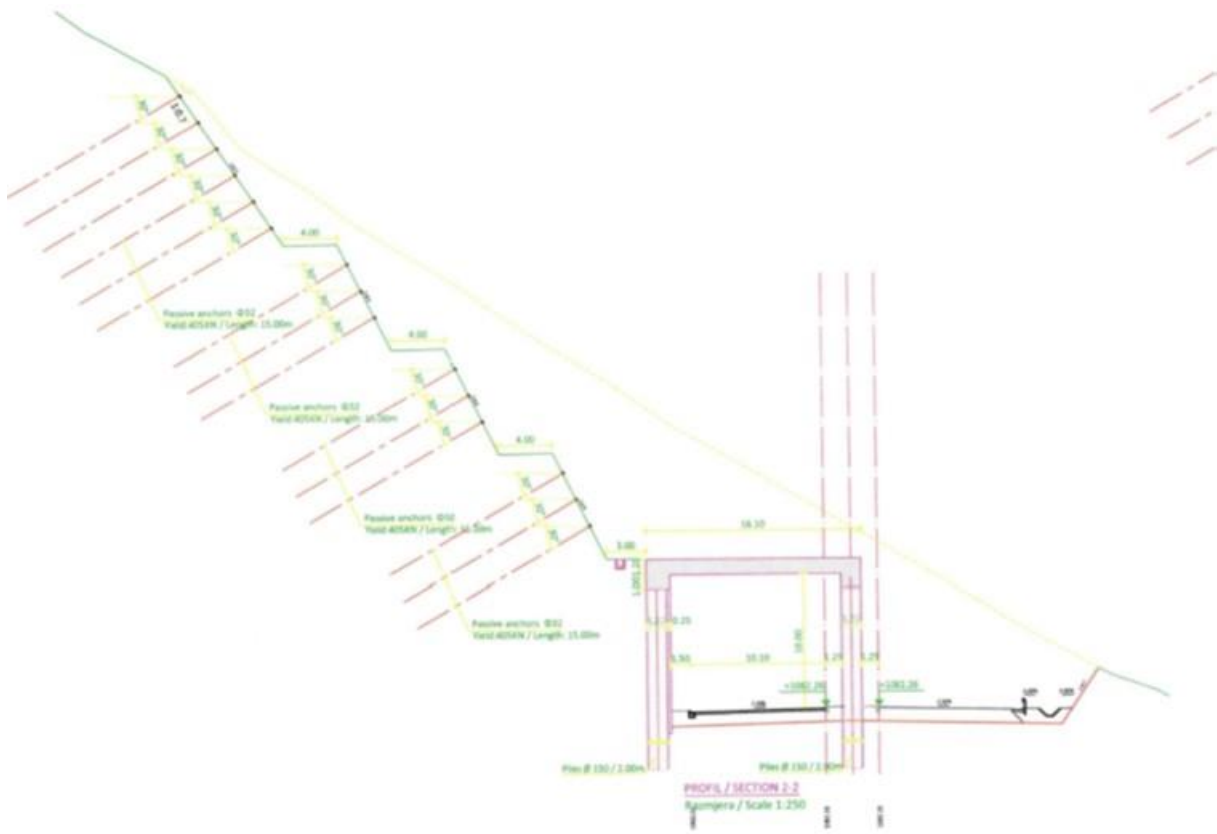


Figure 4-9: Lane Cover at ch 3+699 ÷ 3+825

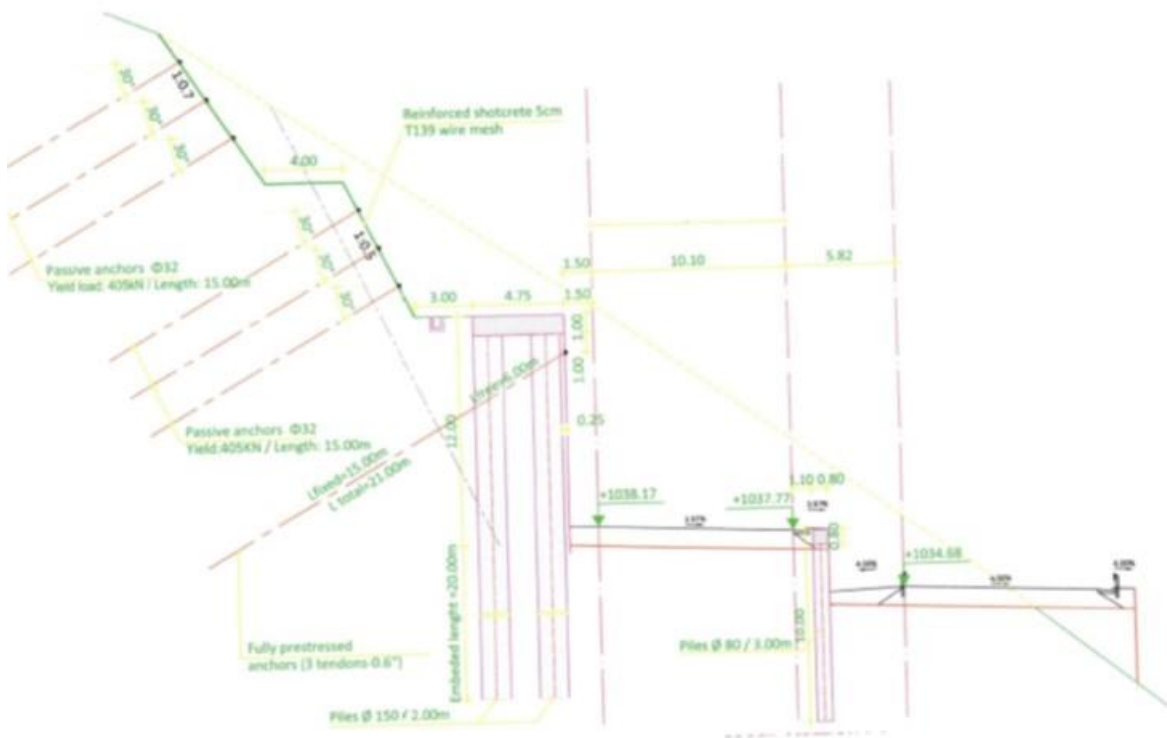


Figure 4-10: Retaining wall at ch 0+798 ÷ 0+917

4.12 Landfills and borrow pits

Within the design, an analysis of potential locations of landfills for excavated material and borrow pits for construction purposes was carried out.

The borrow pits proposal provides locations that according to the adopted criteria can meet the needs for material, for which it is necessary in further work during the preparation of the Main Design to define both in terms of stone quality and quantity.

Proposals for the locations of excavated material landfills are classified into two categories(Figure 4-11):

- i. Temporary landfills, where material will be deposited immediately after excavation, its selection, separation and separation for the needs of embankment construction;
- ii. Permanent landfill, where part of the material that does not meet the conditions for use in construction will be disposed of. The permanent landfill must meet the prescribed criteria for environmental protection.

Individually, each location of the borrow pit and landfill should be designed both in terms of the method of exploitation and in terms of the method of depositing excavated material and conservation and recultivation in order to minimize the negative impact on the environment, especially on surface and underground water.

4.12.1 Landfills

The main criteria applied for the selection of locations for temporary and permanent landfills of excavated materials are:

- Distance of the location from the highway route, cuts, tunnels;
- Access to the location itself;
- Terrain morphology;
- Population (built-up) on the location;
- Agricultural land;
- The available area of the location, that is, the possible volume of deposited material;
- Impact on the environment;
- Impact on surface and underground water;
- Terrain stability.

Considering the above criteria, 15 locations of temporary landfills have been defined, of a total area of approx. 18 ha (Figure 4-11). When choosing locations, care was taken to ensure that landfills are not defined on developed land, on agricultural land locations, as well as that permanent streams are not blocked, given that the locations are mostly connected to ravines in the highway zone. When organizing the construction site and preparing the dynamics of the work, care must be taken that the material from the excavation after separation and granulation can be immediately used for backfilling where possible, and the tailings must be transported to a permanent landfill as soon as possible. This kind of use of temporary landfills will enable a smooth highway construction process.

The topsoil that is removed from the route must be deposited in a special place on the borrow pit or temporary landfill so that after construction it can be used for arranging and greening the slopes, embankments and cuts.

Two locations have been defined for the permanent deposit of excavated materials. One location is located on the left side of the highway section (~ km 3+000), near Bukov stream, while the second, larger one, is proposed on the right side, some 2 km from the highway section (~ km 18+000) on the western slope the hills of Veliki Krš (from the highway up the valley of the Mala River). In terms of morphology, both locations meet the criteria, that is, they have a relatively gentle slope of the terrain and plenty of places for depositing, which is quite rare in the observed terrain. Both locations are underlain by flysch, i.e. Permian sediments with a generally thick Quaternary crust, and due to possible sensitivity, geotechnical investigations should be carried out at the locations for the purposes of the excavation of the main design.

The locations for the permanent deposit of materials are shown in Figure 4-11. They occupy an approximate area of about 111 ha. The main design of landfills will define the method of depositing, the height of the dumped material, as well as the drainage of storm and seepage water. In the main designs, it is necessary to define the actions necessary for the recultivation of landfills. The locations are hidden from populated areas, so there will be no problem of visual integration into the environment. Access to the locations will require the creation of temporary roads or partial adaptation of existing ones.

The highway route was designed through morphologically very adverse area. Large slopes of the terrain do not allow deposition of large amounts of material, since there is a possibility of causing instability and endangering both the deposited material and the surrounding natural terrain. On the other hand, it should be taken into account that flysch and Permian deposits are sensitive to changes in the stress conditions in the soil caused by uncontrolled backfilling.

For each surplus material disposal site (landfill), it is necessary to timely prepare appropriate design documentation, in accordance with legislations and standards. The documentation shall define:

- Detailed position of the site;
- Ownership of the land where the location is planned;
- The area and volume of the landfill;
- Morphometric characteristics of the location and distance from settlements, important water bodies and springs;
- Geological structure of the terrain (geological composition, tectonic structure);
- Engineering geological characteristics of the terrain (lithogenetic types of rocks, engineering geological phenomena, modern geological processes and phenomena, physical-mechanical properties of rock masses, degree of karstification and disintegration of rock masses, etc.);
- Hydrogeological characteristics of the terrain (hydrogeological properties and functions of rock masses, depth to the level of groundwater, hydrogeological phenomena, directions of groundwater circulation, types of groundwater accumulations, etc.);
- Carrying capacity and stability of terrain;
- Seismicity of the terrain;
- Possibilities of polluting water wells and important water sources;
- Environmental impact;

- Landfill impacts to the infrastructure (traffic, hydrotechnical, electrical and telecommunication infrastructure, settlements and individual buildings);
- Methods of classification and disposal of materials;
- Possibilities of recultivating the terrain and its use for specific purposes.

For each landfill, it is necessary to make a geodetic survey of the existing condition, a technical description, characteristic cross-section profiles, material disposal-deposit technology, the final contour of the landfill, i.e. the final layering solution. Furthermore, for each landfill, it is necessary to carry out a reclamation project, i.e. each landfill must be restored to its intended purpose, through implementation of planned recultivation measures.

Landfills are planned only if there is an excess material (remaining from the levelling of masses during excavation and construction activities).

4.12.2 Borrow pits

According to the design, it is estimated that only about 20-25% of the excavated material will be able to be used for the needs of forming embankments and concrete production. The missing material for the formation of the embankment and the production of concrete could be increased by the eventual opening of borrow pits in the area of the highway alignment in parts that, based on the analysis of the geological structure, as well as on the basis of the analysis of the geotechnical investigation works for the preliminary design level, are rich in solid rock masses, specifically sandstones and calcarenites-limestones. The usability of this material needs to be tested beforehand in terms of quality and available quantities so that it can be effectively used in the construction of this section of the highway.

Material required for the construction of highway body or unbound (lower) bearing layers of the highway structure is provided from the material borrow sites.

Material borrow pits are determined by the Conceptual and the preliminary design, in terms of the position of borrow pits in relation to the highway route, and estimated quantities and quality of materials. The quality of borrowed materials should be confirmed by analyses at the level of the Main Design. Main design on regulation of borrow pits will be prepared within the framework of the Main design of the highway section.

Opening of the borrow pit for the materials, for which the main design will be prepared, includes:

- Geodetic survey of the terrain of the borrow pit before its exploitation, and the data is entered in the geodetic survey report;
- Preliminary material quality tests, conducted by an authorized laboratory;
- Preparation of a mining design, that will define the methods of exploitation and the heights up to which exploitation will be carried out;
- Arrangement of access road and operational platform.

Preliminary tests of materials will be carried out on samples of materials from the borrow pits in laboratory conditions, with the aim to prove the quality and suitability of the material. The standards to which material tests are performed, as well as material quality conditions, are defined by:

- Technical conditions for the execution of earthworks (embankments, backfills, wedges, bedding and clay backfill);

- Highway construction design and technical conditions for highway construction (unbound bearing layers and stone aggregate, stone flour, sand, stone chips for the production of bonded bearing layers);
- Design for concrete works (aggregate for concrete production);

The report on the preliminary tests of the material from the borrow pits will give that material the status of a controlled product, compliant with the requirements prescribed by the appropriate technical standards. These tests can also be carried out by the contractor, in order to prove the usability of the excavated material, which will reduce the construction costs of the highway section.

If subsequent tests of the material at the defined borrow pits show that there is not enough material, or that material does not comply with quality criteria defined by the Main Design and valid technical standards, then material required for the highway body or for the lower bearing layers of the pavement structure can be procured from the supplier. In that case, material originates from the existing borrow pits, where the quality of the material is proven by the manufacturer's certificate. In addition to the manufacturer's certificate, before delivery, it is necessary to do the quality control of the material by an authorized institution, which will conduct the necessary laboratory tests on samples taken from the borrow pit. Based on the test results, a report on the preliminary tests of the material from the borrow pit is made.

If materials of quality and quantity required by the Main design and/or technical standards cannot be provided from the suppliers from the existing borrow pits (landfills), the contractor shall carry out the following procedure:

- Inform the Project owner on the material needs, in written;
- After receiving the written consent, purchase the land on behalf of the Project owner (if Project owner had not already directly purchased the land);
- Conclude a contract on the purchase of land, according to the valid procedure;
- Obtain a cadastral certificate and perform all legal actions related to the purchase of land;
- Activate a borrow pit.

The locations of possible borrow pits are shown in Figure 4-11. A total of 6 zones have been marked in this section of the highway, with a total area of about 59 ha:

- Location 1: At the part of the route from borehole B-5 to borehole B-9, sandstones with a Quaternary cover, 3 to 6 m thick, were found. The sandstone below the Quaternary is compact with rare interlayers of siltstone.
- Location 2: On the part of the route from borehole B-11 to borehole B-13, layering of sandstone and siltstone, with a smaller presence of siltstone, was found. The core is compact. The thickness of the quaternary is about 4 m, while in the area of the borehole B-12 the thickness of the quaternary is 10 m.
- Location 3: This zone needs to be further investigated, but on the basis of OGK, conglomerates have been isolated here within the Durmitor flysch.
- Location 4: Zone of borehole B-45. Here, high-quality sandstones appear on the surface of the terrain.
- Location 5: Zone of borehole B-48. Here, high-quality sandstones occur at a depth of 8 m, under the Quaternary cover.
- Location 6: On the part of the route from borehole B-58 to borehole B-63, layered to sheeted sandstone-limestones with a Quaternary cover up to 3 m thick were found.

All locations need to be further investigated for the purposes of opening a borrow pit.

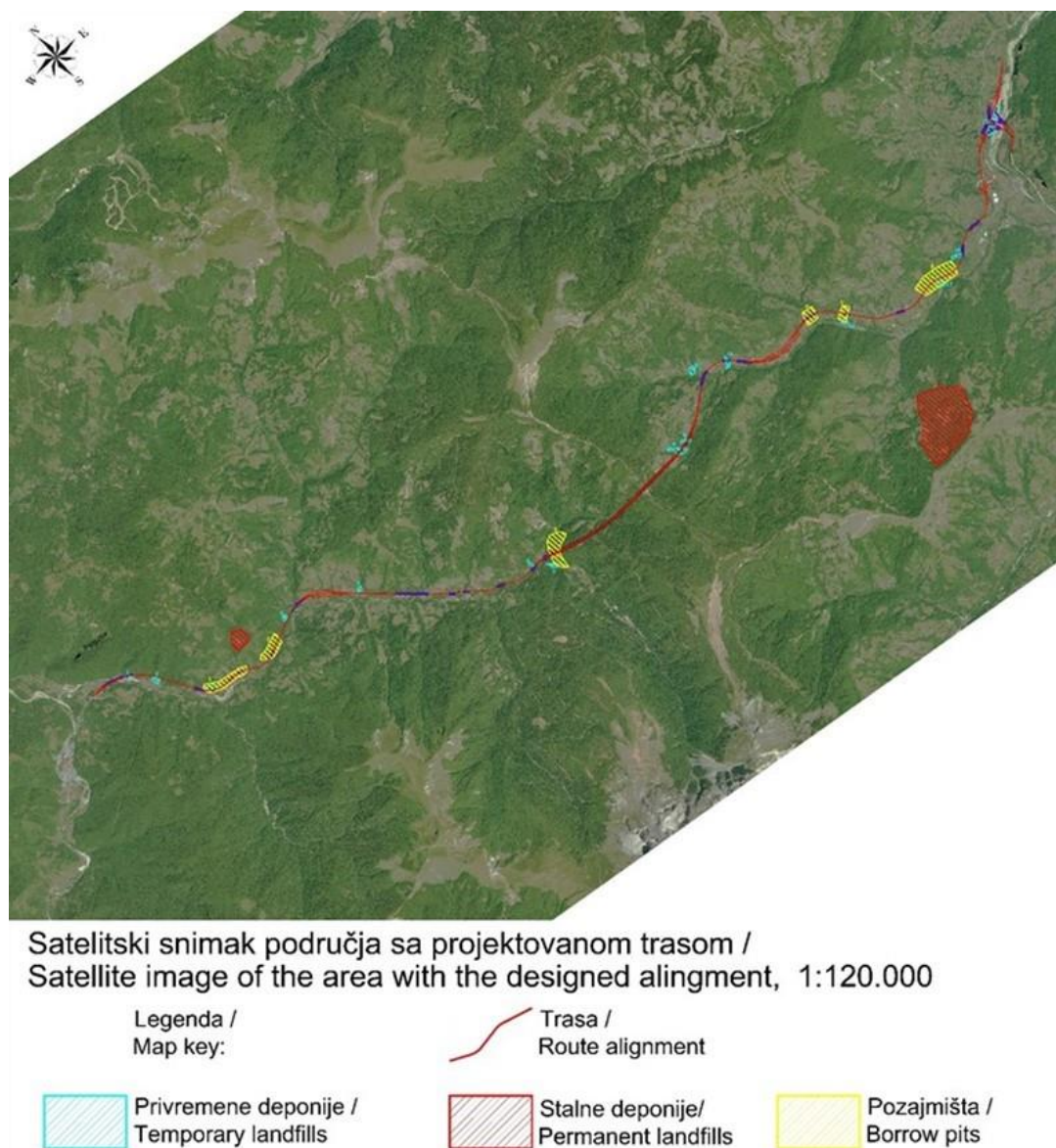


Figure 4-11: Location of borrow pits and landfills

4.13 Construction requirements

The implementation of this project will take place in three steps. Namely, the preparatory works will take place first, following by execution of main works, and finally acceptance works activities.

Preparatory works for the construction of the highway, in addition to the works established by the law regulating the construction of facilities in accordance with Article 10 of the Law on the Bar-Boljare highway (Official Gazette of Montenegro 52/14), include the following types and scope of works:

- geodetic survey works, in particular: staking out the route and other objects, all measurements and markings for the purpose of transferring data from the technical documentation, and the preparation of geodetic drawings for the main design;

- geological works, in particular: additional engineering and geological surveys of the terrain, for the main design and for determining the locations of loan sites for the production of technical and building stone;
- organization of construction sites, especially: construction of new and reconstruction of existing access roads, replacement of existing local roads, construction of construction roads;
- relocation of existing infrastructure lines, construction of electrical, plumbing and other infrastructure, site preparation and installation of equipment for crushing plants, concrete factories and asphalt bases, regulation of construction sites and construction of temporary housing/warehouse facilities for workers and supervisory authorities, materials and equipment;
- preparatory earthworks and other works on the route, in particular: cleaning of the terrain, protection and diversion of water courses, site preparation, installation of equipment at tunnel portals and preparation of sites for deposition of construction waste and borrowing materials.

In accordance with the legal procedure, the contractor is obliged to prepare the "Elaborate on preparatory works" which, together with EIA and completed expropriation, is a precondition for obtaining the consent for start of preparatory works from the Government of Montenegro.

During the implementation of the project in question, classic building materials and the latest technology will be used.

The contractor shall use or purchase materials from existing asphalt production plants, quarries or sand and gravel separation plants which possess valid environmental and other permits and approvals. It is strictly prohibited to use any type of construction material for the highway or facilities which does not have valid certifications.

Finally yet importantly, it should be mentioned, that around the river areas, having in mind that the encountered rock mass along the Mateševu – Andrijevica corridor is rather poor in terms of quality, both the horizontal and the vertical alignment should try keeping a sensitive balance between embankment protection reinforced measures (on the right side) and a cover and cut or retaining pile walls implementation (on the left side), along the – unstable - ground of the alignment.

5 Environmental baseline conditions

This chapter provides a brief introduction to the environmental baseline conditions of the area under examination, with an emphasis to potential changes expected to be caused by the Project and to vulnerability of receptors.

If the project is not implemented, the baseline conditions will remain as it is now, i.e., there will be no environmental impacts due to the highway construction and operation and no changes to existing state of the environment.

5.1 Topography and landscape

5.1.1 National topography and landscape

The area of the Project Bar - Boljare Highway, sections of Mateševu - Andrijevića, belongs to the Landscapes of the mountains and valleys of the northern region.



Figure 5-1: Landscapes of Montenegro

Relief: Mountain ranges Ljubisnja, Lisca, Lisa, Bjelasica, Komovi, Hajla, Prokletije, Visitor and Gelatin and mountain areas: Barice - Krupice Kosanica, Bobovo, on the right side of Čehotina: Mataruge, Obarde, Crljenice, and towards the north are the areas of Bihor and Korita. The region is crossed from east to west by the valleys of the rivers Lim, Ibar, Tara and Čehotina. In the valley of Lim and its tributaries, several watersheds have developed, the largest of which are Beranska, Vraneška, Bjelopljaska, Rožajska and Plavsko-Gusinjska.

In the Tara valley, the Mojkovac and Kolašin basins are the largest. In the Čehotina river valley, the larger valleys of Maočka and Pljevlja are the most significant. The geological basis of the region is diverse. The area from Buren to Bobovo and the plateau to the right of Čehotina are built of limestone.

The central belt on the left side of Čehotina, as well as the northern slopes of Ljubišnje, are built of sandstone and slate. The central and southwestern part of Bjelasica is made of diabases and eruptive rocks, while the western part of Komovo consists of Durmitor flysch sediments. The area of Komovo and Bjelasica is rich in water. The relief of these mountains is divided by the valleys of numerous tributaries of Tara. This region also includes the region in the basin of Lima and the Ibar. The region has a complex geological composition and is lithologically diverse. Paleozoic slates, sandstones and quartz conglomerates predominate, and limestones are present in the higher parts of the mountains. In the middle part, the relief is mountainous, and on the edge of the region there are mountain ranges. This part includes the Plav-Gusin Basin, the Beran Basin and the Bjelopol Basin. The area is very rich in water.

The dominant soil covers:

Vegetation types: *Fagetum montanum montenegrinum*, *Fageto - Abietosum*, *Pineto – Abieti -Fagetum subalpinum*, *Pinetum mughii* and *Picetum excelsae croaticum*. Mostly monodominant spruce forests in Ljubisnja from 1.000 - 1.500 m above sea level, in cold and physiologically dry habitats with harsh mountain climate. The average annual rainfall is 800 - 1.500 mm. It develops on soils with carbonate and non-carbonate soil, predominantly in northern and northeastern exposures.

In the lower parts of the region, in mesophilic habitats, spruce occurs with fir. In this region, spruce forests, spruce forests and fir forests are dominant, and in the valleys of the Čehotina river flows and thermophilic oak forests. To the east, spruce is present in beech and fir forests. In addition to the monodominant spruce forests, there are also spruce forests with the addition of fir.

Molice forests are of relic character and build a climatic zone between 1.500 and 2.100 m. The optimal habitats are on siliceous rocks and siliceous limestones, predominantly brown acidic soils (dystric cambisol). Given the diversity of relief and climate, this region is the most diverse in vegetation. Thermophilic sessile oak forests are represented in the Bjelopolje and Berane basins, and beech forests, beech and fir forests, spruce forests, subalpine beech forests and moth forests are replaced by altitudinal zones. The specificity of this region in terms of vegetation is the forests of moths, which are found only in this area in Montenegro (Hajla, Sjekirica, Bogicevica, Prokletije, Visitor and Zaletin).

Cultural landscape includes:

- urban and semi-urban settlements in river valleys;
- rural mountain settlements with small agricultural holdings (fenced fields, sheds and feeders for keeping livestock, low housing, auxiliary facilities - stalls, haystacks, etc.);
- katuns (mountain huts)

In reference to the landscape character areas (see following Figure), at regional and local level, the landscape belongs to 5.3. Bjelasica and Komovi areas. At the local level, the highway route belongs to the Tara River valley (5.3.1) as well as to the highland area of the Bjelasica (5.3.2).

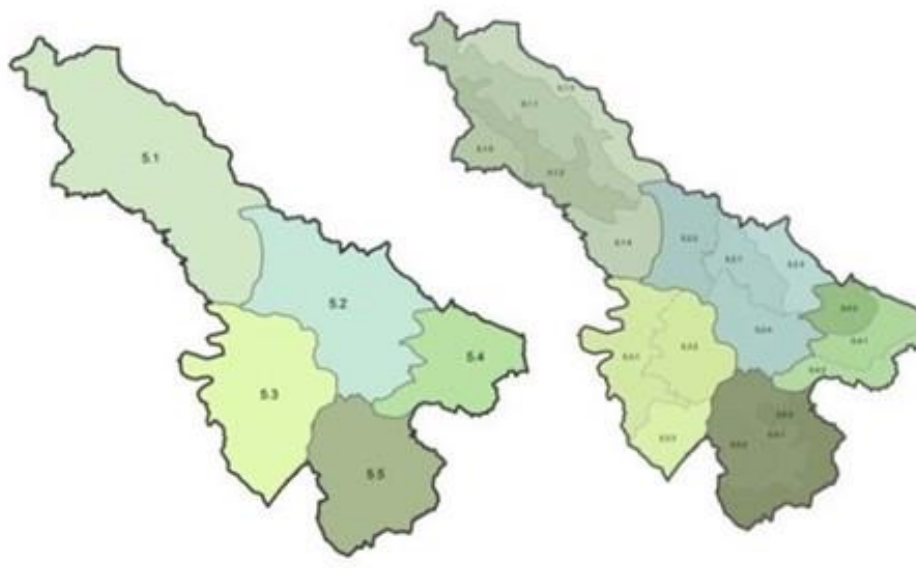


Figure 5-2: Landscape character areas at regional and local level

Within this Typology, types of Landscape Character are distinguished. The areas of the northern region are characterised by the valleys and gorges of mountain rivers framed by numerous mountains. This region is dominated by coniferous fir and spruce forests and mixed conifer forests with beech. The following types of landscape character are distinguished: valleys and valleys of mountain rivers (Cehotina, Tara, Lim, Ibar and their tributaries, Vranes Valley, Ropojanska Valley, etc.); gorges and canyons of mountain rivers (Drage Canyon, Cehotina Gorge, Djalovic Gorge, Tivran Gorge, Radman Gorge, Ibar Gorge, etc.); plains, fields, plateaus (Maočko and Sub-Krajina field, Dry field, Giljevo field, Korita plateau); urban settlements (Pljevlja, Bijelo Polje, Berane, Plav, Rozaje, Andrijevica); aquatic reservoirs - lakes (Plavsko, Ridsko, Biogradsko, Šiško); lower mountain type (along the basin of the Cehotina River, along the Belopolje area along the Lim valley, around the Berane basin); Mountain type entrees (Ljubišnja, Lisac, Podgor, Vrba, Kosanica, Kovac, Grab, Barice, Stozar, Lisa, Lekovina) and high mountain type areas (Bjelasica, Komovi, Hajla, Vlahovo, Zelatin, Visitor and Prokletije).

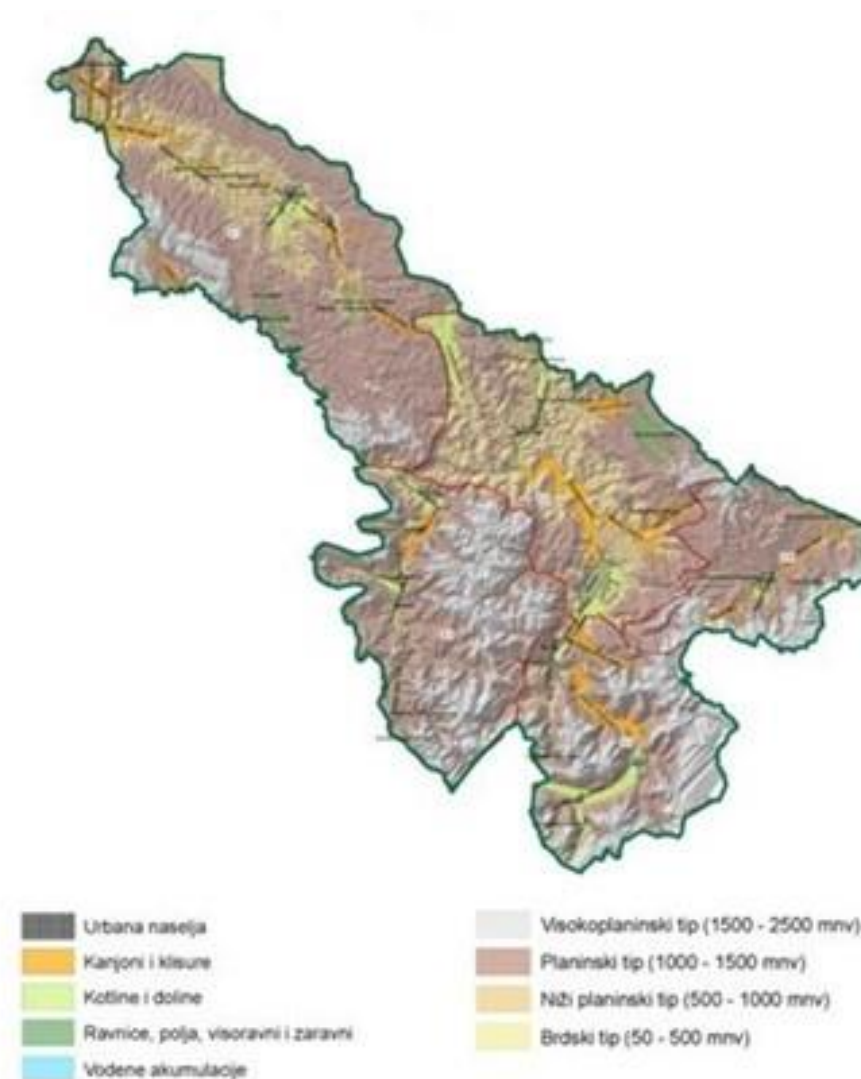


Figure 5-3: Landscape character types

5.1.2 Local landscape

Landscapes represent a visible and integral socio-ecological system with variable spatial and temporal dimensions. They have pronounced aesthetic, natural and cultural qualities whose changes are the result of human action. Acting through the development of a national infrastructure transport network, as one of the main factors in the further social and economic development of a country, is one of the main factors influencing the change in the landscape image.

The areas through which the Bar - Boljare highway passes are defined both in the Mapping and typology of the landscapes of Montenegro (RZUP / Planplus, May 2015), as well as in all applicable planning documents of the municipalities of Kolašin and Andrijevica.

The Bar - Boljare highway, section Mateševo - Andrijevica, belongs to the Bjelasica and Komovi regions. It flows through the valley region of the Drcka and Lim rivers with their tributaries, sandwiched between two mountain ranges that represent the dominant visual features of the area. Along the highway, recognizable patterns of settlements and undeveloped land are changing.

One of the most important factors in shaping what the highway route will look like is the existing terrain relief. Due to this configuration of the terrain, the highway route is formed by a series of

infrastructure facilities, bridges and tunnels. The terrain configuration represents the strength of the area and offers the possibility of forming different views towards the mountain ranges.

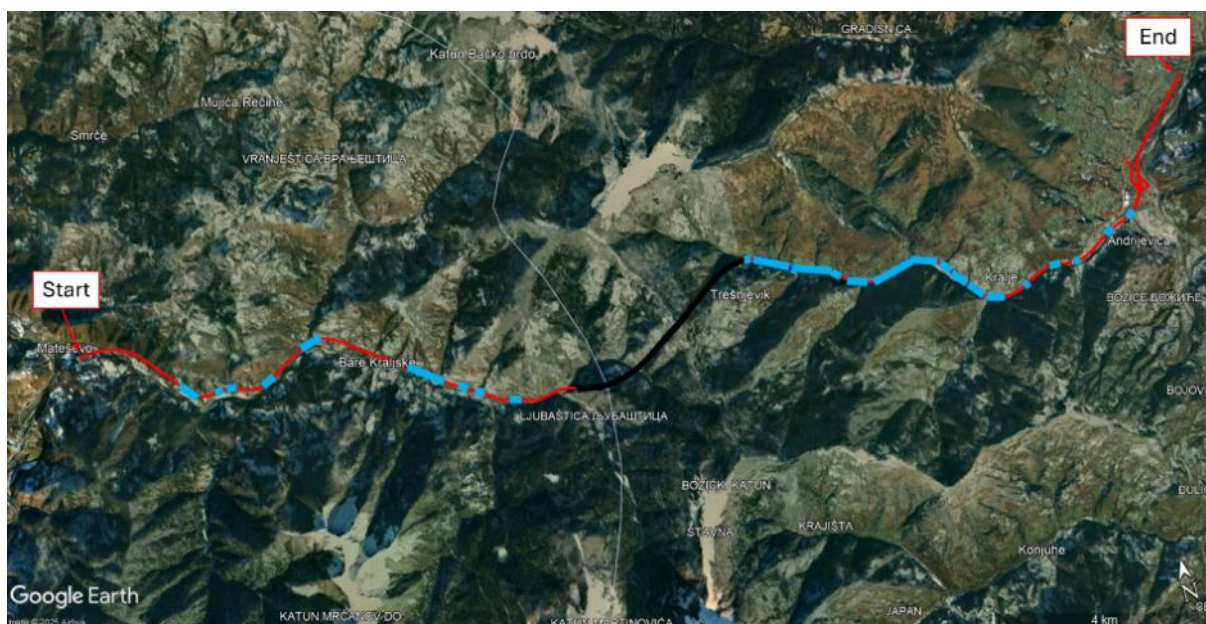


Figure 5-4: Topography of the wider area with the layout of the highway (bridges in blue, tunnel in black)

The vegetation layer alternates between large fragments of forest assemblages belonging to the *Fagetum montanum montenegrinum* and *Fageto - Abietosum*, and pastures and meadows. Due to the construction of highways and local roads, forest assemblies are separated into fragments. Their dominant characteristic is the species *Fagus moesiaca*-beech, while at higher altitudes *Abies alba* - fir also occurs.

5.1.3 Local topography of the terrain

The Mateševo - Andrijevica highway, extends across the steep slopes - mountainous terrain from Mateševo (elev. 1,060 m) to Andrijevica (elev. 780 m) through the Trešnjevik Mountain passage at an elevation of 1,569 m.

The project area starts in the zone of Drcka River, tributary of Tara River and ends in the area of Kraštica River, tributary of Lim River. In a broad geographical sense, the exploratory area is characterized by the river basins of Tara in the west, Lim in the east and the Trešnjevik crossing between the before mentioned basins.

The section is characterized by a low degree of urbanization with a small number of villages and with the city centre of Andrijevica near the end of the highway section.

According to the project task and the adopted spatial planning documents, the corridor of the highway from Mateševo to Andrijevica is defined in the broader area of the Kolašin - Mateševo - Andrijevica - Bjeluha main road.

The Trešnjevik Mountain crossing is critical for the highway alignment. In terms of the vertical alignment approach, it should be primarily taken into consideration that the «lowest points» are defined in the Tara and Lim basins, while the highest point is defined by the rugged-terrain composition of the high-lying mountains areas of Bjelasica in the north, and Komovi in the south.

From a technical perspective the highway corridor links the «low lands» area of the Tara River tributaries (the Drcka valley) with the «low lands» of the Lima river tributaries (the valley of Krica

River). In such conditions there is practically, in a broad sense, one corridor which is actually already defined by the Spatial Plan. So, the choice of the corridor variant is reduced on the determination of the location of the tunnel both in the horizontal plan and in the vertical profile.

So, the topography along these parts of the alignment, with very steep ground slopes (locally up to 75%), creates the need for extensive retaining structures (piles, lane cover, reinforced embankment), both upstream and downstream of the road main axes.



Figure 5-5: View of the rural part of Kralje

The point of the planned rest area on the section of the route near Miravcin, provides wide views of the Komovi Regional Park.

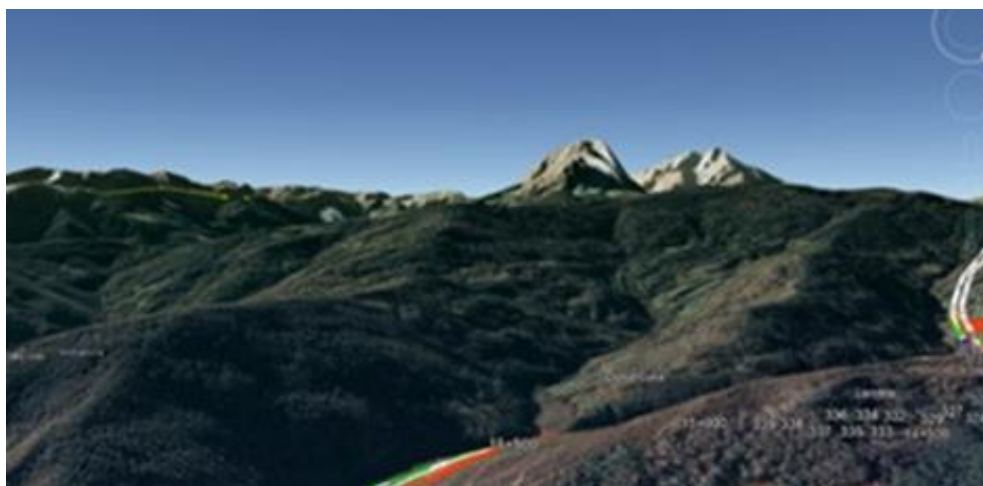


Figure 5-6: View towards Komovi



Figure 5-7: Wide view from Trešnjevnik to the Andrijevac landscapes

UNESCO defines the cultural landscape as “combined works of nature and man” that illustrate the evolution of human society and settlement over time, influenced by the physical constraints and / or opportunities afforded by their natural environment, and by successive social, economic and cultural forces.

As such, the cultural landscape is not only an expression of the interrelationship between man and nature in the present, but through its visible layers it reflects the socially changing relationships of the past. Anthropogenic activity in the past has formed the present image of a landscape, whose further action in the near future will lead to the formation of a new image of a landscape. Looking at this cultural area with its characteristics that define it as part of a comprehensive picture of the landscape of Montenegro, it is necessary to take all measures during the construction of the highway route in order to minimize the negative impact on the cultural area as a whole, and thus on image of the landscape.

5.2 Climate characteristics

5.2.1 Climate characteristics and meteorological indicators

According to the data taken from the 1961-1990 reference climate period, warm temperate (C) and cold temperate (D) climates are found in Montenegro. Warm temperate climate is found in lower parts of the country, while D climate type is found in higher inland mountain regions, above 1000-1200 m AMSL (Table 5-1).

Table 5-1: The Köppen system in Montenegro (according to D. Burić)

Climate class (climates)	Climate type	Climate subtype	Name
	Cs	Csa	Mediterranean climate with hot summer
C		Cs/ s''/b	Transitional variant of etesian climate with warm summer
	Cf	Cfb	Humid temperate climate with warm summer
D	Df	Dfb	Humid cold temperate climate with warm summer
		Dfc	Humid boreal climate with cool summer

Source: Buric, Dragan & Ducic, Vladan & Mihajlovic, Jovan. (2014). *The climate of Montenegro: Modifiers and types - part two*. Glasnik Srpskog geografskog drustva. 94. 73-90. 10.2298/GSGD1401073B.

According to the Köppen criteria three climate types can be found in Montenegro, that is, five climate subtypes (see following figure).

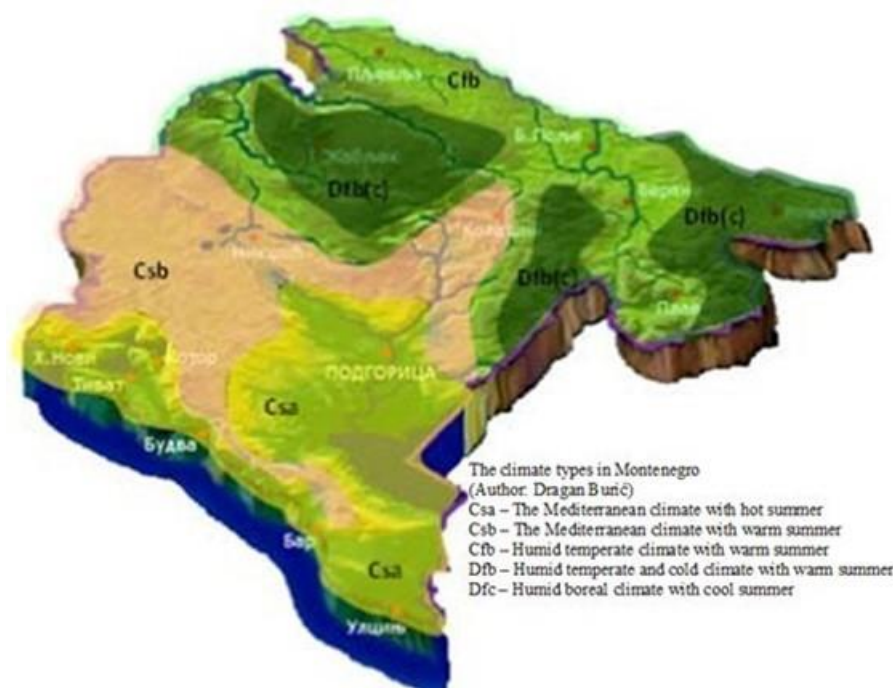


Figure 5-8: General climate regionalization of Montenegro according to the Köppen criteria

Table 5-2: Climate subtypes in Montenegro and meanings of letters used

Climate subtypes in Montenegro								
Csa	Csb	Csbx''	Cs''bx''	Cfwbx	Dfs''bx''	Dfs''cx''	Dfwbx''	Dfwcx''
Explanation								
Label	Name			Features*				
C	Temperate			-3 ⁰ C< Tavɡ.n <18 ⁰ C				
D	Continental			Tavg.x > 10 ⁰ C; Tavɡ.n <-3 ⁰ C				
s	Dry summer			Ravg . x > 3Ravg. n				
with ''	Mainly dry summer, secondary min. Precipitation mainly in early spring (s '' ≈f)			Ravg.x < 3 Ravg.n , mostly weakly expressed secondary min. R				
w	Dry winter			Less precipitation in winter				
f	Fully humid			No dry season				
a	Hot summer			Tavg.x >22 ⁰ C				
b	Warm summer			Tavg.x < 22 ⁰ C; > 4M >10 ⁰ C				
c	Cool summer			Tavg.n > -38 ⁰ C; <4M>10 ⁰ C				
x	Primary max. precipitation at the beginning summer, at the end summer significantly brighter			Secondary max. R weakly expressed				
x ''	Primary max. precipitation in autumn, secondary in spring			Secondary max. R more pronounced				
* Tavɡ.n (Ravg.n) - Mean monthly temperature of the coldest month (sum of precipitation of the driest month) .								
Tavg.x (Ravg.x) - Average monthly temperature of the hottest month (sum of precipitation of the wettest month).								
M- month								

5.2.2 Local climate characteristics

The primary factor that affects the formation of different types of climates along the Mateševsko–Andrijeviča part of the highway is a relief, through its horizontal and vertical dissection. For this reason, it is reasonable to conclude that, there are noticeable microclimate differences among locations, but generally this part of highway can be divided into three main climatic regions: the west facade (area of Mateševsko), middle part (area of Trešnjevsko) and the east facade (area of Andrijeviča). The average altitude of region Mateševsko is around 1000-1200 m, Trešnjevsko around 1300-1500 m and of Andrijeviča area 800-1000 m.

On the area of **Mateševsko**, there is moderate continental climate, with climate subtype Csbx". Average air temperature of the coldest month is about -1.6°C (label C). Summer period is the poorest with precipitation (label s). Mean temperature of the warmest month is about 16,5°C. More than 4 months are with average temperatures higher than 10°C (label b), and primary precipitation maximum is at the end of the autumn - November (label x"). Sun shines about 1742 hours per year, or, from 1,7 hours per day in December to 8,1 hours per day in July. Average annual temperature is about 7,4°C, summer one about 15,7°C, and the winter one about -0,8°C. During the winter, the temperature can go down to -29,8°C (absolute minimum), and during the summer it can go up to the 37,1°C (absolute maximum). Annually, on average, there are about 125-126 frosty days, out of which about 21 ice days. In May - September period regularly occur summer days, and their average annual number is about 45-46 days. Annually, average precipitation quantity is about 2083 mm, and during summer and winter it falls about 64,6% of it. Absolute daily precipitation maximum can go up to the 252,4 mm. Average year has about 168 precipitation days, and 57 days of those are ones with precipitation quantity ≥ 10 mm; about 33 days with sum ≥ 20 mm, about 21 day with precipitation quantity ≥ 30 mm, and about 9 days with daily sum ≥ 50 mm. The average is about 87 days with snow ≥ 1 cm, and about 55 days of those are days with snow level ≥ 10 cm, or about 11 days with snow level ≥ 50 cm. Annual average maximum snow level is about 65 cm, and absolute maximum can go up to the do 192 cm. The average annual humidity is about 80%, and about 6/10 cloud coverage of the visible firmament. The annual average is about 49 clear days and about 116 cloudy days. The wind is blowing at an average speed of 2 m/s, and the maximum gust can go up to 36,5m/s or up to 131.4 km/h, generating a pressure of 83.3 kg/m² vertical surfaces.

Climate formula of **Trešnjevsko area** is Dfs"cx". central highest part of the highway route may be characterized as moderately cold or boreal forest or snowy climate. This is a variant of sub mountain and the highest parts have the characteristics and mountain climate. Mean annual temperature of the warmest month is about 14.7°C, and for the coldest one is around -3.9°C.. There are no pronounced dry seasons during the year but summer precipitation sums is lower than the winter one. Summers are fresh, and during the year is often less than 4 months having an average temperature lower than 10°C, whereas the primary peak precipitation occur in late autumn – November. The average annual insolation is about 1,957 hours, or 5.4 hours per day. The average annual temperature is about 5.2°C, in summer around 13.9°C and in winter around -3.1°C. There are a large number of frosty days, an average of about 160 days per year, of which to be reckoned with on the ice about 39 days a year. The annual rainfall is 1602 mm. Of the total annual rainfall during the autumn and winter is excreted about 61.5% and about 15.5% in the summer. There is a large number of precipitation days - an average of about 175 days per year, of which about 45 days with precipitation ≥ 10 mm. In this part of the highway section to be reckoned with on average 146 days with snow cover, out of which about 122 days with snow height ≥ 10 cm, or about 62 days with snow height ≥ 50 cm. The average peak height of snow is 119 cm and can go up to 225 cm (absolute maximum). Humidity is around 77%. Mean cloudiness is 6/10, and during the year has an average of about 48 clear days, or about 112 cloudy days. Available data indicate that usually wind blowing from the northern and southern quadrant, whose maximum estimated striking can go up to 40 m/s.

The area of **Andrijevića** (eastern facade) has a milder climate than the western and central part of the highway section, because it lies at an altitude below 1000 meters above sea level. The climatic formula of this part of the route is Cs''bx''. It has a moderately warm climate, with the average temperature of the coldest month around -1.0°C (label C). The sum of precipitation in summer is less than in winter, but the ratio between the driest and wettest months is less than 1:3 (label s''). The mean temperature of the hottest month is around 19.1°C and more than 4 months have an average temperature higher than 10°C (label b), The primary maximum of precipitation is at the end of autumn - November (label x''). The average annual sunshine is around 1798 hours. This part is warmer, but poorer in precipitation than other parts of the highway route. The average annual temperature is about 9.4°C, and the average annual precipitation is about 1072 mm. On average, there are about 106 frosty days a year, about 18 icy days, and about 80 summer days in Andrijevića. In this part, there are almost twice as many days with a snow cover than on the western part - there are an average of about 53 days with a formed snow cover per year, of which about 24 days are with snow ≥ 10 cm high. The maximum snow depth can reach 102 cm. The average air humidity is about 74%, the average annual cloud cover is about 6/10. In addition to winds from the south and north, there are also a lot of winds from the west. The average wind speed is around 1 m/s, but maximum gusts of up to 36 m/s should be expected, which is rare. The average year has about 9 days with stormy gusts of wind.

Along the Mateševu - Andrijevića section, an average of 82 days a year with fog, about 43 days with thunder and about 5 days with hail should be considered. Along the entire route, local winds with a daily period - diurnal and nocturnal - should be taken into account. There is a noticeable trend of an increase in the number of days with more intense precipitation, which implies an increase in the frequency of unpleasant events, such as erosive processes, landslides, the occurrence of torrential flows, etc. In general, the climatic conditions along the section are complex, relatively favourable during the warmer part of the year, and more unfavourable in the cold half, primarily due to snowfall, occurrence of frost, ice and sleet, more frequent precipitation, occurrence of snowstorms and drifts, radiation fog and strong winds.

5.3 Air Quality

5.3.1 Air quality monitoring in Montenegro

The *Regulation on determining the types of pollutants, threshold limit values and other air quality standards* (OG 25/12) defines the limit values and tolerance limits, as well as other air quality standards for polluting substances, which are included in Annex I of the Directive 96/62/EC as well as in the Framework Directive 2008/50/EC on ambient air quality and cleaner air for Europe.

Other regulations considered are the following:

- Law of air protection ("Gazette – Montenegro", no. 25/10, 40/11, 43/15)
- Rulebook on the manner and conditions of air quality monitoring ("Gazette - Montenegro", no. 21/11, 32/16)
- Regulation on the establishment of a network of measurement points for air quality monitoring ("Gazette - Montenegro", no. 44/10, 13/11)

The following table contains emission limit values for Sulphur-dioxide (SO₂), Nitrogen-dioxide (NO₂), ambient ozone, Carbon-monoxide (CO), airborne dust, suspended particles PM₁₀ and PM_{2.5}, benzo(a)pyrene and benzene.

The air quality measurements, processing and analysis of the results from the measuring station is performed in accordance with:

Table 5-3: Air quality parameters and limit values

Air quality parameter	Averaging period	Concentration (Limit value)	Permitted exceedances each year
SO ₂	Hourly average	350 µg/m ³	Cannot be exceeded more than 24 times in one calendar year
	Daily average	125 µg/m ³	Cannot be exceeded more than 3 times in one calendar year
NO ₂	Hourly average	200 µg/m ³	Cannot be exceeded more than 18 times in one calendar year
	Annual average	40 µg/m ³	n/a
O ₃	Maximum daily 8-hour average	120 µg/m ³	Cannot be exceeded more than 25 times in one calendar year-an average of three years is taken
CO	Maximum daily eight-hour average	10 mg/m ³	n/a
PM ₁₀	Daily average	50 µg/m ³	Can not be exceeded more than 35 times in one calendar year
	Annual average	40 µg/m ³	n/a
PM _{2.5}	Annual average	25 µg/m ³	n/a
Benzene	Annual average	5 µg/m ³	n/a
Benzo(a)pyrene	Annual average	1 ng/m ³	n/a

The main sectors that contribute to air pollution in Montenegro are industry, energy, transport and fuel combustion in households. More specifically, regarding NO_x at national level, the main contributors to its emissions are combustion in energy and transformation industry (44%) and road transport (39%), while regarding SO_x, the main contributors are combustion in energy and transformation industry (81%), combustion in manufacturing industry (9%) and production process (7%).

Additionally, combustion in energy and transformation industry (46% PM₁₀ and 37% PM_{2.5}), production processes (32% PM₁₀ and 35% PM_{2.5}) and non-industrial combustion plants (16% PM₁₀ and 24% PM_{2.5}) are the main contributors regarding emissions of particulate matters, while the main activities contributing to emissions of carbon monoxide (CO) are non-industrial combustion plants (35%), road transport (44%), and production processes (12%).

Finally, combustion in energy and transformation industry and as well as in manufacturing industry are the main sectors that contribute to emissions of heavy metals, road transport provokes the 98% emissions of benzene, while almost total emissions of polycyclic aromatic hydrocarbons (PAH) (94-97%) are generated by non-industrial combustion plants.

Regarding traffic, the main causes for air pollution are the age/quality of vehicles (according to the Statistical Service of Montenegro (2013), more than 54.2% of vehicles used in Montenegro were produced before 1999), as well as traffic transit during the summer months. Additionally, 58.3% of the total number of vehicles use diesel fuel.

At a national level, an air quality monitoring programme is conducted by the Environmental and Nature Protection Agency, which is in line with the Rulebook on Manner and Conditions for Monitoring Air Quality (Official Gazette of MNE, no. 21/2011). A public station network for air quality monitoring has been established and activities aiming at the increase of the number of measuring points (considering specific morphological and geographical characteristics of terrain in Montenegro) as well as provision of equipment for cross-border monitoring of air pollution are in progress. The air monitoring program includes systematic measurements of the emission airborne pollutants in automatic stationary-measuring stations while monthly reports are published.

The analysis of the obtained results is used as basis for proposal of measures for improvement of air quality. The automatic stationary stations for monitoring air quality monitor air quality in Podgorica, Nikšić, Pljevlja, Bar, Tivat, Golubovci and Gradina (Pljevlja). The concentration of sulphur dioxide (SO₂), nitrogen monoxide (NO), nitrogen dioxide (NO₂), overall nitrogen oxides (NO_x), carbon monoxide (CO), methane (CH₄), non-methane hydrocarbons (NMHC), total hydrocarbons (THC), PM10 particles, ground-level ozone (O₃), benzene, toluene, ethylbenzene, o-m-p xylene (BTX) is measured.

National network for continuously air quality monitoring consists of 9 stationary stations as follows:

Table 5-4: Measuring locations in National network for air monitoring¹¹

No	Name of station	Type of measuring location	Measured pollutants
1	Pljevlja 2-Gagovića imanje	UB	NO, NO ₂ , NO _x , SO ₂ , CO, PM _{2.5} , PM ₁₀ , (Pb, As, Cd, Ni and BaP in PM ₁₀)
2	Gradina	RB	NO, NO ₂ , NO _x , SO ₂ , O ₃ , CH ₄ , THC and Hg
3	Bijelo Polje	UB	NO, NO ₂ , NO _x , CO, PM _{2.5} , PM ₁₀ , (Pb, As, Cd, Ni and BaP in PM ₁₀)
4	Podgorica 2	UB	SO ₂ , PM _{2.5} , PM ₁₀ , (Pb, As, Cd, Ni and BaP in PM ₁₀)
5	Podgorica 3	UT	NO, NO ₂ , NO _x , CO, C ₆ H ₆ , PM ₁₀ , (Pb, As, Cd, Ni and BaP in PM ₁₀)
6	Podgorica 4-Gornje Mrke	RB	NO, NO ₂ , NO _x , O ₃ , CH ₄ i THC
7	Nikšić 2	UB	NO, NO ₂ , NO _x , CO, O ₃ , SO ₂ , PM _{2.5} , PM ₁₀ (Pb, As, Cd, Ni and BaP in PM ₁₀)
8	Bar 3	UB	NO, NO ₂ , NO _x , PM _{2.5} , PM ₁₀ (Pb, As, Cd, Ni i BaP u PM ₁₀)
9	Kotor	UT	NO, NO ₂ , NO _x , CO, SO ₂ , C ₆ H ₆ , PM ₁₀ , (Pb, As, Cd, Ni i BaP u PM ₁₀)

Note: UB: urban background, RB: Rural background, UT: Urban traffic

In accordance with the Rulebook on establishing of a network of measurement points for air quality monitoring (Official Gazette of MNE, no. 44/2010 and 13/2011, 64/18), the territory of Montenegro is divided into three zones, which were defined in preliminary air quality assessment in respect to limits of pollutants based on available data on concentration of pollutants and modelling existing data. The air quality border zones coincide with the administrative boundaries of the municipalities that are part of these zones.

Table 5-5: Air quality zones and municipalities within these zones

Air Quality Zone	Municipalities within the zone
Northern Air quality Zone	Andrijevića, Berane, Bijelo Polje, Gusinje, Pljevlja, Kolašin, Mojkovac, Petnjica, Plav, Plužine, Rožaje, Šavnik, Žabljak
Central air quality zone	Podgorica, Nikšić, Danilovgrad i Cetinje
Southern air quality zone air quality	Bar, Budva, Kotor, Tivat, Ulcinj i Herceg Novi

¹¹ Source: Environmental Protection Agency (2023), Information on the state of the environment (Informacija o stanju životne sredine) - 2022

For Mateševsko-Andrijevića highway section there are no relevant data for air quality, since the closest measuring places are very far from the route. South measuring location Podgorica is 48km far, the closest North-west measuring location Pljevlja is 73km far from the route, west measuring location Nikšić is 59km from the route, and on the East there is no measuring location.

The section from Mateševsko to Andrijevića represents a rural mountainous area, with no industry and very few inhabited areas, and it can be concluded that the air is extremely good in this segment.

5.3.2 Results of air quality monitoring survey in the project area

Due to the lack of air quality data in the project area, and in order to obtain a baseline, air quality monitoring measurements were performed in 4 locations selected with the following criteria:

- Along with new highway alignment
- Locations where homes are close to the highway.

Table 5-6: Air quality measurement points

Measuring point	Latitude	Longitude
MM2 – Bare Kraljske, besides regional road Mateševsko Andrijevića	42° 44' 53.76"	19° 37' 01.27"
MM3 Kralje about 100 m from regional road Mateševsko Andrijevića	42° 44' 02.45"	19° 45' 22.29"
MM4 About 400 m from Most Bandovića besides regional road Mateševsko Andrijevića	42° 44' 23.71"	19° 46' 43.19"
MM5 Besides regional road Andrijevića - Berane	42° 45' 03.89"	19° 47' 23.49"

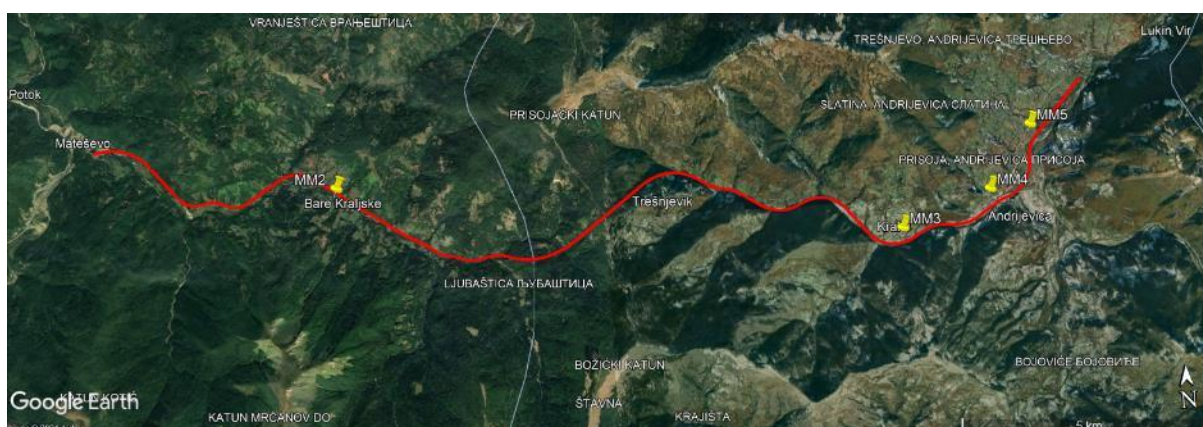


Figure 5-9: Air quality measurement points

The pollutants measured are SO₂, NO, NO₂, CO, PM₁₀, and PM. The pollutants were measured and evaluated according to the “Rulebook on the method and conditions of air quality monitoring (Off. Gazette No 21/11, 32/16) and recommendations of ILAC (ILAC- G8:03/2009), as well as the Regulation on determination of pollutants, limits and other air quality standards (Official Gazette No 25/12). Measurement results were collected for 24-hour measurements, for two days in each measurement point. The results of the measurement campaign are summarized as follows:

- **Sulphur Dioxide (SO₂):** The results are compared with the hourly mean limit value (350 µg/m³) and the daily limit value of (125 µg/m³). All measured values of SO₂ during 24-hour measurement are **below** the limit values.
- **Nitrogen oxide (NO₂):** The results are compared with the hourly limit value (200 µg/m³). All measured hourly mean values during the 24-hour measurements are below the limit
- **Carbon monoxide (CO):** All maximal 8-hour CO daily mean values were compared with the limit value (10 mg/m³) and were found below the limit.

- **Particulate matter (PM₁₀).** All daily mean concentrations were below the limit value (50 µg/m³).

Table 5-7: Air quality measurements results

	PM ₁₀	PM _{2.5}	SO ₂	NO	NO ₂	CO
	µg/m ³	µg/m ³	µg/m ³	µg/m ³	µg/m ³	mg/m ³
MM2	13.82	7.44	2.35	3.35	4.00	0.21
MM3	21.61	8.80	2.71	7.76	6.13	0.21
MM4	11.34	6.83	2.44	4.52	5.58	0.10
MM5	10.70	6.44	2.25	2.83	1.35	0.16

Regarding PN_{2.5}, the limit value is set on a yearly basis. However, the values observed during the measurements are far below the limit of 25 µg/m³, and more specifically <10 µg/m³.

5.4 Noise and vibrations

The Agency for the Protection of Nature and Environment implements the Environmental Noise Monitoring Program every year. The latest published results refer to the monitoring in 2022. The program covers 15 measuring positions in 14 municipalities of Montenegro: Podgorica, Nikšić, Žabljak, Petrovac, Budva, Kotor, Ulcinj, Kolašin, Mojkovac, Bijelo Polje, Berane, Bar, Tivat and Pljevlja. Two measurement cycles were performed at all measurement positions. The first in the period July - October and the second in the period November - February. In Kolašin, the noise level was measured at one point in the city. Based on the Decision on determining acoustic zones on the territory of the municipality of Kolašin, the observed measurement site belongs to the mixed-use zone.

The Rulebook on limit noise values in environment, determining noise incubators and acoustic zones and methods for assessing adverse noise effects (Official Gazette of MNE, No. 60/11) was prepared in line with the Law on Protection Against Environmental Noise ("Official Gazette of MNE", No. 28/11 of 10.06.2011, 28/12 of 05.06.2012, 01/14 of 09.01.2014). Through the determination of the acoustic zones, the limit values for defined parts of municipal territories were set, something which is important for the protection against environmental noise and for the future planning of construction of structures and issuance of work permits to hospitality and other structures. The following table shows the limit values of noise set out in the Rulebook.

Table 5-8: Limit values of noise in acoustic zones

Acoustic zone		Noise level in dB(A)		
		L _{day}	Levening	L _{night}
1	Silent zone in nature	35	35	30
2	Silent zone in agglomeration	40	40	35
3	Zone of elevated noise protection regime	50	50	40
4	Residential zone	55	55	45
5	Mixed use zone	60	60	50
6	Zones under the impact of traffic noise			
6a	Zones under heavy impact of air-traffic noise	55	55	50
6b	Zones under heavy impact of road traffic noise	60	60	55

Acoustic zone		Noise level in dB(A)		
		65	65	60
6c	Zones under heavy impact of railroad traffic noise			
7	Industrial zone	At the boundary of this zone, noise must not exceed limit values of noise level in the zone it adjoins to		
8	Zone of mineral raw materials exploitation	At the boundary of this zone, noise must not exceed limit values of noise level in the zone it adjoins to		

The values indicated in this table refer to the overall noise level from all sources in the acoustic zone. In the areas of delineation of acoustic zones, the noise level in each acoustic zone must not exceed the lowest limit value set for the zone it adjoins to.

Measurements during project development

Due to lack of existing data, noise measurements were performed in the project area, in order to establish a baseline. The measurements were performed by the Center for ecotoxicological research Podgorica LLC.

The locations for the measurement have been selected with the following criteria:

- Along the new highway alignment
- In locations where houses or buildings are close to the new highway i.e. in a distance less than 150m.

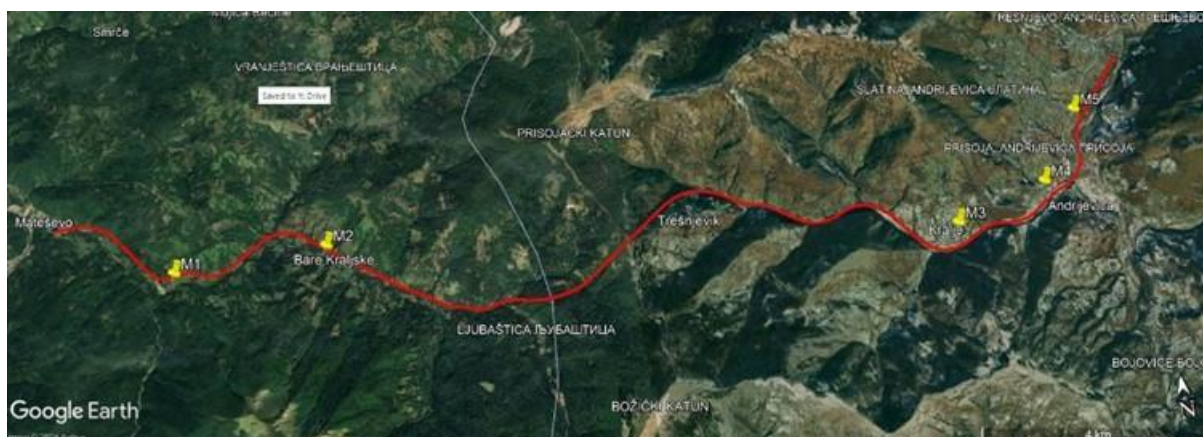


Figure 5-10: Locations of measuring positions on the section of the future highway Mateševsko – Andrijevica



Figure 5-11: Measurement position No. 1 (42° 44' 52.15"; 19° 34' 58.13")

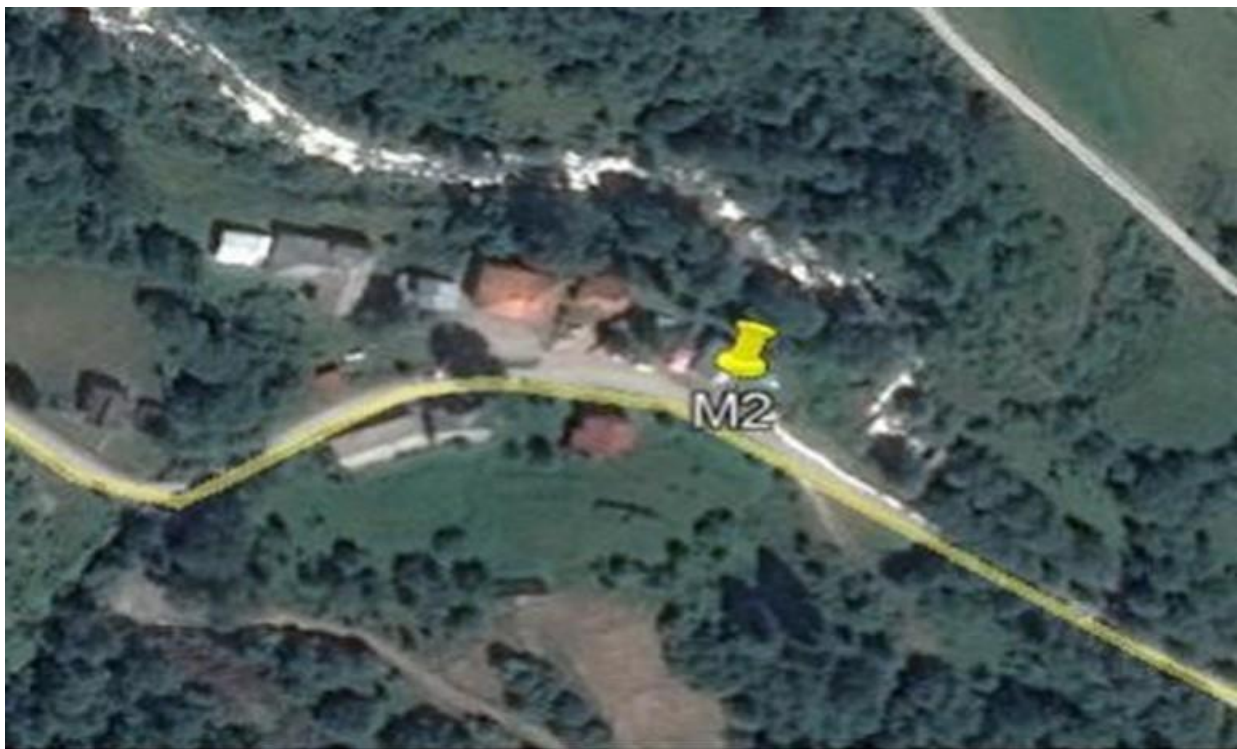


Figure 5-12: Measuring position No. 2 (42 ° 44 '53.76 " ; 19 ° 37' 01.27")



Figure 5-13: Measuring Position No. 3 (42 ° 44 '07.42 " ; 19 ° 45' 24.62")



Figure 5-14: Measuring Position No. 4 (42 ° 44 '23.71 " ; 19 ° 46' 43.19")

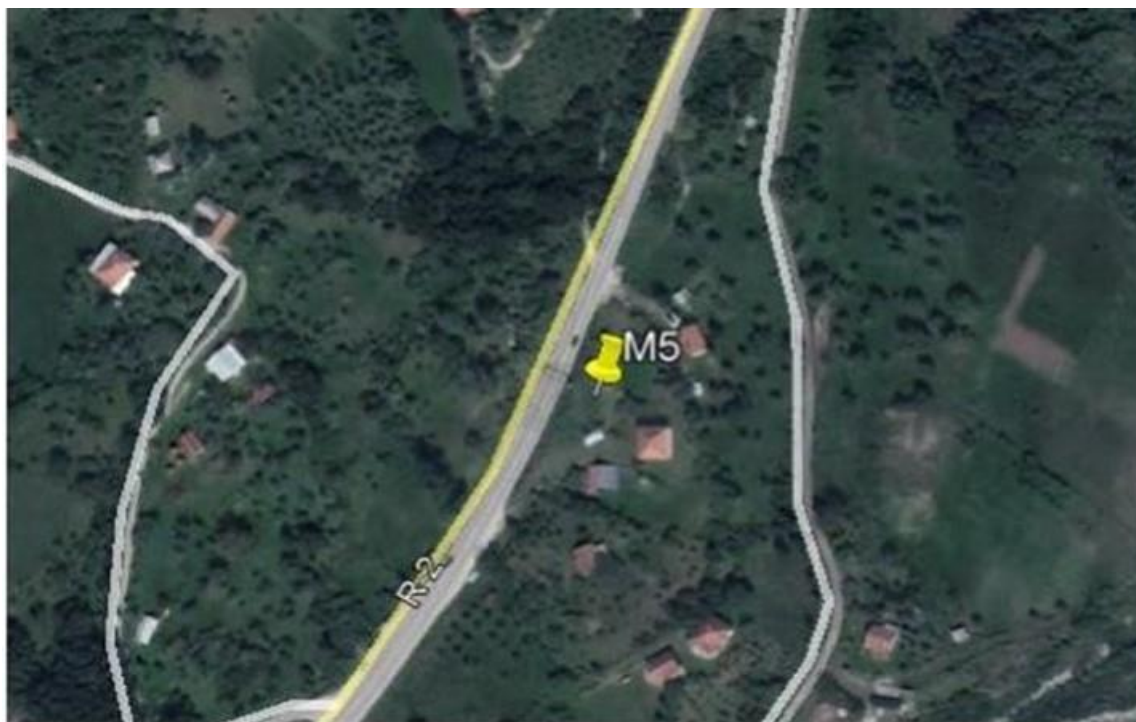


Figure 5-15: Measuring Position No. 5 (42 ° 45 '03.89 " ; 19 ° 47' 23.49")

From the total of 5 measuring positions where the background level of environmental noise was measured on the section of the future Mateševsko – Andrijeva highway, 2 measuring positions (No. 1 and 2) are located in the Municipality of Kolašin and the remaining 3 (No. 3, 4 and 5) are located in the territory of Andrijeva Municipality. The measured noise levels are shown in the following table:

Table 5-9: Measured noise levels [dB(A)]

Location	L _{day}	L _{evening}	L _{night}	L _{den}
M01	50	45	41	50.4
M02	55	54	53	59.8
M03	60	50	44	58.0
M04	61	60	53	62.6
M05	61	59	54	62.8

The analysis of the results shows that daily indicators of the noise level in the measuring positions 4 and 5 exceed the limit value set by legislation. Measuring position No. 4 was located in Andrijeva, at the beginning of the Andrijeva – Mateševsko road via Trešnjevnik (3 m distance). The main sources of noise at this measuring position were vehicles passing by this local road as well as work activities from a nearby pellet factory located 150 m from this position. Measuring position No. 5 was located at the entrance of Andrijeva, in the courtyard of a private residential building, next to the Berane – Andrijeva main road (15 m distance). The main sources of noise at this measuring position were vehicles passing by this main road as well as occasional barking of dogs from neighbouring households.

The other noise level indicators at all measuring positions do not exceed the limit values from the above decisions.

5.5 Geology and soils

5.5.1 Geological characteristics

The geological composition of the terrain consists of clay-schistose facies, which are represented by various schistose, clay, more or less schistose, clay-marl sandy layers and different types of slate with rare interlayers of lenses of limestone and conglomerates, from Carboniferous and Permian periods. This lithological complex forms the greatest part of extended area of the valley of River Lim. Terraces sediments by the rivers of Tara, Lim and their tributaries (confluence of Drcka into Tara (Mateševu), higher terraces along the riverbed of Lim) are practically loose, i.e. in the form of granular sediments of variable granulation, from the Quaternary Period, thus making them unstable and of limited load-bearing capacity. These are often flooded and decomposed by the water from nearby watercourses. The highway alignment passes mainly by brown acidic soils (dystric Cambisol), which is the second most widespread solid in north-eastern Montenegro.

Geomechanical characteristics

Based on the review of available documentation and the results of engineering geological surface mapping, a few types of soil and rock are found to exist at the corridor of the Mateševu - Andrijevu highway section: diluvial sediments, as made of clayey debris, clay with debris, alluvial sediments, carbonate and silician sandstone, siltstone, sandy limestone – calcarenite, two different types of schistose and conglomerates. The type of soils will be reconfirmed after the completion of the geological/geotechnical assessment.

The following modern exogenic processes are present in the broader area: process of physical-chemical decomposition, wasting and weathering processes, process of slope wash, process of sliding and fluvial process. The most dominant process is process of surface decomposition, which is first of all mechanical and then physical-chemical process of rock mass disintegration encored by impact from precipitations, frost, exodynamic processes, etc.

Slope wash and gully processes are also detected in the broader area within the deluvial – elluvial deposits and extremely degraded portion of the rock mass. Thick crust of decomposition and/or surface Quaternary cover in grounds made of flysch sediments and schistose enhances the development of land sliding process. In the areas affected by the sliding process, cut slope angles will be finally defined after conducting the detailed research with the aim of defining the necessary retaining measures.

In general, the recommended slopes in these areas are of the order of 3:2 depending on the morphology of the terrain and on the geotechnical and hydrogeological conditions that prevail in the slopes affected by the sliding.

Retaining measures will, most likely, be necessary for slopes whose height is greater than approximately 8 m. However, it is important to note that in order to define more precisely the necessary measures and cut slope angles it is necessary to perform detailed engineering geological mapping and exploration works in order to separate the zones where the sliding process is more intensive, i.e. for the separation of zones where activation of the process may occur during the excavation of the slopes.

The risk from landslides on this terrain is clearly indicated by the instability of slopes on the part of the highway that is currently under construction (Smokovac - Mateševu), which is of the same or similar geological structure with a large part of the Mateševu - Andrijevu section. The incidence of slope instability is very common, even after the implementation of retaining measures.

In order to provide further justification on the matter it is denoted that apart from the poor geotechnical regime that was described, at the locations where the dominant formation is the highly susceptible to erosion Siltstone, the weathering mantle that is produced gives rise to creeping effects, soil flows and shallow plane or/and circular failures. The extend of these sliding zones cannot be accurately determined at this point (i.e. prior to the execution of the geological mapping and the drilling of the boreholes), but, based on visual observations, it can only be assumed to range between the depth of 3m and 8m.

The above-described geological regime does not favour the cutting of steep slopes as the shear strength of the rockmass is inadequate to cope with the driving forces that will be generated in such a case. Hence, extensive, deep seated sliding failures could be triggered.

The solution of reinforcing the slopes or even constructing retaining pile walls at the toe of the slopes, in order to minimize the height of the cutting, faces difficulties, as in the first case the required support (i.e. permanent anchors, shotcrete, wire mesh, concrete traverses etc.) shall not be cost effective, whereas in the second case the morphology of the ground and by extent the excessive earth pressure that will be imposed on the retaining wall make it technically non feasible.

Hence, **the cover and cut** approach is adopted, along the unstable sections of the alignment as well as at the areas where the shaping of smoother slopes leads to the exceed of the expropriation limit. In that way, not only does the safety of the alignment against any instability is ensured, but also the maximum height of the cutting slopes is reduced by about 10m.

By reducing the height of the slopes, smoother cutting angles, of the order to 3(V):2(H), with intermediate 4m wide benches, can be applied, without increasing the expropriation limit, thus minimizing the need for implementing extensive support measures in the direction of ensuring the global stability.

5.5.2 Hydrogeological characteristics

The rocks from the Quarter period are characterized by effective intergranular porosity, those being granular glacial and diluvial sediments. Glacial sediments occur in the riverbeds of Tara and Lim and their tributary rivers and the diluvial deposits on hill-mountainous slopes. Glacial and diluvial sediments are present in the terrain mainly as hydrogeological collectors.

5.5.3 Soil types

The area is characterized by quite a large variety of selected soil types. According to the national soil classification, nine different soil types (including water-streams), are encountered in this part of route including its wide area. The soil types on the route are:

- District Cambisols
- Fluvisols and
- Water-streams.

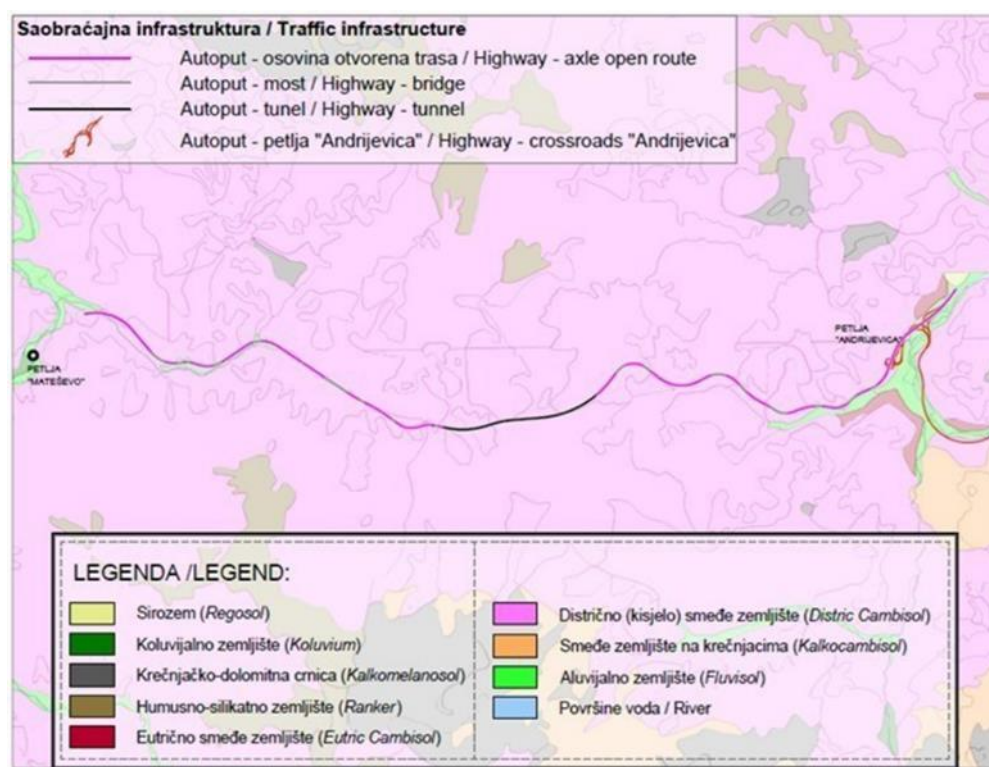


Figure 5-16: Soil types and water streams in the project area

BROWN DYSTRIC (ACID) SOIL (DYSTRICCAMBISOL).

The largest surface after the limestone-dolomitic black soil is taken by this type of soil — i. e. around 395,000 hectares. The main part of this soil is found in the northeastern part of Montenegro. It is usually formed upon the silicate rocks with the dominating schists and sandstones and also upon acid eruptive rocks and flysch. Substrata that take place in the process of their wear and tear and decay include the SiO₂ as the principal ingredient of silicate rocks. This is why the soil is poor in base ions and characterized with acid reaction. The more intensive decay of the substratum and primary minerals contributes to the increased participation of the clay fraction, secondary minerals synthesis and faster process of argilo-genesis. Getting free in these processes are the oxides and hydroxides of iron which — similar to other types of brown soils — are the principal factors in the process of brownization (which is otherwise their important trait). The terrain under the dystric cambisol is of hilly-mountainous character and full of watercourses, so that it is rich in various relief forms. In addition to substratum, climate and vegetation, the relief too has an impact on the intensity of erosion and, in this way, on the depth of the soil. It is somewhat larger in the case of milder slopes, i. e. flat and round surfaces, so that it is apt for cultivation in the form of farming land, meadows and orchards. Agricultural spaces of arable land in the form of enclaves in the forest complexes are created mostly through clearing of forests where the terrain is more accessible and less steep. The steep and inaccessible surfaces, on the other hand, are covered with forests. Natural vegetation on dystric cambisol is mainly composed of swamp forests in the lower zones, while mixture of deciduous trees and conifers grows in the middle zones, and the conifer forests in the upper zones. Forest complexes are characterised by large quantity of plant remnants (foliage, pine needles, barks and the like) that gradually disintegrate and transform into humus.

Humus acids contribute to acidification of the soils which are, by their nature, characterized with acid reaction and low contents of bases (implying the saturation of the adsorptive complex under 50%). The contents of humus of forest varieties of such soil is higher than in the case of arable land where it decreases due to cultivation; this is also the case when the soil with a pronounced erosion is concerned.

The heterogeneousness of substratum, climate and vegetation are important elements in the case of dystric cambisol in distinguishing a typical and the humus subtype and several soil varieties, having somewhat different characteristics and traits. In spite of having the same profile structure and belonging to the same type, they are classified as a large group of different soils found at altitudes between 350 and 2,500 meters. Depending on the altitude and the corresponding climate, the humus dystric cambisol usually occurs at higher altitude mountain ranges, while the typical one is at the lower altitudes. Due to strong impact of parent substratum on the physical and chemical characteristics of soil — especially when appearing as pure substratum without other components — one can distinguish also the following varieties: acid soil on schists, sandstones, hornstones, quartzites and flysch as well as acid eruptive rocks.

The productive value of dystric cambisol depends mostly on the depth of soil, climate, i. e. altitude. The level of quality of arable land moves within the range running between IV and VI class, while the areas under forest and pastures belong most often to the V to VII value class. The economic and productive value of dystric cambisol is rather changeable. Other influential factors in this respect are the relief, the mechanical composition, the proportion of skeleton, the way of utilization, the degree of erosion as well as other factors.



Figure 5-17: Brown acid soil — dystric cambisol on quartz i. e. silicate limestone



Figure 5-18: Brown acid soil – dystric cambisol on sandstone



Figure 5-19: Brown acid soil — dystric cambisol on schists.



Figure 5-20: Brown acid soil — dystric cambisol on acid eruptive rocks

The one that is spread over largest surfaces is the brown acid soil — Dystric Cambisol. It is represented in the tables of physical and chemical properties as a category belonging to profile 25B.

ALLUVIAL SOIL (FLUVISOL).

This type originated under the impact of watercourses, i. e. the depositing and sedimentation of alluvium of various origin, size and texture. Alluvial soil is young, and its texture is most frequently stratified since it is without developed horizons due to a continuing process of accumulation of materials and the beginning of their genesis only after the given stabilization has been over. As a rule, the deeper alluvium is older and most frequently of sandy, loamish, and clayish textures. That type of soil is found in the seaside fields, along the coasts of the Skadar, Plav and Shas lakes as well as between the widened riverbanks. In the narrow watercourse valleys and in riverbeds one finds considerable quantities of gravel and sand alluvial drift. This drift is sterile and, in some places, characterized by the presence of willow, alder-tree and grass. Drifts with loam and clay compounds make rather convenient agricultural soil but the only limiting factor are floods and ground waters.

Alluvial soil frequently appears together with the colluvial one. This kind of soil is present mostly in the Littoral Belt and is expressed in the form of alluvial-colluvial type. In essence, the soil drift in the Littoral Belt is rather similar to the alluvial soil; therefore, it is presented in Soil Atlas of Montenegro as fluvisol spreading over some 34,250 hectares. Productive value of alluvial soil is high because of abundant ground water in its immediate surroundings. Its quality level is graded as I- IV class, but where such soil is exposed to floods, salinization (in the Littoral area) and gleization, there is a limit of its value (V-VI class). The worst quality characterizes the sand and gravel alluvial drifts. They are covered with alder-tree and willow as well as some other kinds of plant.



Figure 5-21: Alluvial (homogeneous) loam-type soil (fluvisol)

Together with, the eutric brown soil, the alluvial soil — Fluvisol is the most important type for agricultural production. Fluvisol, it is represented in the tables of physical and chemical properties as a category belonging to profile 67G.

Table 5-10: Physical Properties

Područje i mjesto (Area and Place)	Broj profila (No of profile)	Dubina cm (Depth cm)	Granulometrijski sastav u % - Granulometric Texture in %							Higroskopska vlaga u % Hygroskop Moisture in %
			Skelet (Skeleton) >2,00 mm	Krupan pijesak (Coarse sand) 2,00 - 0,25 mm	Sitan pijesak (Fine sand) 0,25 - 0,02 mm	Prah (Silt) 0,02 - 0,002 mm	Glina (Clay) <0,002mm	Ukupan pijesak (Total sand)	Prah+glina (Silt +clay)	
Andrijevac	25B	0-17	27.53	18.06	33.94	37.58	10.42	52.00	48.00	3.16
		20-40	15.45	18.20	26.53	40.40	14.87	44.73	55.27	2.70
Gusinje-Vusanje	67G	0-20	25.72	13.78	45.45	32.45	8.32	59.23	40.77	1.80
		20-40	0.00	35.51	40.89	17.03	4.67	77.40	22.60	1.32
		45-60	0.00	33.96	49.69	13.18	3.17	83.65	16.35	1.18
		80-100	0.00	0.69	69.64	22.02	7.65	70.33	29.67	1.58

Table 5-11: Chemical Properties

Područje- Mjesto Place	Broj profila No of	Dubina cm. Depth cm.	pH		CaCO ₃	Humus	Adsorptivni kompleks Adsorptive kompleks				Rastvorljivi Available	
			H ₂ O	KCl			Y ₁	S	T	V	P ₂ O ₅ mg/100 gr	K ₂ O mg/100 gr
					%	%	ccm	m.ekv.	m.ekv.	%		
Andrijevića	25B	0-17	5.41	4.18	0.00	6.03	25.75	10.8	27.53	39.22	2.0	26.1
		20-40	5.06	4.11	0.00	4.10	24.20	7.00	22.73	30.79	1.2	16.4
Gusinje- Vusanje	67G	0-20	6.45	5.40	0.42	4.01	-	-	-	-	3.8	8.3
		20-40	6.46	5.55	0.00	1.97	2.55	11.64	13.29	87.58	8.9	4.9
		45-60	6.38	5.12	0.00	1.44	1.30	13.94	14.78	94.31	8.6	3.7
		80-100	6.05	5.00	0.00	1.62	2.30	14.94	16.43	90.93	7.1	3.9

The data of the following table derive from soil maps of Montenegro (scale 1:50.000) and maps of Soil Atlas of Montenegro (scale 1:150.000) prepared in compliance with the national classification system.

Table 5-12: Summary table of soil types

	Kategorija zemljišta (Soil type - national classification)	Tip trase (Type of road) (m)			Ukupno po kategoriji zemljišta (Total per soil type) (m)	Procenat (Percent) %
		Otvorena trasa (Open road)	Most (Bridge)	Tunel (Tunnel)		
1	DISTRICNO (KISJELO) SMEDJE ZEMLJISTE (BROWN DYSTRIC (ACID) SOIL) (Distic Cambisol)	12814.60	3859.16	3694.84	20368.60	86,38
2	ALUVIJALNO ZEMLJISTE (ALLUVIAL SOIL) (Fluvisol)	2480.26	711.67	0.00	3191.93	13,54
3	VODNE POVRŠINE (WATER STREAMS)	0.00	20.39	0.00	20.39	0,09
	UKUPNO (TOTAL) (m)	15294.86	4591.22	3694.84	23580.92	

The following map shows the intersection of the highway with alluvium soil and sediment. The legend is as follows:

Koridor autoputa (zona eksproprijacije)	Highway corridor (expropriation zone)
Autoput – Otvorena trasa	Highway - Open route
Autoput - Most	Highway - Bridge
Autoput – Tunel Trešnjevnik	Highway – Trešnjevnik Tunnel
Aluvijum (šljunak, pesak, peskovita glina i mulj)	Alluvium (gravel, sand, sandy clay and silt)
Terasni sediment (šljunak, pijesak, glina I dobro zaobljeni nesortirani krečnjački komadi I rjeđe magmatskih stijena)	Terraced sediment (gravel, sand, clay and well-rounded unsorted limestone pieces and rare igneous rocks)



Figure 5-22: Overview map of the intersection of the highway route with alluvial soil and terrace sediment

Source: National EIA (2024), (Excerpt from the Hydrogeological map of DPPP Bjelasica Komovi)

Erosion

According to the Spatial Plan of Montenegro, and having in mind erosion properties, the areas that the highway passes through are classified into three categories. The longest span (18.80 km) passes through the "medium erosion" category, 2.14 km passes through the "weak erosion" category, while 2.56 km belong to the "very weak erosion" category.

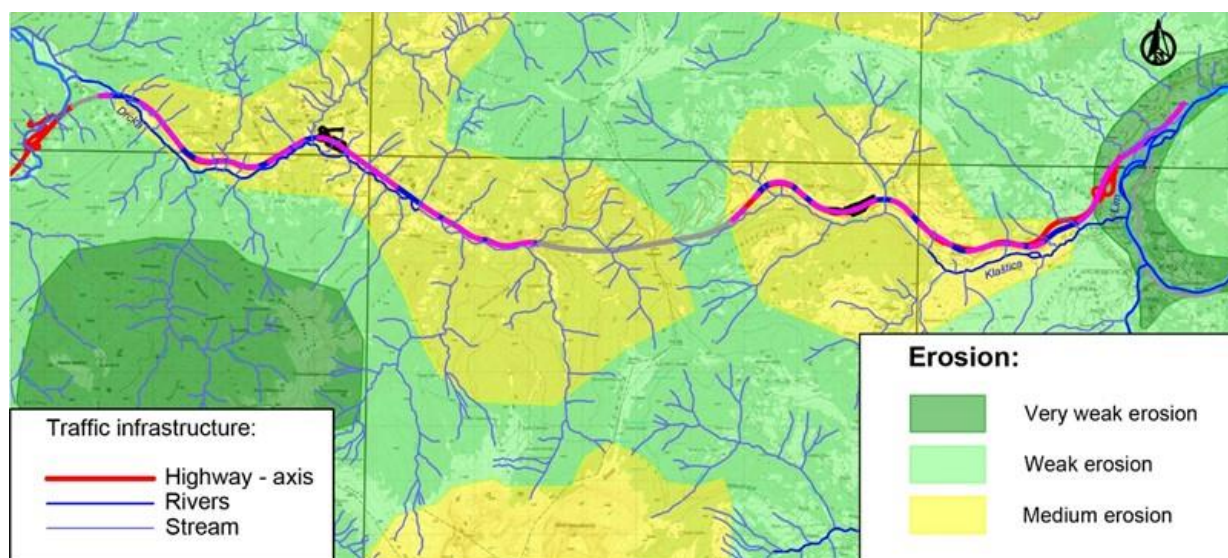


Figure 5-23: Map of erosion intensity

(Source: Spatial Plan of Montenegro until 2020.)

Erosion intensity is determined methodologically on the basis of erosion properties of the rocks that make up the terrain. Thus, due to their geotechnical properties, eluviums and decomposed Paleozoic shells are categorized as weak and medium type of erosion, while parts of the terrain made of limestone, conglomerate and sandstone are categorized as very weak type of erosion. This fully corresponds with the categorization applied in the Spatial Plan of Montenegro until 2020.

5.6 Tectonics and seismicity

Montenegro is located in a relatively active seismic zone with the highest level of vulnerability and risk in the south-eastern coastal area such as Zeta-Skadar depression and the Berane basin, which are considered as areas of significant seismic activity in Montenegro. The seismic activity is associated with the movement of tectonic plates. At the macro level, Montenegro is close to the border of the Eurasian plate and the African plate with the Adriatic and Aegean microplates between them. The complex movements of these plates lead to high seismic activity. The following map shows the seismic reionization of the territory of Montenegro.

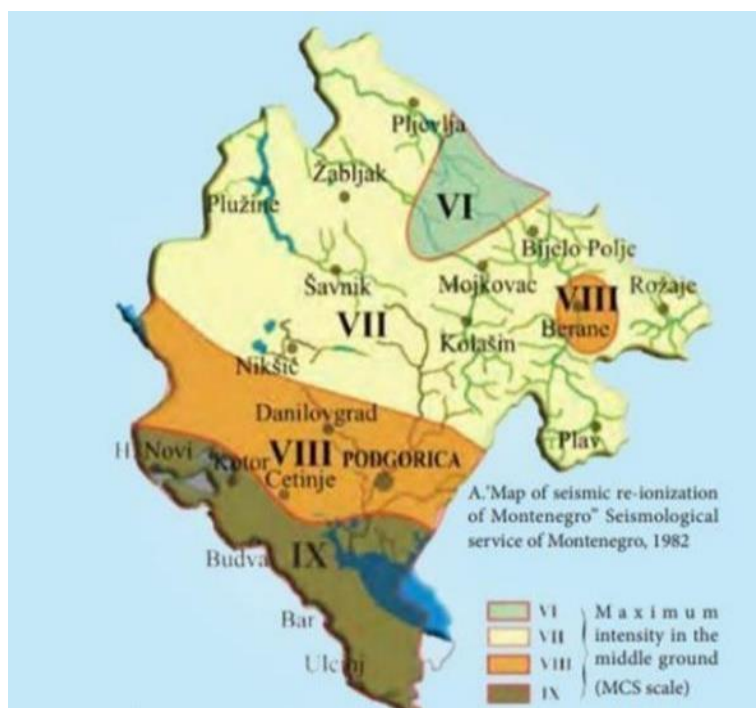


Figure 5-24: Map of the seismic reionization of the territory of Montenegro

Source: Hydrometeorological and seismological service of Montenegro, <http://www.seismo.co.me/Home.htm>

The map is divided into several characteristic seismologic zones that have been manifested in a specific way over the course of time. There Project lies in the Kolašin - Andrijevića zone with the expected maximum intensity of seven degrees of MSC.

The number of earthquakes in the territory of Montenegro varies. During the normally seismically quiet years, the Seismological Institute of Montenegro registers an average of about 400 earthquakes, with magnitudes above 1.2 units of the Richter scale. During the seismically active years, this number can reach a figure of over 30,000 earthquakes above magnitude 1.0. There is one seismic station in Podgorica at 40m (Latitude: 42.42967, Longitude: 19.26083).

5.7 Water resources

The main rivers that lie in the Sub-project area and belong to the Black Sea basin are Tara and Lim. The Tara River is formed where the Verusa River and the Opasanica River meet (at 1,095 m above sea level). The Tara River receives water from the right side from several intermittent streams, scarce water streams, the Drcka River (whose mouth is in Mateševu) and further from the Skrbusa River, as well as from several streams and rivers Velika and Mala Pjesanica and Pcinja to the left. As for the Sub-project area, the relevant hydrological data for the Tara River water may derive from the measurement station "Crna Poljana" located downstream of Mateševu (Bijeli potok) which refer mainly to the waters of the Drcka River (tributary of Tara). The Lim River receives the most important tributaries in the corridor, to the right the rivers of Sekularska, Kaludarska, Dapsicka, Ljesnica and Crnca, and to the left the rivers of Zlorečica, Krastica, Trepacka, Sevarinska, Vinica, Bistrice etc. Regarding the hydrology of the Lim river, flows and water levels can be discussed based on recorded data at the measurement station "Andrijevića", located on the left bank of the Lim river downstream of the bridge on the road Andrijevića - village Seoca. The route of the planned highway on the Mateševu - Andrijevića section does not pass near any public water supply source, except for the wells for individual water supply of households. The consumers of Mateševu receive water supply from the source of "Mateševu" and the consumers of Andrijevića receive water supply from the source of "Krkor".

Water flow and water quality are measured at hydrological stations.



Figure 5-25: Hydrological stations

5.7.1 Surface waters

The Tara River springs below the peaks of Maglić Kariman (about 2,400 m above sea level). From the source to the mouth of river Drcka, the right bank of the Tara River is much more developed than the left. The larger left tributaries are Opasanica, Pčinja, Plašnica, Štitarica, Ravnjak and the spring of Ljutica. On the right side, the Tara receives Drcka, Skrbuša, Svinjača, Jezerštica, Rudnjiča, Bjelojevička and Selačko rivers. The surface of the Tara River Basin is 2,040 km². The length is 148 km.

The **Lim River** originates from the Plavsko Lake, although its source is the Vruja and Grnčar Rivers, which are forming the Ljuča river and bring almost all water in Lake Plavsko. Prior to Andrijevića on the left side in Lim flows Murinska and Zlorečica rivers, while the right are the tributaries are Đurička, Rženička, Velička and Komarača rivers. From Andrijevića to Berane, the Lim receives left tributaries Kraštica, Trebić, Ševarinska and Bistrica rivers, while the right tributaries are Šekularska and Kaludra rivers. From Berane to Bijelo Polje, there are the Brzava and Ljuboviđa tributaries on left side while from the right side there are Dapsićka and Lješnica rivers. From Bijelo Polje to Dobrakov on the left side there is the Bjelopolska Lješnica river and on the right side the Bjelopolska Bistrica river. The total length of Lim within MNE is 98 km with drainage area of 2,280 km².

In this area there is also a source of mineral water Bare Kraljske in Andrijevića (position: X=4 732 850, Y=7 398 000). Physical-chemical properties of this water are: Ca 58.00 mg/l, Mg 19.26 mg/l, K 38.5 mg/l, Fe 0.05 mg/l, HCO₃ 317.22 mg/l, SO₄ 59.7 mg/l, Cl 17.75mg/l, dry residue 351 mg/l, mineralization 510 mg/l, pH 7.6, temperature 11 oC (Source: Thermomineral waters of Montenegro, Mihailo Burić, 1993, Unireks, Nikšić).

Table 5-13: Major rivers within the Danube River Basin in MNE

River Name	Length (km)	Drainage Area (km ²)
Tara	148	2,040
Lim	98*	2,280*

*length and surface area within MNE

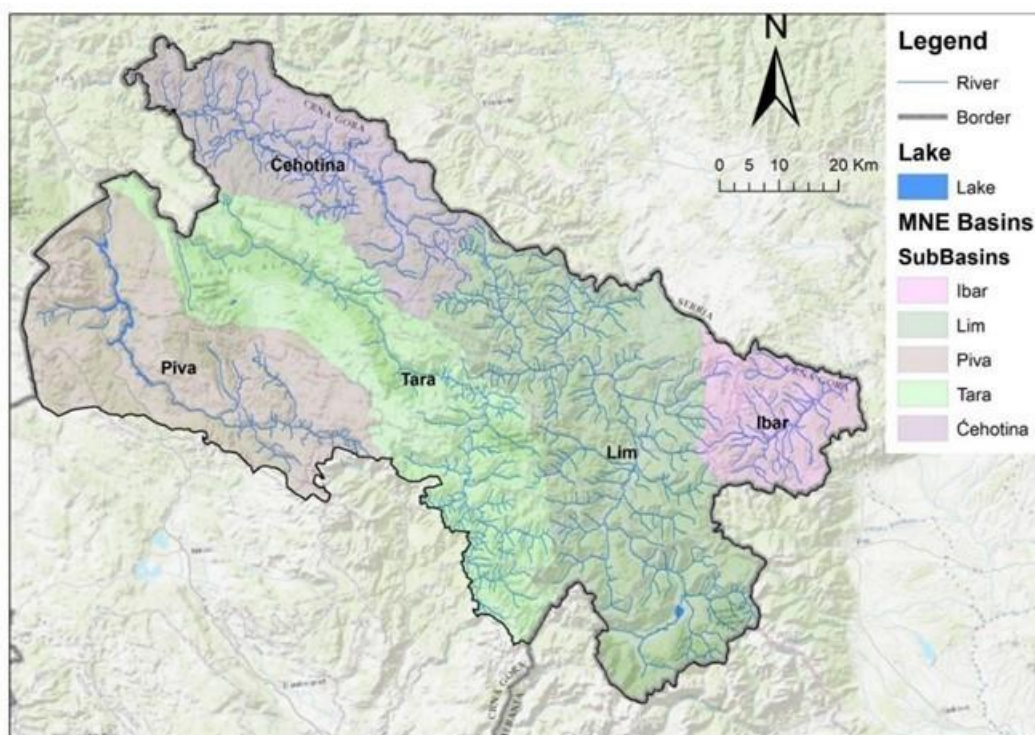


Figure 5-26: Sub-Basin and river network in the Danube River Basin

5.7.2 Groundwater

The whole territory of Montenegro belongs to just one large geostructural unit – Dinarides. The Dinaric system (Dinarides) represents a geologically heterogeneous, south European orogenic belt of the Alpine Mountain chain (Alpides). The main orientation of the system is NW-SE, parallel to the Adriatic Sea. It is a long, mostly mountainous structure with numerous intermountain depressions, large karst poljes or valleys created by numerous perennial or sinking streams^{12 13}.

The major part of the territory of Montenegro belongs to the High karst zone. Its geology is very complex: Mesozoic limestone and dolomite prevail, but there are also spread-out non-karstic rocks such as Lower Paleozoic schist-argillaceous marl layers; Lower and Middle Triassic marl, sandstone and conglomerates as well as Middle Triassic porphyrite, quartz-porphyrite, dacite and andesite. In addition to the above, in two narrow zones across the entire territory of Montenegro from the southwest towards the southeast, there appear Upper Cretaceous – Paleogene sediments of flysch, represented by marl, argillite, limestone, sandstone, breccias and conglomerates. The Inner Dinarides in Montenegro are represented by large Dinaric nappe which extend over ca. 5000 km². Thick limestones and dolomites complex are mostly Triassic and Jurassic ages and is intersected by volcanic rocks or ophiolite impervious rocks. This is an area with highest mountains in Montenegro.

As part of the Dinaric system, Montenegro is a classical karst country. Dinaric carbonate rock complex is the result of the Alpine orogenic phase with the most intensive tectonic movements during the Tertiary. Tectonic events resulted in a complex system of faults and fractures as privileged subterranean water paths. Moreover, climatic conditions, particularly the successions of wet and warm periods, significantly contributed to karstification.

The Danube River Basin comprises 50.4% of the national territory. **Lim**, **Čehotina**, **Tara** and **Piva** are discharging into Drina River. Considering fact that most of Montenegro territory is covered by karstic rocks with specific hydrogeological setting, the surface dividing lines very often do not correspond with underground ones and such statement is supported by results of many conducted tracing experiments. Generally, the watershed and attributed aquifer systems are rich with water, even compared to worldwide standards. However, in high mountains of Montenegro made of karstified rocks there is shortage of waters due to very deep groundwater table and fast water circulation and drainage.

Along with karst, the main aquifer systems are intergranular, the richest resources exist in fluvio-glacial and alluvial deposits.

Karstic aquifers are thus formed within a very thick (over 3,000 m) complex of Mesozoic limestones and dolomites. The recharge of karst aquifers is from precipitation and waters percolated from sinking rivers. It can be assessed that the average infiltration rate varies between 50% and 80% of precipitation depending on the locality, morphology and karstification properties.

As a result of intensive karstification, a network of highly permeable underground channels acts as preferential pathways of intensive groundwater circulation. It is very difficult to estimate the overall effective porosity (considered also as a storage coefficient) of the karst aquifer because of the anisotropic and heterogeneous character of limestones and dolomites. Most references provide values in the range of 0.5% - 1.5%, while locally it can be significantly higher.

¹² Radulović M., 2000: Karst hydrogeology of Montenegro. Sep. issue of Geological Bulletin, vol. XVIII, Spec. ed. Geol. Survey of Montenegro, Podgorica, 271 p

¹³ Stevanović Z., Kukurić, N., Pekaš, Ž., Jolović B., Pambuku A., Radojević D., 2016: Dinaric Karst Aquifer – One of the world's largest transboundary systems and an ideal location for applying innovative and integrated water management. In: Karst Without Boundaries, Stevanović Z., Kresic N., Kukurić N. (eds.), CRC Press/Balkema, Taylor & Francis Group, London, 3-25

Concerning the specific underground yield Montenegro is in group of the world's countries with greatest values: an average is 40 l/s/km².

With respect to intergranular aquifer, the Neogene sediments of lacustrine origins are generally characterized by low permeability and small groundwater reserves. The thickest Neogene (Middle Miocene, M2) lacustrine deposits are in Pljevlja basin where intensive extraction of coal (20m thick layer, in average) is taking place. The major inflow into open mine pit is from underlying and surrounding Triassic karstic aquifer, and not from overlying and lateral Neogene deposits.

The permeability and groundwater availability of alluviums very much depends on river size and flows. Some other alluviums are also supplying potable water but mostly to smaller settlements (villages). Notable thickness, but rarely over 10m characterized alluviums of Piva, Tara, Čehotina, and Lim.

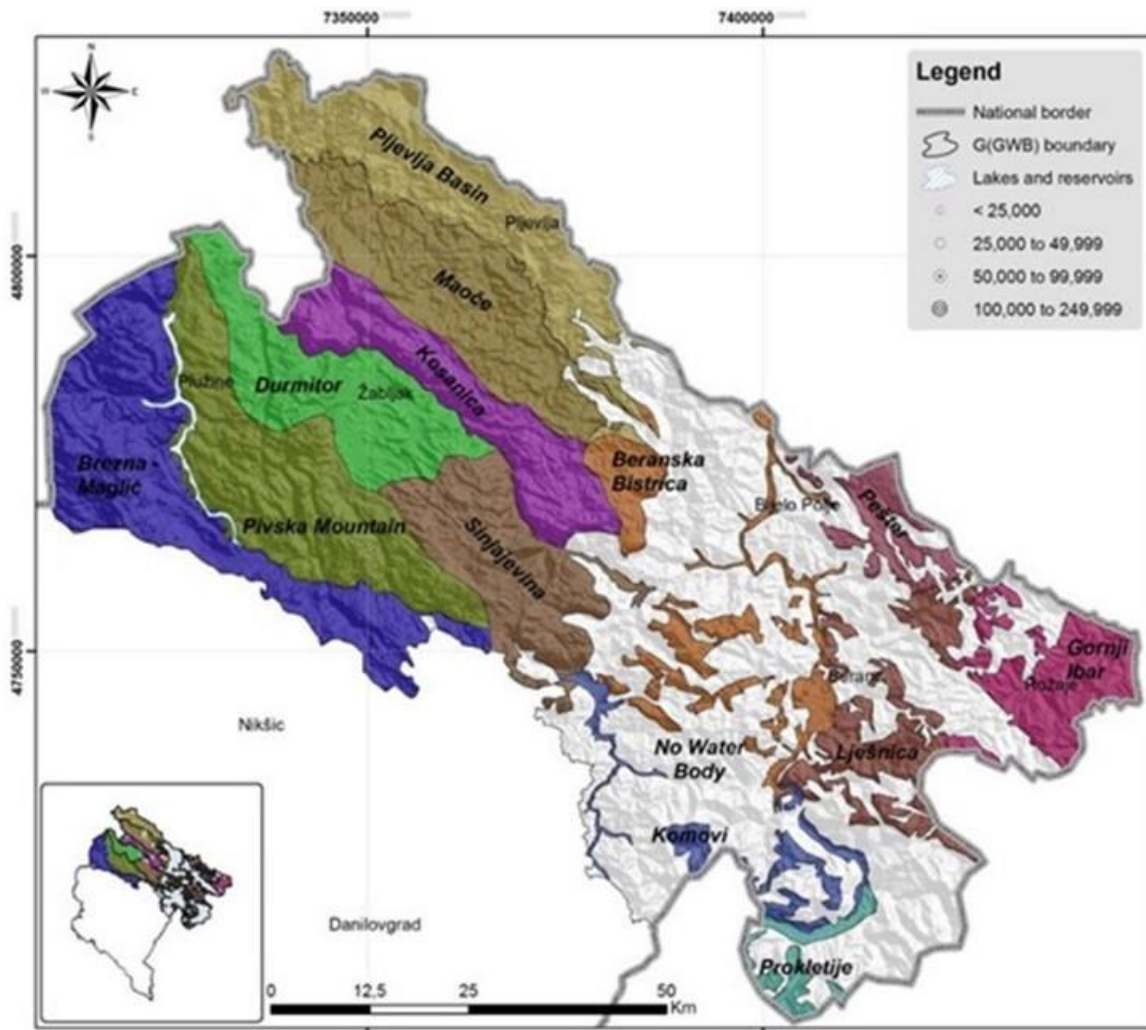


Figure 5-27: Groups of groundwater bodies in the Danube River Basin

The group of transboundary groundwater bodies “Komovi” (ME_DB_GGW_K_7) is located in the eastern part of Montenegro. It is distributed from Tara River in the west to Lim River in the east, and from Gusinje in the south to Andrijevića in the north. The total area of this group of groundwater bodies in the territory of Montenegro is 127.7 km².

The area is represented by hilly-mountainous karst terrains and valley along the Tara River. An elevation ranges from 902 m.a.s.l. in the area of Kolašin to 2,461 m.a.s.l. at the top of Komovi mountains. There are numerous surface and subsurface karst landforms in this area. The main rivers are Tara and Kutska rivers.

This area belongs to tectonic zones “High Karst” and “Durmitor”. According to the Geological Map of Montenegro 1:200,000 the Triassic limestone and dolomite (T) have the dominant distribution. Besides the carbonate rocks, the alluvial and glacial sediments are also present.

The karst aquifer is represented by karstified limestone and dolomite. A groundwater recharge mainly occurs by infiltration of atmospheric water. The aquifer is mostly uncovered. The mean annual precipitation amounts 1,451 mm/year. An assessed recharge rate (effective infiltration) is around 65% of precipitation rate, i.e. around 943 mm/year. One part of recharge area is outside the territory of Montenegro. According to a rough assessment the depth to groundwater level at most of GGWBs is over 200 m. There are no tracer test conducted for this area.

5.7.3 Water quality

For the assessment of the impacts of the new road Andrijevica-Mateševu as part of Bar-Boljare Highway and for updating the baseline information, water quality measurements have been performed.

Two sample campaigns have been performed. Samples have been collected at 5 locations in the project area. The samples have been collected from surface waters(rivers) and water wells in use. The exact locations of the samplings are presented in the table and figure below.

Table 5-14: Water quality measurement locations

WGS84	Lat	Long
Surface water measurement point 1	42.748644°	19.598420°
Surface water measurement point 2	42.742403°	19.737965°
Surface water measurement point 3	42.749337°	19.791404°
Water well measurement 1	42.730852°	19.661272°
Water well measurement 2	42.737429°	19.751186°



Figure 5-28: Water quality measurement locations

Overall, the design and performance of water sampling protocol and strategy is based on the following standards and guidelines: ISO 5667-1:2006, Water quality - Sampling - Part 1: Guidance on the design of sampling programmes and sampling techniques

- ISO 5667-3:2012, Water quality - Sampling - Part 3: Preservation and handling of water samples
- ISO 5667-14:2014, Water quality -- Sampling -- Part 14: Guidance on quality assurance and quality control of environmental water sampling and handling
- ISO 19458:2006, Water quality -- Sampling for microbiological analysis

The water chemical and microbiological analysis package included the following parameters: Heavy Metals, PAHs, Total Petroleum Hydrocarbons C10-C40, PCBs, Nitrate (NO₃), Nitrite (NO₂), Phosphate (PO₄), BOD, Ntot, Ptot, NO₃-N, Xylene (BTEX), Total Coliform, E.coli and Intestinal enterococci. On site measurements of pH, temperature and conductivity have also been performed by using an officially calibrated instrument (portable Multiparameter Meter).

According to the results, the concentrations of the parameters indicate high ecological status.

5.8 Climate Change

5.8.1 Emissions of GHG

According to the National Inventory Report of 2023 of Montenegro in 2021 Montenegro's total greenhouse gas (GHG) emissions (without LULUCF) amounted to 3427,05 kt CO₂ equivalents (CO₂eq). Compared to 1990 GHG emissions decreased by 24.5%, compared to 2005 GHG emissions decreased by 11%.

The most important greenhouse gas is CO₂, contributing 78.2% to total sectoral GHG emissions, followed by CH₄ (13.7%) and N₂O (3.3%).

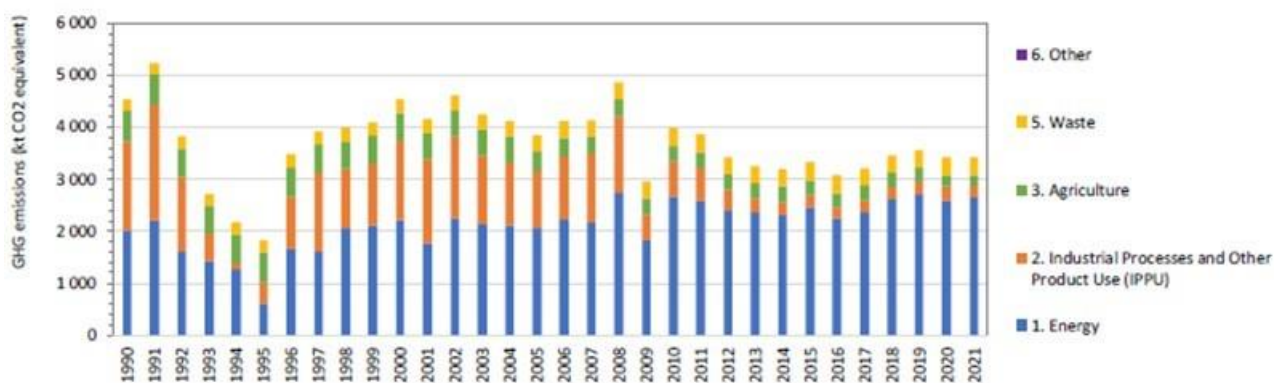


Figure 5-29: Total GHG emissions (CO₂eq) without LULUCF for 1990-2021

Source: National Inventory Report (2023)

In 2021, greenhouse gas emissions from sector Energy amounted to 2654.94 kt CO₂e which corresponds to 75.8% of the total national emissions (without LULUCF). 99.55% of the emissions from this sector originate from fuel combustion (1.A) while fugitive emissions from fuels (1.B) contribute about 0.45 %.

The most important sub-category within the sector of energy is Energy Industries with a share of 52.4% in 2019, followed by Transport (35.5%), Manufacturing industries and construction (8.7%) and the sub-category Other sectors (2.3%).

The greenhouse gas emissions from IPCC category 1.A.3.b *Road transport* increased by 167.1% from 341.00 kt CO₂ equivalent in 1990 to 910.70 kt CO₂ equivalent in 2021. Furthermore, the GHG emissions increased by 90.9% from 477.01 kt CO₂ equivalent (2005). The significant increase of GHG emissions is a result of growing mobility within cities but also between cities, growing freight transport due to increased national production but also due to imports and exports. This development is also reflected in the transport fleet, which is shown in the following figure.

In the period 2020 to 2021 GHG emissions from the IPCC category 1.A.3.b *Road transport* increased by 30.3% from 698.73 kt CO₂ equivalent in 2020 to 910.70 kt CO₂ equivalent in 2021 as a result after the nationwide lockdown due to the covid pandemic. In 2021 about 76.9% of the registered road motor vehicles and trailers are fulling up gas/diesel oil.

Montenegro's contribution to international efforts to address climate change issues, expressed through the Intended Nationally Determined Contribution (INDC) to reductions in GHG emissions, is set at a minimum of 35% (excl. LULUCF) by 2030 compared to 1990 as the baseline year.

5.8.2 Climate change induced risks events that have impact on the road

For the purposes the ESIA, the trend of several temperature and precipitation parameters was calculated, using the least squares equation and the t-test. Namely, the trend component is the best indicator of the basic direction of movement of an element for a longer period of time.

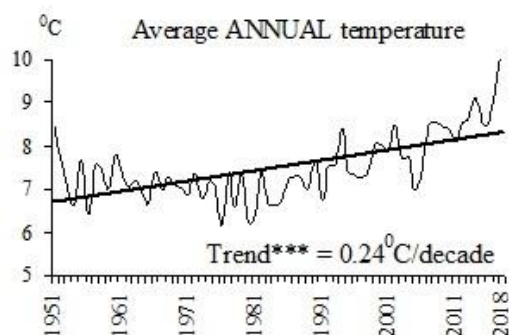
The World Meteorological Organization (WMO) and the Intergovernmental Panel on Climate Change (IPCC) recommend using a trend as an indicator of changes in a given element as a function of time. The trend was calculated for the period 1951-2018. year, and the significance of the tendency was examined at the risk level of 0.001, 0.01, 0.05 and 0.1 (hypothesis correctness degree of 99.9%, 99%, 95% and 90%). The trend was calculated based on data from MS Kolašin and can be taken as a landmark for the Mateševu – Andrijevića highway section

5.8.2.1 Temperature

Historical data

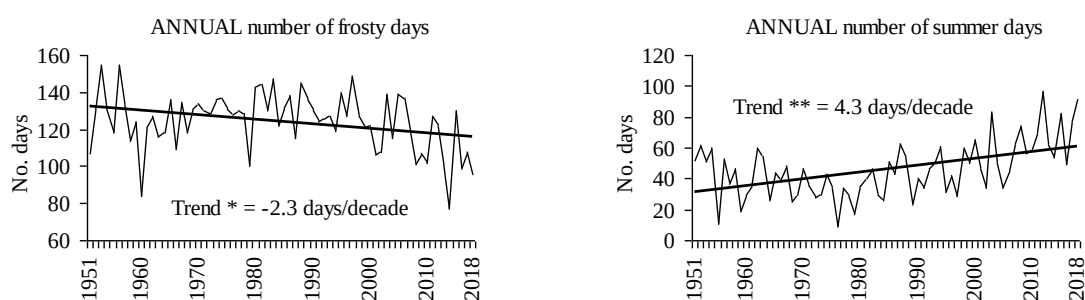
In the period from 1951 to 2018, there is a trend of increasing temperature, and is generally significant. The average annual temperature is rising at a rate of about 0,24°C per decade, a growing trend is significant at the 99.9% level of acceptance of the hypothesis. Therefore, it is the highest level of significance of trend growth. At the level of the seasons, it is interesting that the faster are growing summer and spring than winter and autumn temperatures. The most intensive increase have mid-summer temperatures about 0.41°C/decade, while the slowest is growing medium winter temperature - about 0.13°C per decade (Figure 5-30). Only the upward trend of mid winter temperature is insignificant.

The annual number of frosty days is decreasing at a rate trend of 2.3 days per decade, and these changes are significant at 90% level of accuracy hypothesis. On the other side, the annual number of summer days is significantly increased, and this trend is at a rate of 4.3 days per decade (Figure 5-31). The trend of increasing the number of summer days is significant at the highest level of acceptance of the hypothesis - 99.9% level of confidence. Thus, the trend of these two parameters temperature (frost and summer days) indicates that there is a general tendency of warming along the project area.



(significancy of trend on level: + - 90%; * - 95%; ** - 99% and *** - 99.9%)

Figure 5-30: Mid temperature trend (annual), Kolašin 1951-2018



(significancy of trend on level: + - 90%; * - 95%; ** - 99% and *** - 99.9%)

Figure 5-31: Trend of annual number of frosty and summer days, Kolašin 1951-2018

Thus, the previously obtained results for the project area indicate that air temperature increases, that is all the more frequent the maximum and minimum daily temperatures have „warmer“ value.

Projections

Projected changes in monthly temperatures for the four reference periods with respect to the referent period (1986-2005) under the scenarios RCP4.5 and RCP8.5. All climate simulations show an increase of mean temperatures for both future periods, under both IPCC scenarios, for all months and periods as indicated in the following tables.

Table 5-15: Projected changes of normal monthly temperature (°C) in Montenegro, Scenario RCP 4.5

	Winter			Spring			Summer			Autumn		
	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov
2020-2039	1.11	1.01	0.84	0.94	0.98	1.16	1.54	1.65	1.48	1.03	1.03	0.92
2040-2059	1.37	1.53	1.35	1.55	1.32	1.94	2.00	2.12	1.74	1.44	1.4	1.35
2060-2079	1.81	1.74	1.63	1.73	1.78	2.38	2.65	2.81	2.43	1.92	1.78	1.72
2080-2099	1.94	1.86	1.92	2.07	1.99	2.52	2.9	3.02	2.63	2.33	2.26	2.02

Table 5-16: Projected changes of normal monthly temperature (°C) in Montenegro, Scenario RCP 8.5

	Winter			Spring			Summer			Autumn		
	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov
2020-2039	1.03	1.14	1.03	1.06	1.15	1.36	1.71	1.87	1.76	1.34	0.95	1.12
2040-2059	2.04	1.85	1.99	1.99	1.92	2.51	2.97	2.96	2.65	2.28	1.77	1.77
2060-2079	3.03	2.85	2.56	2.96	2.97	3.91	4.21	4.38	4.17	3.55	2.63	2.79
2080-2099	3.76	3.62	3.2	3.82	4.23	5.11	5.71	6.11	5.51	4.35	3.78	3.58

For projected climate, the worst-case approach has been mainly assessed (period 2080-2099), where under scenario RCP 4.5, there is going to be an increase of 2.85 °C during summer and of 1.91 °C during winter. Under the scenario RCP 8.5, there is going to be an increase of 5.78 °C during summer and of 3.53 °C during winter. Under the scenario RCP 8.5, the highest seasonal increase, comparing decades, is in the summer. More specifically, in the period 2020-2039 there is an increase during the summer months (June, July, August -average) of 1.78 °C, while in the period 2080-2099 the increase is 5.78°C

Ensemble median of change in mean annual number of frost days, icing days, summer days, days with tropical nights and days with maximum temperature above 35°C for all future periods under both RCP scenarios are presented in the following tables for the two scenarios (with respect to the reference period 1986-2005). Changes of the ensemble median show less frost and icing days and more summer days, days with tropical nights and days with maximum temperature above 35°C for both scenarios. The changes are larger for the later period (2080-2099), as well as under the RCP8.5 scenario, alongside with higher uncertainty of the results.

Table 5-17: Projected changes in mean annual number of frost days, icing days, summer days, days with tropical nights and days with maximum temperatures above 35°C (scenario RCP 4.5)

	Annual Summer Days (Tmax>25°C)	Annual Tropical Nights (Tmin>20°C)	Annual Frost Days (Tmin<0°C)	Annual Ice Days (Tmax<0°C)	Annual Hot Day (Tmax>35°C)
2020-2039	22.73	0.11	-13.49	-8.97	0.21
2040-2059	30.89	0.43	-19.46	-9.65	0.41
2060-2079	41.49	0.72	-27.56	-13.22	0.92
2080-2099	42.3	1.19	-29.69	-14.04	1.63

Table 5-18: Projected changes in mean annual number of frost days, icing days, summer days, days with tropical nights and days with maximum temperatures above 35°C (scenario RCP 8.5)

	Annual Summer Days (Tmax>25°C)	Annual Tropical Nights (Tmin>20°C)	Annual Frost Days (Tmin<0°C)	Annual Ice Days (Tmax<0°C)	Annual Hot Day (Tmax>35°C)
2020-2039	21.93	0.3	-15.41	-7.76	0.24
2040-2059	39.71	1.52	-30.29	-13.73	1.36
2060-2079	62.74	6.58	-44.15	-18.22	4.85
2080-2099	78.02	21.06	-56.76	-21.46	15.48

Projected changes of the ensemble median of mean annual number of frost and icing days for the period 2020-2039 are 13.5 and 9 days less under the RCP4.5 scenario respectively and 15.5 and 8 days less under the RCP8.5. Changes for the period 2080-2099 are greater, namely from 30 frost days and

14 icing days less under the RCP4.5 and 57 frost days and 21.5 icing days less under the RCP8.5. Median change of mean number of summer days for the period 2020-2039 is 23 for the scenario RCP4.5 and 22 days for the scenario RCP 8.5, while in the period 2080-2099 is 42 more under the RCP4.5 and 78 more under the RCP8.5. Median change of mean number of days with tropical nights for the period 2020-2039 is 0,1 day more under the RCP4.5 and 0,3 more under the RCP8.5, while for the period 2080-2099 is 1.2 days more under the RCP4.5 and 21 days more under the RCP8.5. Finally, median change of mean number of days with hot days ($T_{max} > 35^{\circ}\text{C}$) for the period 2020-2039 is 0.2 days more under the RCP4.5 and 0.25 more under the RCP8.5, while for the period 2080-2099 is 1,6 days more under the RCP4.5 and 15.5 days more under the RCP8.5.

Climate change projections are presented as developed for the Initial and 2nd Communication of Montenegro under the United Nations Framework Convention on Climate Change² using regional model EBU-POM for the time periods 2001-2030 and 2071-2100 in comparison to the reference period 1961-1990. The modelling uses the A1B (“medium”) and A2 (“strong”) scenarios to project the changes in temperature and precipitation as well as the changes in extreme climate events.

For Podgorica area, there are available data from the two regional climate models (RCM): A2 scenario of EBU-POM model, or RCP4.5; and RCP8.5 scenario of ALADIN model.

Results of EBU-POM model for A2 scenario

By the projections of A2 scenario of EBU-POM model, the mid annual temperature, in the period 2011-2040, will be $0,50^{\circ}\text{C}$ higher; in the period 2041-2070 will be higher for 1.7°C , and in the period 2071-2100 will be higher for 3.6°C . At the level of the seasons, it is expected to have the most intensive increase in the mid-winter and mid-summer temperatures. In qualitative terms, the same results were, also, obtained for mid maximum and the mid minimum temperature. It is noticeable that the maximum temperature grows more intensively than the minimum one. In other words, the highest increase in temperature is expected in the last 30-year period (2071-2100). Compared to the base period (1981-2010), projections indicate that the mid annual temperature for the period 2071-2100 will be higher for 3.8°C and mid maximum for 5.0°C . According to A2 scenario, the expected increase of summer temperature in Kolašin in the period 2071-2100. will be: mid 3.6°C ; mid minimum 3.5°C , mid maximum 5.4°C (Table 5-19). If these projections come true, the future will be warmer, and at the end of the 21st century, even extremely warm.

Table 5-19: Projections of mid annual and season temperature in Kolašin until 2100. in relation to base period 1981 – 2010, scenario A2 of EBU-POM model

	Base period	A2 scenario		
Avg.T. ($^{\circ}\text{C}$)	1981-2010	2011-2040	2041-2070	2071-2100
Year	7.4	+0.5	+1.7	+3.6
Winter	-1.1	+1.1	+2.1	+3.8
Spring	6.5	+0.6	+1.2	+3.0
Summer	14.9	+0.8	+1.6	+3.6
Autumn	7.7	+0.4	+1.4	+3.2
Avg.Tn. ($^{\circ}\text{C}$)	1981-2010	2011-2040	2041-2070	2071-2100
Year	2.3	+0.6	+1.8	+3.8
Winter	-5.0	+1.3	+2.5	+4.2
Spring	1.3	+0.5	+1.1	+2.9
Summer	8.5	+0.9	+1.6	+3.5
Autumn	2.8	+0.5	+1.6	+3.5
Avg.Tx. ($^{\circ}\text{C}$)	1981-2010	2011-2040	2041-2070	2071-2100
Year	14.0	+0.6	+2.2	+5.0

	Base period	A2 scenario		
Winter	3.5	+1.3	+2.3	+4.3
Spring	12.7	+0.8	+1.6	+4.1
Summer	22.9	+1.1	+2.3	+5.4
Autumn	14.7	+0.6	+1.8	+4.4
Avg. T -mid temperature; Avg.Tn (Tx).-mid minimum (maximum) temperature				

Also, days with characteristic temperatures indicate a warmer future. It is expected that, in the period 2011-2040, the annual number of summer days become higher for 9.1 days compared to the base period. During the period from 2041. to 2070, projected average annual number of summer days will be for 29.2 days higher than in the period 1981-2010. According to projections, in the period 2071-210, Kolašin will have, in average, 66.9 more summer days per year than in the base period. In the last 30-year period (2071-2100) it is expected to be about 50 (50.3) tropical days more than in the base period. According to these projections, after 2070, in Kolašin are possible tropical night, in real, up to 1 tropical night, but only during certain years. In Kolašin rarely occur days with a maximum temperature of 35°C. But, projected number of days with maximum temperature $\geq 35^{\circ}\text{C}$ in the period 2071-2100. is 12-13 days per year. In period of instrumental measuring (1949 – to date) in Kolašin were not registered temperatures of 40°C or higher. But projections indicate that, after 2070. are, during the summer, possible even maximum temperatures $\geq 40^{\circ}\text{C}$, in real, up to 1 such day during certain years. On the other side, until 2100, less frequently will occur frosty and icy days. In an average year, in Kolašin were registered between 120 and 130 frosty days, and projections for the period 2071-2100. indicate that this number will decrease even for 59.5 days (Table 5-20).

Table 5-20: Projections of number of days with temperature above a fixed threshold, per year, in Kolašin, until 2100, in relation to base period 1981-2010, A2 scenario of EBU-POM model

	Base period	scenario A2		
Number of days	1981-2010	2011-2040	2041-2070	2071-2100
Summer days ($T_x \geq 25^{\circ}\text{C}$)	44.3	+9.1	+29.2	+66.9
Tropical days ($T_x \geq 30^{\circ}\text{C}$)	5.1	+4.6	+17.7	+50.3
Tropical nights ($T_n > 20^{\circ}\text{C}$)	0.0	0.0	0.0	+0.5
Icy days ($T_x < 0^{\circ}\text{C}$)	17.6	-0.4	-7.4	-12.7
Frosty days ($T_n < 0^{\circ}\text{C}$)	122.1	-14.0	-29.9	-59.5
Days with $T_x \geq 35^{\circ}\text{C}$	0.2	0.0	+1.4	+12.7
Days with $T_x \geq 40^{\circ}\text{C}$	0.0	0.0	0.0	+0.5

For the study, the trend of the considered parameters of air temperature was calculated. Calculations show that trend of mid temperature is fairly uniform: from 0,46°C per decade (spring) to 0,52°C per decade (summer and autumn). So, the most intensive is the increase of mid-summer and mid-autumn temperature. In the period from 2011 to 2100. projected trend of the mid-summer temperature mid-autumn temperature will be around 0.52°C per decade. The tendency of the projected increase of the mid temperature during the 21st century is significant at the highest level of trust - 99.9% level of acceptance of the hypothesis, as for year as for the season.

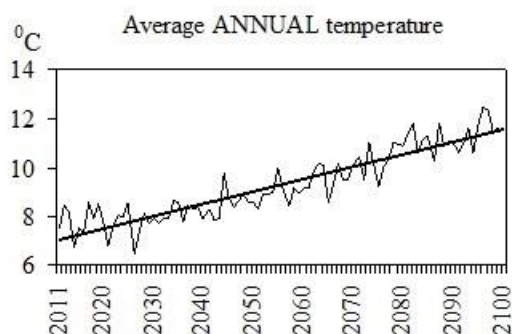


Figure 5-32: Mid temperature trend (annual), Kolašin 2011-2100 (significance of trend on level: *** - 99,9%), A2 scenario of EBU-POM model

Trend of the projected mid annual minimum and maximum temperature in period 2011-2100 in Kolašin, statistically is very significant (99.9% level of trust). The trend of increase of mid maximum temperature ($0.72^{\circ}\text{C}/\text{decade}$) is more pronounced than of mid minimum temperature ($0.52^{\circ}\text{C}/\text{decade}$) (Figure 5-33).

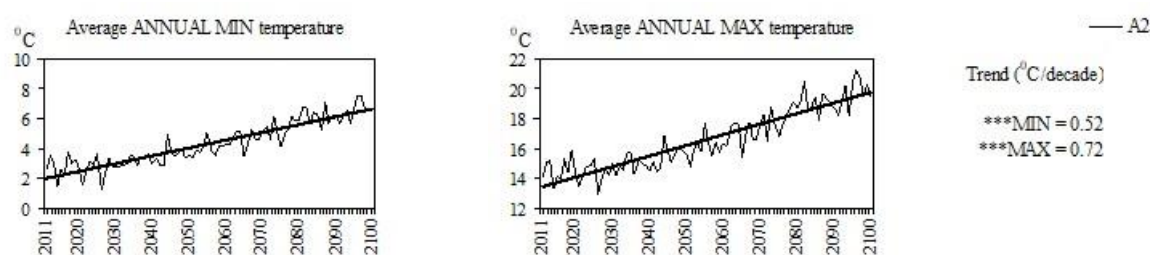


Figure 5-33: Trend of projected mid annual maximum and minimum temperature in Kolašin, period 2011-2100. (significance of trend on level: *** - 99,9%), A2 scenario of EBU-POM model

Results of CNRM-ALADIN53 model for RCP4.5 and RCP8.5 scenario

Table 5-21: Projections of mid annual and season temperature in Kolašin until 2100. year, compared to base period 1981-2010, RCP4.5 and RCP8.5 scenario of CNRM-ALADIN53 model

	Base period	Scenario RCP4.5			Scenario RCP8.5		
Avg. T. ($^{\circ}\text{C}$)	1981-2010	2011-2040	2041-2070	2071-2100	2011-2040	2041-2070	2071-2100
Year	9.3	+0.7	+1.4	+2.2	+0.8	+2.1	+3.6
Winter	0.8	+0.8	+1.2	+2.0	+0.9	+2.0	+3.2
Spring	8.0	+0.9	+1.2	+2.4	+1.0	+2.2	+3.7
Summer	18.0	+0.9	+1.9	+2.2	+0.9	+2.1	+4.2
Autumn	10.4	+0.3	+1.2	+1.9	+0.5	+2.0	+3.2
Avg.Tn. ($^{\circ}\text{C}$)	1981-2010	2011-2040	2041-2070	2071-2100	2011-2040	2041-2070	2071-2100
Year	4.6	+0.7	+1.4	+2.2	+0.8	+2.1	+3.7
Winter	-3.0	+0.8	+1.2	+1.9	+0.7	+1.8	+2.9
Spring	3.4	+0.9	+1.2	+2.6	+0.8	+2.4	+3.9
Summer	12.4	+0.9	+1.9	+2.3	+1.0	+2.3	+4.4

Autumn	5.7	+0.2	+1.2	+1.9	+0.7	+2.0	+3.3
Avg.Tx. (°C)	1981-2010	2011-2040	2041-2070	2071-2100	2011-2040	2041-2070	2071-2100
Year	13.9	+0.7	+1.4	+2.1	+0.9	+2.0	+3.5
Winter	4.6	+0.9	+1.3	+2.1	+1.0	+2.1	+3.4
Spring	12.5	+0.8	+1.1	+2.3	+1.1	+2.1	+3.6
Summer	23.6	+0.9	+1.8	+2.2	+0.9	+1.9	+3.9
Autumn	15.0	+0.3	+1.2	+1.9	+0.4	+1.9	+3.1
Avg. T -mid temperature; Avg.Tn (Tx).-mid minimum (maximum) temperature							

Table 5-22: Projections of number of days with temperature above fixed thresholds in Kolašin, until 2100. compared to base period 1981-2010, RCP4.5 and RCP8.5 scenario of CNRM-ALADIN53 model

	Base period	Scenario RCP4.5			Scenario RCP8.5		
Broj dana	1981-2010	2011-2040	2041-2070	2071-2100	2011-2040	2041-2070	2071-2100
Number of days	36.7	+9.8	+20.0	+26.7	+10.8	+20.6	+45.4
Summer days (Tx≥25°C)	4.2	+4.2	+9.1	+11.2	+2.1	+9.7	+23.2
Tropical days (Tx≥30°C)	0.1	+0.4	+1.2	+1.3	0.0	+2.1	+10.2
Tropical nights (Tn>20°C)	15.9	-1.3	-4.7	-8.2	-3.0	-7.1	-9.8
Icy days (Tx<0°C)	93.3	-11.1	-14.2	-23.4	-7.0	-22.0	-33.1
Frosty days (Tn<0°C)	0.0	+1.0	+1.6	+1.5	+0.4	+2.6	+6.0
Days with Tx≥35°C	0.0	0.0	0.0	+0.1	0.0	0.0	+0.9
Tx(n) - daily maximum (minimum) temperature							

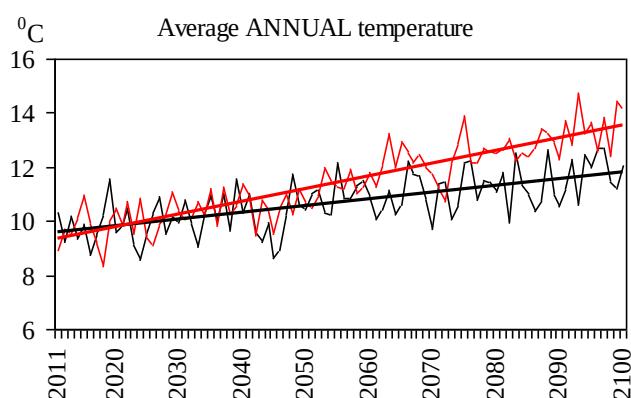


Figure 5-34: Mid temperature trend (annual), Kolašin 2011-2100 (significance of trend on level: * - 99,9%), RCP4.5 and RCP8.5 scenario of CNRM-ALADIN53 model**

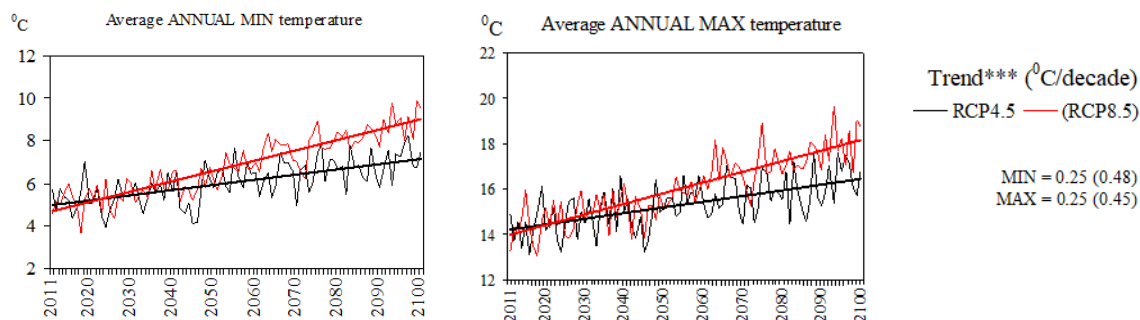


Figure 5-35: Trend of projected mid annual maximum and minimum temperature in Kolašin, period 2011-2100, (significance of trend on level: *** - 99.9%), RCP4.5 and RCP8.5 scenario of CNRM-ALADIN53 model

The absolute maximum temperature registered in Kolašin, in the period of instrumental measuring was 37,1°C, and it was on 23 August 2012. Projections of EBU-POM model show that the maximum temperature in Kolašin, by the end of the 21st century can reach a value of up to 43,8°C (Table 5-23).

Table 5-23: Measured and projected absolute lowest and the highest temperature in Kolašin

Temperature (°C)	Instrumental period	Projections do 2100		
	(1949-2019)	A2	RCP4.5	RCP8.5
Abs. MAX	37.1	43.8	40.4	41.8
Abs. MIN	-29.8	-32.1	-16.5	-19.1

5.8.2.2 Precipitation

Historical data

Regarding **precipitation** quantity, there are changes, but they are insignificant. Spring and autumn precipitation is increasing at the trend line, and it is for 9.7 mm/decade, and 19.6 mm/decade. Summer and winter precipitation decrease - about 3.0 mm/decade (in summer) and 12.5 mm/decade (in winter). Given that the cumulative increase in intense precipitation during transitional seasons than the overall decrease in summer and winter, annual precipitation shows a tendency to grow by a paltry 0.8 mm / decade). Thus, we can conclude that regarding the total annual and seasonal precipitation the changes are not significant.

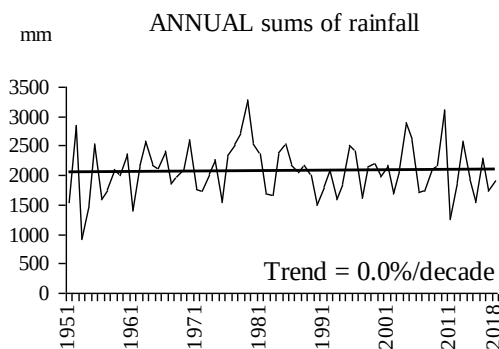


Figure 5-36: Trend of the annual precipitation sums, Kolašin 1951-2018

(significance of trend on level: + - 90%; * - 95%; ** - 99% and *** - 99.9%)

Changes in the number of days with precipitation of more than 20, 30 and 50 mm are insignificant. Although the changes are insignificant, it should be noted that the number of days with extreme rainfall over 50 mm, increases at a rate trend of 0.3 days per decade (Figure 5-37).

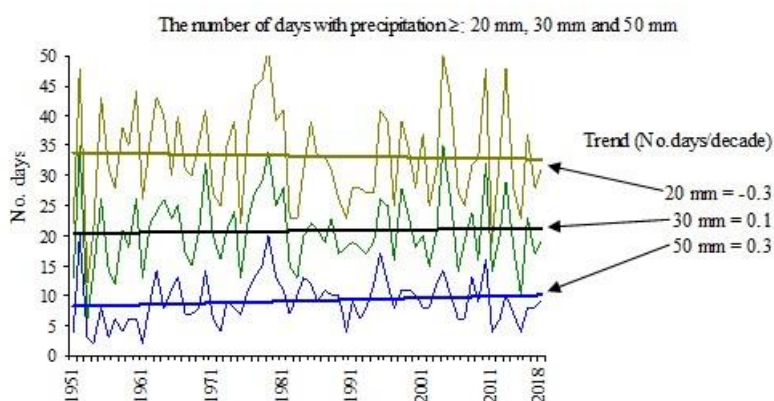


Figure 5-37: Trend of annual number of days with precipitation $>$: 20 mm, 30 mm and 50 mm, Kolašin 1951-2018

Projections

Projected changes in monthly precipitation for the four reference periods with respect to the referent period (1986-2005) under the scenarios RCP4.5 and RCP8.5.

Unlike the temperature change projections, precipitation changes are not uniform in size, however they present a uniformity in sign since, there is a reduction in precipitation in the majority of the months of both scenarios for all time periods (in comparison to the reference period 1986-2005).

Table 5-24: Projected changes in monthly precipitation (mm) in Montenegro, ensemble median, Scenario RCP 4.5

	Winter		Spring			Summer			Autumn			Win
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2020-2039	-6.59	5.75	-0.62	-2.17	-1.74	-3.89	-3.32	-1.45	-2.9	-6.09	-0.3	4.07
2040-2059	1.54	-4.64	0.51	0.4	-2.46	-6.59	-2.25	-4.08	-8.68	-3.36	-3.13	7.93
2060-2079	-5.49	-1.99	-4.29	-0.97	-0.4	-2.52	-3.12	-7.77	-7.32	7.92	2.7	-2.96
2080-2099	4.39	-2.18	1.11	-3.18	-4.73	-7.14	-3.72	-5.29	-9.06	-4.34	6.92	3.99

Table 5-25: Projected changes in monthly precipitation (mm) in Montenegro, ensemble median, Scenario RCP 8.5

	Winter		Spring			Summer			Autumn			Win
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2020-2039	-7.07	-6.74	4.48	-0.77	-2.64	-3.57	-0.51	-1.48	-5.81	-3.71	-1.07	2.63
2040-2059	2.73	-2.46	0.41	-5.61	-4.2	-5.25	-3.12	-4.72	-7.29	-6.69	5.72	3.52
2060-2079	-6.07	-4.3	-0.96	-4.79	-7.2	-11.98	-5.19	-9.11	-13.18	-5.09	-1.18	2.91
2080-2099	-8.68	-6.29	-2.59	-11.99	-13.84	-11.89	-12.41	-9.51	-23.01	-10.25	-8.41	-3.03

Under the scenario RCP 8.5, the largest precipitation deficit is identified in the period 2080-2099, while on the contrary, this is not uniform under the scenario RCP 4.5, where depending on the month, different periods may have higher or lower values. For example, under this scenario, the average values for January of the period 2080-2099 have a positive sign, while the ones of the period 2060-2079 have a very negative value, while average values for February of the period 2080-2099 show a smaller decrease than those of the period 2040-2059.

Projections of change in annual days with rainfall > 20mm, annual days with rainfall > 50mm, annual rainfall of very wet days (mm), annual maximum monthly rainfall - 10yr RL (mm) annual maximum monthly rainfall -25yr RL (mm) for the periods 2020-2039, 2040-2059, 2060-2079 and 2080-2099 with respect to the referent period 1986-2005 under the IPCC scenarios RCP4.5 and RCP8.5 for Montenegro are presented in the following tables.

Table 5-26: Projected changes in annual days with rainfall (scenario RCP 4.5)

	Annual Days with Rainfall > 20mm)	Annual Days with Rainfall > 50mm)	Annual Rainfall of Very Wet Days -mm	Annual Maximum Monthly Rainfall (10-yr RL) -mm	Annual Maximum Monthly Rainfall (25-yr RL) -mm
2020-2039	0.22	0.0	-8.41	0.39	4.88
2040-2059	0.68	0.0	-1.15	10.54	14.32
2060-2079	0.95	0.03	1.66	8.05	9.7
2080-2099	1.45	0.01	-0.7	10.38	11.4

Table 5-27: Projected changes in annual days with rainfall (scenario RCP 8.5)

	Annual Days with Rainfall > 20mm)	Annual Days with Rainfall > 50mm)	Annual Rainfall of Very Wet Days -mm	Annual Maximum Monthly Rainfall (10-yr RL) -mm	Annual Maximum Monthly Rainfall (25-yr RL) -mm
2020-2039	0.74	0.01	1.26	12.83	16.12
2040-2059	1.46	0.0	-4.23	12.85	17.26
2060-2079	1.61	0.07	-8.22	18.43	24.1
2080-2099	2.09	0.06	-12.63	15.81	22.7

Regarding annual days with rainfall > 20mm, scenario RCP 8.5 shows higher values with a steady increase compared to the scenario RCP 4.5. However, the increase from 2020 to 2100 under the scenario RCP4.5 is almost seven times while under the scenario RCP 8.5 is almost three times.

Regarding annual days with rainfall > 50 mm, both scenarios show that there is an almost zero probability of such a precipitation.

As far as annual rainfall of very wet days, scenario RCP 8.5 shows a steady decrease in the number of very wet days along the timeline, while scenario RCP 4.5 does not present a uniformity in terms of steady increase or decrease (there is a major change indicated the first two decades). Under the scenario RCP 8.5, the annual rainfall of very wet days has the biggest decrease in the period 2080-2099 (-12.63mm).

The same appears to be with the annual maximum monthly rainfall in a 10-year RL, where there is a steady increase in the values along the time under the scenario RCP 8.5, while the periods 2040-2059 and 2080-2099 have the highest values under the scenario RCP 4.5. Under the scenario RCP 4.5, there is a major increase in mm between 2020-2039 and 2040-2059, then a slight decrease and then again a more moderate increase.

Finally, regarding the annual maximum monthly rainfall in a 25 year RL, there is no uniformity under the scenario RCP 4.5, while there is a steady increase in values under the scenario RCP 8.5 up to the period 2060-2079 and then there is a decrease.

MATESEVO ANDRIJEVICA

Results of EBU-POM model for A2 scenario

Projected rainfall deviations are also calculated relative to the base period 1981-2010, and the results of modeling for the period 2011-2100. Also in this case 30-year periods were abstracted, and for each of them the mid value was calculated, also as the deviation relative to the base period. According to the projections of scenario A2 of EBU-POM model, in the period from 2011 to 2040. the average annual amount of precipitation in Kolašin is expected to be higher for 10.8% compared to the base period. Projected annual average rainfall in the period 2041-2070. will be lower for 6.8%. In period 2071-2100. A decrease of summer rainfalls for even 28.8% compared to base period is expected. In the last 30 years of the 21st century, modelling projections show increase only in spring rainfall, even for 21.3%, while in other seasons, and on annual level, a lower precipitation quantity is expected. It should be emphasized that the IPCC reports and scientific thesis note that the modelling of rainfall is much more complex and uncertain in comparison to temperature, and that there are great regional and even local differences in the projections.

Table 5-28: Projections of mid annual and season precipitation quantity in Kolašin until 2100, compared to base period 1981-2010, A2 scenario of EBU-POM model

Sum of precipitation	Base period	A2 scenario (in % of normal)		
	1981-2010 (mm)	2011-2040	2041-2070	2071-2100
Year	1986.6	+10.8	+6.1	-6.8
Winter	670.1	+3.5	-1.0	-19.6
Spring	447.0	+21.4	+28.5	+21.3
Summer	263.2	+7.8	-13.2	-28.8
Autumn	604.2	+13.0	+6.1	-5.0

Regarding the trend of rainfall, projections for the 21st century indicate that in the period 2011-2100. annual precipitation will decrease at a rate of 2.9% per decade, and the decline in rainfall is significant at the 99% level. A significant reduction in rainfall is expected, even, during the winter. The most intense precipitation decrease is expected to be in the summer (-5.9% / decade), significant at the 99.9% level of accuracy of the hypothesis. In spring and autumn changes of precipitation per trend line are insignificant (Figure 5-38).

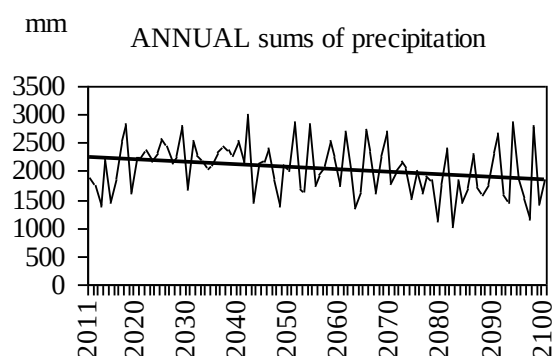


Figure 5-38: Trend of projected annual precipitation sum in Kolašin for period 2011-2100, (significance of trend on level: * - 99,9%, ** - 99%, + - 90%), A2 scenario of EBU-POM model**

The calculations of days with projected rainfall for the 21st century was also done, and deviations were given in relation to the base period 1981-2010. Modelling results for Kolašin show that in period 2011-2040 it should count on increase of the number of days with precipitation of ≥ 1 , 10, 20, 30, 40 and 50 mm. In the period from 2041. to 2070, it is expected to reduce the number of days with precipitation ≥ 1 mm and 10 mm and increase of the number of days from extreme rainfall (20, 30, 40 and 50 mm). During the last 30 years of the 21st century (2071-2100) it is expected to reduce the number of days with precipitation ≥ 1 mm for even 26.8 days compared to the base period. It is also expected decrease of the number of days with precipitation ≥ 10 and 20 mm. On the other hand, the number of days with precipitation of 30, 40 and 50 mm and over will slightly increase in this period.

Table 5-29: Projections of number of days with precipitation above fixed threshold until 2100. in Kolašin compared to base period 1981-2010, A2 scenario of EBU-POM model

No of precip. days	Base period	A2 scenario		
	1981-2010	2011-2040	2041-2070	2071-2100
≥ 1 mm	124.8	+4.1	-11.5	-26.8
≥ 10 mm	52.5	+5.9	-0.1	-7.5
≥ 20 mm	29.8	+3.9	+2.1	-1.4
≥ 30 mm	18.6	+3.0	+1.9	+0.4
≥ 40 mm	12.9	+2.0	+2.0	+1.1
≥ 50 mm	8.8	+1.3	+1.8	+1.1

The trend of projected changes of annual number of days with precipitation ≥ 1 mm, 10 mm, 20 mm and 30 mm has the negative sign (Figure 5-39). Also, a decreasing trend in the annual number of days with precipitation of ≥ 1 mm and 10 mm is statistically very significant. According to the modelling, in the period 2011-2100. it is expected increasing tendency in the number of days with precipitation ≥ 50 mm, but the changes are insignificant (+0.1 day / decade).

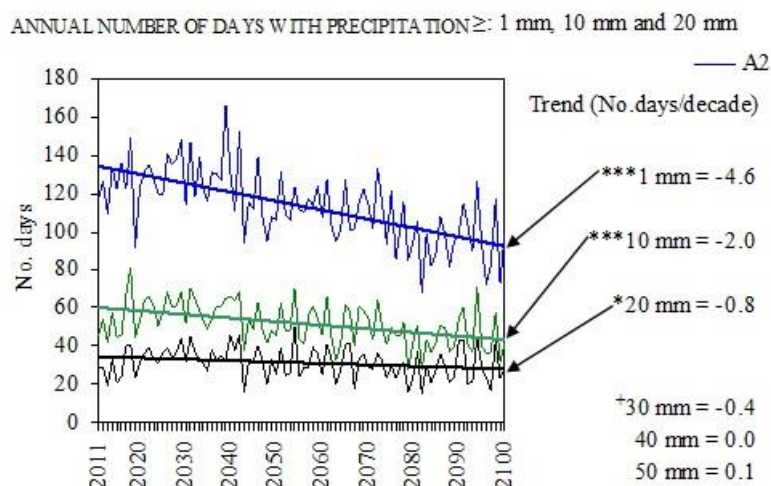


Figure 5-39: Trend of annual number of days with projected precipitations $\geq$ 1 mm, 10 mm i 20 mm, in Kolašin 2011-2100, (significancy of trend on level: * - 99,9%, ** - 99%, * - 95%, + - 90%), scenario A2 of EBU-POM model**

Results of CNRM-ALADIN53 model for RCP4.5 and RCP8.5 scenario

Table 5-30: Projections of annual and season precipitation sum until 2100. in Kolašin, compared to base period 1981-2010, RCP4.5 and RCP8.5 scenario of CNRM-ALADIN53 model

Sum of	Base period	Scenario RCP4.5 (in % of normal)			Scenario RCP8.5 (in % of normal)		
precip	1981-2010	2011-2040	2041-2070	2071-2100	2011-2040	2041-2070	2071-2100
Year	1708.9	-1.6	-0.2	+0.6	+0.9	-1.2	-1.9
Winter	558.1	-3.3	-2.3	-3.7	-15.2	-7.1	-14.5
Spring	378.6	+1.5	-4.5	+3.7	-9.1	-8.4	-0.3
Summer	231.6	-2.5	-1.4	-8.3	-5.4	-1.1	-1.8
Autumn	540.7	-2.0	+5.9	+5.9	+26.3	+10.3	+10.0

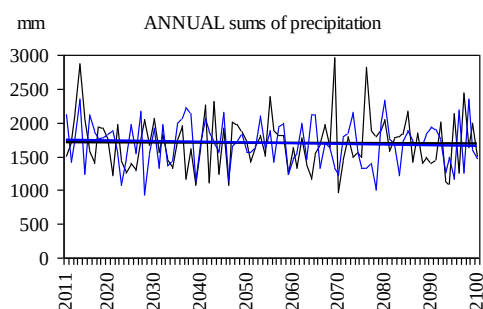


Figure 5-40: Trend of annual and season sum of precipitation in Kolašin for period 2011-2100, RCP4.5 and RCP8.5 scenario of CNRM-ALADIN53 model

Table 5-31: Projections of annual number of days with precipitation above fixed thresholds until 2100. in Kolašin, RCP4.5 and RCP8.5 scenario of CNRM-ALADIN53 model

Sum of	Base period	Scenario RCP4.5 (no of days)			Scenario RCP8.5 (no of days)		
precip	1981-2010	2011-2040	2041-2070	2071-2100	2011-2040	2041-2070	2071-2100
≥ 1 mm	112.1	+0.6	-0.9	-2.0	-0.5	-2.0	-6.8
≥ 10 mm	51.5	-1.6	-3.1	-1.8	+0.3	-2.0	-3.0
≥ 20 mm	28.2	-0.7	-1.1	-0.8	-0.8	-1.5	-0.8
≥ 30 mm	16.9	-0.1	+0.1	+0.5	0.0	-0.6	-0.7
≥ 40 mm	9.6	-0.2	+1.1	+1.2	+0.4	+0.6	+0.6
≥ 50 mm	6.2	-0.6	+0.7	+0.8	+0.6	+0.3	+0.6

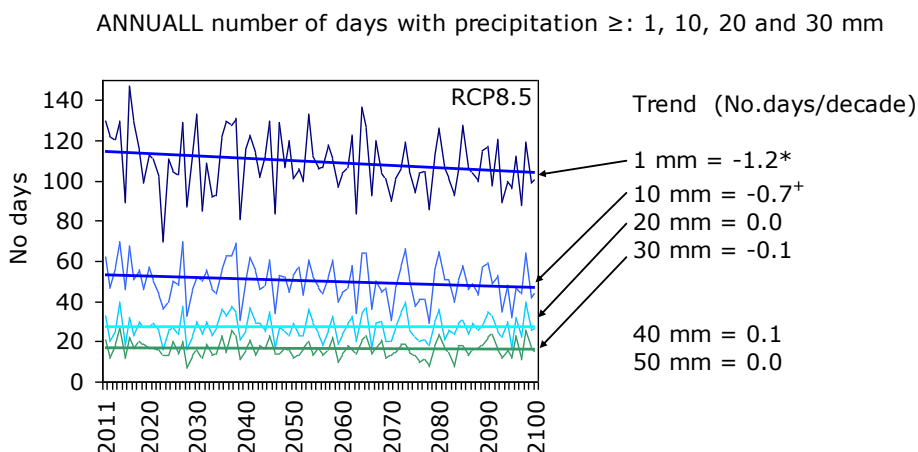


Figure 5-41: Trend of annual number of days with projected precipitation $\geq$ 1, 10, 20 i 30 mm in Kolašin for period 2011-2100, (significancy of trend on level: * - 95%, + - 90%), RCP4.5 and RCP8.5 scenario of CNRM-ALADIN53 model

5.8.2.3 Drought/water indicators

Historical data

Droughts have a regional character and have more and more economic and ecological consequences. Typical drought years in Montenegro by decade is as follows:

- 1951-1960: 1953
- 1961-1970: 1962, 1967, 1969
- 1971-1980: 1978
- 1981-1990: 1981, 1982, 1985, 1988, 1989
- 1991-2000: 1993, 1994, 1996, 1999
- 2001-2010: 2000, 2003, 2007, 2008

Based on collected information about drought impact, it can be said that:

- 2000 was a year of drought at regional level, what confirms the monitoring data from the countries in surroundings of Montenegro. The biggest impact of drought was on agricultural production. Yields were significantly lower than expected, what was evident in July. Also, forest fires were frequent and burned areas were huge (7500ha).
- 2003 was a year of drought with impact on whole territory. Agricultural drought was mostly present in middle and northern parts of Montenegro, where the yield quantity of agriculture (mostly fields and vegetables) was considerably lower than expected. Till the end of August about 100 larger forest fires have been noted (estimated damage is around 3million of euros), from which major was in surroundings of municipalities Tivat, Kotor, Cetinje and Podgorica. Drought had an impact on lack of drinking water, what was the reason of frequent and long restrictions in water supply, especially in the coastal areas of Montenegro. Even though there were significant economic losses in 2003, they were much smaller than in 2000.
- 2007 was the year of regional drought, and Montenegro was also affected. Drought has affected the whole country and caused huge economic losses (10 to 15 million of euros). Agricultural production was decreased, and forest fires were numerous in all areas. Also, the problem was lack of drinking water supply. Rivers and lakes were dried up, what influenced the production of electric energy.

- In 2008 long periods of droughty and severe drought impacts were not detected. During August were present certain problems related to the lack of water and water supply as well as several larger fires.
- Extremely dry conditions were recorded during the whole year 2011. Drought has developed to hydrological drought. Mean air temperature was above the average for the most part of the year. November of 2011 was the driest month observed since 1970. This year was characterized by a very warm spring, the extremely hot summer and autumn, and a winter in the warm category.
- During the summer season of 2012, very dry conditions dominated. Due to the hydrological drought during the previous year 2011, favourable conditions for large-scale forest fires were created. Spring was in the category of very warm, and summer, autumn and winter were extremely hot.

Droughts caused limitations in the availability of drinking water, whereas agricultural production in suburban areas suffered extensive damage. The water level in the rivers reached the minimum. Smaller streams dried up. Damage to biodiversity was reported, there was a drying of vegetation that is less resistant to high temperatures and has a greater need for water. As a side-effect of drought, hot asphalt surfaces further increased air temperature.

Projections

As far as projected change in annual severe drought is concerned, under the scenario RCP 4.5, there is a mild increase among the time periods, starting from a probability of 0.15 during the period 2020-2039 and reaching the probability of 0.27 change during the period 2080-2099. Under the scenario RCP 8.5, this probability starts from 0.15 in the period 2020-2039 and reaches the probability of 0.72 in the period 2080-2099.

5.8.2.4 Flooding risk

Floods in the area of Montenegro differ depending on the characteristics of the watercourse causing the floods. Along the valleys of most river flows, extreme water flows endangered settlements, industrial plants and agricultural land. These currents are characterized by large longitudinal falls, high speeds at the floodwaters, as well as significant amounts of suspended and traction. It should be noted that floods, which originate from large water main streams, often superimpose with floods that arise from torrential tributaries, and it is often very difficult and even impossible to separate these two phenomena. Also, the consequences of floods along these streams are accompanied by changes in the river basin. That is why the floods surfaces change their position and size.

According to Montenegro's 3rd National Communication particularly sensitive areas for heavy rainfall are Ulcinj Field (at the River Bojana's high-water levels), the zone from Vladimir to Veliki Ostros, and from Sutomore to Virpazar, the area of the old town of Kotor, Sutorina, Herceg Novi, Crkvice, and part of the Luštica Peninsula.

The following map presents the flood hazard at a country level.

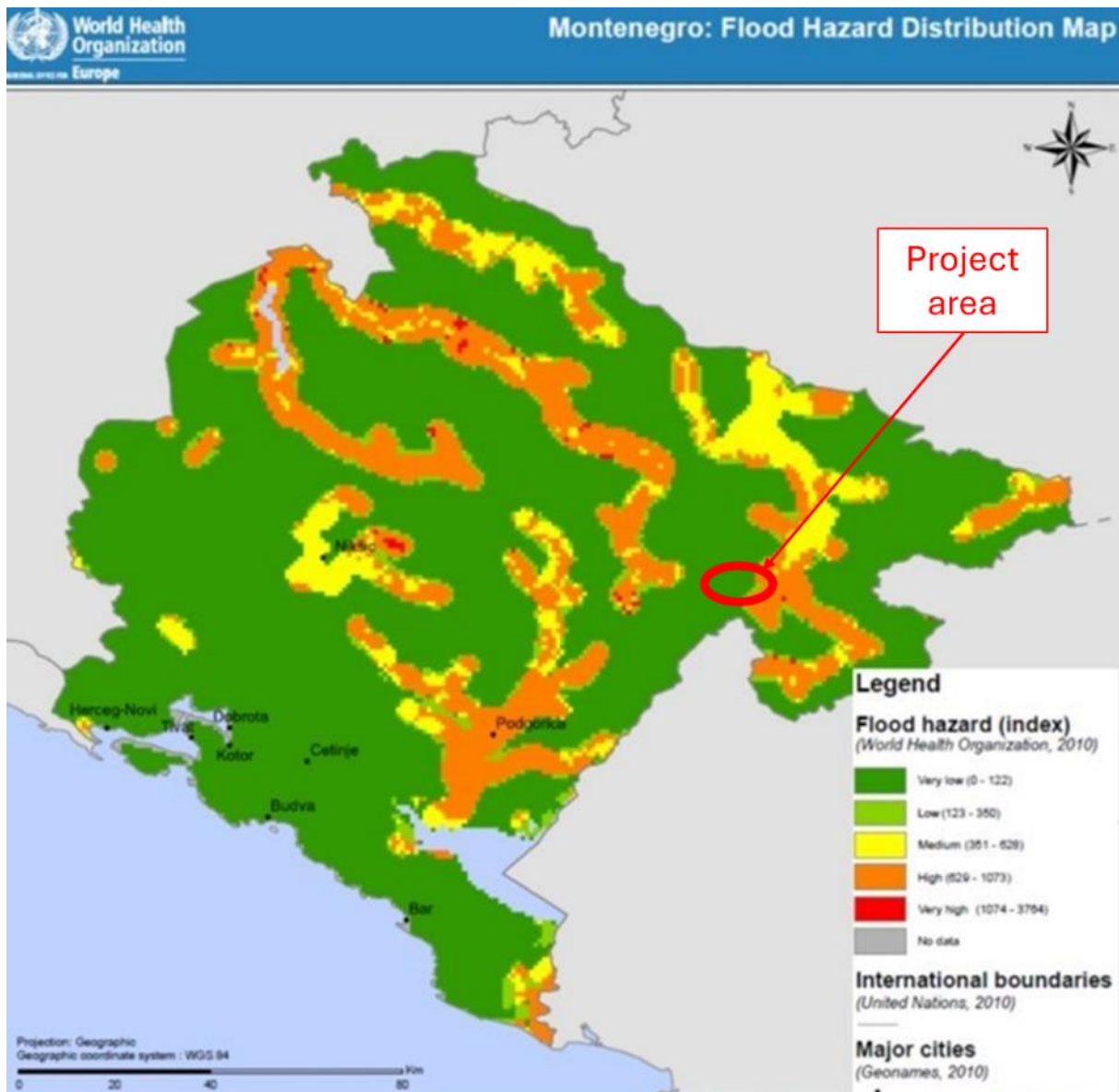


Figure 5-42 Flood hazard map

As seen in the previous figure, the project passes through areas with varying flood risk from very low to high.

5.8.2.5 Storms

Storms are winds with maximum gusts that reach storm to hurricane speeds and are caused by passing of cyclones in the winter part of the year (October-April). As such, they can cause:

- Lighter as well as more substantial damages on buildings, built structures, constructions, and overhead power transmission lines
- Storm waves on the sea which cause flooding and erosion of the shore, damages on built infrastructure along the coastline

Storm winds are represented in almost all parts of Montenegro, The beginning of 2006 was characterized by high speeds of the north-east wind in Podgorica, reaching up to 25m/s. Podgorica area was several times affected by storms, as follows: February 2009 (NE wind strikes of 50 km/h), 15/05/2010, 09/06/2010 (the amount of precipitation was 21.5 l/m² with a blast of wind of 12.8 m/s

from east-southeast and the occurrence of hail), 05/10/2010 and 12/07/2012. Extreme event was snow blizzard on 11/12/2012 (not typical for Podgorica, 20 cm of snow was measured, very strong gusts of wind of 16.9 m/s). Finally, there was a tornado on 30/05/2013.

5.9 Ecological resources and biodiversity

Baseline conditions for ecological resources and biodiversity is set based on bibliographical data and field investigations that were conducted for the project.

In the framework of the Preliminary ESIA field surveys were conducted in the period 2019-2021 (Appendix I-A). As a new alignment was proposed from the entrance of the Tresnjevnik tunnel to Andrijevica, a complementary biodiversity assessment for this new alignment, Tresnjevnik-Andrijevica was conducted during October–November 2024 (Appendix I-B).

5.9.1 Flora and vegetation (habitats)

Habitats

The project area is located in the eastern part of Montenegro, bordered by the Bjelasica mountains to the north and the Komovi mountains to the south. It stretches in an east-west direction and mainly follows the valley of the Kraštica River, along with its tributaries (Rajovića Potok, Dubokalj, Novovića Potok, Prisojački Potok, Durački Potok, Gnjili Potok), all of which flow into the Lim River near Andrijevica.

In the western part (Mateševo-Trešnjevnik) the route of the road passes through the riparian habitats of the rivers Drcka, Vranještica, Ljubaštica and numerous streams, acidophilic forests and woodlands, hilly and mountain meadows. Most of the habitats are mosaically distributed. The area is exposed to anthropogenic influence, which is reflected in the felling of the forest, the regulation of the river flow (Drcka-Đekići), the flow of meadows and pastures. Representative forest stands in Crnja and Ljubaštica (local population and concessionaires) were not spared from felling.

On Mateševo, the route is about 107 m away from the protected area of Regional Park 'Komovi'. The boundaries of the protected area include meadows, forests, woods, Nesirenski potok stream, Grba stream, Pecka river and Drcka river, mostly of good ecological quality. Riparian forests along the rivers Drcka, Crnja and Ljubaštica are of high ecological value, with an anthropogenic impact on Mateševo (Drcka), the mouth of the river Crnja and the mouth of Ljubaštica. Forests, hilly and mountain meadows stretch along the hamlets (Mateševo, Lazi Đekića, Vranještica, Bare Kraljske, Crnja). Hilly and mountain meadows are mowed and used for grazing, which contributes to the richness of flora, while forests are degraded by felling with frequent occurrence of shrubs overgrown with Common bracken (*Pteridium aquilinum*). The area is considered to be at a moderate level of environmental sensitivity. The exceptions are acidophilic beech forests on the Mateševske strane area, which are well preserved and have good ecological values.

Between the rivers Crnja and Ljubaštica, there is a mixed beech-spruce forest, which has been degraded by felling at the edges. In the direction of Ravni brijeg, which also belongs to the protected area of RP (Regional Park) Komovi forest, high ecological values have been preserved. At the same time, this is the part of the route in which RP Komovi enters the zone of influence and is about 300 m away from the route. The impact zone also includes a representative alkaline fen, which is about 500 m away. Route continues through a tunnel through the hill Turlog and through Trešnjevnik.

In the Trešnjevnik area, the highway passes through a spruce and beech forest, with an existing road being expanded. Heading from Trešnjevnik towards Andrijevića, the zone of influence will extend through mixed deciduous forests, predominantly beech, on the right side, and through mixed forests, often dominated by oak, on the left side.

From Trešnjevnik, the road continues toward the Novovića Potok area, where the riparian forests along the Novovića Potok stream exhibit moderate ecological quality, with noticeable deforestation of surrounding beech-spruce forests. The route crosses a bridge over the mouth of Novovića Potok, where it meets the Rajovića River, descending from the northwest, north of the village of Lanište. It then traverses groves, which are degraded remnants of turkey oak and beech forests, often interspersed with clearings overgrown with common bracken (*Pteridium aquilinum*). Around the villages of Gnjili Potok and Miravčina, mountain meadows of good ecological quality and moderate ecological sensitivity are present. Representative riparian forests are well-developed along the Dubokalj stream, which flows into the Rajovića River.

The road descends to the village of Kralje, where mountain meadows and well-maintained orchards are prevalent. In Kralje, along the Kraštica River, riparian vegetation has developed but is not representative, due to anthropogenic influence. The route then ascends through forests of high ecological value within the EMERALD area. To the south, the Kraštica River flows within the EMERALD area and is bordered by high-quality riparian forests. Along the Kraštica River and surrounding hamlets, there are mowed hilly meadows of good ecological value.

In the vicinity of Peovac village, beech forests and fragments of oak-hornbeam forests within the EMERALD area have been established. The route passes the Bandovića Most bridge and descends to the existing regional road from Berane to Andrijevića, reaching the left bank of the Lim River in Andrijevića (EMERALD area). In the Lugovi hamlet, representative Alnetum riparian forests are well-developed, with communities of gray willow and German tamarisk along the Lim River, accompanied by herbaceous vegetation. The German tamarisk (*Myricaria germanica*) habitat on the riverbank is a rare habitat type in Montenegro, and a representative community is located only 60 meters from the road route. These riparian habitats are highly ecologically sensitive. Surrounding scattered houses, there are mowed mountain meadows, orchards, and fields. North of the route, above the Berane-Andrijevića regional road, lie turkey oak forests, mountain meadows, and orchards in the hamlets of Prisoja, Slatina, and Guvna. Southeast of the route, on the Lim River's right bank, communities with gray willow are present, along with mountain meadows and turkey oak forests above the bank. The route ends in the village of Sitna Luka, where orchards, meadows, and arable land are present.

The road crosses 5 main watercourses (before Trešnjevnik: Drcka, Vranještica, and Ljubaštica and after Trešnjevnik: Rajovića rijeka, Lim) which together with the streams form a network of forest habitats. These habitats are further connected to larger forest areas and form important corridors for amphibians, reptiles, small mammals and invertebrates, and also serve as navigational aids for bats. The presence of large trees and shrubs provides conditions for shelters and nests of bats and birds, which is why forest habitats and their networking are estimated to be at a high level of ecological sensitivity. On the west side, within and around the EMERALD area, the project passes through areas of greater ecological importance. Turkey oak forests, the Kraštica River and the habitats around Lim, also form areas with significant diversity, and a range of opportunities to use meadows for fauna development, which is why they are considered to be at a high level of environmental sensitivity.

Habitat analyses have identified 14 habitats of the NATURA 2000 network, which are of greater importance, as well as orchards that occur in the villages from Kralja to Sitna Luka. Habitats are described in the Table below. A map of the habitats are provided in the Annex. Among the habitats encountered in the area, the habitat with Natura 2000 code 91E0 is a priority habitat type.

Status of protection of taxa (species and subspecies). In the investigated area (on the route Mateševo - Andrijević), 12 plant taxa (species and subspecies) protected at the national and/or international level were found during the surveys of 2019-2021, of which 4 were confirmed for the new Trešnjevnik-Andrijević part. All identified protected species belong to the orchid family (Orchidaceae) and have national protection - protected Decisions on protection of certain plant and animal species ('Official Gazette of the Republic of Montenegro' 76/06) and international protection.

Endemic taxa (species and subspecies). In the territory of Montenegro, 372 endemic taxa of the Balkans (levels of species and subspecies) were found, of which 39 taxa were distributed only in Montenegro (Vuksanović et al. 2016). In the investigated area (on the route Mateševo - Andrijević), 5 endemic plant taxa (species and subspecies) of the Balkan Peninsula were found.

Invasive alien plant species. Along the highway route Mateševo - Andrijević, the presence of three invasive plant species was ascertained: *Robinia pseudacacia*, *Reynoutria japonica* and *Erigeron canadensis*, while the species *Helianthus tuberosus* can be managed as a naturalized species and has no invasive character. The species *R. pseudacacia* and *R. japonica* were found in a number of localities, while the species *E. canadensis* and *H. tuberosus* were found only along the Lim River in one locality.

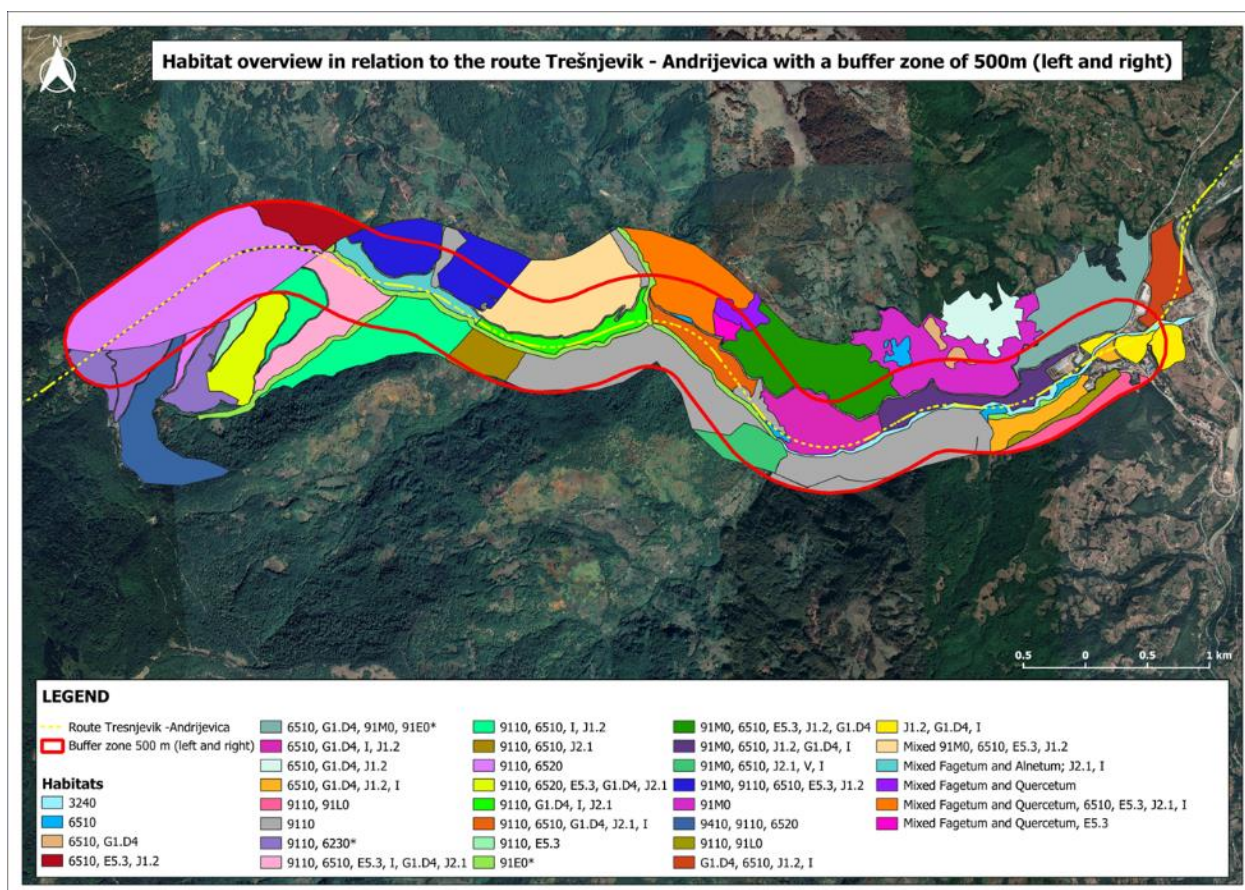


Figure 5-43: Habitats in the part Trešnjevnik - Andrijević

Table 5-32: Natura 2000 habitat types identified in Project area

Habitats	Survey	Eunis code / Bern convention	NATURA 2000			
			Natura 2000 code	Natura 2000 Annex	Habitat type	
Alpine rivers and the herbaceous vegetation along their banks	2019-2021 2024	C3.5, C3.551, C3.552	3220	Annex 1	Not priority	The habitat includes open pioneer communities of herbaceous plants, shrubby willows and heather, developed on the gravel banks of fast-flowing mountain rivers, which are characterized by high water flow in the summer period. Typical plant species that are dominant in communities of this type of habitat are <i>Epilobium dodonei</i> and/or <i>Calamagrostis pseudophragmites</i>. There are also other species and seedlings of hygrophilous bushy willows (<i>Salix eleagnos</i>, <i>S. purpurea</i>, <i>S. amplexicaulis</i>), sometimes heather (<i>Myricaria germanica</i>), which cannot develop into characteristic thickets due to the constant movement of the substrate caused by strong spring and autumn torrents. This type of habitat at the highway route was found along the Lim River in the area of Andrijeviča. The habitat is represented in two localities: on the left bank of the river Lim in the area of Andrijeviča, fragmentarily along the river Kraštica (Kralje). This habitat type on the left bank of the Lim in the area of Andrijeviča is located within the EMERALD Area, and in that sense, it is important as a potentially priority site for protection within the NATURA 2000 network of protected areas. Habitat coverage: approx. 3 ha
Alpine rivers and their ligneous vegetation with <i>Myricaria germanica</i>	2019-2021 2024	F9.1, F9.11, F9.13	3230	Annex 1	Not priority	This habitat includes communities of low pioneer shrubs on gravelly and sandy river sediments, dominated by German tamarisk (<i>Myricaria germanica</i>) and shrubby river willows (<i>Salix</i> spp.). It occurs in alpine, subalpine and mountain belts of high mountains, on the banks of rivers with a high flow regime in the summer months. This type of habitat was found at three locations on the highway route, on the left bank of the Lim River, while individual specimens were observed on the right bank, within the <i>Salicetum</i> in Andrijeviča. Habitat coverage: approx. 2 ha
Alpine rivers and their ligneous	2019-2021 2024	F9.1, F9.11, F9.14	3240	Annex 1	Not priority	This habitat includes coastal galleries and low thinned or folded shrub formations on gravelly river deposits next to fast mountain streams, dominated by gray willow (<i>Salix eleagnos</i>) or occasionally some other species (<i>Salix amplexicaulis</i>, <i>S. purpurea</i>, <i>Alnus incana</i>). They occur in the mountain and subalpine belt of high

Habitats	Survey	Eunis code / Bern convention	NATURA 2000			
			Natura 2000 code	Natura 2000 Annex	Habitat type	
vegetation with <i>Salix elaeagnos</i>						mountains, on the banks of rivers with a high flow regime in the summer months. Communities developed on different types of alluvial sediments, mainly on a limestone substrate dominated by gravel and coarse sand, along the banks of fast and cold mountain streams and smaller rivers, whose level during the summer months considerably decreases, so the substrate becomes dry and loose, with a lot of air. This type of habitat was found in the following localities in the Project's influence zone: Mateševo - Drcka River (42° 45.527'N 19° 33.845'E, 1005 msl; 42° 44.986'N 19° 34.559'E, 1028 msl); Kralje - Kraštica river (42° 42.960'N 19° 45.062'E, 825 msl, up until the confluence with the Lim river); Andrijeviča - along Lim river (42° 44.917'N 19° 47.430'E to 42° 45.008'N 19° 47.537'E, 750 msl). In the influence zone, in the Mateševo locality, on the left bank of Drcka River, there is a coastal vegetation built by willows, dominated by <i>Salix elaeagnos</i>, while the species <i>Alnus incana</i>, <i>Salix purpurea</i>, <i>Salix amplexicaulis</i>, <i>Clematis vitalba</i>, <i>Rubus ulmifolius</i> occur as well. Petasites hybridus was dominant in the ground layer of herbaceous species, and next to it, in this layer occur: <i>Tussilago farfara</i>, <i>Brachypodium sylvaticum</i>, <i>Nasturtium officinale</i>, <i>Fragaria vesca</i>, <i>Scrophularia nodosa</i>, <i>Daucus carota subsp. maximus</i>, <i>Agrostis capillaris</i>, <i>Mentha longifolia</i>, <i>Epilobium parviflorum</i>, <i>Stellaria media</i>, <i>Rumex conglomeratus</i>, <i>Juncus articularis</i>, <i>Plantago intermedia</i>, <i>Persicaria maculata</i>, <i>Lamium purpureum</i>, <i>Cirsium arvense</i>, <i>Chaeniorhinum majus</i>, <i>Capsella bursa pastoris</i>, <i>Veronica beccabunga</i>, <i>Atriplex patula</i>. Habitat coverage: approx. 50ha (approx. 20 Ha at the Tresnjevik – Andrijeviča section)
Semi-natural dry grasslands and scrubland facies on calcareous substrates (Festuco-Brometalia) (*)	2019-2021	E1.2, E1.22, E1.26, E1.27, E1.28	6210	Annex 1	Not priority	Dry to semi-dry carbonate meadows and pastures of the <i>Festuco-Brometalia</i> class. This type of habitat includes, on the one hand, steppe and steppe-like subcontinental grass communities (<i>Festucetalia valesiacae</i>) and, on the other hand, grass communities under Atlantic or sub-Mediterranean influence (<i>Brometalia erecti</i>). The latter are differentiated into primary dry Xerobromion grasslands, and secondary moderately humid (semi-natural) Mesobromion grasslands dominated by <i>Bromus erectus</i>, which represent important habitats for orchids.

Habitats	Survey	Eunis code / Bern convention	NATURA 2000			
			Natura 2000 code	Natura 2000 Annex	Habitat type	
important orchid sites)						Important orchid habitats can be interpreted as sites that are important according to one of the following criteria: (a) the site is a habitat for a large number of different species of orchids, (b) there is a significant population of at least one species of orchid that is very rare in the national territory, (c) the locality represents a habitat for several species of orchids that are considered rare, very rare or exceptional in the national territory. In the influence zone of the Project, at Mateševo (42° 44.914'N 19° 34.741'E, 1028 msl), on both sides of the road from Mateševo to Bare Kraljske, there is a vegetation of silicate meadows of Bromion erecti (Mesobromion) order, and in the research period (June 2020), they were represented by the dominant species Bromus erectus and Festuca valesiaca. Besides them, significant presence also had Potentilla erecta, Helianthemum obscurum ssp. canum, Polygala comosum, Galium verum, Cruciata laevipes, Sanguisorba minor, Plantago media, P. lanceolata, Thymus pulegioides, Genista sagittalis, Leucanthemum vulgare, Briza media, Trifolium montanum, Clamatis vitalba, Teucrium chamaedrys, Knautia sp., Lathyrus sp. Orchids include Anacamptis morio (Orchis morio) and Neotinea ustulata (Orchis ustulata). The Mesobromion meadows at the confluence of Vranještica into Drcka (42° 45.113'N 19° 36.110'E, 1120 msl) are especially ecologically valuable, where 7 species of orchids have been recorded: Anacamptis morio, Anacamptis coriophora, Anacamptis tridentata, Neotinea ustulata, Traunsteinera globosa, Gymnadenia conopsea, Neottia ovata. In the locality of Miravčine (42° 44.549'N 19° 44.454'E, 940 msl), the meadow was dominated by the species Brachypodium sylvaticum, Danthonia alpina, Leucanthemum vulgare, Scabiosa ochroleuca and Dorycnium herbaceum, with a smaller presence of Teucrium chamaedrys, Dactylis glomerata, Galium verum, Briza media, Muscari neglectum, Asperula cynanchica, Ononis spinosa, Plantago lanceolata, Achillea millefolium, Trifolium pratense, Pimpinella saxifraga, Helleborus, odoratus, Helianthemum obscurum, Viola tricolor, Vincetoxicum hirundinaria, Daucus carota subsp. maximus, Agrostis capillaris, Centaurea jacea, Lathyrus megalanthus, Lolium multiflorum, Danthonia decumbens, with individual specimens of Quercus cerris, Ostrya carpinifolia, Crataegus monogyna.

Habitats	Survey	Eunis code / Bern convention	NATURA 2000			
			Natura 2000 code	Natura 2000 Annex	Habitat type	
						Habitat coverage: approx. 30 ha
Hydrophilous tall herb fringe communities of plains and of the montane to alpine levels	2019-2021 2024	E5.4, E5.41, E5.43, E5.5, E5.51, E5.52, E5.57, E5.58	6430	Annex 1	Not priority	Wet and usually nitrified tall herbaceous edge communities, along water streams and forest edges in lowland and mountain belts, that belong to orders Glechometalia hederaceae and Convolvuletalia sepium (Senecion fluviatilis, Aegopodion podagrariae, Convolvulion sepium, Filipendulion), as well as hygrophilous perennial communities of tall herbaceous plants (tall green) of Betulo-Adenostyletea class. The vegetation included in this broadly present type of habitat is very diverse, and the only property they have in common is the dominance of tall herbaceous plants in very to relatively humid habitats. Communities occur on relatively deep soils that develop from marginal forest formations or around large rivers in lowland and mountain areas, as well as at the foot and in the shade of high vertical rocks, in places where snow longer remains unmelted, thus providing high soil moisture, or on the edge of mountain springs and streams, and in the sites of surface drainage, in the mountain, subalpine and alpine belt. In the floristic sense, the Balkans' lush vegetation of tall herbaceous plants on the deep, moist soil of the mountain, subalpine and alpine region are of particular importance. Communities usually occur around springs, and their physiognomy is mainly determined by numerous Balkan endemic species, such as Lactuca pancicii, Rumex balcanicus, Wulfenia bleicii, Cirsium wettsteinii, Cephalaria pastricensis and others. In the area affected by the Project, at the location of the Grba stream (42° 44.901'N 19° 34.536'E, 1070 msl), in the zone of the beech forest (Luzulo-Fagetum), thanks to the presence of moisture in the soil, there are also fragments of tall green vegetation that are dominantly represented by the species Telekia speciosa and significant participation of Viola sylvestris and Mercurialis perennis. In addition to the above, there are also Luzula luzulina, Symphytum tuberosum, Rubus idaeus, Geranium robertianum, Lamiastrum galeobdolon, Geum urbanum, Carex sylvaticum, Mercurialis perennis, Stellaria nemorum, Ajuga reptans, Fragaria vesca, Sanicula europaea, Listera ovata, Anthyrium filix-femina, Mycelis muralis. The habitat occupies a relatively small area (approx. 50 m2). Fragments of this type of habitat also occur along the Drcka River in Bare Kraljske (42° 44.488'N 19° 37.159'E, 1020 msl), in the community zone of Alnetum incanae where the basis of

Habitats	Survey	Eunis code / Bern convention	NATURA 2000			
			Natura 2000 code	Natura 2000 Annex	Habitat type	
						the habitat is <i>Potamogeton hybridus</i> and <i>Lactuca pancicii</i>. Furthermore, in its vicinity (42° 44.458'N 19° 37.179'E, 1020 msl), in addition to <i>P. hybridus</i> vegetation of tall plants along the Drcka River, there are <i>Equisetum palustre</i>, <i>Cirsium vulgare</i>, <i>Ranunculus carinthiacus</i>, <i>Taraxacum officinale</i>, <i>Rumex conglomeratus</i>, <i>Chaerophyllum hirsutum</i>, <i>Vicia sp.</i> Hydrophilic tall plants occur fragmentarily along the larger water streams (Drcka, Rajovića Rijeka, Kraštica). Hydrophilic tall herbs occur in fragments along the larger watercourses (Rajovića rijeka, Kraštica, Sitna Luka - above the Lim River, close to Andrijevića). At the locality Sitna Luka - above the Lim River (close to Andrijevića) there are very representative stands of the type of habitat with the dominance of very tall black alder trees (<i>Alnus glutinosa</i>) and a significant share of species <i>Alnus incana</i> but in the ground layer of this community near the Black Alder, there are habitats with a predominance of <i>Potamogeton hybridus</i> (which can be included in the habitat type - Hydrophilous tall herb fringe communities). This habitat type is located about 100 meters away from Lim River towards the existing regional road, in the ground layer of the community with <i>Alnus glutinosa</i>. Habitat coverage: small areas that cannot be mapped.
Lowland hay meadows (<i>Alopecurus pratensis</i> , <i>Sanguisorba officinalis</i>)	2019-2021 2024	E2.2, E2.22, E2.23	6510	Annex 1	Not priority	This type of habitat is characterized by meadows, with a high diversity of plant species that grow on poorly or moderately fertilized soils in the lowland and mountainous regions, and belong to the Arrhenatherion class. This type of habitat is dominated by mesophilic grasses: <i>Arrhenatherum elatius</i> and <i>Alopecurus pratensis</i>, as well as numerous meadow species of clover (<i>Trifolium spp.</i>) and <i>Dactylis glomerata</i> (in slightly ruderalized meadows), and somewhat lower ones: <i>Holcus lanatus</i>, <i>Festuca rubra</i>, <i>Poa pratensis</i>, <i>Anthoxanthum odoratum</i>, <i>Agrostis capillaris</i> and <i>Trisetum flavescens</i>. These species (except <i>Holcus lanatus</i>) occur regularly in mountain grasslands, too, so they can lead to confusion. Lowland mesophilic tall meadows develop on deep soils outside the direct influence of flood and groundwater. The soils in them are generally rich in mineral substances and have a favorable water regime throughout the entire growing season, so the production of plant mass in them is very high. In the zone of the Project influence, at the location Mateševo (42° 44.899'N 19° 35.832'E, 1020 msl) on the right bank of the Drcka River, in addition to the coastal

Habitats	Survey	Eunis code / Bern convention	NATURA 2000			
			Natura 2000 code	Natura 2000 Annex	Habitat type	
						riparian vegetation, the vegetation of the lowland meadows also occurs. During research period, it was represented by the following dominant species: <i>Agrostis capillaris</i>, <i>Cynosurus cristatus</i>, <i>Dactylis glomerata</i>, <i>Briza media</i> and less numerous <i>Centaurea jacea</i>, <i>Hypericum perforatum</i>, <i>Achillea millefolium</i>, <i>Daucus carota</i> subsp. <i>maximus</i>, <i>Teucrium chamaedrys</i>, <i>Plantago media</i>, <i>Galium corrudifolium</i>, <i>Prunella laciniata</i>, <i>Prunella vulgaris</i>, <i>Bromus erectus</i>, <i>Gentiana cruciata</i>, <i>Festuca rubra</i> subsp. <i>fallax</i>, <i>Poa pratensis</i>. In the area of Bare Kraljske (42° 44.867'N 19° 37.171'E, 1095 msl), the vegetation of lowland meadows was dominated by the following species: <i>Centaurea jacea</i>, <i>Festuca pratensis</i> and <i>Dactylis glomerata</i>, while <i>Galium verum</i>, <i>Briza media</i>, <i>Potentilla reptans</i>, <i>Daucus carota</i> subsp. <i>maximus</i>, <i>Convolvulus arvensis</i>, <i>Achillea millefolium</i>, <i>Leontodon</i> sp., <i>Trifolium pratense</i>, <i>Plantago media</i>, <i>Colchicum autumnale</i>, <i>Vicia</i> sp., <i>Agrostis capillaris</i>, <i>Cerastium</i> sp., <i>Hypericum perforatum</i>, <i>Knautia arvensis</i> were also present. In the Tresnjevik – Andrijevića part, lowland meadows have been recorded at the locality the Đekić houses. Nevertheless, this habitat type is predominantly distributed in the eastern part of the Project Area. Lowland meadows in the village of Kralje and around Andrijevića are especially ecologically valuable and rich in flora Habitat coverage: approx. 2000 ha (and about 800 ha in the Tresnjevik – Andrijevića part)
Mountain hay meadows	2019-2021 2024	E2.3, E2.31	6520	Annex 1	Not priority	This type of habitat is represented by species-rich mesophilic high meadows of the mountain and, less often, subalpine belt (most often above 600 msl), which are often dominated by <i>Trisetum flavescens</i>. As with lowland and mountain grasslands, these meadows also get mowed. In terms of composition and structure, they differ from the surrounding pastures and are regularly richer in species. In relation to the degree of cultivation and position on the vertical profile, the mesophilic meadows and pastures in the Montenegrin mountains are differentiated into: extensively cultivated meadows in the hill and mountain belt (<i>Cynosurion</i>), which are maintained by mowing, grazing and occasional stable fertilization, and poorly cultivated mesophilic meadows of the mountain and subalpine belt (<i>Pancicium</i>). The composition often includes numerous common

Habitats	Survey	Eunis code / Bern convention	NATURA 2000			
			Natura 2000 code	Natura 2000 Annex	Habitat type	
						plant species, as well as lowland and mountain meadows, but mountain elements regularly appear (and often dominate). This is widespread habitat type in the western part of the Project area. Mountain meadows used for mowing were observed within the area of RP Komovi in Mateševo and in Bare Kraljske, where they occur in mosaic with beech groves. Representative mountain meadows were observed in the area of Crnja and Ljubaštica, as well as in the direction of the Trešnjevik pass. In the locality Crnja, on the edge of Komovi RP (42° 44.229'N 19° 38.367'E, 1135 msl), this type of habitat was observed with extraordinary representativeness (A) and the dominance of <i>Leucanthemum vulgare</i>, <i>Campanula patula</i>, <i>Rhinanthus minor</i>, <i>Trifolium pratense</i>, <i>Anthyllis vulneraria</i>, <i>Trisetum flavescens</i>, <i>Ranunculus carinthiacus</i>, <i>Viola tricolor</i>, <i>Polygala comosa</i> and with a significant participation of <i>Trifolium repens</i>, <i>Rumex acetosa</i>, <i>Sanguisorba minor</i>, <i>Silene sendtneri</i>, <i>Bromus racemosus</i>, <i>Trifolium campestre</i>, <i>Dactylis glomerata</i>, <i>Plantago media</i>, <i>Centaurea jacea/weldeniana</i>, <i>Anacamptis morio</i> (<i>Orchis morio</i>), <i>Briza media</i>, <i>Veronica jacquinii</i>, <i>Euphrasia rostkoviana</i>, <i>Thymus pulegioides</i>, <i>Cynosurus cristatus</i>, <i>Gentiana utriculosa</i>, <i>Achillea millefolium</i>, <i>Plantago lanceolata</i>. In addition to these, <i>Galium verum</i>, <i>Tragopogon pratense</i>, <i>Lotus corniculatus</i>, <i>Leontodon crispus</i>, <i>Colchicum autumnale</i>, <i>Gentiana cruciata</i>, <i>Trifolium montanum</i>, <i>Achillea millefolium</i>, <i>Convolvulus arvensis</i>, <i>Neotinea ustulata</i> (<i>Orchis ustulata</i>), <i>Stellaria graminea</i>, <i>Veronica chamaedrys</i>, <i>Potentilla reptans</i>, <i>Prunella vulgaris</i>, <i>Anthoxanthum odoratum</i>, <i>Alchemilla glaucescens</i>, <i>Festuca sp.</i> and others were also found. This type of habitat was found above the river Ljubaštica (42° 44.050'N 19° 39.514'E, 1190 msl). Here, mountain meadows were dominated by the following species: <i>Alchemilla glaucescens</i>, <i>Plantago media</i>, <i>Achillea millefolium</i>, <i>Centaurea jacea</i>, <i>Hypericum maculatum</i>, <i>Knautia arvensis</i>, <i>Trifolium repens</i>, <i>Galium verum</i>, <i>Trisetum flavescens</i>, <i>Agrostis capillaris</i>, <i>Cynosurus cristatus</i>, <i>Daucus carota subsp. maximus</i>, <i>Plantago lanceolata</i>, <i>Potentilla reptans</i>, <i>Potentilla sp.</i> In addition to the above, the following species were also present: <i>Bromus erectus</i>, <i>Genista sagittalis</i>, <i>Helianthemum nummularium subsp. obscurum</i>, <i>Euphrasia rostkoviana</i>, <i>Phleum pratense</i>, <i>Rhinanthus major.</i>, <i>Briza media</i>, <i>Prunus spinosa</i>, <i>Rosa sp.</i>, <i>Aegopodium</i>

Habitats	Survey	Eunis code / Bern convention	NATURA 2000			
			Natura 2000 code	Natura 2000 Annex	Habitat type	
						<i>podagraria, Colchicum autumnale, Viola tricolor, Clinopodium vulgare, Polygala commosa, Galium verum, Juniperus communis, Lilium bosniacum and others.</i> <i>Habitat coverage:</i> These meadows are common in all mountainous continental regions of Montenegro. This type of habitat covers a significant area of approximately 1500 ha. <i>At the locality of Trešnjevik (42°44.834'N 19°40.372'E, alt. 1460 m) the mountain hay meadows were the presented with the following dominant species: Festuca pretensis, Nardus stricta, Dactylis glomerata, Cynosurus cristatus, Anthoxanthum odoratum and were present also Briza media, Agrostis capillaris, Leucanthemum vulgare, Silene sendtneri, Genista sagitata, Hypericum perforatum, Carex leporina, Vicia tricolor, Leontodon sp. Additionally, at the locality of Trešnjevik (42°44.334'N 19°41.462'E, alt. 1360 m), in the mountain hay meadows, at the same zone, the following dominant species were present: Festuca pretensis, Cynosurus cristatus, followed by the species the species with the lower presence: Daucus carota subsp. maximus, Dactylis glomerata, Potentilla argentea, Hypericum perforatum, Dianthus cruentus, Clinopodium vulgare, Poa trivialis, Achillea millefolius, Agrostis capillaris, Veronica chamaedrys, Betonica officinalis, Centaurea jacea, Potentilla montenegrina, Carduus acanthoides, Knautia arvensis, Briza media, Thymus pulegioides, Linaria vulgaris, Trifolium pretense, Petrorhagia saxifraga, Genista sagittalis, Leucanthemum vulgare, Prunella laciniata, Campanula patula, Cichorium intybus, Silene vulgaris, Plantago media, Pilosella officinarum, Leontodon sp.</i>
Alkaline fens	2019-2021	D4.1	7230	Annex 1	Not priority	Wetland habitats populated by low sedges and brown mosses that form peat and/or tufa developed on permanently waterlogged soils. The habitat type is wetted by underground (topogenic) or surface (soligenous) alkaline waters. The upper limit of groundwater is at the surface, either slightly above or below the surface of the substrate on which these communities develop. Peat, if formed, develops in aquatic conditions. Calciphilous low sedges (Cyperaceae), characteristically <i>Caricion davallianae</i>, usually dominate these communities, and the vascular flora is also very rich with narrowly specialized species. In a wider area (42° 43.768'N 19° 39.716'E, 1285 msl), this type of habitat was found above the river Ljubaštica and is located in the zone of mountain meadows

Habitats	Survey	Eunis code / Bern convention	NATURA 2000			
			Natura 2000 code	Natura 2000 Annex	Habitat type	
						dominated by <i>Trisetum flavescens</i>. The habitat was developed on a relatively small area (approx. 200 m²) and was dominated by the following species: <i>Caltha palustris</i>, <i>Listera ovata</i>, <i>Pedicularis palustris</i>, <i>Eriophorum angustifolium</i>, <i>Carex spp.</i> and others. There was an obvious absence of mosses, which are characteristic for this type of habitat. Habitat coverage: In the mentioned localities, this type of habitat covers an area of 1.5 ha.
Siliceous rocky slopes with chasmophytic vegetation	2019-2021	H3.1	8220	Annex 1	Not priority	The habitat includes vegetation in the cracks of continental silicate rocks with several described subtypes, depending on the biogeographic region and the type of geological substrate. The chasmophytic vegetation on silicate rocks is significantly poorer compared to carbonate rocks, both in terms of the number of species and the percentage of endemic species. Here in this particular case, the hill and mountain silicate rocks with the <i>Asplenium septentrionalis</i> stand out. On the planned highway route, in the locality of Bare Kraljske, on a silicate rock (42° 44.928'N 19° 36.840'E, 1070 msl), next to the regional road, there is a habitat dominated by <i>Asplenium septentrionale</i>. This habitat occurs individually and sporadically on the rocks in this part of Bare Kraljske. In addition to <i>Asplenium septentrionale</i>, the following species were also found: <i>Asplenium trichomanes</i>, <i>A. ruta muraria</i>, <i>Polypodium vulgare</i>, <i>Poa bulbosa</i>, <i>Tunica saxifraga</i>, <i>Minuartia verna</i>, <i>Milium effusum</i>, <i>Sedum hispanicum</i>, <i>Acinos arvensis</i>, <i>Bromus erectus</i>, <i>Silene italica</i>, <i>Fraxinus ornus</i>, <i>Geranium pyrenaicum</i>, <i>G. robertianum</i>, <i>Polygala commosa</i>. Habitat coverage: This habitat type was recorded in one single location, outside the designed highway route, and covers a small area that could not be mapped.
Luzulo-Fagetum beech forests	2019-2021 2024	G1.6, G1.61	9110	Annex 1	Not priority	Beech forests, and in higher areas beech and fir, or beech, fir and spruce forests, which develop on acidic soils in the Central European region, with characteristic acidophilic species <i>Luzula luzuloides</i>, <i>Polytrichum formosum</i>, <i>Deschampsia flexuosa</i>, <i>Vaccinium myrtillus</i>. This type of habitat includes both pure beech forests on acidophilic soils, as well as mixed deciduous-coniferous forests of beech and fir, as well as beech, fir and spruce, in which beech has a share greater than 10%. These forests are floristically very uniform, poor in terms of flora, and their composition is very similar

Habitats	Survey	Eunis code / Bern convention	NATURA 2000			
			Natura 2000 code	Natura 2000 Annex	Habitat type	
						throughout Europe. The soil is often bare or covered with mosses (<i>Polytrichum formosum</i>, <i>Dicranum scoparium</i>, <i>Leucobryum glaucum</i>, etc.), carpets of graminoid plants (<i>Luzula luzuloides</i>, <i>L. luzulina</i>, <i>Festuca drymeja</i>, <i>Deschampsia flexuosa</i>) or blueberry carpets (<i>Vaccinium myrtillus</i>), with regularly found acidophilic plants amongst them: <i>Melampyrum sp.</i>, <i>Hieracium sp.</i>, <i>Pyrola sp.</i>, <i>Pteridium aquilinum</i>, <i>Calamagrostis villosa</i> and similar. This type of habitat can be easily distinguished due to the dominance of these plants and the absence of characteristic alkalophilic and mesoneutrophilic plants common in physiognomically similar pure and mixed beech forests on carbonate substrates, which do not tolerate the acidity of the substrate. This type of habitat is observed in the greater part of the highway route, dominantly in the western part of the Project area (Mateševci-Trešnjevci), above the banks of the Drcka river, Bare Kraljske, Crnja, Ljubaštica, Han Drndarski and Trešnjevci. In the great part of the Project area, the forests have no continuity due to tree felling, and are represented as a mosaic, alternated with mountain meadows and homesteads. Habitat coverage: This type of habitat covers a significant area, measuring approximately 9000 ha.
Alluvial forests with <i>Alnus glutinosa</i> and <i>Fraxinus excelsior</i> (Alno-Padion, Alnion incanae, Salicion albae)	2019-2021 2024	G1.1, G1.111, G1.12, G1.121, G1.2, G1.21, G1.211, G1.212, G1.213	91E0	Annex 1	Priority	This is a Priority habitat type (*) in terms of the Habitats Directive, i.e. NATURA 2000. This type of habitat includes several different subtypes: coastal forests of black alder (<i>Alnus glutinosa</i>) and ash (<i>Fraxinus excelsior</i>) in temperate lowland and mountain areas (Alno-Padion); coastal gray alder (<i>Alnus incana</i>) along mountain streams and rivers (<i>Alnion incanae</i>) and strip galleries of tall willows (<i>Salix alba</i>, <i>S. fragilis</i>) and poplars (<i>Populus nigra</i>, <i>P. alba</i>) along river courses in lowland, submountain and mountain regions of the temperate zone (Salicion albae). All habitat types occur on heavy, periodically flooded soils, which are poorly aerated during high water levels, while on the contrary, during low water levels, they are well drained and aerated. The layer of herbaceous plants includes many tall plants such as: <i>Filipendula ulmaria</i>, <i>Angelica sylvestris</i>, <i>Cardamine sp.</i>, <i>Rumex sanguineus</i>, <i>Carex sp.</i>, and various spring plants: <i>Ficaria verna</i>, <i>Anemone nemorosa</i>, <i>A. ranunculoides</i>, <i>Corydalis solida</i>.

Habitats	Survey	Eunis code / Bern convention	NATURA 2000			
			Natura 2000 code	Natura 2000 Annex	Habitat type	
						These forests are present in almost all continental parts of Montenegro, both along large rivers and along occasional or permanent streams, up to the upper mountain belt. This habitat occurs in the greater part of the Project's route, usually along the Drcka river, almost along its entire length, along Novovića stream, Dubokalj, Rajovića river and Sitna Luka above Lim River but the habitat is also present at Dubokalj stream and Novovića potok stream.. Habitat coverage: This type of habitat covers in total an area measuring approximately 600 ha in the broader project area (not all area impacted by the project, see relevant impacts chapter 7.1.6.1).
Illyrian oak-hornbeam forests (Erythronio-Carpinion)	2019-2021 2024	G1, A1A	91L0	Annex 1	Not priority	The habitat includes forests of red oak (<i>Quercus robur</i>) or red oak (<i>Q. petraea</i>), sometimes also Austrian oak (<i>Q. cerris</i>), with hornbeam (<i>Carpinus betulus</i>) on carbonate or silicate substrates, on deep, neutral to slightly acidic, forest brown soils. The climate is significantly more continental compared to the sub-Mediterranean region, and significantly warmer compared to Central Europe. These forests are floristically much richer than the Central European oak-hornbeam forests. This type of habitat occurs as a fragment, in the locality Peovac. In the Peovac locality, the habitat is dominated by the species <i>Carpinus betulus</i> (<i>Carpinetum betuli community</i>). In addition to hornbeam, the presence of beech (<i>Fagus sylvatica</i>) and oak (<i>Quercus cerris</i>) is significant; among other species there are <i>Acer pseudoplatanus</i>, <i>Fraxinus excelsior</i>, <i>Corylus avellana</i>, <i>Clematis vitalba</i>, <i>Pirus piraster</i>, <i>Evonymus verrucosus</i>, <i>Stellaria holostea</i>, <i>Asarum europeum</i>, <i>Mercurialis perennis</i>, <i>Aremonia agrimonioides</i>, <i>Lonicera caprifolium</i>, <i>Helleborus odorus</i>, <i>Lamium luteum</i>, <i>Euphorbia amygdaloides</i>. Habitat coverage: A small area (approx. 0.1 ha) that mosaically alternates with beech forests.
Pannonian-Balkan turkey oak - sessile oak forests	2019-2021 2024	G1.769	91M0	Annex 1	Not priority	The habitat includes subcontinental thermoxerophilic forests of Austrian oak (<i>Quercus cerris</i>), sedum (<i>Q. petraea</i>) and Hungarian oak (<i>Q. frainetto</i>) and related deciduous oaks, locally large-leaved honeysuckle (<i>Q. virgiliana</i>), developed in the area from the Pannonian plains to the supra-Mediterranean zones of the southern Balkans. The habitat is spread generally between 250 and 600 (800) msl., and

Habitats	Survey	Eunis code / Bern convention	NATURA 2000			
			Natura 2000 code	Natura 2000 Annex	Habitat type	
						occurs on different types of substrate: limestone, andesite, basalt, loess, sand and the like, on slightly acidic, deep brown forest soils. This type of habitat includes practically all the thermophilic oak forests of Montenegro, with the exception of forests of common honeysuckle (<i>Quercus pubescens</i>), which occupy large areas in the Mediterranean and sub-Mediterranean parts of Montenegro (they are not of importance for the EU), but also appear extrazonally deeper in the continent, in the southernmost slopes of the gorges. This type of habitat continuously occurs on the part of the Project route - on a large area, along the old road route near Andrijevića (42° 44.228'N 19°45.816'E, 855 msl). Oak groves occur along the entire highway route in the eastern part of the Project area, but they are not representative. Better stands are developed in the villages around Andrijevića, above the left and right banks of the Lim (Prisoja, Slatina, Guvno). At the locality near Andrijevića, the habitat is dominated by the species <i>Quercus cerris</i>. The ground layer of herbaceous plants is dominated by <i>Lathyrus nigra</i>, and other species include <i>Pteridium aquilinum</i>, <i>Brachypodium sylvaticum</i>, <i>Veronica chamaedrys</i>, <i>Trifolium pratense</i>, <i>Campanula trachelium</i>, <i>Helleborus odoratus</i>, <i>Aegopodium podagraria</i>, <i>Galium corradefolium</i>, <i>Agrostis capillaris</i>, <i>Dactylis glomerata</i>, <i>Dorycnium herbaceum</i>, <i>Crataegus monogyna</i>, <i>Hieracium sylvaticum</i>, <i>Viola odorata</i>. Habitat coverage: This type of habitat covers a significant area, measuring approximately 1050 ha. It is a common habitat type in Montenegro.
Acidophilous Picea forests of the montane to alpine level (<i>Vaccinio- Piceetea</i>)	2019- 2021 2024	G3.1, G3.1B	9410	Annex 1	Not priority	This type of habitat includes dark coniferous forests of common spruce (<i>Picea abies</i>), which grows in the subalpine zone, less often in the cold places of the mountain zone, which are unfavorable for the development of beech and fir. These cold and mostly dark conifer forests, in the area of Montenegro and the wider area of the Dinarides, in addition to pure acidophilic spruce forests, also include a number of other subtypes. Among them are pure dark and acidophilic forests of Scots pine, as well as mixed forests of Scots pine and spruce, but also mesoneutrophilic coniferous forests of fir, mixed forests of fir and spruce, and open alkaliphilic forests of fir on limestone blocks, as well as closely related spruce forests, on a similar broken relief.

Habitats	Survey	Eunis code / Bern convention	NATURA 2000			
			Natura 2000 code	Natura 2000 Annex	Habitat type	
						In the area of Ljubaštica, at the locality of Turirog, groves of spruce (<i>Picea abies</i>) were observed. Along with spruce, <i>Abies alba</i>, <i>Fagus sylvatica</i>, <i>Vaccinium myrtillus</i>, <i>Hieracium murorum</i> and others occur as well. Habitat coverage: Small areas (approx. 0.5ha) that mosaically alternate with mixed beech-spruce forests, where the share of beech is over 10%.

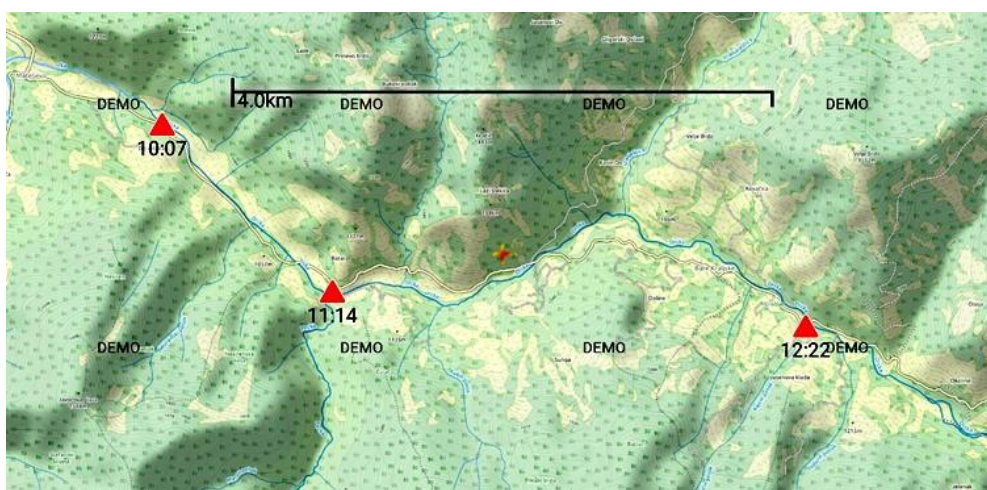
5.9.2 Fauna

5.9.2.1 Fish fauna (Ichthyofauna)

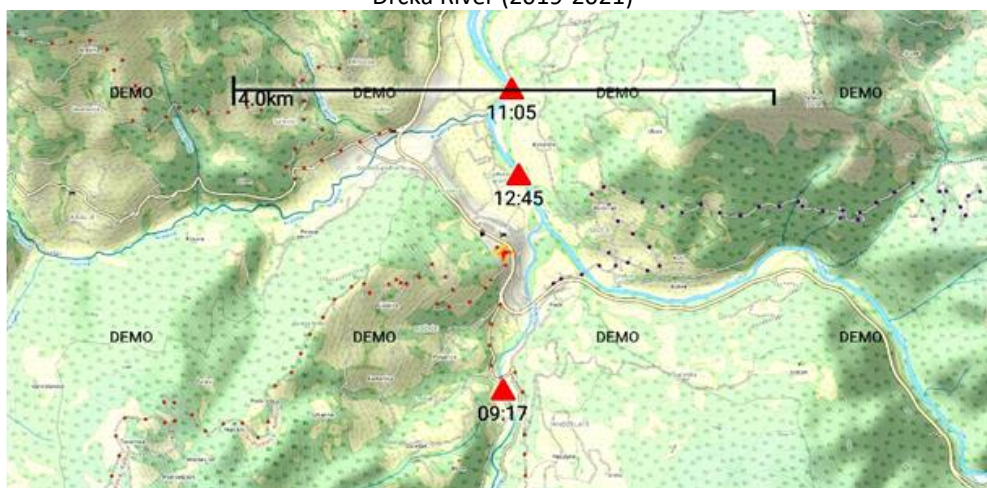
A baseline survey of the biodiversity of fish fauna in Drcka River and Lim River was conducted as part of the ESIA procedure in 2019-2021. During this survey, Drcka River was investigated at 3 sampling points, Lim River at 2 sampling sites and Zlorečica River at one sampling site near the confluence of Lim River.

The supplementary survey of 2024, additional sampling was performed at two sampling points in river Kraštica.

Apart the above, results from recent field research of ichthyofauna conducted for the development of the Fisheries Management Plans for Plav Lake, the Lim River and its tributaries, as well as the Fisheries Management Plan for the Tara River and its tributaries are considered. These two studies are designed to manage fish stocks in the watersheds of these rivers and will serve as the official documents guiding fish stock management over the next five-year period (see Annex I-B).



Drcka River (2019-2021)



Zlorečica River and Lim River (2019-2021)



Kraštica (2024)

Figure 5-44: Position of investigated localities during ichthyofauna surveys

The main outcomes of the surveys are presented below.

Drcka River (survey 2019-2021)

In the drainage basin of Tara River, nine (9) species of fish have been recorded up to now. Also, earlier investigation in the past confirmed the presence of five (5) species from 4 families in the Drcka River on the investigated sampling sites (Marić & Milošević, 2011; Marić, 2019) as it follows:

Familia: Salmonidae

Salmo labrax (Pallas.1814) – Black Sea trout

Familia: Thymallidae

Thymallus thymallus (Linn. 1758) - European Grayling

Familia: Cyprinidae

Barbus balcanicus (Kotlik, Tsigenopoulos, Rab and Berrebi, 2002) - Large spot barbel

Phoxinus csikii (Hanko, 1922) - Danube Minnow

Familia: Cottidae

Cottus gobio (Linn. 1758) – European Bullhead

By this investigation, the species *Phoxinus csikii* has not been recorded. According to former data, this species was represented in a small number and was not recorded at all investigated sites within her area of distribution. The following table shows list of fish species from Drcka River with their common name (English and Montenegrin).

Table 5-33: Findings of fish species from Drcka River

Latin name	English common name	Montenegrin common name	Literature data	Survey
<i>Salmo labrax</i>	Black Sea trout	Crnomor. pot. pastrmka	+	+
<i>Thymallus thymallus</i>	European grayling	Lipljen	+	+
<i>Barbus balcanicus</i>	Large spot barbel	Balkanskaa mrena	+	+
<i>Phoxinus csikii</i>	Danube Minnow	Dunavska gaovica	+	-
<i>Cottus gobio</i>	European Bullhead	Peš	+	+

At the sampling site in the middle of investigated area (on the beginning of Bare Kraljske area) species *B. balcanicus* was not recorded, and at the third sampling site (the end of Bare Kraljske area), only species *S. labrax* and *C. gobio* were recorded (data presented in the table).

Other species from Tara River such as: *Hucho hucho* (Linnaeus, 1758) - huchen, *Chondrostoma nasus* (Linnaeus, 1758) - common nase and *Squalius cephalus* (Linnaeus, 1758) - chub, have not been registered in these localities in earlier (Maric & Milošević, 2011, Marić, 2019) or during this investigation. All species found are indicators of clean water. Only common barbel can tolerate waters that are more heavily loaded with organic matter, regardless of their origin. It should be emphasized here that such a qualitative composition of the community (biodiversity) is characteristic for the salmonid and salmonid-thymalid region in all rivers of this type in the Danube River Basin, as well as for all clean waters of the area.

Table 5-34: Conservation status of fish in Drcka river

Latin name	Common English name	Montenegrin name	Bern Convention	Habitats Directive	IUCN - Red List	Montenegrin Legislation
<i>Salmo labrax</i>	Black Sea trout	Blatnjača			LC	VU
<i>Thymallus thymallus</i>	Grayling	Lipljen	Annex III	Annex V	LC	VU
<i>Barbus balcanicus</i>	Large spot barbel	Balkanskaa mrena		Annex V	LC	LC
<i>Phoxinus csikii</i>	Danube Minnow	Dunavska gaovica				LC
<i>Cottus gobio</i>	Freshwater sculpin	Peš	Annex I, Res. 6	Annex II	LC	LC

Source: EUNIS (<https://eunis.eea.europa.eu/>), Conservation status in Montenegro according to Marić, 2019.

In the waters from Danube drainage basin, the migrator species such as European eel (*Anguilla anguilla*) and sturgeon (*Acipenser* spp.) are not presented.

Regarding the abundance of species (quantitative composition), at the site in the middle course of the river, the abundance of grayling was higher than the abundance of Black Sea trout, both in number and weight. However, considering the abundance, regardless of weight part, European Bullhead (*Cottus gobio*) is the dominant species throughout this river. The high abundance of this species in such waters is a normal occurrence, but it should be noted that this species also tolerates habitats that have been altered by anthropogenic activities. The most abundant species, *C. gobo*, is generally similar in all rivers that belong to the Danube drainage basin in Montenegro. The table below shows the representation of species during field research in the Drcka River.

Table 5-35: Presence and abundance of species from locality Drcka River (survey 2019-2021)

Species	L-1. above Mateševo, br/gram	L-2. middle part of the river br/grami	L-3. upper part of the river, br/gram
<i>Salmo labrax</i>	21 / 1264	17 / 918	27 / 1303
<i>Thymallus thymallus</i>	7 / 1212	20/ 3425	
<i>Barbus balcanicus</i>	9 / 678		
<i>Cottus gobio</i>	72 / 217	86 / 446	118 / 497
Total	109/3371	114/4789	145/1800
kg/km (kg/ha)	23 (27)	32 (32)	12 (20)

However, the abundance of *cottus gobio* (as resulted from the 2019-2021 survey and shown in the above table), seems very high and is not consistent with the results of the survey for fisheries management in which in Drcka river three species were recorded at this sampling location: *Salmo labrax*, *Thymallus thymallus* and *Cottus gobio* (bullhead). Among these recorded species, the brown trout (*Salmo labrax*) was dominant in both abundance and biomass.

Lim River and Zlorečica River (survey 2019-2021)

Two localities on the Lim River and one on its tributaries Zlorečica River were selected for a more reliable view of the possible impacts of the construction highway on aquatic organisms: fish and aquatic macroinvertebrates. The Zlorečica River is in the immediate vicinity of the works, and its confluence with the Lim River is just below Andrijevića. Obtained data on the ichthyofauna of the Zlorečica River will, in subsequent studies (monitoring), show if there was an impact and what was its extent during the construction and during the exploitation of the highway on the fish in its immediate surrounding.

Based on the available literature data (Drecun, 1962; Maric and Milosevic, 2011; Maric, 2019), in the Lim River and its whole drainage basin there are 24 fish species (+ 1 river lamprey) from 8 fish families and one lamprey family (Petromyzonidae) (list below):

Class Monorhina (Agnatha) - lamprey

Fam. Petromyzonidae

Eudontomizon sp. (cf. *E. vladikovi* Oliva & Zanandrea, 1959)

Class Osteichthyes

Oncorhynchus mykiss (Walbaum, 1792) – rainbow trout

Salmo labrax Pallas, 1814 – Black Sea trout

Hucho hucho (Linnaeus, 1758) – Huchen

Thymallus thymalus (Linnaeus, 1758) - European grayling

Alburnus alburnus (Linnaeus, 1758) – bleak

Alburnoides bipunctatus (Bloch, 1782) – spirlin,

Barbus balcanicus (Kotlik, Tsigenopoulos, Rab and Berrebi, 2002) – large spot barbel

Barbus barbus (Linnaeus, 1758) – barbel

Chondrostoma nasus (Linnaeus, 1758) - nase

Gobio obtusirostris (Valenciennes, 1842) - Danube gudgeon

Leuciscus leuciscus Linnaeus, 1758 – dace

Squalius cephalus (Linnaeus, 1758) – chub
Rutilus virgo (Linnaeus, 1758) - cactus roach
Telestes ryssela (Heckel, 1852) - Danube riffle dace
Scardinius erythrophthalmus (Linnaeus, 1758) - rudd
Phoxinus phoxinus (Hankó, 1922, 1758) - Danube minnow
Cobitis elongata Heckel et Kner, 1858 – Balkan spined loach
Misgurnus fossilis (Linnaeus, 1758) - Weather loach #
Sabanajewia balcanica (Karaman, 1922) – Balkan golden loach
Barbatula barbatula (Linnaeus, 1758) – stone loach
Lepomis gibbosus Linnaeus, 1758 – pumpkinseed
Esox lucius Linnaeus, 1758 – pike
Lota lota (Linnaeus, 1758) – burbot
Cottus gobio (Linnaeus, 1758) – European bullhead

The fish list from the Lim River basin comprises 8 (eight) species that were not recorded during this survey. These species are cited in the literature (cited above), and two of them are present in the waters of Lim River, but downstream in the area of Bijelo Polje. The presence of three species: *S. erythrophthalmus*, *L. leuciscus*, and *M. fossilis* remain questionable and these species are only listed by Drecun (1962). The presence of the species *Esox lucius* is likely to be characteristic for the upper course of Lim River because the river flow of this river is not suitable for this species. *Oncorhynchus mykiss* and *Thymallus thymallus* are rare in this part of the river, although *O. mykiss* is caught only sporadically and originates from fish farm (escaped specimens). Data on the species presence in the two localities studied were grouped into one table because the data on them were similar or identical. The data presented in this way in all the tables that follow illustrate well the condition of the ichthyofauna in the part of the river below Andrijevića, in the river section about 3km, and near the foreseen works.

During this investigation 16 species of fish from 6 families were recorded (Table 5-36).

Table 5-36: Check list of the species from Lim River and its tributary Zlorečica River

Latin name	English common name	Montenegrin common name	Literature data	This report
<i>Oncorhynchus mykiss</i>	Rainbow trout	Kalifornijska pastrmka	+	–
<i>Salmo labrax</i>	Black Sea trout	Crnomorska pot. pastrmka	+	+
<i>Hucho hucho</i>	Huchen	Mladica	+	+
<i>Thymallus thymallus</i>	European grayling	Lipljen	+	–
<i>Alburnus alburnus</i>	Bleak	Zela, dunavska ukljeva	+	+
<i>Alburnoides bipunctatus</i>	Spiralin	Ukljevica	+	+
<i>Barbus balcanicus</i>	Large spot barbel	Balkanskaa mrena	+	+
<i>Barbus barbus</i>	Barbel	Velika mrena	+	+
<i>Chondrostoma nasus</i>	Nase	Skobalj	+	+
<i>Gobio obtusirostris</i>	Danube gudgeon	Dunavska mrenica	+	+
<i>Leuciscus leuciscus</i>	Dace	Klenić	+	–
<i>Rutilus virgo</i>	Cactus roach	Plotica	+	+
<i>Telestes ryssela (souffia)</i>	Danube riffle dace	Jelšovka	+	+

Latin name	English common name	Montenegrin common name	Literature data	This report
<i>Phoxinus phoxinus</i>	Danube Minnow	Dunavska gaovica	+	+
<i>Scardinius erythrophthalmus</i>	Rudd	Crvenperka	+	–
<i>Squalius cephalus</i>	Chub	Klen	+	+
<i>Cobitis elongata</i>	Balkan spined loach	Velikli vijun	+	+
<i>Misgurnus fossilis</i>	Weather loach	Čikov	+	–
<i>Sabanajewia balcanica</i>	Balkan golden loach	Balkanski vijun	+	–
<i>Barbatula barbatula</i>	Stone loach	Brkica	+	+
<i>Lepomis gibbosus</i>	Pumpkinseed	Sunčanica	+	–
<i>Esox lucius</i>	Pike	Štuka	+	–
<i>Lota lota</i>	Burbot	Manic, derać	+	+
<i>Cottus gobio</i>	European Bullhead	Peš	+	+
<i>Eudontomiza vladikovi</i>	Danubian brook lamprey	Zmijuljica	+	–

It is noted however that some of the species in the above table, according to other sources are unlikely to be expected (*Alburnus alburnus* and *Alburnoides bipunctatus* at the Zlorečica River site, *Thymallus thymallus*, *Gobio obtusirostris* and *Lota lota* at the Lim River's confluence site, *Barbus barbus*, *Barbus balcanicus*, *Gobio obtusirostris*, *Cobitis elongata*, and *Barbatula barbatula* at Lim – bridge to Seoce).

Additionally, as for the case of Drcka river, the abundance of *Cottus gobio* seems quite high and not consistent with other surveys in which:

- In Lim river: five species were recorded: *Salmo labrax*, *Thymallus thymallus*, *Telestes ryssela*, *Chondrostoma nasus*, *Hucho hucho*, and *Cottus gobio*. Among the species, *Telestes ryssela* was the most abundant, while *Thymallus thymallus* had the highest biomass.
- In Zlorečica river: two species were recorded *Salmo labrax* and *Thymallus thymallus*. Among the recorded species, *Salmo labrax* was dominant in both abundance and biomass.

Table 5-37: Conservation status of fish fauna in Lim River (Zlorečica River also included)

Latin name	Common English name	Montenegrin name	Bern Convention Annex	Habitats Directive	IUCN - Red List	Montenegrin Legislation
<i>Oncorhynchus mykiss</i>	Coast angel trout / rainbow trout	Kalifornijska pastrmka			Not evaluated	
<i>Salmo labrax</i>	Black Sea trout	Blatnjača			LC	VU
<i>Hucho hucho</i>	Danube / Huchen	Mladica	Annex III	Annex II, Annex V	EN	EN
<i>Thymallus thymallus</i>	European grayling	Lipljen	Annex III	Annex V	LC	VU
<i>Alburnus alburnus</i>	Bleak	Zela, dunavska ukljeva			LC	EN
<i>Alburnoides bipunctatus</i>	Spirlin	Ukljevica	Annex III		LC	LC
<i>Barbus balcanicus</i>	Large spot barbel	Balkanska mrena		Annex V	LC	LC
<i>Barbus barbus</i>	Barbel	Velika mrena		Annex V	LC	VU
<i>Chondrostoma nasus</i>	Undermouth	Skobalj	Annex III		LC	LC

Latin name	Common English name	Montenegrin name	Bern Convention Annex	Habitats Directive	IUCN - Red List	Montenegrin Legislation
<i>Gobio obtusirostris</i>	Danube gudgeon	Dunavska mrenica			LC	LC
<i>Leuciscus leuciscus</i>	Dace	Klenić			LC	LC
<i>Rutilus virgo</i>	Cactus roach	Plotica			LC	VU
<i>Telestes rsysela (souffia)</i>	Danube riffle dace / Soufie	Jelšovka	Annex III	Annex II	LC	LC
<i>Phoxinus csikii</i>	Danube Minnow	Dunavska gaovica			LC	LC
<i>Scardinious erythrophthalmus</i>	Rudd / Redeye	Crvenperka	Annex III		LC	LC
<i>Squalius cephalus</i>	Chub	Klen			LC	LC
<i>Cobitis elongata</i>	Balkan spined loach	Velikli vijun	Annex III	Annex II	LC	VU
<i>Misgurnus fossilis</i>	Weather loach	Čikov	Annex III	Annex II	LC	
<i>Sabanajewia balcanica</i>	Balkan golden loach	Balkanski vijun			LC	VU
<i>Barbatula barbatula</i>	Stone loach	Brkica			LC	LC
<i>Lepomis gibbosus</i>	Pumpkinseed	Sunčanica			Not evaluated	LC
<i>Esox lucius</i>	Pike	Štuka			LC	
<i>Lota lota</i>	Burbot	Manic, derać			LC	LC
<i>Cottus gobio</i>	European Bullhead	Peš	Annex I	Annex II	LC	LC
<i>Eudontomyzon vladikovii</i>	Danubian brook lamprey /Vladikov's lamprey	Zmijuljica	Annex III	Annex II	LC	

Table 5-38: Presence and abundance of species at the studied sites in the Lim River and Zlorečica River

Species	Zlorečica River no./grams	Lim- nearby confluence no./grams	Lim – bridge to Seoce no./grams
<i>Salmo labrax</i>	19 / 2264	7 / 1.329	3 / 111
<i>Thymallus thymallus</i>	–	–	–
<i>Hucho hucho</i>	–	–	1/10
<i>Alburnus alburnus</i>	7/61	5/47	13/119
<i>Alburnoides bipunctatus</i>	14/108	16/125	
<i>Barbus barbus</i>	–	–	3/74
<i>Barbus balcanicus</i>	9 / 678	5/382	7/136
<i>Chondrostoma nasus</i>	–	–	4/430
<i>Gobio obtusirostris</i>	2/10	3/21	9/45
<i>Rutilus virgo</i>	–	–	1/7
<i>Telestes rsysela</i>	5/39	12/53	24/127
<i>Phoxinus csikii</i>	3/14	2/9	6/19
<i>Squalius cephalus</i>	11/413	14/1070	23/1892
<i>Cobitis elongata</i>	–	–	2/18
<i>Sabanajewia balcanica</i>	–	–	–
<i>Barbatula barbatula</i>	–	–	3/23
<i>Lota lota</i>	–	3/43	5/72
<i>Cottus gobio</i>	67/302	79/360	82/368
<i>E. vladikovii</i>	–		
Total	137/5065	146/3799	186/3450

Species	Zlorečica River no./grams	Lim- nearby confluence no./grams	Lim – bridge to Seoce no./grams
kg/km river flow (kg/ha)	34 (42)	25 (32)	23 (23)

Kraštica River (survey 2024)

In the surveyed sector of the Kraštica River, five fish species were identified: brown trout (*Salmo labrax*), river huchen (*Hucho hucho*), grayling (*Thymallus thymallus*), chub (*Squalius cephalus*), and bullhead (*Cottus gobio*). In terms of relative biomass (CPUE) most dominant was brown trout than chub, grayling, river huchen and bullhead, respectively. In terms of relative abundance (NPUE), most abundant was chub than brown trout, grayling, bullhead and river huchen, respectively.

5.9.2.2 Benthic fauna and aquatic microinvertebrates

Survey 2019-2021

A total of 70 taxa from the ten groups of macroinvertebrates were identified during this investigation, as follows: Ephemeroptera, Plecoptera, Coleoptera, Diptera, Trichoptera, Hydrachnidia, Gastropoda, Tricladida, Oligochaeta and Nematoda (Annex 1, Annex 2 of the baseline survey report). The taxa richness at investigated sampling sites ranged from 27 taxa in site T3 to 40 taxa at sampling site T2. Based on this benthic invertebrate survey, total density in the Lim River (3363.27 to 3493.88 individuals/m²) was lower than the total density in the Drcka River (2563.27 to 7118.37 individuals/m²) (Figure 5-45).

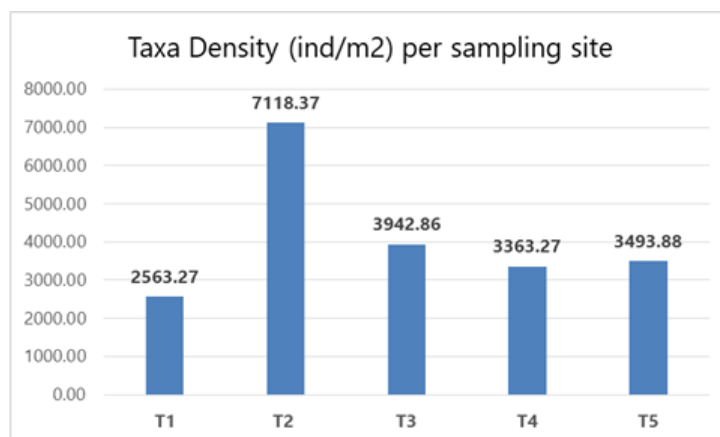


Figure 5-45: Taxa density (ind/m²) at investigated sampling sites, September 2019

When examining taxonomic groups, *Trichoptera* (caddisflies) were observed as dominant taxa at all sampling sites. This group participated in benthic fauna with ratio of 38,55% to 64,68% (Figure 5-46) including their dominant families *Lepidostomatidae*, *Leptoceridae* and *Sericostomatidae*. The least dominant and least abundant group was Nematoda with participation at sampling site T2 only with abundance of 32.65 ind/m².

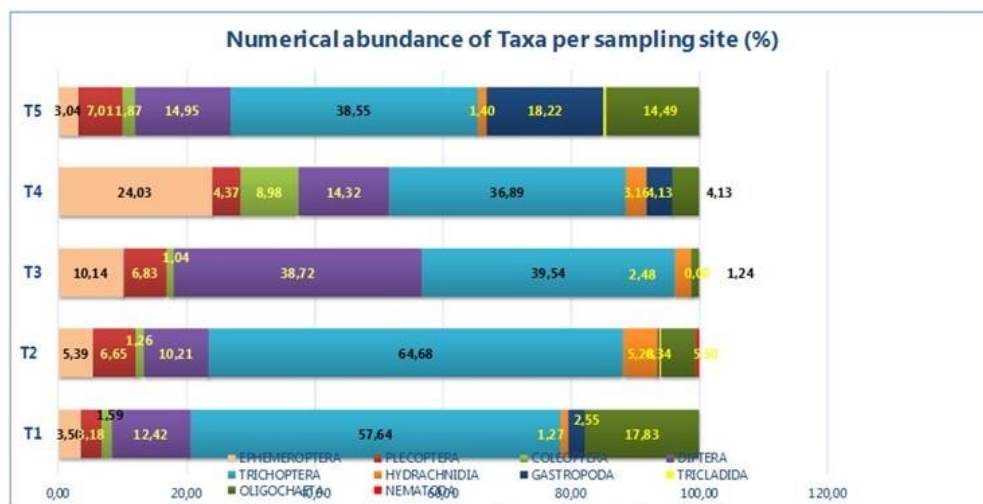


Figure 5-46: Comparative numerical abundance of investigated taxa per sampling site (%), September

The diversity index was fairly high across all sites and ranged from 3.07 at sampling site T3 to 3.46 at sampling site T2 in Drcka River). The evenness was also high across investigated sites, with almost uniform values of 0.91 at T1 to 0.94 at T5.

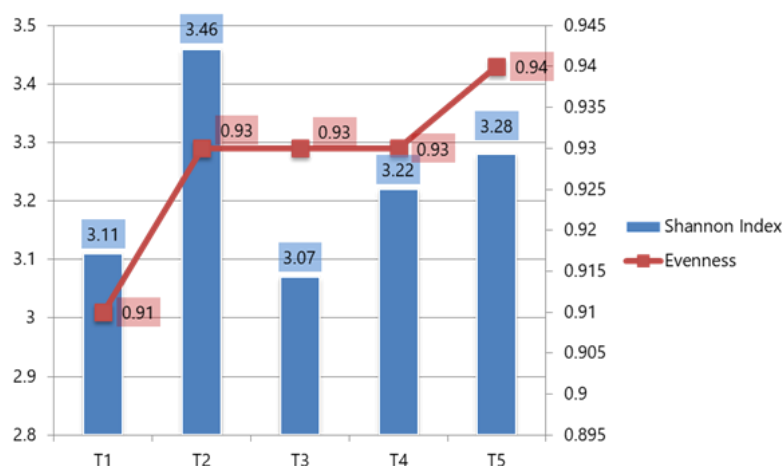


Figure 5-47: Values of Diversity Index and Evenness at investigated sampling sites, September 2019

The proportion Chironomidae (%C) was low at all investigated sites and %EPT was fairly high (Table 5-39), which indicates good quality of the benthic community overall. These trends were also recorded when it comes to the EPT/C ratio.

Table 5-39: Proportions of Ephemeroptera, Plecoptera and Trichoptera (%EPT), Chironomidae (%C), and ratio of EPT/C at the sampling sites, September 2019

	T1	T2	T3	T4	T5
% EPT	63.32	76.72	56.52	65.29	48.60
% Chironomidae	10.03	6.88	35.82	9.95	14.02
Ratio EPT/Chironomidae	6.31	11.15	1.58	6.56	3.47

The performed analysis during a one-time survey in September 2019, and values of different community indices suggest that benthic fauna at all investigated sampling sites in Drcka River and Lim River is of good biotic condition. Therefore, these water bodies are assessed as those with good water quality. Also, the dominance of highly pollution-sensitive taxa belonging to Trichoptera, Ephemeroptera,

Plecoptera (Henriques-de-Oliveira et al. 2007; Narangarvuu et al. 2014; Zaiha et al. 2015) indicates good water quality all sampling site.

Metrics used for rapid assessment of water quality (FBI, BMWP, ASPT), which are based on composition and abundance of benthic community indicated the high-water quality at all investigated sites in Drcka River and Lim River.

Only four gastropod species: *Amphimelania holandrii*, *Ancylus fluviatilis*, *Bithynia tentaculata* and *Lithoglyphus naticoides* are on the IUCN Red list having (LC) Least Concerned status. In addition to this, among investigated species there are no species with status of nationally protected species.

Survey 2024 - Kraštica.

The survey at the Kraštica site confirmed the presence of 22 macroinvertebrate species, categorized into 7 taxonomic groups. The most diverse class, Insecta, is represented by 6 orders and 19 species, comprising 72.44% of the community. The order Trichoptera is the most diverse, with 7 species and a 41.08% share of the community, followed by Ephemeroptera with 3 species (15.41%), Plecoptera with 3 species (7.11%), and Diptera, also with 3 species, contributing 4.34%. Additionally, the order Coleoptera is represented by 2 species, making up 3.55% of the community, while Odonata is represented by 1 species with a 1.18% share. The most dominant species in the sample is the snail *Lymnaea peregra* from the class Gastropoda, comprising 19.76% of the community, while the subdominant species is the Trichoptera larva *Hydropsyche angustipennis*, making up 15.81%. The phylum Mollusca, particularly the class Gastropoda, is represented by three species, collectively accounting for 27.66% of the sample. The Margalef diversity index for this site is 3.79, indicating a favorable diversity of microhabitats and environmental conditions.

No species protected under EU legislation, international agreements, or national legislation were found in the benthic samples from the Kraštica River.

5.9.2.3 Terrestrial invertebrates

During the previous biodiversity study for the Mateševo–Andrijević highway section (2019-2021), no terrestrial invertebrate surveys were conducted. Five field days were conducted in October 2024 along the new alignment of the Mateševo–Andrijević section, covering the area from the entrance of the Trešnjevik Tunnel towards Andrijević. It is noted, however, that research for terrestrial invertebrates is better to be conducted during spring / summer.

Numerous species were recorded (see detailed report in Appendix I-B). The species of international and/or national importance are shown in the following table:

Table 5-40: Species of international and/or national importance presume to be presented

Group	Species name (latin/english)	Protected in Montenegro	conservation status (IUCN)	conservation status (IUCN) in Montenegro	EU HD directive annex	Bern convention appendix
Insects/ Lepidoptera	<i>Iphyclides podalirius</i> Scarce Swallowtail	+	LC	NT	-	-
Insects/ Lepidoptera	<i>Papilio machaon</i> Old World Swallowtail	+	LC	NT	-	-
Insects/ Lepidoptera	<i>Parnassius mnemosyne</i> Clouded Apollo	-	LC	VU	IV	II

Group	Species name (latin/english)	Protected in Montenegro	conservation status (IUCN)	conservation status (IUCN) in Montenegro	EU HD directive annex	Bern convention appendix
Insects/ Lepidoptera	<i>Euphydryas aurinia</i> Marsh Fritillary	-	LC	VU	II	II
Insects/ Lepidoptera	<i>Euphydryas maturna</i> Scarce Fritillary	-	VU	VU	II, IV	II
Insects/ Lepidoptera	<i>Euplagia quadripunctaria</i> Jersey Tiger	-	LC	n.a.	II	I
Insects/ Coleoptera	<i>Morimus funereus</i> Beech Longhorn Beetle	-	VU	n.a.	II	II
Insects/ Coleoptera	<i>Rosalia alpina</i> Alpine longhorn beetle	+	VU	n.a.	II, IV	II
Insects/ Coleoptera	<i>Lucanus cervus</i> Stag beetle	+	NT	n.a.	II	III
Insects/ Coleoptera	<i>Cerambyx cerdo</i> Great Capricorn Beetle	-	VU	n.a.	II, IV	II
Insects/ Coleoptera	<i>Oryctes nasicornis</i> European Rhinoceros Beetle	+	NT	n.a.	-	-

List of protected species in Montenegro: "Decision on placing under protection particular plant and animal species" Official Gazette 76/06; **IUCN** (International Union for Conservation of Nature) **red list**; **LC**- least concern; **NT** – near threatened; **VU** – vulnerable species; **EU Habitat direktiva (HD)**- Council of European Communities (1992): Council Directive 92/43/EEC of 21 May 1992 on the conservation of natural habitats and of wildlife and flora Habitats Directive - 92/43/EEC. **Resolution 6 of the Bern Convention (BC)**, - Council of Europe (1979): Convention on the conservation of European wildlife and natural habitats. Bern, Switzerland; **II, III, IV, V** – vrsta se nalazi u navedenom appendiksu ili aneksu; **CITES** - the Convention on International Trade in

5.9.2.4 Amphibians and Reptiles

A baseline survey of the amphibians and reptiles in the project area was conducted as part of the ESIA procedure in 2019-2021.

Table 5-41: Locations of surveys for amphibians and reptiles (survey 2019-2021)

#	Location	Altitude, msl	Coordinates
1	Drcka river	1013	42.759445°, 19.563593°
2	Regional park "Komovi"	1030	42.748994°, 19.577293°
3	Bukov stream	1050	42.748821°, 19.586973°
4.	Confluence of Vranještica and Drcka river (Bare Kraljske)	1070	42.752074°, 19.606890°
5.	Veljebrdski stream	1153	42.743267°, 19.632300°
6	Ljubaštica river	1185	42.735512°, 19.655579°
7.	Novovića stream (Gnjili stream)	1000	42.745150°, 19.715817°
8.	Dubokalj stream	944	42.744833°, 19.737433°
9.	Kraljštica river (Lim ASCL item I)	770	42.735350°, 19.773917°

#	Location	Altitude, msl	Coordinates
10.	Confluence of Prisojački stream and Kraljštica at location Bandovića bridge (Lim ASCI item II)	757	42.739901°, 42.739901°
11.	Lim river (Lim ASCI item III)	730	42.755116°, 19.801226°

Table 5-42: Conservation status of amphibians and reptiles

Latin name	English name	Montenegrin name	Bern Convention Annex	Habitats Directive	IUCN - Red List	Montenegrin Legislation
<i>Salamandra salamandra</i>	Fire salamander	Šareni daždevnjak	Annex III		LC	LC
<i>Bombina variegata</i>	Yellow-bellied toad	Žutotrbi mukač	Annex II	Annex II and Annex IV	LC	LC
<i>Bufo bufo</i>	Common toad	Obična krastača ili smeđa krastača	Annex III		LC	LC
<i>Pelophylax ridibundus</i>	Marsh frog / Lake frog	Velika zelena žaba	Annex III	Annex V	LC	LC
<i>Rana graeca</i>	Greek stream frog	Grčka smeđa žaba	Annex III	Annex IV	LC	LC
<i>Rana temporaria</i>	European common frog / Grass frog	Livadska smeđa žaba	Annex III	Annex V	LC	LC
<i>Lacerta agilis</i>	Sand lizard	Livadski ili sivi gušter	Annex II	Annex IV	LC	LC
<i>Lacerta viridis</i>	Eastern green lizard	Zelembač	Annex II / Annex III	Annex IV	LC	LC
<i>Podarcis muralis</i>	Common wall lizards	Zidni gušter	Annex II	Annex IV	LC	LC
<i>Anguis fragilis</i>	Slow worm	Sljepić	Annex III		LC	LC
<i>Zamenis longissimus</i>	Aesculapian snake	Obični smuk ili šumski smuk / eskulapov smuk			LC	LC
<i>Coronella austriaca</i>	Smooth snake	Smukulja	Annex II	Annex IV	LC	LC
<i>Natrix natrix</i>	Grass snake	Bjelouška	Annex II / Annex III		LC	LC
<i>Natrix tessellata</i>	Dice snake	Ribarica	Annex II	Annex IV	LC	LC
<i>Vipera ammodytes</i>	Nose-horned viper	Poskok	Annex II	Annex IV	LC	LC

In 2024 supplementary surveys were conducted section from Trešnjevik to Andrijevića over five days, at five locations. During the survey, the following species were recorded:

- Three amphibians: *Salamandra Salamandra*, *Bufo bufo*, *Rana graeca*,
- Two reptiles: *Podarcis muralis*, *Vipera ammodytes*.

These species are common within the Project's impact zone. Streams, rivers, their slow-flowing sections, and floodplains within the Project's impact zone serve as corridors and as permanent or breeding habitats for the detected amphibians. With the exception of the Greek stream frog (*Rana graeca*), which rarely occupies man-made or altered habitats, the other detected species sometimes or frequently inhabit areas under anthropogenic influence.

The habitat characteristics and population of observed species (both surveys) are summarized in the following table:

Table 5-43: habitat characteristics and population of observed amphibians and reptiles

Specied	Distribution in Montenegro	Abundance in Project impact zone	Relationship with artificial or human-changed habitats	Corridors and reproductive center within Project impact zone	Activity, year.
<i>Salamandra salamandra</i>	Mountains and valleys	Average	n/a	Corridor and reproductive center	April-October
<i>Bombina variegata</i>	More populous in mountains and valleys	Average	Frequently populates	Corridor and reproductive center	March-October
<i>Bufo bufo</i>	Widespread	Average	Frequently populates	Corridor and reproductive center	March-November
<i>Pelophylax ridibundus</i>	Widespread	Average in second half of the route	Frequently populates	Corridor and reproductive center	March-November
<i>Rana graeca</i>	Mostly in mountains and valleys	Abundant/average	Rarely populates	Corridor and reproductive center	March-October
<i>Rana temporaria</i>	Mountains and valleys	Rarely observed, but potentially more abundant	Rarely populates	Corridor and reproductive center	March-Oct/Nov
<i>Lacerta agilis</i>	Mountains and valleys	Rarely observed, but potentially more abundant	Sometimes populates	Corridor	mid March – mid October
<i>Lacerta viridis</i>	Widespread	Average	Frequently populates	One of many corridors in Montenegro	March-October
<i>Podarcis muralis</i>	Widespread	Abundant/average	Veoma adaptabilna	One of many corridors in Montenegro	March-November
<i>Anguis fragilis</i>	Widespread	Assumed to be average	Sometimes populates	One of many corridors in Montenegro	March-Oct/Nov
<i>Zamenis longissimus</i>	Widespread	Average	Frequently populates	One of many corridors in Montenegro	March/April - Oct/Nov
<i>Coronella austriaca</i>	Mountains and valleys	Assumed to be average	Sometimes populates	One of many corridors in Montenegro	March/April - Oct/Nov
<i>Natrix natrix</i>	Widespread	Average	Sometimes populates	One of many corridors in Montenegro	March-November
<i>Natrix tessellata</i>	Widespread	Average	Sometimes populates	One of many corridors in Montenegro	March-November
<i>Vipera ammodytes</i>	Widespread	Average	Frequently populates	One of many corridors in Montenegro	March-October

Sensitive areas of batracho- and herpetofauna

The proposed highway routes pass through or around the edges of the following designated or proposed sites for nature protection: Regional Nature Park “Komovi” and Area of Special Conservation Interest (ASCI) “Lim River”. Riparian areas of the Lim river and other numerous streams and small rivers within the Project impact zone are very sensitive to impacts on water quality through pollution, disturbance of riverbeds, sedimentation and turbidity. The impacts associated to highway construction

and operation should be minimised, otherwise they will result in significant damage to the ecological value of these areas and their batracho-and herpetofauna.



Figure 5-48: Mapped locations of species recorded at the first surveyed site (1) Drcka River: (L) *L. viridis*, (M) *P. muralis*, (N) *N. natrix*, (Z) *Z. longissimus*, red pin – *B. bufo*, violet pin – *R. graeca* (Survey 2019-2021).



Figure 5-49: Mapped locations of species recorded at the second surveyed site (2) RP "Komovi": (A) *L. agilis*, (M) *P. muralis*, (F) *A. fragilis*, (V) *V. ammodytes*, yellow pin – *B. variegata*, violet pin – *R. graeca* (Survey 2019-2021).



Figure 5-50: Mapped locations of species recorded at the third surveyed site (3) Bukov stream: (M) *P. muralis*, (V) *V. ammodytes*, (Z) *Z. longissimus*, violet pin – *R. graeca* (Survey 2019-2021).



Figure 5-51: Mapped locations of species recorded at the fourth surveyed site (4) confluence of the Vranjestica and Drcka rivers (Bare Kraljske): (M) *P. muralis*, (N) *N. natrix*, (Z) *Z. longissimus*, red pin – *B. bufo*, violet pin – *R. graeca* (Survey 2019-2021).



Figure 5-52: Mapped locations of species recorded at the fifth surveyed site (5) Veljebrdski stream: (M) *P. muralis*, (V) *V. ammodytes* (Survey 2019-2021)..

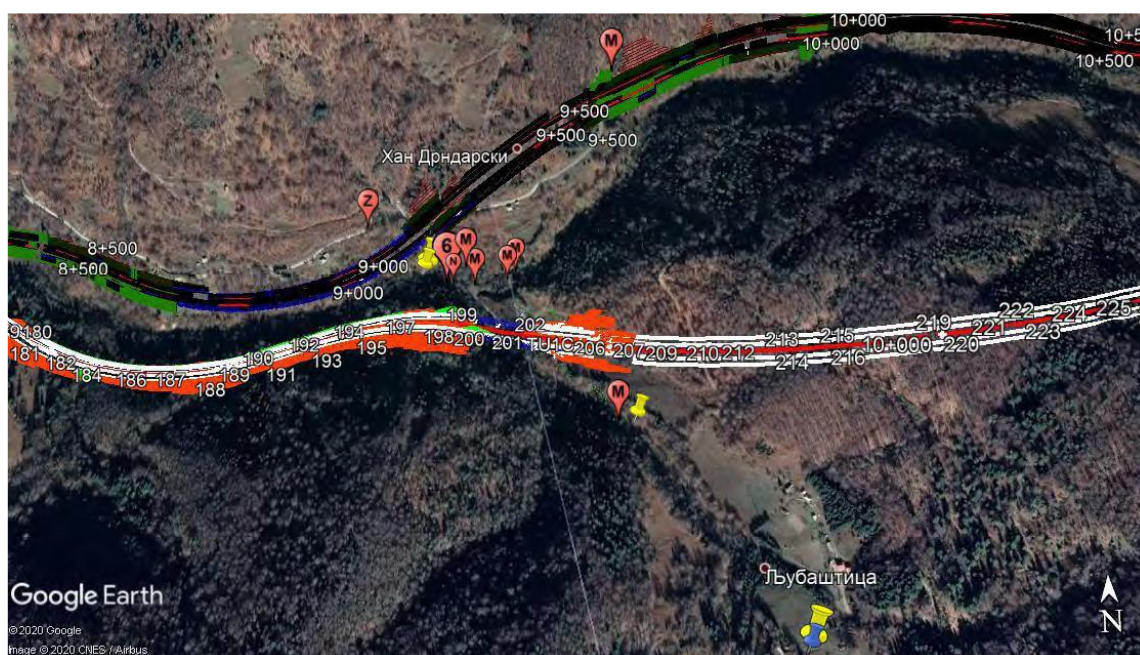


Figure 5-53: Mapped locations of species recorded at the sixth surveyed site (6) Ljubaštica River: (M) *P. muralis*, (N) *N. natrix*, (Z) *Z. longissimus*, yellow pin – *B. variegata*, blue pin – *R. tempo* (Survey 2019-2021).

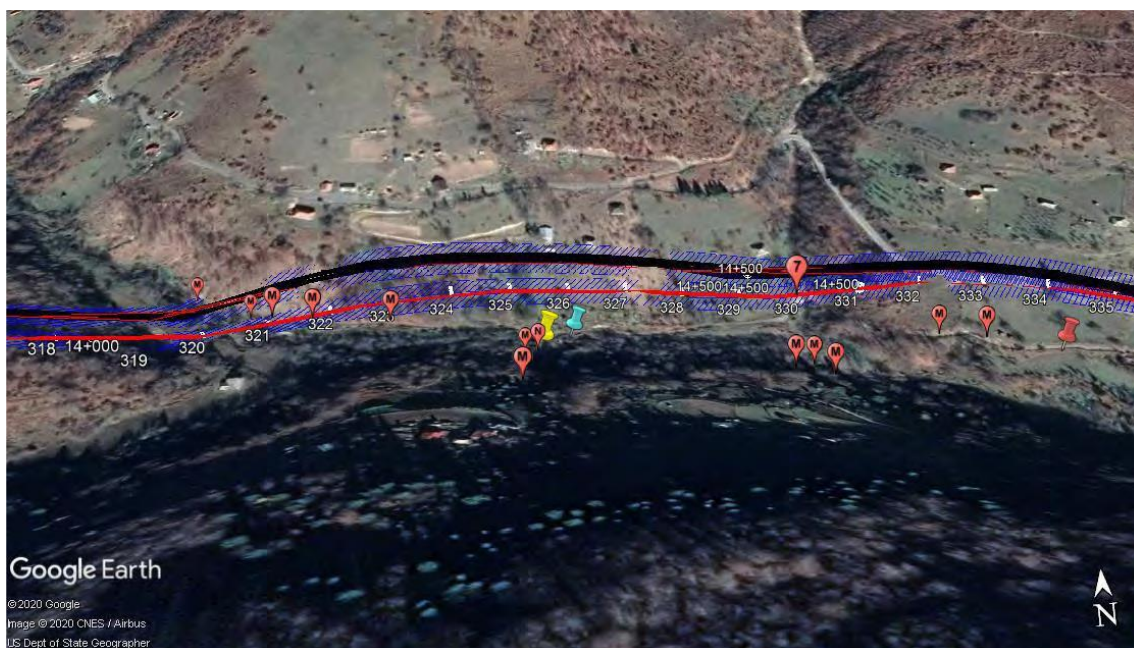


Figure 5-54: Mapped locations of species recorded at the seventh surveyed site (7) Novovića stream (Gnjili stream): (M) *P. muralis*, (N) *N. natrix*, red pin – *B. bufo*, yellow pin – *B. variegata*, light blue pin – *S. salamandra* (Survey 2019-2021).

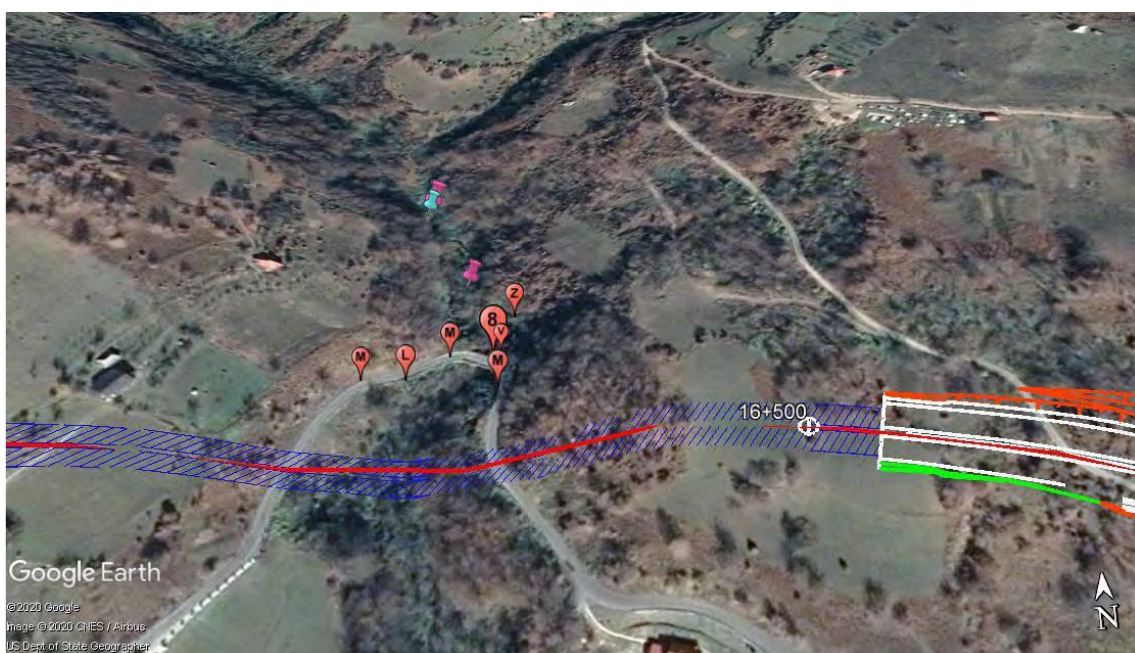


Figure 5-55: Mapped locations of species recorded at the eighth surveyed site (8) Dubokalj stream: (L) *L. viridis*, (M) *P. muralis*, (Z) *Z. longissimus*, (V) *V. ammodytes*, violet pin – *R. graeca*, light blue pin – *S. salamandra* (Survey 2019-2021).

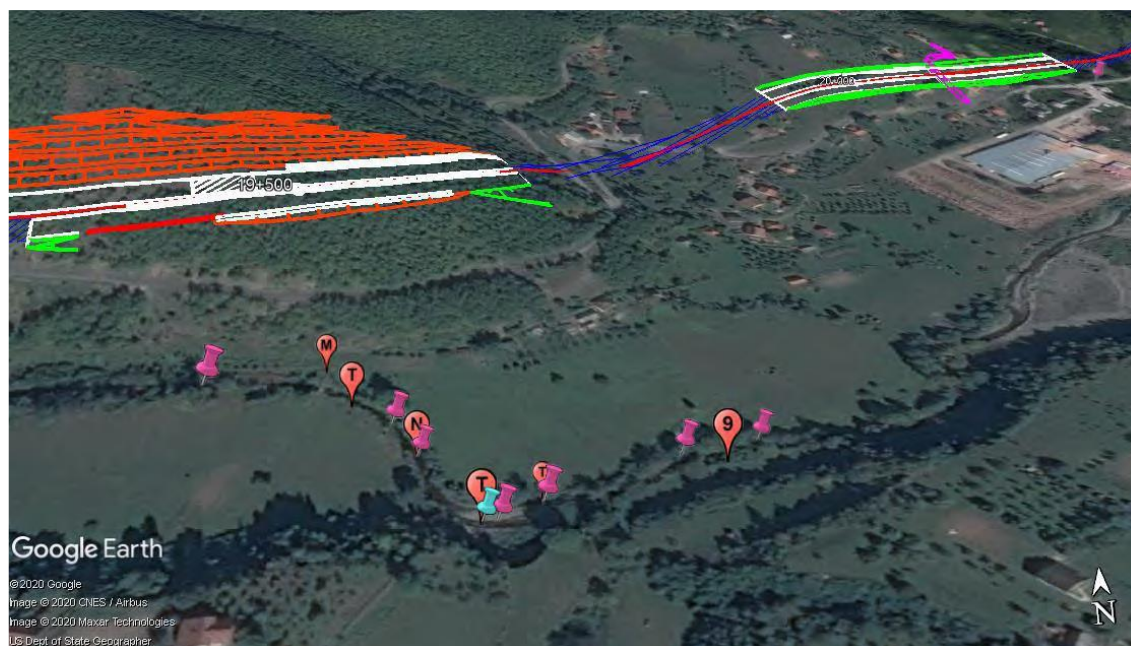


Figure 5-56: Mapped locations of species recorded at the ninth surveyed site (9) Kraljštica River (Lim ASCI 1st point): (M) *P. muralis*, (N) *N. matrix*, (T) *N. tessellata*, violet pin – *R. graeca*, light blue pin – *S. salamandra* (Survey 2019-2021).



Figure 5-57: Mapped locations of species recorded at the tenth surveyed site (10) confluence of the Prisojački stream and Kraljštica River in Most Bandovića (Lim ASCI 2nd point): (F) *A. fragilis*, violet pin – *R. graeca* (Survey 2019-2021).



Figure 5-58: Mapped locations of species recorded at the eleventh surveyed site (11) Lim River (Lim ASCI 3rd point): (L) *L. viridis*, (M) *P. muralis*, (T) *N. tessellata*, yellow pin – *B. variegata*, green pin – *P. ridibundus*, red pin – *B. bufo*, violet pin – *R. graeca* (Survey 2019-2021)..

5.9.2.5 Birds

Survey of 2019-2021

To study the ornithofauna along the 23-kilometer highway corridor Mateševu-Andrijevića (2019-2020), seven linear transects of 1 km each were conducted, along with eight shorter transects on the sides of the highway (up to 500 meters) and two-point censuses.

Out of 97 species registered so far in the protected area of the Komovi Nature Park, and whose borders are in the contact zone of the grip, 81 species of birds were registered on the highway route in the autumn and spring research.

Out of the new species for this area (in relation to the data from the Komovi Nature Park), one territory of the owl *Aegolius funereus* was registered. In the spring of 2020, 33 species of definite breeding birds were registered on the corridor route. It should be noted that not a single golden eagle has been registered (at least one pair is expected), but we registered a small number of woodpecker species and owls. For this species, the research period coincided with the movement ban period due to the coronavirus lockdown.

Mainly, the route of the highway is covered by species of forest biotopes, in this case beech forests, sparse beech forests and cleared lands of beech and oak forests, and open meadows. In recent years, forests have been exposed to intensive felling, which results in bare areas that poorly overgrow with woody vegetation. Also, these habitats are of interest to tourists and mountaineers during the summer months, which results in disturbance to the existing communities. On the transect Han Drndarski - Drcka, upstream (Ljubastica and Crnja) and downstream, the activities on the construction of a small hydroelectric power plant have begun. In the spring of 2020, 800 meters of canals and pipes were dug and partly laid. The synergistic effect of water abstraction in this area from Drcka, Cestogaz and Crnja and the construction of the highway can drastically affect the condition of the ornithofauna of the area.

The route of the road passes partly through the cultural landscapes of villages, arable lands and orchards, which are inhabited by species that are characteristic of such habitats.

During the work on the protection of the area, the contact zones with the route of the highway were classified, after the zoning of the area, in the III protection zone (the most liberal protection regime according to the Law on Nature Protection).

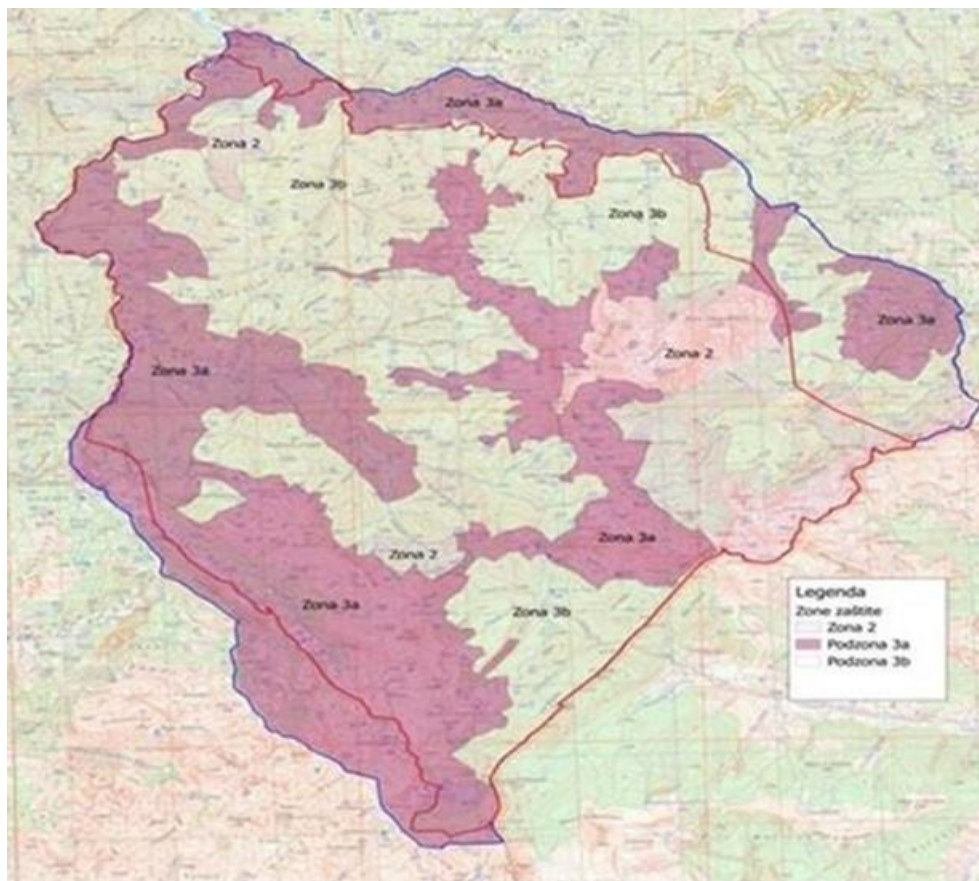


Figure 5-59: Protection zones of the Komovi NP (zone 3a at the top of the Photo goes along the highway corridor)

The results of birds' census point at:

- common species for these habitats
- significantly sparse populations of these species
- evident absence of predators

According to the *Bird Species Reference List* for Natura 2000 in Montenegro, the following species were registered in the corridor during the autumn observation, which, according to this list, can be considered as species of special interest for protection, both the species and their habitats:

Lullula arborea, *Anthus campestris*, *Cinclus cinclus*, *Sylvia hortensis*, *Accipiter gentilis*, *Buteo buteo*, *Falco vespertinus*, *Pernis apivorus*, *Aegolius funereus*, *Dryocopus martius*, *Leopieus medius* and *Dryobates minor* (12 species). During the spring research, the following species were registered from the list of species of special interest for protection: *Lanius senator*, *Lanius collurio*, *Upupa epops*, *Caprimulgus europaeus*, *Tachymarptis melba*, *Jynx torquilla* and *Dendrocopus syriacus*.

Priority species and their ecological requirements

Lullula arborea: The species mainly inhabits steppes, tablelands or open meadow habitats. It breeds from 50 to 1869 meters above sea level (Šekular, the northernmost registered breeding territory in Montenegro). It is estimated that the population in Montenegro ranges from 5000 – 10.000 breeding

pairs. On Komovi, its populations did not exceed the census for an important habitat for this species, while on nearby Bjelasica, which has large areas with habitats that are optimal for this species, it is estimated that it breeds 115 - 230 pairs.

The impact of the section of the highway in question on the population, given the habitats required by the species which are along the highway corridor, is of no serious significance.

Anthus campestris: The species mainly inhabits open, dry habitats with rocky lands and tall grass, and there are none along the highway corridor (only one individual was registered during the autumn observation, probably in wandering). It is estimated that the population in Montenegro ranges from 730 - 1460 breeding pairs.

The impact of the section of the highway in question on the population of this species and taking into account the requirements of the habitat it inhabits, is minimal or does not exist.

Cinclus cinclus: The species inhabits flowing and clean mountain streams. At least 4 territories along the Drcka river have been registered. The construction of the highway can have a significant impact on this species through habitat defragmentation, redirection of river flow or turbidity of the river during works. It is very likely that the species will make significant shifts during the construction of the highway. After construction, they will probably repopulate their original habitats (provided that the construction of SHPP Bare Kraljske is excluded).

Sylvia hortensis: The species inhabits pastures with shrubs. In the observed area, it was registered in the altered natural areas around Mateševo and in the village of Kralje. The species is widespread in Montenegro. The species is insectivorous and during the construction of the highway in the habitats it inhabits, it will disappear, i.e. shift. After construction, the probability that it will inhabit the same habitats again is high, thus the impact is minimal.

Accipiter gentilis: A forest bird which lives farther from the settlement. It is a regular but not frequent predator of Montenegro. Disturbance and habitat alteration during construction are very likely to significantly distance this species from the highway corridor. The impact during the construction and operation of the highway can be significant and cause the shift of the territory.

Buteo buteo: The most common breeding predator of Montenegro. It inhabits and breeds in different habitats: forest, rocky, plain, altered cultural landscape... opportunistic species. Registered along the entire corridor. It is likely that during the construction of the highway, the species will disappear along the corridor due to disturbance as well as due to the destruction of habitats on the route. Equally likely, the species is expected to return to the surrounding habitats along the corridor after the completion of the works, and the birds that were directly along the route will be forced to look for new territories, so the impact is not strong.

Falco vespertinus: The breeding migratory species of Montenegro. Small in number. It is often seen in migration when it is in large flocks in open fields and chooses electric lines as a resting place. It is very likely registered on the migration in this area during the autumn observation. The route of the corridor should not have a significant impact on the species.

Pernis apivorus: The breeding migratory species of Montenegro. It inhabits similar habitats as *Buteo buteo*. It is likely that during the construction of the highway, the species will disappear along the corridor due to disturbance as well as due to the destruction of habitats on the route. Equally likely, the species is expected to return to the surrounding habitats along the corridor after the completion of the works, and the birds that were directly along the route will be forced to look for new territories, so the impact is not strong.

Aegolius funereus: A resident of coniferous forests. In Montenegro, its population is estimated at 600 - 1200 breeding pairs. During the inventory, 7 - 15 occupied territories were registered in Komovi, while

two pairs were registered on the highway route. The species lives far from human influence and the construction of the highway will surely drastically affect the pairs that breed along the corridor.

Dryocopus martius: This species of woodpecker breeds along the corridor and covers all types of forests. It prefers older forests (they are all like that on the corridor). The species has adapted to the presence of man, so the construction of the highway, if there is no destruction of habitats in the territory occupied by this species, would probably lead to either shifting or adaptation to new conditions. The construction of the highway will surely drastically affect the pairs that breed on the corridor. Due to the construction of the highway, the probability of their relocation and conquest of new territories is possible.

Leiopicus medius: Woodpecker of more open deciduous forests, mainly oak forests. It feeds and breeds in older orchards. The species is registered in several territories on the corridor. The construction of the highway will surely drastically affect the pairs that breed on the corridor. Due to the construction of the highway, the probability of their relocation and conquest of new territories is possible.

Dryobates minor: It lives in open habitats of willow, poplar, alder. Mainly along watercourses. Registered along the Drcka River in open, flooded habitats. The construction of the highway will probably lead to the disappearance of this species from the corridor. Later, in the case of habitat restoration under the viaduct, its return is possible.

Lanius collurio: Birds of meadows interspersed with shrubs, orchards and backyards. Registered in the area of Mateševu and meadows and orchards around Kralje. The construction of the highway will lead to the loss of the habitats of this species on the corridor belt. The bird is a migratory one and is in the conquest of new territories every spring, so the impact of the highway on this species cannot be considered more serious.

Lanius senator: Birds of meadows interspersed with shrubs, orchards and backyards. Registered in the area of Mateševu and meadows and orchards around Kralje. The construction of the highway will lead to the loss of the habitats of this species on the corridor belt. The bird is a migratory one and is in the conquest of new territories every spring, so the impact of the highway on this species cannot be considered more serious.

Upupa epops: A bird of meadows, orchards and backyards. Livestock indicator. Registered in the area of Mateševu and meadows and orchards around Kralje. The construction of the highway will lead to the loss of the habitats of this species on the corridor belt. The bird is a migratory one and is in the conquest of new territories every spring, so the impact of the highway on this species cannot be considered more serious.

Caprimulgus europaeus: Open habitat bird. The construction of the highway will lead to the loss of the habitats of this species on the corridor belt. The bird is a migratory one and is in the conquest of new territories every spring, so the impact of the highway on this species cannot be considered more serious.

Tachymarpis melba: No breeding of this species has been registered on the highway corridor, but it is present along the entire corridor. The construction of the highway will not have a significant impact on the species. If it is lit, and the entrances to and exits from the tunnel mainly are, this can have a positive effect on the species in relation to nutrition.

Jynx torquilla: Orchard and backyard bird, more present in the oak forest around Kralje. The construction of the highway will lead to the loss of the habitats of this species on the corridor belt. This is especially important because the species breeds in cavities. The bird is a migratory one and is in the conquest of new territories every spring, so the impact of the highway on this species cannot be considered more serious.

Dendrocopus syriacus: Woodpecker of open habitats and cultural landscapes. The construction of the highway will lead to the loss of the habitats of this species on the corridor belt in Mateševu and Kralje. The bird is a resident and this project may have more serious consequences on the population of this species in the corridor.

Survey 2024.

The survey from 2020 also covers the revised 12km highway route (Tresnjevik-Andrijevića), rendering the findings from the previous route applicable to the updated one. The update regarding the new alignment is based on the data collected in 2019 and 2020, as the update was performed in the fall of 2024, a time when ornithological field research—conducted outside the nesting season—cannot provide fully comprehensive understanding of the actual state of the area. Additionally, an analysis of habitat changes was conducted using Google Earth's time slider tool, comparing habitat conditions during the period of bird field research for the original report with the conditions observed in 2024.

Habitat change analysis for the period 2021–2024 is showing that there are no habitat changes that occurred in the observed section of the highway corridor (Tresnjevik-Andrijevića). Therefore, the findings of the previous survey remain current. The quality of species is consistent, although slight variations in population numbers can be expected, particularly for breeding species.

5.9.2.6 Mammals (including bats)

MAMMAL SPECIES (excluding bats)

By the fieldwork survey of 2019-2021, 15 other mammal species were detected. Four (4) of these species are recognized as rare / endangered on a national / international level: *Canis lupus* (Grey wolf), *Lutra lutra* (Eurasian otter), *Nannospalax leucodon* (Lersser mole rat) and *Ursus arctos* (Brown bear). Species such as *Felis silvestris* (Wild cat), *Mustela nivalis* (Weasel) should be expected, but during this biological survey were not registered.

During the survey of 2024, in the Tresnjevik-Andrijevića part four of the species already identified in the previous survey were confirmed, i.e. *Lutra lutra*, *Martes foina*, *Sciurus vulgaris* and *Vulpes vulpes*.

Table 5-44: Conservation status of mammal species

Latin name	English name	Montenegrin name	Bern Convention Annex	Habitats Directive	IUCN - Red List	Montenegrin Legislation
<i>Canis lupus</i>	Grey wolf	Vuk	Annex II	Annex II, Annex IV, Annex V	LC	
<i>Capreolus capreolus</i>	European Roe Deer	Srna	Annex III		LC	
<i>Erinaceus roumanicus</i>	Northern White-breasted Hedgehog	Sjeverni bjelopsi jež			LC	
<i>Glis glis</i>	Edible Dormouse	Obični puh	Annex III		LC	
<i>Lepus europaeus</i>	European hare	Zec	Annex III		LC	
<i>Lutra lutra</i>	Eurasian Otter	Vidra	Annex II	Annex II, Annex IV	NT	+
<i>Martes foina</i>	Beech Marten/ Stone Marten	Kuna bjelica	Annex III		LC	
<i>Martes martes</i>	Pine Marten	Kuna zlatica	Annex III	Annex V	LC	
<i>Meles meles</i>	Badger	Jazavac	Annex III		LC	

Latin name	English name	Montenegrin name	Bern Convention Annex	Habitats Directive	IUCN - Red List	Montenegrin Legislation
<i>Mustela putorius</i>	European Polecat	Tvor	Annex III	Annex V	LC	
<i>Nannospalax leucodon</i>	Lesser Mole Rat	Slijepo kuće			LC	+
<i>Sciurus vulgaris</i>	Eurasian Red Squirrel	Crvena vjeverica	Annex III		LC	
<i>Sus scrofa</i>	Wild Boar	Divlja svinja	Annex III		LC	
<i>Ursus arctos</i>	Brown bear	Mrki medvjed	Annex II	Annex II, Annex IV	LC	
<i>Vulpes vulpes</i>	Red Fox	Lisica			LC	
<i>Felis silvestris</i>	Wild cat	Divlja mačka	Annex II	Annex II, Annex IV	LC	
<i>Mustela nivalis</i>	Weasel	Lasica	Annex III		LC	

***Canis lupus* (Linnaeus 1758); vuk; Grey wolf**

Species data quality: The wolf population in Montenegro belongs to the Dinaric-Balkan population, which is approximately 4,000 in size. The population trend is completely unknown. In addition, there are no precise data on the distribution and number of wolves in Montenegro. According to the available data and personal estimation, it can be concluded that the total population is declining.

Ecological characteristics for species: The wolf is a generalist, whose natural distribution includes not only the forest zone but also other habitats. Availability of food and safe shelters for rest and making a den are the main requirements of this large mammal. The proximity of the water is also of great importance for wolves. Today, forests are the main habitat of wolves in Europe, because large carnivores feel safer there. The fact that wolves have become typical forest dwellers is secondary and its occurrence on high mountain pastures is a common thing.

Distribution in Montenegro: According to the available literature, the species is widespread in both biogeographical regions, and most of the population is certainly concentrated in the alpine biogeographical region.

***Lutra lutra* (Linnaeus, 1758); Vidra; Eurasian Otter.**

Species data quality: The otter is one of the least researched mammals in Montenegro. Paunović & Milenković (1996) conclude that otters are more widespread in Montenegro than previously known and that individuals have been recorded in most areas except the western and central part of Montenegro, but its presence is not excluded from these areas. According to the data of Paunović & Milenković (1996), the otter in Montenegro is located along the coast, probably in small numbers and extends from 0 to 1400 m above sea level. Recent data on the presence of this species were recorded in the water net of Lim, Ibar, Piva, Čehotina, Morača (Mrtvica and Cijevna) and on the river Grlja (Prokletije) within the Project "Establishment of Natura 2000 network in Montenegro" where it is generally assessed that the population of this species is growing slightly. During the field survey within this Project, high otter activity was recorded along the entire course of the Drca river as well as in its streams from both sides. Based on recent data, it can be concluded that in Montenegro there are very suitable habitats for otter life, which is associated with a very rich web of watercourses and lakes. The great richness of the ichthyofauna of both the Black Sea and the Adriatic basin has a great influence on the life cycle of otters as roof predatory species on water surfaces. Due to the lack of data, we cannot conclude what the status of the population is (ie. what is the density and trend), but one should expect great activity in other ecologically attractive habitats for this species.

Ecological characteristics of habitats for species: The otter is the only semi-aquatic mammal from the *Mustelidae* family, which inhabits Montenegro, for whose life cycle it is necessary to closely

connect the water surface with the coastal land areas. It is an indicator of healthy ecosystems and as a top predator an important link in food chains. It inhabits large aquatic habitats (rivers and lakes) on whose banks it makes dens and on which it feeds on fish as well as crabs, amphibians, birds and even smaller mammals.

Distribution in Montenegro: This species is present in both biogeographical regions. According to some rough estimates, it can be concluded that it is more widespread in the alpine than in the mediterranean biogeographical region. This may be reflected by habitat loss in the coastal region in the last 20 years, but to confirm this it is necessary to apply regular field surveys to the most attractive ecological sites for this species in the country. Due to the lack of continuous data collection on this species, it is still not possible to assess its status (distribution, abundance and trend).

***Nannospalax leucodon* (Nordmann, 1840); Slijepo kuće; Lesser Mole Rat**

Species data quality: There is not much data on this species both at the level of the Balkan and at the level of Montenegro. Although the distribution of this species has not yet been defined. It is known so far that it is found only in the alpine biogeographical region of Montenegro. The three most important habitats for this species are the Durmitor plateau, the Sinjajevina plateau and Krnovo (personal observations). Globally, the trend of this species is declining because it has little reproductive power and locally, where the population is stable it is generally considered a “pest”. Precisely because of all the above, the mole rat is a legally protected species. In the project scope at an altitude of 1800m, this biodiversity survey confirmed the 4th habitat of this species in Montenegro. As its habitats are located at a higher altitude than planned road, thus its population is not endangered.

Ecological characteristics for species: It inhabits steppe grasslands, meadows and pastures (from 0 to 2400 m above sea level), in areas with a deep layer of soil, in which it digs its large pits. It is not found in fields and arable monocultures, although it can be found in agricultural areas where pastures, small arable lands and orchards are mixed.

Distribution in Montenegro: Based on the available data, it can be concluded that the species is present only in the alpine biogeographical region.

***Ursus arctos* (Linnaeus, 1758); mrki medvjed, Brown bear**

Species data quality: The population of the brown bear in Montenegro belongs to the Dinaric-Pindus population, which has not yet been scientifically estimated. Status of this species is unknown. However, according to available data, it can be concluded that the total population has been increasing in the last 30 years and that according to the Ministry of Agriculture, the population size is about 400 individuals.

Ecological characteristics of habitat for species: Found in deciduous and mixed forests with open grasslands around them. Availability of food and safe shelters for rest and roaming are the main requirements of this large mammal. The proximity of the water is also of great importance for bears as well as mature deciduous forests. Today, forests are mostly wolf habitats in Europe, because large carnivores feel safer there. As the bear is exclusively a nocturnal animal, in the search for food at night it also descends to rural households to orchards and beehives.

Distribution in Montenegro: According to the available literature, the species is widespread in both biogeographical regions, and most of the population is certainly concentrated in the Alpine biogeographical region.

BATS

By the biodiversity survey (2019-2021), 13 species of bats were registered. Three (3) species are identified as species of high importance: *Rhinolophus hipposideros* (Lesser Horseshoe Bat), *Barbastella barbastellus* (Western Barbastelle) and *Myotis myotis* (Great Mouse-eared Bat). Very possibly, due to habitat diversity it is the presence of several more species is expected: *Myotis capaccinii* (Long-fingered Bat), *Myotis mystacinus* (Whiskered Myotis), *Pipistrellus nathusii* (Nathusius's pipistrelle).

Table 5-45: Conservation status of bat species

Latin name	English name	Montenegrin name	Bern Convention Annex	Habitats Directive	IUCN - Red List	Montenegrin Legislation
<i>Barbastella barbastellus</i>	Western Barbastelle	Širokouhi slijepi miš	Annex II	Annex II, Annex IV	VU	+
<i>Eptesicus serotinus</i>	Serotine bat	Kasni slijepi mišić	Annex II	Annex IV	LC	+
<i>Hypsugo savii</i>	Savi's Pipistrelle	Savijev slijepi mišić	Annex II	Annex IV	LC	+
<i>Myotis alcathoe</i>	Alcathoe bat	Alkatojn večernja	Annex II	Annex IV	DD	+
<i>Myotis brandtii</i>	Brandt's Myotis	Brandtov večernjak	Annex II	Annex IV	LC	+
<i>Myotis daubentonii</i>	Daubenton's bat	Vodeni večernjak	Annex II	Annex IV	LC	+
<i>Myotis myotis</i>	Greater Mouse-eared Myotis	veliki mišouhi večernjak	Annex II	Annex II, Annex IV	LC	+
<i>Nyctalus leisleri</i>	Lesser Noctule.	mali noćnik	Annex II	Annex IV	LC	+
<i>Nyctalus noctula</i>	Noctule bat	obični noćnik	Annex II	Annex IV	LC	+
<i>Pipistrellus pipistrellus</i>	Common Pipistrelle	Mali slijepi mišić	Annex III	Annex IV	LC	+
<i>Pipistrellus pygmaeus</i>	Soprano Pipistrelle	patuljsti slijepi mišić	Annex II	Annex IV	LC	+
<i>Pipistrellus kuhlii</i>	Kuhl's Pipistrelle	Bjelorubi slijepi mišić	Annex II	Annex IV	LC	+
<i>Rhinolophus hipposideros</i>	Lesser Horseshoe Bat.	Mali potkovičar	Annex II	Annex II, Annex IV	NT	+
<i>Myotis capaccinii</i>	Long-fingered bat	Dugoprsti slijepi miš	Annex II	Annex II, Annex IV	VU	+
<i>Myotis mystacinus</i>	whiskered bat	Brkati slijepi miš	Annex II	Annex IV	LC	+
<i>Pipistrellus nathusii</i>	Nathusius' pipistrelle	Nathusijev slijepi miš	Annex II	Annex IV	LC	+

During the survey of 2024, seven of the above species were confirmed in the Tresnjevnik-Andrijeviča part:

- *Hypsugo savii*
- *Myotis sp.*
- *Nyctalus noctule*
- *Pipistrellus pipistrellus*
- *Pipistrellus pygmaeus*
- *Pipistrellus kuhlii/nathusii*
- *Rhinolophus hipposideros*

***Barbastella barbastellus* (Schreber, 1774); Širokouhi slijepi miš; Western Barbastelle**

Species data quality: Until recently (2014) almost nothing was known about this species, but more frequent use of bat detectors and the use of "invisible mist nets" in projects that support the survey of rare species of bats for better identification of Natura 2000 sites in Montenegro, distribution of this species has spread to both the alpine and mediterranean biogeographical regions. So far, the only place where the reproduction of this species has been recorded is in the canyon of the river Tara in the NP "Durmitor". During this field survey, reproduction of this species was recorded at the Bare Kraljske site, at the river junction of Crnja river into Drcka river.

Ecological characteristics for species: The species prefers exclusively cave wooded areas and areas with shrubby vegetation. The composition of tree species does not play as much a role in the preference of habitats of this species, as the structural abundance of different age groups and the bordering structure of trees. They inhabit various types of shelters, spaces under the bark of trees, cracks in trees, buildings, caves, cracks in the rocks, etc.

***Eptesicus serotinus* Schreber, 1774; Kasni slijepi mišić; Serotine bat**

Species data quality: Not many confirmed locations are known. However, its presence is confirmed for both biogeographical regions in Montenegro.

Ecological habitat characteristics of species: It is mainly crevice dwelling species, roosting in the cavities under roofs, bridges or rocks. Hunting over lowland wooded agricultural landscapes, hay meadows, parklands and semi-arid habitats. Often found in towns and villages.

Distribution in Montenegro: It can be concluded that this species is present in both biogeographical regions. The size of the population is unknown.

***Hypsugo savii* Bonaparte, 1837; Savijev slijepi mišić; Savi's Pipistrelle**

Species data quality: Based on former research, this species is probably widespread in our country and present in both biogeographical regions. Its presence is registered from the coast itself until 1750m above sea level.

Ecological habitat characteristics of species: Mountain pastures and surrounding water bodies. It is often present around human settlements as well.

Distribution in Montenegro: It can be concluded that this species is present in both biogeographical regions. The size of the population is unknown.

***Myotis alcathoe* von Helversen & Heller, 2001; Alkatoin večernjak;**

Species data quality: There are only 3 records (including finding in this implemented field survey) in Montenegro. Species is not very well researched even on European level.

Ecological habitat characteristics of species: Dense and humid mixed forests often near water or in small ravines with streams. Roost mainly in trees.

Distribution in Montenegro: It is assumed that this species can be present in both biogeographical regions.

***Myotis brandtii* (Eversmann, 1845); Brandtov večernjak; Brandt's Myotis**

Species data quality: There are only 3 records (including finding in this implemented field survey) in Montenegro. According to this data, species is present only in alpine biogeographical region. Species is not very well researched in Montenegro.

Ecological habitat characteristics of species: Usually it could be found in mixed and broad leaf forests often close to the water. Summer roosts in crevices in buildings, tree holes and bat boxes. Hibernates in caves, mines and other underground places.

Distribution in Montenegro: It is assumed that this species can be present just in alpine biogeographical region.

***Myotis daubentonii* (Kuhl, 1817); vodeni večernjak; Daubenton's bat**

Species data quality: According to previous literature data, this species is widespread in Montenegro, although most of the known population so far is in the alpine biogeographical region of the country. So far, the only known important reproductive nucleus of this species has been registered in the alpine biogeographical region (NP Biogradska Gora). By spreading knowledge about the distribution of this and its sister species, these species likely live in sympatry and further research is needed to delineate their distributions and thus define the most important habitats. We also had phonetic groups of *M. daubentonii* / *capaccinii* in the project area, however, using the methods of inspection of the objects, we registered only *M. daubentonii* species and in the continuation, I present data on phonetic groups as data on the distribution of *M. daubentonii* species.

Ecological characteristic of species: The species is closely related to deciduous and mixed forest ecosystems that have water bodies nearby. Summer colonies are mostly in tree crevices, while males are solitary in trees or rock crevices. The species can be found in Montenegro from 0 to 1700 m above sea level.

Distribution in Montenegro: According to the available literature, the species is more widespread in the alpine biogeographical region than in the Mediterranean. However, more and more data point to the fact that these two species live in sympatry throughout Montenegro. Due to the ignorance of the status of this species, it is very difficult to give population estimates.

***Myotis myotis* (Borkhausen, 1797); veliki mišouhi večernjak; Greater Mouse-eared Myotis**

Species data quality: There is very limited data on this species, and an estimate of population size can not be concluded. The only possible reproductive center of this species is in the village of Vranjina in cave Golubija, in the national park "Skadar Lake". However, literature data show that this species is mostly concentrated in the northern parts of the country. According to available data and data from neighbouring countries, it should be considered widespread, but more detailed research is needed to confirm this.

Ecological characteristics for species: This species is mainly present up to 800 m above sea level in lowland and mountainous areas, although in warmer regions they can be found higher (e.g. in Montenegro up to 1700 m above sea level). Colonies of this species prefer caves as shelters, but it is not excluded that smaller colonies can also occur in cracks in trees. The colonies are mostly around very wooded habitats made up of deciduous and mixed middle-aged forests. They prefer wooded habitats with open pastures and mountain meadows that are mowed in the nearness. During feeding, they spend 98% of their time in the forest.

Distribution in Montenegro: This species is also present in the Mediterranean and alpine biogeographical region. Little is known for its more detailed distribution. Size of national population unknown.

***Nyctalus leisleri* (Schreber, 1774); mali noćnik; Lesser Noctule.**

Species data quality: In Montenegro, the noctule bat is a widespread species, from 0 to 1800 m above sea level. Although so, there is still no data on the most significant shelters of this species as well as data on population size at the state level.

Ecological characteristics of species: The noctule bat is mostly a forest species, although in many countries it has adapted to the urban environment. Maternity colonies are in cracks in trees, while during the winter they are mostly in cracks in rocks or buildings (buildings, bridges, etc.). They feed in open areas and prefer wetlands or water bodies near these open areas.

Distribution in Montenegro: This species is also present in the Mediterranean and alpine biogeographical region. Little is known for its more detailed distribution. Size of national population unknown.

***Nyctalus noctula* (Schreber, 1774); obični noćnik; Noctule bat**

Species data quality: In Montenegro, the noctule bat is a widespread species, from 0 to 1800 m above sea level. Although so, there is still no data on the most significant shelters of this species as well as data on population size at the state level.

Ecological characteristics of species: The noctule bat is mostly a forest species, although in many countries it has adapted to the urban environment. Maternity colonies are inhabited by cracks in trees, while during the winter they are mostly in cracks in rocks or buildings (buildings, bridges, etc.). They feed in open areas and prefer wetlands or water bodies near these open areas.

***Pipistrellus pipistrellus* (Schreber, 1774); Mali slijepi mišić; Common Pipistrelle**

Species data quality: The common pipistrelle is a typical species in Montenegro, present in both biogeographical regions, although almost nothing is known about the more important shelters. In our country, it is represented from the coast to 1700m above sea level.

Ecological characteristic for species: The species prefers wooded areas near riverbeds and wetland habitats. It can also inhabit urban areas. Maternity and hibernation habitats are mainly in buildings or trees.

Distribution in Montenegro: It can be concluded that this species is present in both biogeographical regions. Significant shelters are still unknown.

***Pipistrellus pygmaeus* (Leach, 1825); patuljsti slijepi mišić; Soprano Pipistrelle**

Species data quality: Soprano pipistrelle is a common species in Montenegro, present in both biogeographical regions, although almost nothing is known about the more important shelters. In our country, it is represented from the coast to 1600m above sea level.

Ecological characteristics of habitat for species: The species prefers wooded areas near stagnant waters.

Distribution in Montenegro: This species can be concluded to be present in both biogeographical regions. The only potential maternity shelter in Montenegro was registered at the bus station in Sutomore in 2001.

***Pipistrellus kuhlii* (Kuhl, 1817); Bjeloruski slijepi mišić; Kuhl's Pipistrelle¹⁴**

Species data quality: Kuhl's Pipistrelle is a very common species in Montenegro, represented in both biogeographical regions, although almost all, so far, maternity shelters have been destroyed, precisely by the construction of new facilities and other infrastructures. The species can be found in all possible

¹⁴ This field survey, through use of detector, recorded the phonetic group *P.kuhlii* / *nathusii*, but based on the habitat, it is not likely that it is *Nathusius* bat, and in the following text, we described the characteristics related to this statement.

environments and especially in urbanism and semi-urban environments. In our country, it is represented from the coast to 1100m above sea level.

Ecological characteristic for species: The most important ecological elements for this species are lowland thermophilic habitats, but it also inhabits warm mountainous areas. Very connected with human settlements, it inhabits cracks in residential buildings, but also rocks and trees.

Distribution in Montenegro: The species is insufficiently researched in the alpine biogeographical region of Montenegro, but it can be stated that the population density in the Mediterranean bioregion is high.

***Rhinolophus hipposideros* (Bechstein, 1800); Mali potkovičar; Lesser Horseshoe Bat.**

Species data quality: This species is widespread in Montenegro, which can be concluded, both from the literature and from the new findings collected during the field inspection within this project.

This species is found at almost all altitudes from sea level to 1700m above sea level. And in both scopes given by the project task. However, even though it is so widespread, little is known about maternity and even less about hibernation shelters. The largest registered maternity colony of this species so far has more than 215 adults and is located in the house at the entrance to the NP Biogradska Gora, which was never put into function by the so-called visitor centre. It is also the only such large colony known so far in the Alpine biogeographical region. Until 2011, another colony of similar size was known in the school in Tepci, NP Durmitor. However, that colony has not returned to this day, most likely due to the opening of that facility and putting it into operation due to certain needs of the village. In the Mediterranean biogeographical region, the most important maternity colony so far (about 100 adults) is located in an abandoned hotel on the shores of Lake Shasko. Very little is known about hibernation colonies of this species and further research is needed.

Ecological characteristics of species: Due to the relatively well-preserved ecosystems and the application of good agriculture practices, the habitats of this species in Montenegro are still well preserved. The most important ecological elements for this species are thermophilic meadows with linear bushy vegetation as well as open forests as well as gardens, pastures and orchards in the surrounding villages.

Distribution in Montenegro: The species is widespread in both biogeographical regions. According to current literature data, the population in both biogeographical regions can be roughly estimated at 700 individuals because the dynamics of this species have not been well researched. In general, 1/3 of the population is concentrated in the north, while 2/3 of the population is in the Mediterranean biogeographical region. Of course, this estimate does not represent a realistic numerical value because the northern part of the country is scarcer with data.

5.9.3 Critical Habitat Assessment

A Critical Habitat Assessment for the Bar-Boljare Highway - section Mateševu – Andrijevića was performed according to the requirements of EBRD's PR6 - Biodiversity Conservation and Sustainable Management of Living Natural Resources and the relevant guidance note issued in March 2023. The conclusions are summarized as follows (the Critical Habitat Assessment report is annexed to the ESIA report).

All habitats are qualified for Priority Biodiversity Features according to IUCN and Bern Convention criteria. If the EU criteria (applicable to EU member states) are followed, the 91E0 habitat (Alluvial forests with *Alnus glutinosa* and *Fraxinus excelsior* (*Alno-Padion*, *Alnion incanae*, *Salicion albae*)) qualifies as Critical habitat as it is a priority habitat type.

According to the criteria for non-EU member states, no species qualify for critical habitats.

If the EU-member states criteria are applied, several species could qualify as CH. However, all these species are widely distributed in the country. These species are:

- Amphibians: *Bombina variegata*, *Rana graeca*
- Reptiles: *Lacerta agilis*, *Lacerta viridis*, *Podarcis muralis*, *Coronella austriaca*, *Natrix tessellate*, *Vipera ammodytes*
- Mammals: *Canis lupus*, *lutra lutra*, *ursus arctos* and *felis sislvestris*
- All bat species

6 Social baseline conditions

The social baseline conditions relevant to the route before its change has been established and observed in a wider scope than just the physical footprint of the analysed Section. Hence, they remained fundamentally the same given that they relied on the Census 2011 and other reliable resources publicly available, as updated with the data from the 2023¹⁵ Census in the extent released by the National Statistical Office (Montstat). These were coupled with results from field visits and knowledge gained during stakeholder engagement at local level. Where the social baseline has been additionally scrutinized are areas of vulnerable receptors such as physical displacement and resources commonly used by local communities. ... The Route change has minimised prominent adverse impacts which are addressed and elaborated in Chapter 7.2.

Understanding the value or sensitivity of the resources and receptors to impacts and changes was an important consideration when determining the significance of effects and allows for better identification of the most appropriate measures that could be employed to avoid impacts, and to mitigate any adverse impacts.

The methodology deployed for the collection of baseline data was a combination of mutually complementary methodological approach. The methodology was tailored to respond to general requirements of EBRD, the national regulatory and legal framework, methods to bridge gaps between these two, operationalized through *in situ* research and data collection (field visits, public meetings, and key informant interviews) and multifunctional analysis of impacts from the route change on social, physical and spatial parameters and receptors.

The identification of social baseline conditions has considered a wide range of data and information gathered from various sources, including:

- Census of Population, Households and Dwellings in 2023, data from the official Statistical Source MONTSTAT.
- Census of Population, Households and Dwellings in 2011.
- Desk-based studies and literature reviews.
- Data from stakeholders (communication and collection of data from institutional stakeholders)
- Key informant interviews (perceptions, data, and critical information from presidents of all eight local community offices. These have taken the form-guided conversations with key informants where broad questions were asked which did not constrain the conversation, and in which new questions are allowed to arise because of the discussion. At times, this has taken the form of semi-structured interview around predetermined topics and historic issues and concerns the interlocutors have highlighted.
- Direct and indirect observation of the ESIA team. This technique included observations about normal everyday activities of the local communities. The observations were in presence of the ESIA Team, with focus on specific issues and open issues related to adverse impacts of the alignment.

¹⁵ The 2023 Census of Population, Households and Dwellings was implemented as of on October 31st, 2023. At settlement level, only data on population, households and dwellings were published and available for this ESIA¹⁵. Therefore, majority of statistical data that have been used in description of social conditions are based on the Census 2011 updated where possible with primary data received during the site visits. Considering these annotations, each statistical data has a corresponding designation of source i.e. Census. Besides the 2011 and 2023 Census, other sources, such as MONSTAT publications (Statistical Office of Montenegro), various studies available on the Internet, reports and statistics published by the public institutions, scientific and education institutions were used to present the Social Baseline Conditions. The parameters used have covered all those social aspects related to the Project which have been scoped in during the scoping phase, as part of this ESIA (but was not presented as a separate report) and represent those conditions which would prevail in the absence of the Project.

- Public Meetings and site visits in July 2024 as part of the Due Diligence, and verification of the scoping results through active participation of local communities and/or their elected representative.
 - Presentation of the Route change during public meetings in September 2024 by MONTEPUT .
 - Walk over surveys and in situ verification of land acquisition physical displacement impacts (September and December 2024).
- Follow up community meetings on the Route change during December 2-5, 2024.

6.1 Administrative organization

The territorial organization of Montenegro is determined both by the Constitution of the Republic of Montenegro and by a number of other laws, of which the most important the Law on Local Self-Government (OfG.2/18, 34/19 and 38/20) and Law on Territorial organization (OfG 54/2011, 26/2012, 27/2013, 62/2013, 12/2014, 3/2016, 31/2017, 86/2018, 3/2020 and 92/2022.).

Montenegro comprises 25 municipalities (opstina) and the district of Golubovci. (Zeta received municipal status in 2022.). Two municipalities have a special status (the Capital City of Podgorica and the Historic Royal Capital of Cetinje), regulating by the Law on Administrative Capital (Podgorica) and the Law on Historic Capital (Cetinje). The country is also divided into three regions, for statistical purposes: The Coastal, Central and Northern. The regions do not have legislative or implementation power (Regional Development Law, Official Gazette, 2011). Both municipalities on the Mateševo – Andrijevisa Section belong to the Northern region. Both are in the category of smaller municipalities by criteria of population number. According to the Census 2023, municipality of Andrijevisa has 3978 inhabitants, and municipality of Kolašin 6765 inhabitants. Municipalities are further subdivided into settlements (approximately 1310 in MNE), out of which around 50 are urban localities while others are rural communities (villages).

According to the Law on Local Self Government (last amendment in 2014) the competence assigned to the municipalities (articles 32 and 33) are limited with the very few responsibilities in social sectors (primary education, pre-school services/kindergartens, social assistance and elderly care).

Municipalities consist of several urban (cities) and rural areas. Further, municipalities can be divided into smaller cells called "Local communities" (Mijesne Zajednica). In these small cells, as a rule, the basics of services of public interest are provided (four-grade / regional basic schools, including place of "Community Centres", which are founded by a municipality for addressing common needs and interests of citizens in the smaller part of its territory, outpatient clinic (most often with a doctor who comes once or twice a week and a nurse - this service is being organized less and less in villages where the number of inhabitants is decreasing), the church, the local cemetery. These local communities are bodies in which citizens participate in decisions on matters of relevance for their local community. The organization and functioning of the local community in rural areas is of great importance for the life of the local population, since it is the only link of the administrative structure in the state organization in those areas.

Mjesna zajednica is usually established in villages to address local needs and interests in the following areas: administrative organization of settlements, consumer protection, culture, physical education, the environmental protection and improvement. (Art. 153 Law on local self-government) However, *Mjesna Zajednica have few or no legal decision-making authority, but should be deemed as an important place for informing, consulting and interacting with citizens on the subjects regarding their quality of life, including the Project issues and impacts. The socio-economic survey and site visits clearly identified that the people are confident to receive communication through the representative of the*

community. This has been verified during community meetings in July 2024. It is understood that this is the best understanding the makeup of the constituency that it serves, in terms of age, social status, occupation, cultural background, the better it will be placed to gain the trust of citizens. Local media and municipal information services have a role to play in promoting a positive image of the diversity and representative nature of the Mjesna Zajednica which can serve to encourage people from a wide range of backgrounds to actively engage in the Project. The formal local governmental powers reside and remain with the Municipal Government and elected government representatives.



Figure 6-1: Administrative units of Montenegro

The Project impacts areas under administration of two Municipalities: **Kolašin** and **Andrijevica** respectively.

The Municipality of **Andrijevica** is one of the smaller Montenegrin municipalities and is relatively young in the administrative sense. It is located in the north-east of Montenegro and is characterized by a low rate of development. The territory it occupies is predominantly hilly and mountainous, so the structure of the settlement is very scattered. On the one hand, it represents an aggravating circumstance when it comes to the development of municipal infrastructure, while on the other hand, such geographical features provide exceptional opportunities for the development of special sectors of tourism and agriculture. It is surrounded by the natural wealth of the Bjelasica, Komovi and Prokletije mountains and covers an area of 340 km². According to the 2023 Census, there were 3978 inhabitants which is 1.093 persons less (21,6%) compared to the Census 2011. (5.071). According to Census 2011, almost 80% (79,33%) of population in the municipality of Andrijevica lived in rural areas, and only one fifth in the Municipal (urban) centre. In the period between the two Censuses, the number of households has decreased from 1.648 in 2011 to 1.453 in 2023. The Municipality of Andrijevica has 24 settlements organized into **17** local communities. The Project will directly impact **6** local communities and **7** Cadastral Municipalities. Settlements are mostly well connected by road infrastructure and electricity distribution network. The road infrastructure consists of a network of regional and local roads. The city does not have a bus station and public intercity transport is provided by transit lines from neighbouring municipalities. Andrijevica borders the municipalities of Berane and Plav, with which it is connected by a good-quality main road, as well as with the municipality of Kolašin, with which it is connected by the old main road through the Trešnjevik pass. Territorially, it also borders the municipality of Podgorica and the Republic of Albania.

The municipality of **Kolašin** lies in the northern mountainous area of Montenegro at an altitude of 954 m surrounded by mountains: Sinjajevina, Kapa moračka, Maganik, Bjelasica, Vučja and Ključ. The Municipality hosts the National Park Biogradska Gora with the Biograd lake covering an area of 4000 ha. The total area of the territory of the municipality is 898 km², which is 6.42% of the area of Montenegro. The population density is 9.33 persons/Km². The urban settlement occupies the central location of the municipality at altitude of 965m, and a central position in Montenegrin territory. The Municipality has **77** settlements organized into **24** local communities (Mjesne zajednice). The Project directly impacts only **2** local communities and **3** Cadastral Municipalities. According to the Census 2023 the municipality of Kolašin has a population 6765 inhabitants, which is 1615 persons less (19.3%) compared to the statistics from the 2011 Census. The number of households has decreased for 285 i.e. 10.5% (from 2703 to 2418).

Both Municipalities are divided into **Cadastral Municipalities** and the figure below provides an overview of Cadastral Municipalities impacted by the Project and in particular its involuntary land acquisition, restrictions on land and resettlement needs. The Project runs through two administrative municipalities, Kolašin and Andrijevića respectively, and the expropriation spans across 8 Cadastral Municipalities depicted on Figure 6-2 (left hand side before the entrance to the Tunnel Trešnjevik and right-hand side after the Tunnel exit i.e. Route change).

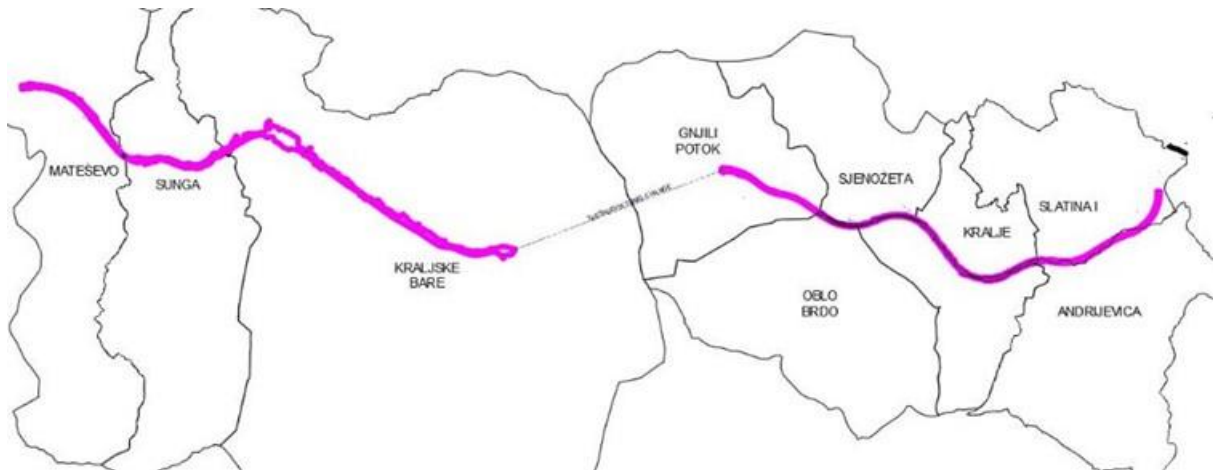


Figure 6-2: Overview of Cadastral Municipalities

In the Municipality of **Kolašin** the impacted CMs are: CM Mateševo, CM Sunga, CM Bare Kraljske, while in the Municipality **Andrijevića** the Project impacts: CM Gnjili Potok, CM Sjenozeta, CM Kralje, CM Slatina I, and CM Andrijevića.

6.2 Settlements on the Mateševo Andrijevića Route

The proposed route is likely to directly impact 8 settlements. The settlements are listed in the table 6-1 below.

Based on geographic and functional indicators, coupled with the analysis of planned and future urban development between the settlements and the migratory patterns the following 4 gravity zones can be identified within the Municipality of Andrijevića: **The first one** is the gravity zone of municipal centre with a total of 12 settlements (Rijeka Marsenića, Trepča, Trešnjevo, Zabrđe, Slatina, Prisoja, Božići, Anželati, Bojovići, Gornje Luge, Gračanica and Ulotina) and a total number of population of 3024 inhabitants by Census 2023 compared to 4,470 inhabitants by Census 2011; **The second one** is the gravity zone of the settlement Kralje with 2 settlements (Sjenozeta, Gnjili Potok) with a total number of 242 inhabitants (Census 2023) compared with 434 inhabitants by Census 2011; **The third one** is the

gravity zone of settlement Dulipolje with 2 settlements (Košutići, Jošanica) with a total number of population of 193 (Census 2023) compared to 439 inhabitants in 2011; and a **fourth one** is the gravity zone of Đulići with a total of 2 settlements (Cecune and Kuti), with total number of inhabitants of 145 (Census 2023) compared with 256 inhabitants in 2011.

Table 6-1: List of administrative units within settlements to be affected by the development

	MUNICIPALITY KOLASIN	MUNICIPALITY ANDRIJEVICA
Primary Area of Influence DIRECTLY IMPACTED by the land acquisition needs	1. Mateševu 2. Bare Kraljske 3. Sunga	1. Gnjlji Potok 2. Kralje 3. Klanac 4. Sjenozeta 5. Prisoja 6. Slatina 7. Salevici 8. Lugovi 9. Protići 10. Most Bandovica 11. Miravcine
Secondary Area of Influence INDIRECTLY IMPACTED	4. Han Drndarski 5. Krgovići 6. Tresnjevik 7. Ravni Brijeg 8. Ljubaštica	12. Zabrdje 13. Trepca 14. Lanista 15. Peovac 16. Oblo Brdo

6.3 Demography

According to the 2023 Census, Montenegro has a total population of 633158 inhabitants, with similar percent of males (49.4%) and females (50.6%) according to Census 2011. It is an increase of 13129 persons (2.1%). That shows that the natural increase of population is still on the positive side although diminishing year after year (compared to 5.5% in 2001 or 2.2% in 2011). Regardless of positive natural increase, the population shows decrease due to emigration trends to foreign countries (-0.34% annually, est. in 2018). Basic demographic indicators in 2022 were¹⁶:

- Natality rate – 11.4 per mille,
- mortality rate 11.5 per mille.
- Infant death per 1000 live birth – 3.8 per mille;
- Under five mortality rate – 4.4 per mille;
- Life expectancy – total 76,2 years, males – 73,7 years, females – 78,8 years. .

However, the most recent formal population census in Montenegro was conducted in 2023 and up to now very few data are published by statistical Office of Montenegro - MONSTAT as the competent body to produce official statistics. National and international public recognizes MONSTAT role as a provider of official statistics in Montenegro's statistical system.

Andrijevića is one of the smaller Montenegrin municipalities and is relatively young in the administrative sense. Andrijevića acquired the status of Municipality in 1991, separating from the

¹⁶ Source: Statistical Yearbook 2023

Municipality Berane. Andrijević covers an area of about 340 km² (population density is 11.7 persons/km²). The 2023 Census captured 3978 inhabitants which is 1093 less (21.6%) compared to the Census 2011. (5.071). According to the Census 2011, 20.7% of population lived in municipal centre, i.e, urban area, while 70.3% lived in rural settlements. The municipality of Andrijević has around 70 villages and hamlets organized in 18 local communities (Mjesna zajednice).

The number of inhabitants in **the municipality of Andrijević** is constantly decreasing, from 9.792 inhabitants as recorded in 1961 to 5.071 inhabitants, as recorded in the 2011 Census and further decreasing to 3.978 inhabitants (recorded in the Census 2023), or for 1.091 persons captured (21.6%) compared to Census 2011. Index of population decline in 2023 was 78,4 (2011 = 100). The number of households decreased for 212 i.e. 12.9% (from 1.648 to 1.435). Index of households' decline was 87.1 (2011 = 100).

Population reduction is a consequence of both negative natural growth and negative growth migration balance faced by this municipality. The exception is 2016, when a positive migration balance has been recorded.

Key demographic contingents, based on the Census 2011, for the Municipality Andrijević are presented in the table below¹⁷. Data at settlement level are not available from the 2023 Census yet and data from the 2011 Census are used.

Table 6-2: Key demography information from 2011 and 2023 of the Municipality Andrijević¹⁸

Demographical data	Total population	Gender		Large age groups		
		Female	Male	0-18	18-65	65+
2011						
Andrijević (Municipal level)	5071	48.45%	51.55%	24.97%	58.23%	16.80%
Andrijević [¹⁹]	1048	53.24%	46.76%	26.05%	61.26%	12.69%
Tresnjevo	461	44.50%	55.50%	6.29%	57.04%	36.67%
Gnjili Potok (settlement level)	87	41.38%	58.62%	24.14%	59.77%	16.09%
Kralje (settlement level)	205	49.76%	50.24%	21.95%	60.98%	17.07%
Kuti (settlement level)	30	33.33%	66.67%	16.67%	66.67%	16.67%
Oblo Brdo (settlement level)	54	40.74%	59.26%	14.81%	53.70%	31.48%
Prisoja (settlement level)	339	47.79%	52.21%	30.97%	57.82%	11.21%
Seoca (settlement level)	104	43.27%	56.73%	24.04%	59.62%	16.35%
Sjenozeta (settlement level)	56	60.71%	39.29%	19.64%	60.71%	19.64%
Slatina (settlement level)	449	50.78%	49.22%	28.29%	56.57%	15.14%
Andrijević (Municipal level)	3978	N/A	N/A	N/A	N/A	N/A
2023						
Andrijević [²⁰]	988	N/A	N/A	N/A	N/A	N/A
Tresnjevo	367	N/A	N/A	N/A	N/A	N/A
Gnjili Potok (settlement level)	43	N/A	N/A	N/A	N/A	N/A
Kralje (settlement level)	168	N/A	N/A	N/A	N/A	N/A
Kuti (settlement level)	20	N/A	N/A	N/A	N/A	N/A
Oblo Brdo (settlement level)	32	N/A	N/A	N/A	N/A	N/A
Prisoja (settlement level)	566	N/A	N/A	N/A	N/A	N/A
Seoca (settlement level)	93	N/A	N/A	N/A	N/A	N/A

¹⁷ Source: Monstat: <https://monstat.org> - Montenegro population census 2011.

¹⁸ Source: Employment Strategy of Andrijević 2021-2025 <https://opstinaandrijevic.me/wp-content/uploads/2021/04/Andrijevic-Strategija-zaposljavanja-nacrt-10-02-2021-1.pdf>

¹⁹ Only settlements impacted by the Construction/operation activities are listed

²⁰ Only settlements impacted by the Construction/operation activities are listed

Sjenozeta (settlement level)	31	N/A	N/A	N/A	N/A	N/A
Slatina (settlement level)	20	N/A	N/A	N/A	N/A	N/A

The number of inhabitants in **the municipality of Kolašin** is also constantly decreasing. From 14,882 inhabitants as recorded in 1961 to 8,380 inhabitants, as recorded in the 2011 Census and further decreasing on 6765 inhabitants (recording in the Census 2023), or for 1615 persons captured (19.3%) compared to Census 2011. Index of population decline in 2023 was 80.7% (2011 = 100). The number of households decreased for 285 i.e. 10.5% (from 2703 to 2418). Index of households decline was 89.5 (2011 = 100).

The population density in the territory of the municipality of Kolašin (which covers an area of 898 km²) is 7.5 inhabitants/km², which makes it scarcely populated municipality.

Key demographic contingents for the Municipality of Kolašin are presented in the tables below²¹.

Table 6-3: Key demographic data of the Municipality of Kolašin from 2011

Demographical data	Total population	Gender		Large age groups		
		Female	Male	0-18	18-65	65+
Kolašin(Municipal level)	8380	49.53%	50.47%	23.28%	59.70%	17.02%
Mateševo (settlement level)	68	54.41%	45.59%	25.00%	51.47%	23.53%
Bare (settlement level)	78	44.87%	55.13%	21.79%	55.13%	23.08%
Bare Kraljske (settlement level)	175	44.00%	56.00%	20.00%	50.86%	29.14%

Table 6-4: Key demographic data of the Municipality of Kolašin from 2023

Demographical data	Total population	Gender		Large age groups		
		Female	Male	0-18	18-65	65+
Kolašin(Municipal level)	6765	N/A	N/A	N/A	N/A	N/A
Mateševo (settlement level)	50	N/A	N/A	N/A	N/A	N/A
Bare (settlement level)	71	N/A	N/A	N/A	N/A	N/A
Bare Kraljske (settlement level)	70	N/A	N/A	N/A	N/A	N/A

Roma, Ashkali and Egyptian population

The 2011 census counted 6251 Roma and 2054 Egyptians (Ashkali are presented as Roma in the census), i.e. around 1.3 % of total population. However, the available data cannot be considered as accurate statistics to establish the actual number of the Roma population. The phenomena of “ethnic mimicry” make it difficult to determine the real number of Roma population within the community. Thus, the real number of Roma permanently settled in Montenegro is certainly higher than the number officially reported. The presence of Roma in Montenegro was increased after the outbreak of the war in former Yugoslavia. The Roma minority constituted the third largest group with 7479 persons or 25.7% of all refugees and displaced persons. In reality, this figure is probably even higher, due to the Roma attitude to identify themselves as members of other ethnic groups like Montenegrins, Serbs or Muslims. Some estimation of the number of Roma ethnic group population living in Montenegro indicates that the number of between 12-15000 would be more accurate, meaning between 2 and 2.5% of total population, or even more: according to estimation of World Bank the Roma population in Montenegro is closer to 20.000 (3.3% of population).

²¹ Source: Monstat: <https://monstat.org> - Montenegro population census 2011.

During the 2011 Census none of the surveyed citizens in the Municipalities of Andrijeviča and Kolašin has declared as a member of Roma ethnic group. The shadowed presence of Roma is in general prevalent as a significant number of Roma ethnics are often not captured by the survey for different reasons: living in remote or ghettoized part of the cities below poverty line, not being available for census, avoiding census out of fear, minor pregnancies not being reported by parents etc, so unofficial estimates put their actual number to be twice or three times as high.

The Socio-economic survey and stakeholder engagement activities in particular with representatives of local communities confirmed *no presence of Roma households or communities in general* in the area of influence. However, whether Roma are potentially present as private owners affected by land acquisition and resettlement cannot be conclusively ruled out at this point and will be confirmed during development of the Land Acquisition and Resettlement Plan (LARP).

6.4 Households

The number of households has been declining in both municipalities as well as in all impacted local communities. Most of the households are small average in size, of fewer than three persons per household with the exceptions in the villages of Kralje (3,4 members per household), Slatina (4 members, but the total number of households is very low), and Tresnjevo (3 members per household in average). Most of the small sized households single and/or two-members (elderly without members below 65 years. The composition, or membership, of households has important consequences also for the well-being of families and individuals. Those households are facing multiple difficulties in everyday life: loneliness, lack of support in performing everyday household chores, limited availability of medical service because of old age and reduce mobility and lack of public transport, maintenance of home hygiene, and basic supply challenges etc. Their position is particularly difficult during winter months. All of those villages are in mountainous areas, without public transport and are therefore poorly connected to the municipal centre with reliance on taxi services or private car transport facilitated by relatives or neighbours.

Table 6-5: Number of population, households and average size of households in impacted LC

Settlement	Number of inhabitants	Number of households	Average size of households	Number of dwellings
Municipality of Kolašin	6765	2.418	2.8 members	5.631
Bare Kraljske	70	28	2.5 members	129
Mateševo	50	20	2.5 members	91
Municipality of Andrijeviča	3978	1435	2.8 members	3.325
Gnjili Potok	43	20	2.2 members	70
Kralje	168	50	3.4 members	100
Sjenozeta	31	16	1.9 members	30
Slatina	20	5	4.0 members	74
Andrijeviča (municipal center)	988	352	2.8	517

Source: Census 2023.

6.5 Religion

The Constitution of Montenegro provides for freedom of religion as well as the right to change one's religion. It specifies there is no state religion and stipulates equality and freedom for all religious communities. The Census conducted in 2011 and 2023 (results of which are not yet available) included methodologically collection of these data, however persons were not obliged to answer on ethnicity,

on neither religion nor mother tongue. These would be covered under the “undeclared” responses. The law prohibits religious discrimination and hate speech. According to the 2011 Census, approximately 72 percent of the population is Orthodox. The decennial 2011 Census reports 19.1 % of the population is Muslim, 3.4 % Catholic, and 1.2 % atheist. In addition, 2.6 % of respondents do not report a religious preference, and several other groups, including Seventh-day Adventists (registered locally as the Christian Adventist Church), Jehovah’s Witnesses, other Christians, Buddhists, and agnostics, together account for less than 1 percent of the population. According to the World Jewish Congress, approximately 400 to 500 Jews live in the country.

Survey data reflect there is a strong correlation between ethnicity and religion: ethnic Montenegrins and ethnic Serbs are predominantly associated with Orthodoxy, ethnic Albanians with Islam or Catholicism, and ethnic Croats with the Catholic Church. Many Bosniaks (ethnic Bosnians who are Muslim) and other Muslims live in the northern towns of Rozaje, Pljevlja, Bijelo Polje, Petnjica, Plav, and Gusinje near the border with Serbia and along the eastern and southern borders with Kosovo* and Albania.

Table 6-6: Religious groups in the Project area

	Total	Orthodox	Catholics	Islam	Adventist	Agnostic / Atheists
Andrijević (Municipal level)	5071	4909	6	8	4	0
Kolašin Municipal level	8380	7795	28	45	7	80

Source: MONSTAT, Population Census in Montenegro 2011 data from 2023 are not available

6.6 Gender

Montenegro has made strides in promoting equality between men and women, but gender disparities still exist. In certain cases, such gender differences highlight barriers to wellbeing for a particular group. For instance, females live longer than males while male workers earn more than females, on average. The Government of Montenegro has made progress in bringing attention to gender issues through measures such as instituting the Department of Gender Equality and Gender Equality Offices and the creation of the Action Plan for Achieving Gender Equality. Nonetheless, significant gender inequalities remain²². Key areas of concern are (i) agency, including violence against women and a lack of female representation in leadership; (ii) gender gaps in access to economic opportunities; and (iii) low educational attainment for particular population groups. Analysis undertaken for this gender assessment provides additional insights into gender gaps in Montenegro.

Agency. Significant gender gaps persist in agency. Women are still underrepresented at all levels of government. For example, in 2022, 22 women were elected as representatives in the Parliament (27% of total number of representatives in Parliament), and in the current convocation (2024) that number was reduced to 17 women (14.8% of total number of representatives). There are only three women in the position of minister in the Government of Montenegro, while the number of women in lower positions is increasing. Not one of the nine electoral lists included in the last convocation of the MNE Parliament at the constitutive session had 30% women, which is mandatory according to the Law on the Election of Councillors and Members of Parliament ("Official Gazette of the Republic of Montenegro", No. 16/2000, 109/2020). The education sector is most often cited as an example.

²²<https://openknowledge.worldbank.org/bitstream/handle/10986/21827/786780WPOP13340ic0June020130Revised.pdf?sequence=1&isAllowed=y>

Despite the fact that women in educational institutions are in the absolute majority, very few of them are in the positions of directors of educational institutions or deans of faculties. Men also hold more leadership positions in the media and there are perceptions that the media reinforces gender stereotypes.

Women and gender issues. Gender equality is guaranteed under the Montenegro Constitution and legislation, there are significant residues of gender inequality (higher percentage of illiteracy, lower percentage of women headed households, lower percentages of activity and employment etc.) Furthermore, women's wages are lower than those of men for comparable work. Women have the same legal rights as men in property law, family law, and the judicial system etc; however, in practice women do not enjoy equal social status with men. Traditional patriarchal ideas of gender, which maintain that women should be subservient to male members of their families, persisted and resulted in continued discrimination against women in the home. In rural areas, women cannot always exercise their right to control property, and husbands occasionally directed their wives' voting.

Women are often less educated than men: with no education (not enrolled or not finished elementary school), only elementary school M:15.6%/W:**19.5%**, all types of high school education M:64.5%/W:**40.7%**, higher education M:17.3%/W:**20.5%** (when a certain point of emancipation is passed, women tend to be more successful of acquiring highest forms of education than men). Very low number of women are able to reach managerial and senior officials positions, only 2.9%.

In comparison with the **Gender Equality Index** in EU member states (which is measured through six domains: work, money, knowledge, time, power, health) and has values on a scale from 1 to 100, (where 1 represents complete inequality, while the value 100 shows complete equality), Montenegro had an index of 59.3 for 2023, which shows an increase of 4.3 index values compared to the index from 2019. In 2023r, the EU-27 Gender Equality Index was 68.6, which means that in Montenegro the Index was 9.3 index points lower than the EU-27 average. The index of the main domains of gender equality shows that in MNEs the biggest gap in inequality is in the area of money (20.7 index points below the EU-27 average), while the smallest gap is in the domain of health (a low value of 0.8 index points in compared to the EU-27 average). (Source: MONSTAT, ANNOUNCEMENT 100/2023).

The Law on Domestic Violence Protection prescribes mandatory psychosocial treatment as one of the protective measures imposed on perpetrators of violence. Mandatory psychosocial treatment can be imposed on the perpetrator of violence in order to eliminate the causes of violent behaviour and re-education, that is, in order to reduce and eliminate the risk of committing violence again. The protective measure lasts until the end of the reason for which it was issued, but not longer than six months. The detailed method of determining and implementing protective measures is prescribed by the ministry responsible for social welfare affairs. In 2013, the Ministry of Labor and Social Welfare issued a Rulebook on the closer method of determining and implementing the protective measure of mandatory psychosocial treatment, which is not fully aligned with the standards prescribed by the Istanbul Convention, and is therefore part of the National Plan for the Implementation of The Council of Europe Convention on preventing and combating violence against women and domestic violence for the period 2023-2027, the adoption of a new one is foreseen. Also, the National Plan foresees the creation and implementation of training for experts to work with perpetrators of violence, as well as the implementation of programs for perpetrators of violence that are not exclusively based on medical treatment of substance abuse and mental problems, and the establishment of mandatory guidelines for psychosocial treatment programs defined in Article 20, paragraph 5 and Article 25 of the Law on Protection against Domestic Violence

Regarding violence against women evidence suggests that it is a pervasive problem but goes widely unreported in Montenegro, as in many other countries. Data on other forms of violence (against

children, person with disabilities, poor, etc., are incomplete and not substantially differentiated. No systematic research of these important issues was identified.

Health. Key health indicators for Montenegro suggest a number of substantial gender gaps in this area. Both female and male life expectancies are falling further below EU averages. Adolescent fertility rates are moving towards the EU average. However, only 33 percent of women report regular gynaecological check-ups and there is wider concern that women do not engage in preventative health care. However, nearly all pregnant women (97% in 2006) receive prenatal care. Maternal mortality is low, it is estimated that 8 women per 100,000 live births died during pregnancy and childbirth in 2010. Little is known regarding men's use of preventative health care. Utilization of preventative care, psychological distress, and domestic violence are areas of concern for female wellbeing in Montenegro. Higher rates of alcohol abuse, higher smoking rates, and risky sexual behaviour are issues particular to men. The other gender disparities exist with regards to health; however, women's use and access to health care and reports of high rates of psychological distress among women are areas of concern: Forty-five percent of females and 39 percent of males were found to experience psychological distress.

Access to economic opportunities. Activity rate in 2022 was 58.9% (males – 65.9%; females – 52.1%). The lowest activity rate is in the Northern region (46.4%; 55.4%; and 37.3% respectively). Employment rate in 2022 was 50.3% (males – 55.2%; females – 45.4%) and was lower in the Northern region (30.5%; 35.5%; and 25.5% respectively). The average unemployment rate was 14.7% (males – 16.2%; females 12.8%), and as expected the highest is in the Northern region – 34.1% (males – 35.8%; females – 31.6%). (Source: Labour force survey, Montenegro in figures, 2023. Montenegro Statistical Office, Podgorica 2023). Much of the inactivity gap is explained by large gender disparities experienced by rural people. Economic inactivity is especially high among women with primary schooling or less, ethnic minorities, and older women. Overall, women spend more time caring for their families and children, which contributes to reducing their opportunities to participate in the labour market in the absence of alternative childcare options. There is little difference between male and female unemployment rates in Montenegro in 2022 (16.2 percent and 12.8 percent respectively), but high rates of unemployment occur among younger workers (of individuals 15 - 24 years, 51% of females and 43% of males). Both male and female workers experience high rates of long-term unemployment. Average wage without taxes and contribution in 2022 was 712 EUR. Among those who work, a clear wage gap exists, with women earning 13.9 percent less than men. (Data in 2019. [Cin-cg.me/nejednake-plate-zenama-u-odnosu-na-muskarce-diskriminacija-i-po-novcaniku](https://cin-cg.me/nejednake-plate-zenama-u-odnosu-na-muskarce-diskriminacija-i-po-novcaniku)) This gap is not explained by workers' characteristics (e.g., education and experience) but rather by unobserved factors, of which traditional values may play a role. Finally, women self-employ is less compared to males and have lower rates of firm ownership and management.

Education. On average, Montenegro has achieved gender equality in school enrolment. However, in terms of educational attainment, gender disparities exist for some population subgroups. In particular, gender gaps in educational attainment are higher among those not in the labour force – suggesting that the lack of education might represent a barrier to jobs as well as among people in rural areas. On the other side, tertiary enrolment of women has grown rapidly in the past two decade compared to significantly lower enrolment for men: 2010 enrolment rates were 53% for women and 43% for men. In 2022, faculty graduates on basic studies were 974 males and 1458 females. The higher number of female students compared to males was also recorded on specialists, masters and doctor's studies. The number of females in student's dormitories is significantly higher compared to males (1032 and 685 in 2022/2023 respectively). There is evidence of gender segregation in fields of study – with potential impact on labour market outcomes. Male graduation is more focused toward mathematics-, engineering-, and science-related fields than female graduation. The preferences and constraints that potentially affect gender differences in educational decisions are discussed. Regarding the number of

students on basic studies by place residence in 2022/2023, 86 were from the municipality of Andrijeviča and 173 from the municipality of Kolašin.

Policy. Policy to address the gender issues of most concern to human wellbeing in Montenegro should be based on greater research in the following areas: (1) measuring and reducing violence against women; (2) identifying and remedying barriers to equality which relate to lower female labour force participation, earnings, and the attainment of leadership positions; (3) addressing disparities for particular to subgroups of the female population, like low primary education attainment among minorities and rural women and poor health among Roma females; and (4) addressing the low use of preventative health care and high reported incidences of psychological distress among both men and women. Additionally, a number of differences in gender outcomes require further study, including a) the reasons for higher tertiary education enrolment among women (and the potential long-term implications of this); b) the factors related to gender differences in field of study and occupation; and c) the factors underlying the high long-term employment rates for both male and female workers. Research for this report suggests that there is a lack of NGO's working on issues focusing on men, including increased suicide cases, poor health and psychological problems. Data on the prevalence of these men's issues and measures to address them is needed.

6.7 Labour and Working Conditions

MAIN DIFFERENCES and CHALLENGES

- In summary, the national legislation is partially aligned with PR2 in a few minor areas.
- There are no explicit prohibitions of quid pro quo explicitly quid pro quo sexual harassment.
- Harmonizing the definitions of sexual harassment throughout its legislative framework.
- Actively prevent and address sexual harassment at work, including any awareness-raising activities; and (ii) provide information on any cooperation with workers' and employers' organizations in this regard
- In 2022 2570, inspection audits were conducted. 2981 irregularities identified the most common of which were: Informal labor, employment of foreigners without residence and work permit, delay in payment of salaries and payment of contributions for compulsory social insurance, Employment of children (aged 15 to 18) in informal work, mainly during the holiday season in coastal resorts, failure to provide employees with adequate tools for work with an OHS certificate, Not providing workers with PPE; workers working without a certificate of competence for safe work; workers working without medical certificates confirming their medical fitness for work with increased risk, Record keeping failure, Failure to conduct a risk assessment for all jobs.
- During 2022 six workplace fatalities were identified, 4 grave and 2 collective workplace injuries, which is a decrease of 68, 57% compared to 2008. Which had the highest fatality and workplace incident rate ever.

In summary, there are a few minor areas in which the national legislation is partially aligned with PR2. Employers must pay all outstanding wages, compensations, social security benefits, and other incomes earned by the employee until the day of termination of employment; however, the LL allows employers to make the aforementioned payments within 30 days from the day of termination at the latest, which is not aligned with the PR2. Regarding overtime, employees may work over 40 hours a week if a suddenly increased workload cannot be completed by an appropriate organization of work and working hours, in case of a force majeure and in other exceptional circumstances. The overtime work may last only as long as necessary but, in general, it should not require work over 48 hours a week (but it can go up to 50 hours) within a period of four months. Exceptionally, collective agreements may provide that overtime work per year can be 250 hours per annum. The LL does stipulate the right to increased pay for overtime work but does not provide for the rate. The LL allows

redistribution of hours if so required by the nature of the job, better or more rational use of resources, and the like. Accordingly, employees may work longer hours during one period and shorter hours during another period, but the working hours cannot be longer than determined in the employment contract. The redistribution of hours cannot last less than one month nor more than six months per annum. Employees working overtime due to redistribution of hours may not work more than 48 hours a week. Exceptionally, overtime work in such situations may last up to 54 hours per week or up to 60 hours per week for seasonal workers. Finally, there are no specific provisions requiring employers to conduct an appropriate risk assessment prior to the work commencement by minors; however, employers are under the general obligation to issue a risk assessment enactment for all workplaces, to determine the methods and measures to eliminate any risks and ensure their implementation.

While the OHS regulations address the main PR2 requirements related to occupational health and safety, coverage of certain requirements is partial. Although the law provides for OHS representatives and OHS boards and allows employees and their representatives to give suggestions and information, initiate measures and demand inspection, the Law does not require a balanced representation of women on OHS committees to help design policies responding to the needs of female project workers. Regarding occupational health and safety trainings, employers are obliged to train employees in safe work in accordance with the law. The employers cover the cost of trainings. The trainings should be organized during working hours if they are related to OHS or upskilling; however, there is no requirement for employers to keep training records. Neither the Labor Law nor the Law on Safety at Work addresses contractors' OHS responsibility. However, employers are under the obligation to ensure that the planning and introduction of new technologies is the subject of consultations with the employees or their representatives in charge of health and safety at work (hereinafter referred to as the employees' representatives) about the choice of work equipment, the working conditions, the working environment and their implications for health and safety at work. Finally, in the event of a serious and imminent threat to life and health, employees may take appropriate measures in accordance with their knowledge and technical means at their disposal. In case of unavoidable danger, they are entitled to leave the dangerous workplace, work processes or work environment and will not be held liable for any damage that may occur, unless they had acted in a careless or negligent way. Prohibition of retaliation is not explicitly mentioned neither in the LL nor in the OHS.

Occupational Health and Safety (OHS) in Montenegro is regulated mainly by the Law on Protection and Health at Work, in conjunction with numerous implementing regulations. The provisions of this Law apply to all employees working in the territory of Montenegro, for legal entities and entrepreneurs in all sectors, and for state and local administration. Also, this Law applies to employees who are sent to work abroad, if the regulations of the receiving country provide fewer occupational safety and health protection measures from those provided by this Law. This Law is based on the occupational safety and health regulatory approach underpinned by the European Framework Directive on Safety and Health at Work (Directive 89/391 EEC). Since 2022 the OHS inspectorate is a separate Labor inspectorate Department. The results of the analysis of the ratio between the number of labor inspectors and the number of employees, based on ILO data on the total number of labor inspectors, indicate that the situation in Montenegro is somewhat more favorable than in other European countries. In Montenegro there are 23 labour inspectors per 100,000 employees.

In the legal system of Montenegro, the basis for regulation of harassment at work is the constitutional guarantee concerning the prohibition of discrimination and the equality of men and women. In this sense, Article 8 paragraph 1 of the Constitution¹ prohibits "direct or indirect discrimination on any grounds". Furthermore, Article 18, on "gender equality", prescribes that the state "shall guarantee the equality of women and men and shall develop the policy of equal opportunities". Finally, Article 28 paragraph 3 prescribes that "no one shall be subjected to torture or inhuman or degrading treatment". Labor issues are regulated by Articles 62–67 of the Constitution and refer to: (1) the right to work, (2)

prohibition of forced labour, (3) rights of the employed, (7) social councils, (8) strike action and (9) social security.

The Law on the Prohibition of Discrimination,² as the main anti-discriminatory regulation, prohibits (in Article 2 paragraph 1) any form of discrimination, on any grounds.

Sexual harassment, pursuant to this Law, “shall represent any unwanted verbal, non-verbal or physical conduct of a sexual nature intended to or actually undermining the dignity of a person seeking employment, as well as employed persons, particularly when such behaviour causes fear or creates a hostile, humiliating, intimidating, degrading or offensive environment”. It is important to note that, in line with Article 10 paragraph 4 of the Labour Code, employees must not suffer damaging consequences if they report or testify to harassment or sexual harassment at work. Abuse at workplace (bullying) is regulated by Article 14 of the Labour Code, which prohibits any form of abuse at the workplace (bullying), or any conduct towards an employee or a group of employees of an employer which is repeated, and which is intended to or actually undermines the dignity, reputation, personal and professional integrity, or position of an employee, which causes fear or creates a hostile, humiliating or offensive environment, aggravates working conditions, or leads an employee to become isolated or induces an employee to terminate the labour contract on their own initiative. Prohibition of abuse at the workplace (bullying), measures for prevention of abuse, the procedure for protection of persons exposed to bullying, as well as other issues relevant for prevention of and protection against bullying at work and in connection with work shall be regulated in more detail by a special law.

Based on the Law on the Prohibition of Harassment at Work, the Rulebook on Codes of Conduct for Employers and Employees Regarding Prevention and Protection from Bullying⁶ has been adopted, listing forms of behaviour to be avoided, including: (1) inability to mutually communicate, (2) violation of interpersonal relations, (3) violation of personal reputation of the employee, (4) violation of personal integrity of the employee, (5) violation of the health of the employee, (6) other behaviour that may be considered harassment and (7) sexual harassment.

From the aforementioned, it is clear that the legislator in Montenegro has launched certain measures and initiatives for the purpose of raising awareness in the area of prevention of violence and harassment at work. (a) violence and harassment in the world of work are addressed in relevant national policies, such as those concerning occupational safety and health, equality and non-discrimination, and migration There is a Strategy for Occupational Safety and Health in Montenegro for the period 2016– 2020 with an Action Plan for its implementation. However, this Strategy does not include issues related to violence and harassment in the world of work. (b) employers and workers and their organizations, and relevant authorities, are provided with guidance, resources, training or other tools, in accessible formats as appropriate, on violence and harassment in the world of work, including on gender-based violence and harassment Educational workshops for employers and employees related to violence and harassment in the world of work, as well as occupational safety and health at work, have been organized in the past by the Ministry of Labour and Social Welfare. (c) initiatives, including awareness-raising campaigns, are undertaken²³

Security personnel. The Law on protection of persons and assets regulates all activities in the field of private security. The applicable laws on labor regulate working conditions for Security Workers. Only companies licensed can provide security services. No gaps there in the legal requirements. Implementation may vary. While the law requires security service providers to be adequately trained in the use of force and appropriate conduct toward workers and affected communities, there may be variations in the actual training provided. While the law outlines clear requirements for obtaining a

²³ Comprehensive Comparative Analysis of Montenegro’s Current Legislation on Violence and Harassment and the Provisions of ILO Convention No. 190

license to provide security services, including background verifications, there may be limited enforcement mechanisms in place to ensure compliance. This could result in some security companies operating without fulfilling the necessary background checks, undermining the integrity of the licensing process.

6.8 Employment

In the 2022, active population²⁴ of Montenegro consisted of 294.4 thousand (46% of total population), of which there are 251.2 thousand or 85.3% employed and 43.2 thousand or 14.7% are unemployed persons. The inactive population consists of 219.9 thousand persons (35.3% of total population). The unemployment rate shows constant decrease in previous years, as table below shows:

Table 6-7: Unemployment population and rates in Montenegro

Year	Unemployed ²⁵ persons			Unemployment rate		
	Total	Men	Women	Total	Men	Women
	in 000			in %		
2012	49.4	26.8	22.6	19.7	19.3	20.3
2013	48.9	27.8	21.1	19.5	20.0	18.8
2014	47.5	25.9	21.6	18.0	17.8	18.2
2015	47.2	26.0	21.1	17.6	17.7	17.3
2016	48.3	27.5	20.8	17.7	18.2	17.1
2017	43.9	23.4	20.6	16.1	15.4	17.0
2018	42.5	23.9	18.5	15.2	15.2	15.1
2022	43,2		17.0	14,7		12.8

In Montenegro, the labour force participation rate among females is 47.8% and among males is 63.6% for 2019.

The labour force participation rate is the proportion of the population ages 15 and older that is economically active. Since 1990, female labour force participation has increased. Compared with labour force participation in the upper-middle income group, the gap between men and women is lower in Montenegro.

²⁴ The term "active and inactive population" refers to the population of Montenegro between 15 and 74 years of age. Active population are either employed, or unemployed but actively searching for an employment during last four weeks from the day the survey is taking place. The table below shows the number of unemployed persons and unemployment rates by gender in Montenegro.

²⁵ The number of unemployed and their respective percentages doesn't include inactive population and population below 15 and above 74 years of age.

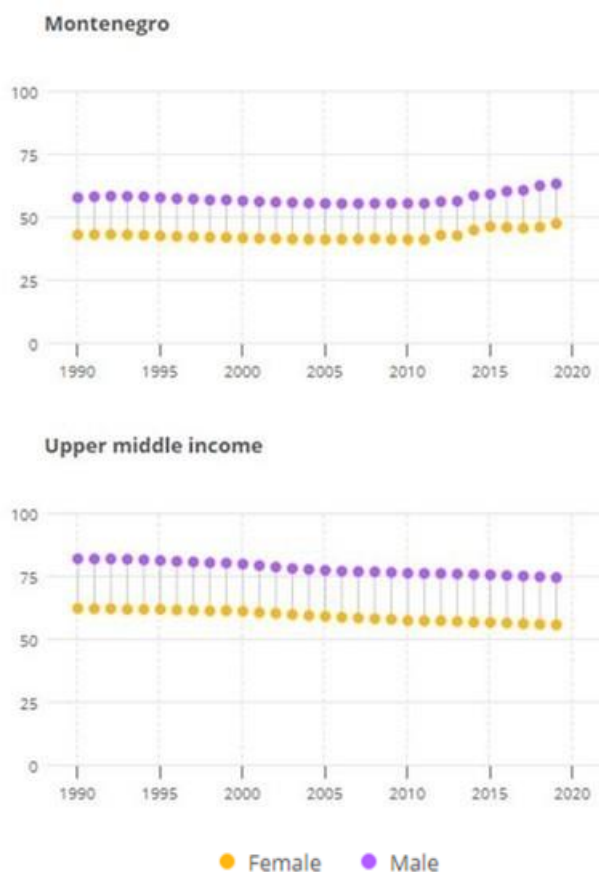


Figure 6-3: Female – male gap in employment (upper middle income and national level)

Source: <https://genderdata.worldbank.org/countries/montenegro/>

Vulnerable employment among women has remained nearly the same since 1991. Workers in vulnerable employment are the least likely to have formal work arrangements, social protection, and safety nets to guard against economic shocks; thus, they are more likely to fall into poverty. Vulnerable employment among women is 8.6% and among men is 17% in Montenegro for 2019. The rate of vulnerable employment is similar for men but lower for women in Montenegro.

The Table below shows employment rates in Kolašin and Andrijevičica compared to the national average level:

Table 6-8: Employment rates in Montenegro 2021

		Montenegro	Kolašin	Andrijeva
Active population	In 000	279.9	100.4	1.434
	Rate ²⁶	56%	68.6% ²⁷	
	Female %	48.1%	61%	
Inactive population	In 000	219.9	46.0	
	Rate	44%	31.4%	
	Female %	51.9%	39%	
Employed	In 000	237.4	90.7	0.807
	Rate	47.5%	62%	
	Male	133.2	48.5	
	Female	104.2	42.2	
Employed male/female ratio		1,27	1.14	
Unemployed ²⁸	In 000	42.5	9.7	0.627
	Rate	15.2%	9.7%	
	Female %	15.1%	8.5%	

There is a high inactive population rate of the labour force (persons of working age not looking for a job actively at least during previous four weeks since the survey took place). Reasons are sometimes inability to find work for a larger period. There is a long searching period for work.

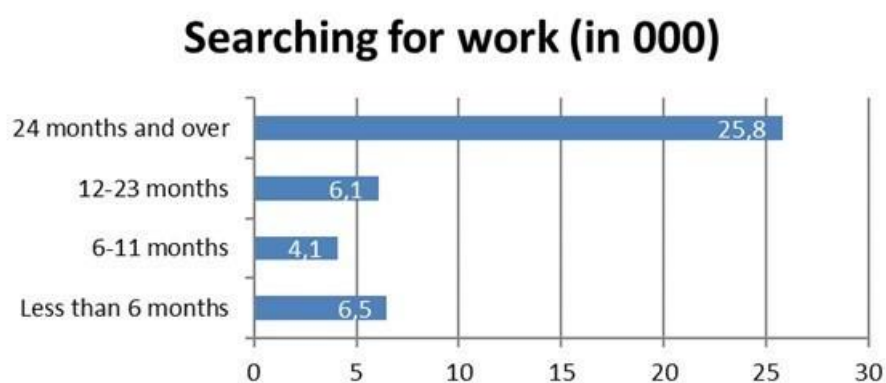


Figure 6-4: Time waiting for employment

Many of these persons are close or below poverty line and as such should be further identified through the detailed socio-economic survey to confirm whether they are to be considered vulnerable. The RAP will take into consideration the PAPs with under the category of long period of employment search and explore whether these are drivers of vulnerability. Notwithstanding these persons along with the ones listed below should also be considered as a priority group in the Contractor's Employment Plan.

²⁶ Calculated out of population older than 15 years and younger of 74 years of age.

²⁷ Hereafter, the positive trends in certain data in tables or text will be presented in green colour, and negative trends in red color letters. The positivity or negativity of a data should be regarded as relative and will be usually evaluated by comparing it to Montenegro national averages, to international trends, or to negative or positive trends in the society.

²⁸ Calculated out of active population

Members of the local partnership for employment determined the following groups that are in the most disadvantaged position on the local labour market:

- Single parents with children below 15 years.
- Persons with disabilities.
- Long-term unemployed persons (especially registered in the records of the Labor Bureau for over 3 years).
- Women over 35 years of age (especially without work experience).
- Unqualified persons.

The latest data provided during the socio-economic survey and baseline identification and stakeholder engagement activities show the below data on employment per sector national vs municipal.

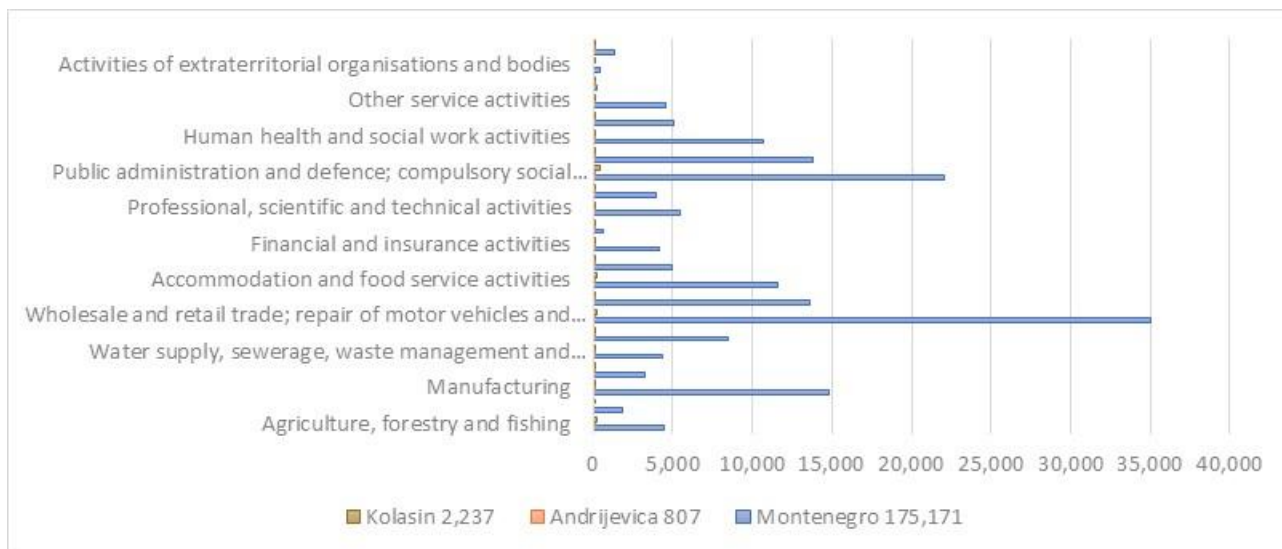


Figure 6-5: Employment per sectors (national vs municipal)

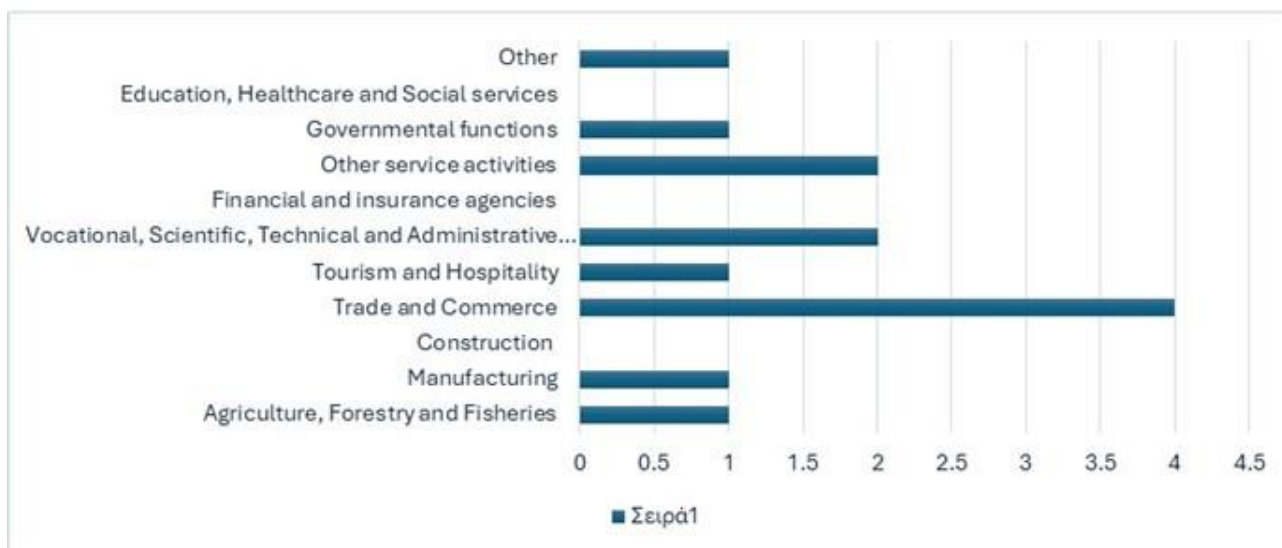


Figure 6-6: Employers based on sectors of ownership



Figure 6-7: Employment by occupation – national vs municipal

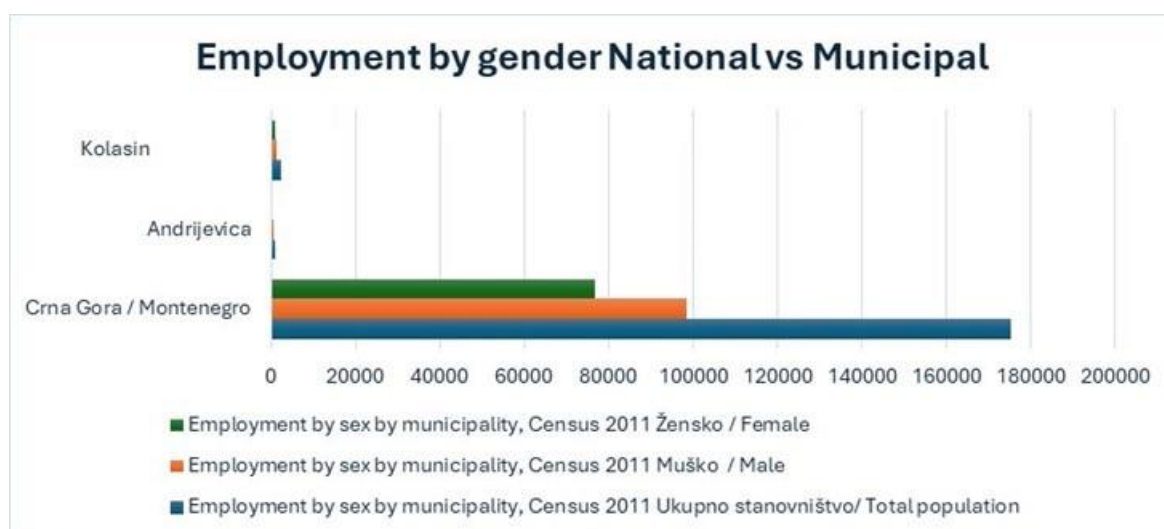


Figure 6-8: Employment by gender (national vs municipal)

6.9 Migration (emigration and immigration)

During the end of 20th century and the beginning of 21st century, Montenegro suffered loss of population by emigration. The reasons for the emigration of the population can be found in the low level of economic development and wars that took place in ex-Yugoslavia countries (1991-1999). The negative trend of the migration balance was somewhat reduced and amounted to 16,442 population decrease by migrations²⁹. During recent years, migration balance of Montenegro rouse again to reach 2400 decrease of population due to economic migration per year³⁰. It is estimated that presently close to 70,000 Montenegrins lives and work abroad.

The population decrease by emigration is not impacting all regions and all municipalities of Montenegro in the same way. Due to internal migrations, municipality of Podgorica is constantly experiencing increase in population over recent years by positive net migrations (1418 net increase of population by migration in 2018), mostly for economic reasons and education.

²⁹ Source: Monstat: <https://monstat.org>; publication: Demographic trends in Montenegro, published March 2014.

³⁰ Source: World Bank Data: https://data.worldbank.org/indicator/SM.POP.NETM?year_high_desc=true

According to UNHCR's Statistical Online Population Database in 2017, there were 12813 "persons of interest"³¹, mostly in the municipalities of Podgorica, Herceg Novi and Bar. However, only 163 persons (from Syria, Iran etc.) can be attributed to the recent refugee international crisis. As per Montenegro law, these refugees seek asylum but, in most cases, during administration waiting process, continue their journey further to Western Europe countries. Most of "persons of interest" are still unresolved cases of refugees and IDPs of ex-Yugoslavia 90's wars. Some of them lived in refugee camps in Podgorica (Konik I and Konik II) in reportedly poor conditions, but these camps were finally closed by the end of 2018. There are no refugee or IDP camps or settlements on the route that might be impacted by construction or operational facilities. Notwithstanding, Andrijevića host one residential area hosting IDPs

Although the Montenegro government adopted an "Act on permanent resolution of the status of IDPs" in 2011, there are still significant number of persons with an unresolved status. The total number of persons with approved permanent residence in the territory of the municipality of Andrijevića is 106 and in the territory of the municipality of Kolašin 103. There are no persons with approved temporary residence in these municipalities.

When it comes to internal migration, in 2019, most residents from Andrijevića moved away to Berane (42), Podgorica (40), Budva (15), Kotor (6), Herceg Novi (5) and significantly less to other cities (e.g. Tivat, Plav, Bar, Bijelo Polje, Nikšić, Petnjica and Danilovgrad). On the other hand, the most evident migration activities to Andrijevića were from Berane (24), Plav (5), Kolašin (4), Bijelo Polje, and there are significantly fewer immigrants from Bar, Danilovgrad, Mojkovac, Herceg Novi, Tivat, Podgorica, Budva.

6.10 Economy and agriculture

Montenegro's economy is transitioning to a market system economy. Around 90% of all large Montenegrin state-owned companies have been privatized, including 100% of banking, telecommunications, and oil distribution. Montenegro uses the EURO as its domestic currency, though it is not an official member of the Euro zone. In January 2007, Montenegro joined the World Bank and IMF, and in December 2011, the WTO. Montenegro began negotiations to join the EU in 2012, and the process is still undergoing.

The Gross Domestic Product (GDP) has been on a steady rise in recent years. It reached the value of 7.40 billion US dollars in 2023, according to official data from the World Bank, and 8375.22 US dollars per capita which represents a better GDP per capita than those of some of the other countries in the region (Serbia, Bosnia and Herzegovina, Macedonia and Albania)³². Real and nominal BDP growth has mostly been positive and steady during the last decade, reaching 2.5% real and 6.5% nominal GDP growth average.

In 2017, the national GDP³³ was attributed to: 6.9% to agriculture (with constant decline over the last decade), 6.6% construction (constantly on the rise in last decade), industries to 15% (shows decline in recent years), and services around 76%, out of which 12.3% to retail and wholesale trade and 7.2% to tourist accommodation and boarding. However, it is estimated that over 20% of real GDP value can be attributed to tourist driven consumption, possibly even more when effects of informal economy are

³¹ This term includes refugees, IDP's (Internally Displaced Persons) and asylum seekers.

³² Source: CIA World Factbook.

³³ Ibid.

taken into account, making this economic sector the single most important Montenegro economic activity. Tourism brings in three times as many visitors as Montenegro's total population every year.

Agriculture is neglected and undeveloped as economic sector in Montenegro at national level. It has been mentioned that this sector accounts only for 6.9% of national GDP, and that it keeps falling. Due to insufficient domestic agricultural production, there is an import of large quantity of food products,³⁴ partially due to needs of seasonal tourist visits. An undersized level of grain production is one of the peculiarities of Montenegrin agriculture and agricultural land use. According to the Statistical Yearbook, the plant production in Montenegro is practiced on 12% of total agricultural land, of which the crop and vegetable production amounts to 8.8%, fruit and vine production amounts to about 3.2% of the total agricultural area.

Montenegro has a negative foreign trade balance. The Table³⁵ below shows key data on foreign trade for 2016:

Table 6-9: Foreign trade balance Montenegro per countries and for agriculture products

Foreign trade 2016 (in 000)	Trade balance (EUR)	Foreign trade balance per key partners (EUR)			Agriculture and food products (EUR)		
		EU	China	Serbia	Import	Export	Balance
Montenegro	-1735842	-870191	-166250	-375241	27337	397228	-369891

The influence of informal economy³⁶ in Montenegro can be considered significant. Although there are no official statistics on the influence of the informal economy, or so-called "grey economy" in Montenegro, some estimates have shown that this percentage of this from of economy amounts to 26-31% of the GDP, depending on the width of the definition of the grey economy that was used in different surveys. The most common forms of informal economy in Montenegro are informal forms of employment (so-called "black market employment"), that can occur both in formal and informal economic entities and informal business (when the entire economic activity of the subject passes beyond the legal regulations, completely unregistered), as well as partially informal economy subjects (that base often significant part of their economic activity beyond legal regulations and unregistered maintaining part of it registered in order to keep the legal facade). The informal economy influence on touristic economical sector is considered to be very high.

Natural conditions in Montenegro are suitable for diversified development of agriculture and are at the same time extremely complex. Hilly-mountainous zone with distinctive relief and a deficiency of lowland are the main limiting factor in agriculture development. On the basis of common features like climatic conditions, agricultural production structure, arable land, yield size, cattle density etc., Montenegro can be conditionally divided into five characteristic regions, with adjoining municipalities. The existing natural conditions, together with property relations, are the main reason why production in Montenegro is based on small-scale family households. Municipality Kolašin I belongs to the Karstic while Andrijević belongs to the Polimsko-ibarski region. The Karstic region has a scarce quantity of arable land, which is mainly located in karsts, sinkholes and depressions, which are numerous but small and scattered. Although Karstic region comprises 21% of the complete territory, arable land makes up only 8% of the region. This feature together with emphasized aridity, limits plant production to crop and partially fruit production (up to 700-800 metres). The most significant agricultural sector in this

³⁴ Source: National strategy of sustainable development of Montenegro until 2030, published July 2016.

³⁵ Source: Monstat: <https://monstat.org>;

³⁶ The term is guided by the definitions given in the conclusions of the International Conference of Labor in 2002, in which the term "Informal economy" is linked to "all economic activities carried out by workers or business subjects that are not - in law or in practice - fully covered by formal arrangements or contracts.

region is livestock production, particularly goat and sheep production that benefit the most from karstic grasslands. Beef and beekeeping are also important in this region. Polimsko-ibarski Region comprises municipalities extending through the Lim and Ibar valleys (20.5% of the territory). Proportionally, this region has the largest share of arable land 32.9% or 62.000 ha of the total arable land in Montenegro. Arable land consists of relatively fertile alluvial, delluvial and brown soils in the old river terraces, and lake sediments in lowlands and slightly hilly relief; and brown, mainly acid soils on the moderately steep slopes of river valleys. All these traits, together with climatic conditions and an abundance of springs and flowing waters that may be used for irrigation, make this region important for all three agricultural sectors, crop and vegetable production, fruit and livestock production.

Municipality of Andrijevića has 10257ha of registered agricultural land, of which 8710 ha are in use. According to the latest agricultural census, there are 1417 agricultural farms in Andrijevića. If we take into account the data from the 2011 census, that in Andrijevića the total number of households is 1666, it can be concluded that about 85% of the population is engaged in agriculture. Agricultural production is mainly based on production in individual households, mostly on small land holdings. Arable land covers 72.4 ha, nurseries cover 59.5 ha, meadows and pastures cover an area of 8494 ha, while orchards are represented on a small area of 2.1 ha. However, in the last few years, agricultural production has been characterized by the growth of areas under raspberry and other fruit plantations, and the local self-government, through dedicated budget lines, allocates funds for the improvement and stimulation of agricultural production. Along with this, it is important to note that organic production is gaining more and more importance. Compared to the neighbouring municipalities and taking into account the size of the municipality, a significant number of organic producers are registered in Andrijevića, and this number is increasing year by year (in 2014 - 24, 2015 - 31, 2016 – 37, 2022-38 organic producers). In accordance with this, there were plans for construction of the "House of Fruit" facility, which commenced but was found to be abandoned since 2018, with the structure in an early phase of construction. The research has not identified imminent plans for its completion, although some options to develop business models for the facility. Regardless of the outcomes of the market studies and demand analysis, this facility would not be under direct adverse impacts of the Highway as its location is already on the Andrijevića-Peovac road³⁷.



Figure 6-9: Online picture and construction board indicating the beginning and end of construction of the House of Fruits (beginning 2018 end 2019) online source

³⁷ https://www-dan-co-me.translate.google/crna-gora/ni-nakon-pet-godina-nema-nastavka-gradnje-kuce-voca-razvojna-investicija-pretvorena-u-gomilu-betona-5263991?_x_tr_sl=sr&_x_tr_tl=hr&_x_tr_hl=hr&_x_tr_pto=sc



Figure 6-10: Location of the “House of Fruits” in relation to the proposed route

As for animal husbandry, out of the total number of farms, 1,053 have conditional head of cattle. The largest number of households is classified as having 0-5 conditional heads (937 households), so it can be concluded that livestock production is mainly based on smaller family farms. The municipality has a significant area of forest land that covers 17,434 ha, of which deciduous forests cover 12,726 ha, and evergreen forests cover 4,708 ha. On the territory of the municipality of Andrijevica, 19 companies are registered that deal with various activities in the field of forestry (the largest number deals with cutting and processing of wood, production of other products made of wood, cork, straw and wicker). At the beginning of 2015, the municipality of Andrijevica joined the project of the Ministry of Economy and UNDP and identified a cluster of wood processors consisting of 4 companies engaged in wood processing. In addition to smaller, mostly family-owned companies, the cluster member is Biotel I, the first certified pellet producer in Montenegro that produces 24,000 tons of pellets annually. A significant role in the wood processing sector is occupied by the company Boj Komerc, which employs 35 workers. Montenegro has a high level of import dependence, and this is also the case at the level of local self-government units. When it comes to exports at the level of the municipality of Andrijevica, it is worth mentioning the company Biotel DOO, which is mainly oriented towards foreign markets (79.16% of the produced pellets are exported to Italy, 8.33% to Kosovo and 4.16% to the territory of North Macedonia).

Census of Agriculture is the only good basis for establishing the register on holdings. The register on holdings is the only valid sample frame for all regular statistical surveys in the area of agriculture. The census covered the following reporting units:

- Family agricultural holdings, no matter of their household members' occupation (farmers or non-farmers), and location where they are placed (town or village); Family agricultural holding represented a unit that is enumerated, and that is used at the time of enumeration at least 1 000 m² of agricultural land or less than 1 000 m² of agricultural land, and that possessed: - 1 cow, and 1 calf or 1 cow and 1 heifer, or - 1 cow, and 2 adult heads of small stock, or - 5 adult sheep or goats, or - 3 adult pigs, or - 4 adult heads of sheep or goats or pigs together, or - 50 heads of adult poultry, or - 20 beehives. Exceptions were households not fulfilling the above-mentioned conditions, if the agricultural production was the only source of income, as well as households engaged only in the cultivation of mushrooms in special buildings (cellars, tunnels).
- Legal and natural persons (hereinafter referred to as "business entities") engaged in the agricultural activity.

The total area of arable land in Montenegro is 309 240.7 ha, of which 95.2% belongs to family agricultural holdings, and the rest of only 4.8% belongs to business entities. Family agricultural holdings and business entities enumerated by the Census of Agriculture 2010 had 179 634.4 ha of total land owned. The Census covered 48 044 family agricultural holdings with 166 486 ha. The average family agricultural holding has 3.5 ha land owned. The total area of land taken in tenure, including common land (mountain land) is 132 989.4 ha. The area of land taken in tenure by 2 710 family agricultural holdings is 131 280.5 ha, what makes 98.7% of the total land taken in tenure. The total 365 family agricultural holdings and business entities in Montenegro gave 3383.1 ha in tenure. The average family agricultural holding giving land in tenure has 9.2 ha of land given in tenure. This Census of Agriculture in 2010. was the fourth and latest Census of Agriculture. Activities on the new Census are planned between October 1 and December 1, 2024.

Table 6-10: Family agricultural holdings by Total utilised agricultural area (UAA), economic size, and labour force by municipalities

	Total utilised agricultural area (UAA) ha	Economic size of family agricultural holdings €	Labour force in family agricultural holdings AWU
Andrijevića	8710.3	2,932,215.5	1083.4
Kolašin	8629	3,129,438.0	1436.3

Source: Statistical Office of Montenegro – Agricultural Census 2010

Table 6-11: Family agricultural holdings by type of farming, and by municipalities

	Total	Type of farming			
		Field crops	Horticulture crops	Orchards and vineyards	Grazing livestock
Andrijevića	1417	369	3	3	770
Kolašin	1575	681	3	9	729

Source: Statistical Office of Montenegro – Agricultural Census 2010

The natural characteristics of the terrain in **Municipality of Kolašin** have influenced that the population in this area has always been engaged in agriculture as a basic activity. However, due to the strong deagrarianization processes recorded in this area in the last several decades, the number of the total and agricultural population had a pronounced trend of decrease. Agricultural production in this area

is not developed in accordance with existing resources. Market production is extremely small, production for household consumption and sale at green markets and local markets prevails. The structure of land use in this area is determined by the natural characteristics of the area (mountain climate, pedological properties of the soil, etc.). From the structure of agricultural land, it can be seen that there are significant opportunities for the development of animal husbandry, which is the most represented and at the same time has the greatest potential for development. The development of animal husbandry (cattle and sheep breeding) is the absolute driver of agricultural development in this area and a great opportunity for the farmers of Kolašin. The wealth of pastures and meadows is a significant prerequisite for raising ruminants (cows, sheep, and goat). Special emphasis should be placed on sheep and cattle breeding. Numerous pastures and katuns can be valorised in the best way through the development of sheep breeding, especially if you take into account the fact that over 70% of the total number of sheep are raised in the northern part of Montenegro. In addition to the development of animal husbandry, as a priority of agriculture in this area, the development of other branches is also important: farming, vegetable growing, fruit growing and beekeeping, which complement and round off the development of agriculture as a whole and are complementary to the development of tourism. Characteristic for fruit production is that it is mostly extensive and takes place mainly on homesteads. It is rare to find orchards with semi-intensive production.

The assortment is outdated and does not follow the trends in the environment, and agro technical and auxiliary measures (pruning, processing, fertilizing, and protection) are rarely applied. In this area, there are exceptional natural potentials for the development of beekeeping. The abundance of honey plants and the low use of pesticides provide the opportunity to increase the number of beekeepers and bee colonies. This region has exceptional natural potential when it comes to medicinal and aromatic herbs and forest fruits. The wealth of plant species, plants of endemic origin and diverse flower flora provide a chance for their more significant use. There is a lot of room for potential and new investments in this area. Thanks to the diversity of climate and soil types, there are favourable locations for growing certain types of fruits and vegetables in the vast area of the municipality of Kolašin. These locations are also recognized in the Resource Map of Montenegro, prepared by the Ministry of Economy.

In addition to other resettlement impacts, during the social impact assessment process, specifically while conducting socio-economic survey/census, resettlement of small "grey economy businesses" must be accounted for. Resettlement of premises that are used for informal businesses (i.e. small workshops, small retail shops) can significantly influence the household livelihood. Income made by such entrepreneurship will not be registered and are likely to be kept out of survey by the owners itself. A land segments, the most common farm animals are cows, pigs and poultry. Small scale livestock farming is widespread, but it is not an important source of income. State lands are used for grazing land while pigs and poultry are left free to wander near the household. On average, households have two or three dairy cows. They produce mainly cheese, cream and butter for household consumption. Households that produce excess dairy products trade or sell the products to neighbours.

In general, local farmers have little information or knowledge of different livestock breeds. The most predominant breeds are so-called local breeds. As stated above, interviews indicated that State land is used for grazing, and cattle graze freely without formal control.

According to the latest data available from the Ministry of Agriculture and Rural Development, 241 agricultural holdings were registered in the municipality of Andrijevisa. The registered agricultural holdings by settlement are shown in the following tables.

Table 6-12: Agricultural holdings in the Municipality of Andrijeva

Settlement	Number of registered ag.holdings	Settlement	Number of registered ag.holdings
ANDRIJEVICA	20	GORNJE LUGE	4
ANDŽELATI	1	GRAČANICA	12
BOJOVIĆI	6	JOŠANICA	1
BOŽIĆI	15	KOŠUTIĆI	10
CECUNI	5	KRALJE	22
ĐULIĆI	14	KUTI	5
DULIPOLJE	6	OBLO BRDO	4
RIJEKA MARSENIČA	6	PRISOJA	14
SEOCA	9	GNJILI POTOK	5
TREŠNJEVO	30	SJENOŽETA	3
ULOTINA	10	SLATINA	17
ZABRĐE	10	TREPČA	12

Table 6-13: Settlements in the zone of influence: Bare Kraljske and Mateševu.

Settlement	Number of registered ag.holdings
BARE KRALJSKE	7
MATEŠEVO	1

6.11 Tourism and fishing

In 2022 Municipality of Andrijeva was visited by 767 guests, out of which 582 were foreigners. They realised 3259 overnight stays (2878 were foreigners). It is moderate increase compared to previous years.

Municipality of Kolašin was visited in 2022 by 35656 guests, out of which 26180 were foreigners. They realised 82086 overnight stays (57701 were foreigners). It is moderate increase compared to 2020 and 2021, but significantly less that during the years 2018 and 2019.

The mountainous region of Bjelasica, Komovi and Prokletije is rich in water, streams, rivers and lakes. The fish population was devastated over the last decades, but efforts were made in recent time to restore it and to preserve particular zones. The Regional Development Agency cooperating with the active fishing clubs has established 8 fly fishing districts in the region at rivers Tara, Lim, Bistrica, Kuckaja, Zlorečica, Ljuca and Ljuboviđa.

The fish population was renewed with the autochthonous river trout, the districts were marked with pictograms and info boards, the resting areas were set up and the ranger service was provided with the equipment.

Fly fishing and sports fishing has been identified in the area of Andrijeva. The flyfishing zone attract yearly several dozens of sport fishermen. The events held on that occasion vary in dates but the Touristic organisation hosting the events is providing regular updates on their websites. Calendar of events and schedule of works and activities potentially causing turbidity, noise, vibration need to be synchronized.

6.12 Land use and land tenure

According to the Law on state survey and real estate cadastre, data on land ownership, persons with ownership rights and other rights on land and buildings are kept in the Real Estate Cadastre (or Real Estate Administration). The Administration is also in charge of creating the Geodetic Informational System (GIS), Land Administration and Management Project (LAMP) and system of Infrastructure of National Land Data (NIPP). However, most of these systems are still under construction and information about land property is available only by individual request.

After adopting Law on Housing Relations property law, the Law on restitution of property rights and compensation, the Privatization law and implementation of these laws and other consistent legal solutions, most of the real estate, including buildings, agricultural land, construction land etc. became private property. As a result, agricultural land is presently close to 99% privately owned, mostly by agricultural households (96.3%), while the rest is owned by companies and cooperatives, again mostly private capital. However, concerning construction and forest land, there is still a significant portion of that land remaining in state or municipality ownership. Construction land in state or municipality property is used by various public services, under infrastructure buildings and construction as well as protective area around such buildings, public utility companies, military or police forces, some small area for housing purposes, as property of still not privatized companies.

According to the Real Estate Administration of Montenegro, in the period from 2006 to 2020, foreign citizens became owners of 19,209 hectares and 1,529,001 square meters of apartments, or 1.4% of construction land and 8.4% of apartments in Montenegro. According to the current laws, there are no special restrictions in Montenegro for the purchase of real estate in Montenegro. Every foreign buyer can become the owner of the property (houses, apartments, estates) in Montenegro, in the same way as its citizens.

Approximate structure of land use for the total territory of the Republic of Montenegro (total area: 13812 km²): agricultural³⁸ land approximately 5140 km² or 37% of the territory; forests approximately 6622 km² or 45% of the territory, and settlements, roads, stony areas and other categories approximately of land use approximately 2442 km² or 18% of the territory. However, Montenegro has only 741 km² of the higher quality agricultural land (5.4% of the territory) what indicates that it has special importance for Montenegro.

Two major agricultural holdings are registered in Bare Kraljske (Household Đurković (Kralje bb) and Kraljska koliba (Kralje bb). Agricultural households having to battle unfavourable structure of land, small area of plot, lack of irrigation, agricultural households are by far the main producer of agricultural products in Montenegro.

Women are owners of only 4% of houses, 8% of land and 14% weekend houses, as a result of the tradition that men are mostly defined as successors of family property and formal holders of spouse joint property. In entrepreneurship women are represented far less than men, as shown by data that say that only 9.6% of women are registered of business owners, putting Montenegro behind the EU and the countries of the region. Such data also include those women who are only formally declared as owners of the business, while the functions of conducting business and entrepreneurial activity are performed by their relative's men³⁹.

³⁸ Includes pastures and meadows.

³⁹ Source: UNDP research for 2011.

The land administration system prevailing in Central Europe is based on principles which in general are followed by Montenegro, such as:

- The cadastre defines an object, i.e. a land parcel with all improvements (buildings, or parts of buildings permanently fixed on it; this is called the “superficies solo cedit principle”.
- The purpose and objective of the cadastre is the collection and processing of data on cadastral plots, buildings and parts of buildings, i.e. the position, shape, area and use of a land parcel, and people claiming rights on it. • All land parcels are supposed to be registered with their physical data in the cadastre. No difference is made between state- or privately-owned land as in the eyes of the law, public and private parties have equal rights.
- The acquisition of property rights (purchase/sale, heritage, gift), mortgage rights and other rights, i.e. the “title”) has to be realized through the legal “modus” of registration in the real property register. The registration has a constitutive character. Cadastre and real property registration are essential instruments for providing the State and the economy with reliable data on real estate and about real property and its improvements. Such data are not only necessary for the creation of legal certainty with regard to real property, but also serve as an authentic source of information for economic transactions with real property and for each citizen involved in such a transaction. In addition, reliable data on land and real estate guarantee fair taxation and provide the basis for land administration, land use planning and for other areas. Land use is a core element for economic activities and has to be organized in terms of objectives, laws and regulations and institutions for implementation.

The objectives of the determination of land use are to keep a balance between (1) economic development of the land, (2) social, economic, cultural needs of the population affected by the actual or planned use of the land, and (3) the protection of nature and natural resources. To arrive at such balanced sustainable policy decisions, a carefully structured decision-making process based on objectives, reliable information and data that have been prepared by a competent institution is required. An effective control mechanism preventing and correcting misuse or abuse of land and providing feedback for regulatory changes is needed.

6.13 Legal status of settlements

Building without or in excess to the acquired legal permit is a practice present in Montenegro in general, but this is not a topic of concern for the mountainous areas and the settlements impacted by the Project. The legal requirements for acquiring building permits for construction in rural areas is novel and date back to the beginning of the 21st Century.

Montenegro is a signatory to the Vienna Convention on informal settlements, which aims to harmonize the activities that will be carried out in regularization (legalization) and improvement of informal settlements in a sustainable manner and to prevent the emergence of future illegal settlements. We emphasize that the Vienna Declaration states that spatial, social and economic integration of informal settlements with the overall structure of the settlement is regarded to be a key factor in the preparation for EU accession. The Department for Housing Development, formed as part of the Ministry of Spatial Planning and Environmental Protection, coordinated the drafting of the Strategy for Converting Informal Settlements into Formal and Regularization of Building Structures with Special Emphasis on Seismic Challenges, which contains basic principles and postulates that were taken as the basis for the elaboration of other documents⁴⁰.

⁴⁰ National housing strategy of Montenegro for the period from 2011 to 2020, published 2011.

The Detailed Spatial Plan for the Bar-Boljare Highway in 2007 established a 2 km wide (1 km either side of the proposed centreline) corridor in which development restrictions were applied. Although a moratorium had been imposed it has been evident that full enforcement of these clauses was lacking for some time. However, either of the considered alternatives for the alignment are not significantly affecting large informal settlements but will have a medium scale impact on residential structures and livelihood.

EBRD PR 5 recognizes the compensation eligibility of owners and users of all Project impacted structures, including those with recognizable legal rights on the property they are occupying, which is the case with informally built structures regardless of the ownership on land (which in some cases may be state or "public" owned land) and those without legally recognizable claim to the property they are occupying. Informal building owners must be equally compensated to the full replacement costs following the standards of the EBRD PRs which is in line with the practice implemented during land acquisition based on right to security of housing.

Legal practices in place including the latest court rulings allows determining the compensation informal immovable structures at replacement cost.

6.14 Facilities and Public Services

This chapter addresses issues of vital importance to the wellbeing network of communities and municipalities that will be under impact of the Project, including transport, water supply and sewage, waste management, electrical supply, telecommunications, education and health services. With the Route change the baseline conditions remain mainly the same.

6.14.1 Transport

The primary airport network of Montenegro includes the airports of Podgorica and Tivat. The air traffic infrastructure of Podgorica Airport has higher capacities, area and installations from the current level of use. However, the number of flights and passengers has been significantly growing during previous years. From 2016 (873000 passengers) to 2018 (1.2 million passengers) it has risen for nearly 50%. The airport "Podgorica" is located south from the city and not near the Podgorica bypass highway route.

Regardless Montenegro's orientation as an Adriatic and maritime country, the nautical traffic, both in passengers numbers and tons of goods, is not that developed. The only two important international ports are at Bar and Kotor, both internationally ranked as "small ports". The construction of the Bar-Boljare Highway should increase possibilities for maritime passenger and cargo transport, both in constant fall over last decades.

Length of roads in Montenegro in 2016 was 8625 km. regarding the type of road the highest share in the 2016 had an asphalt surface whose length was 6147 km (71.3%), followed by gravel with 1664 km (19.3%) and earthen roads with 814 km (9.4%). The number of bridges in 2016 was 427. Number of registered road motor vehicles in 2016 amounted 209098. There are 326 registered motor vehicles per 1000 inhabitants, which is a significantly higher average than most countries in the region (Serbia 288, BiH 258, Macedonia 206, Albania 167, and Kosovo 150). During the year 2016 motor vehicles registered in Montenegro carried 852 thousand tons of goods and performed 120 582 thousand tons-kilometres. Distance travelled by loaded vehicles was 5264 thousand kilometres. Exported goods were transported by road vehicles in 45% of volume but close to 90% in value and import transport by roads amounts to around 88% of value of all imported goods.

Public transportation in the two affected Municipalities is organized through suburbia transport from the settlements to the city of Podgorica. Further delays due to construction of Highway can additionally and significantly deteriorate public transportation. Plans must be made to involve stakeholders in this subject and public consultation on this subject organized.

As mentioned, Montenegro traffic safety standards are below EU road and traffic safety management standards. In many cases, even defined legal standards of OHS and CHS are not fully implemented during construction works. Therefore, ESIA and more importantly ESMP must include additional planning measures to uphold standards of EBRD PRs.

Public intercity transport is mostly provided by transit lines between the municipal centres and, as reported by the local residents during the perception survey in 2022 there is no organized public transport connecting local communities (rural settlements) with the between the Municipal centres of Andrijević and Kolašin.

The only traffic modality in the municipality of Andrijević is road transport. Public roads are categorized as main, regional and local roads. In addition to public, in the territory of the municipality there is also a network of uncategorized roads consisting of rural, field and forest roads, roads on embankments for flood defence, etc. The backbone of the municipality's road network is the main road R-19, which passes through the territory of the municipality in an approximately west-east direction, and which provides a direct connection with the neighbouring municipal centres of Kolašin and Plav. Regional road R-2 passes through the territory of the municipality, which extends approximately in the south-north direction, and which provides a direct connection between the municipal centre of Andrijević and the neighbouring municipal centre of Berane. The national roads, both M-9 and R-2, have a direct connection with the main road M-2 (part-European road E-65, i.e. E-80), and through it the municipality of Andrijević is connected to the rest of the road network in the region, the state and the wider environment.

On the territory of the municipality of Andrijević, the main road R-19 stretches in the length of approximately 31 km and passes through a total of 6 settlements (Gnjili Potok, Sjenožeta, and Kralje, the municipal centre of Andrijević, Gornje Luge, and Ulotina). The road has two-lanes, stretches at an altitude of more than 1000 m above sea level and follows the difficult terrain of the Komovi and Tresnjevik mountains. The average width of the road lanes on the section of this road from the border with the municipality of Kolašin (from the direction of Mateševo) to Andrijević is even less than 2 m, and on the section Andrijević - Murino 3.5 m. Regional road R-2 Andrijević - Berane stretches along the Lim river valley with a total length of about 7.9 km. It starts in the urban area of Andrijević (Bandovića most) at the intersection with the main road M-9, it extends through the urban area for a length of about 1 km and then in the direction of Berane it passes through and near the settlements of Prisoja, Slatina, Trešnjevo and Rijeka Marsenića. The road is narrow, with blind bends and brows and limited safe places to pass. The pavement is damaged with no cycle paths and is frequently used by some of the most vulnerable road users such as people walking. The road surface is in poor condition and limited or no crash protection (such as no crash barriers either at the side or in the middle of the road). It was observed that traffic often includes vehicles travelling at a wide variety of speeds, including slow-moving farm vehicles, animals, spillages of trees and branches, hay etc. At the same time the road is used by heavy vehicles transporting harvested woods from the Forrest often travelling at speed above permitted. What was observed during the December 2024 site visits is that most of the traffic was attributable to the heavy vehicles transporting harvested woods and in the winter road conditions it was observed to be very unsafe for passenger vehicles moving past the trucks. What was also observed is that the road is narrow with sub-standard surface conditions, with major devastations on certain section of the road which makes it unsafe and increases road safety risk in this hilly and mountainous area.



Photo 6-1: Section of the R-19 picture taken during December 2024 (Source Paseco)

A significant part of the road network in the territory of the municipality is also a network of local and uncategorized roads. Based on the "Decision on municipal and uncategorized roads" passed at the session of the Andrijeva City Council on June 26, 2007, as well as amendments to this decision from December 2007, December 2008 and June 2009, the road routes shown in the table below have the rank of local roads (the classification is still in force):

Table 6-14: Road routes in the project area

Oznaka puta	Trasa	Dužina (km)
L1	Most Bandovića - Žoljevica	4,7
L2	Andrijevic – Đuliće – Jošanica	10,0
L3	Đulić – Kuti	7,0
L4	Ramin Lom – Zoriće	8,0
L5	Marsenića Rijeka – Navotina	2,0
L6	Kralje - Oblo Brdo	3,0
L7	Crvena prla – Žoljevica	3,0
L8	Trepča – Brodac	2,0
L9	Marsenića Rijeka – Kruševo	17,0
L10	Andrijeva – Seoce	3,0
L11	Magistrala – Staro groblje – Fetov Do – Savi do	2,1
L12	Magistrala - Dolivi	2,7
L13	Trešnjevnik – Preslo – Eko katun	4,2
L14	Sitna luka – Groblje na Glavici - Žoljevica	3,0
L15	Rijeka Marsenića – Lukin Vir	2,0
	UKUPNO	73,7

From a total of 73.7 km of local roads, according to the data of local municipal services, close to 94% are with asphalt pavement, while the remaining 6% are with earth roads.. However, the network of local roads is characterized by a small roadway width (it ranges from 3.0 to 5.0 m), as well as the absence of horizontal and vertical signalling, which creates an additional disadvantage in the development of traffic. The public company for residential and communal services has a permanent road service (7 roads distributed on all our local roads), and winter maintenance equipment. This company also performs winter maintenance work of main road R-19 section Trešnjevnik - Kralje - Andrijeva, which has the fifth priority in the maintenance of state roads. A special problem on local

roads in the municipality of Andrijevac is the issuance of concessions for the use of forests, as a result of which heavy vehicles are transported on roads that are not dimensioned for such type of traffic, and as a consequence there is damage to the road body as well as the entire road surface. In the area of Andrijevac municipality there is a very developed network of uncategorized roads (rural, field, forest and other roads) with a total length of about 697 km. Most of these roads are dirt curtain, and they are characterized by a very small width of the roadway, unfavourable technical - operational and terrain characteristics, that is, unfavourable conditions for traffic on them.

Since September 2024 works on adaptation of the the Regional road R-19 are ongoing in the location of the Tresnjevik pass, in the lenght of 3,00km which are expected to be completed in February 2025.



Photo 6-2: Construction board picture taken during December 2024 (Source Paseco)

6.14.2 Water supply

Coverage of water supply by central water supply in Montenegro urban areas can be considered good, as around 99% of all urban areas are covered.

The first water supply system in **Andrijevac** dates to 1931 with a capacity of 0.3 l/s. Later there were several connections of smaller sources, but the development of the Andrijevac settlement, with the appearance of new water consumers, as well as the development of population standards, created a demand for higher consumption of water so that the existing water system could not cope with the increased water demand. Today the Water company DOO Vodovod i kanalizacija is the manager and provider of drinking water. The population of the municipality of Andrijevac is supplied with water from the spring "Krkori" which is outside the area of influence of the Project.

The length of the water supply network is 31 km including the primary and secondary network. The total number of connections is 735, of which 120 are in the city area. About 30% of households are covered by water supply services. Other households are supplied with water from village springs. The

urban part of the Andrijevića area is supplied with water from the Krkori spring, which was captured in 1984, with an installed capacity of 107 litres per second. 2,100 inhabitants of the municipality, public institutions, healthcare, education, as well as several industrial plants are supplied from this water supply system. In 2015/2016, works were carried out on the water intake of the Krkori source with an installation capacity of about 505 litres per second. The project includes the reconstruction of water intakes and the replacement of asbestos-cement pipes with materials that are not harmful to human health. Upon completion of the project, consumers will have an orderly and high-quality water supply. This water supply system supplies 638 households and 84 legal entities. In addition to the city area, the local communities of Trešnjevo, Zabrđe, Slatina, Prisoja, Seoce, Anželite and Bojoviće are also included in this water supply system. The pipeline was reconstructed in a length of 3336 m, where steel pipes Ø 800 mm were installed, which lead to the pre-break chamber, the chlorine station and the future hydropower plant. During 2016 and 2017. The pipeline from Đekić's house to the veterinary station was reconstructed in a length of 4.5 km, where polyethylene pipes Ø 315 mm were installed. A chlorination station was built, and proper chlorination and delivery of correct water was enabled. The pool has a capacity of 100m³. The water supply is of the gravity type, the primary network is 15 km long, and the secondary network is 16 km long. Coverage by the water supply network is about 25%. The primary water supply system is made of cement-asbestos pipes. The price of water for legal entities is €0.41/m³ (with sewerage €0.57/m³). The price of water for natural persons is €0.21 m³ (with sewerage €0.25 m³). The percentage charge is about 60%. The Institute for Public Health from Podgorica performs the analysis and correctness of the ode every month.

Kolašin is supplied with water from the springs of the Mušovići River, which are located about 3.5 km east of Kolašin. The group of hot springs of Mušovića Rivers are of karst origin. The springs belong to the catchment area of the river Svinjača. The course of the river Svinjača is formed by two smaller streams: the river Ljevaja, which rises on the northern side of the catchment area, and the Paljivinska River, which originates on the southern part of the catchment area. The source parts of these rivers are at an altitude of 1,800 meters above sea level. The city of Kolašin with its suburban settlements is covered by the city water supply network: Babljak, Breza, Bakovići, Biočinovići, Vladoš, Drijenak, Dulovine, Plana, Radigojno, Selišta and Smailagića Polje. The city of Kolašin itself is completely (100%) covered by the city's water supply network, while the coverage of suburban settlements varies and ranges from 30% to 100%, with an average of 85%. In suburban settlements there are also private (individual and shared) water supply systems, so in addition to unfavourable topographical conditions, this is one of the reasons why not all households are connected to the city water supply system. An immediate protection zone was established by building a fence around the water catchment area, but the fence was seriously damaged due to lack of maintenance. A detailed study on sanitary-technical protection zones has never been conducted. The immediate and narrower protection zone, shown in the picture below, were defined only in the Main Project of the water supply system in Kolašin, which was carried out by the Institute of Architecture and Urban Planning of Serbia in 1980. The narrower and wider protection zone were never established. In the Kolašina water supply system, there are no measuring devices, neither at the source nor in the network, which would provide accurate data on the amount of captured (produced) water, as well as data on water flow and consumption in the system and its parts. Only 13% of connections are equipped with water meters. Households are usually charged 5m³ per household member, and institutions and industry (only a part of significant consumers have water meters) are charged a flat rate, usually in accordance with the agreement on consumed water.

There are numerous places with quality spring water. The yield of the main spring for the city area (Mušovića River) has been halved in the last 30 years. The reasons for this are numerous and the biggest cause is the cutting of forests as well as other unwanted activities in these areas. Until now, legally prescribed research and determination of protection zones have not been carried out for the majority of water sources that are in use. In addition to this, the cadastre of existing and potential

sources (water bodies) has not been processed, so at this moment it is not possible to carry out a precise identification of all water sources and their protection zones. There are glacial lakes on the mountains. Lake Biograd is located at the western foot of the mountain

Bjelasica, at an altitude of 1094 m. It is 19 km from Kolašin. Via Jezerštica it belongs to the Tara basin. According to its origin, the lake belongs to the group of glacial accumulative lakes.

The potential of the springs for bottling water has not been used enough for now. However, recently there has been an increased interest in filling water into packaging, and concessions are being issued and new factories are being built. Existing facilities within the scope of the plan and in the immediate vicinity include the following facilities:

- "Aqua Monta" (source of Ropušica) in Gornji Lipovo,
- "Gorska" source of Jeremiah),
- "Aqua Bianca" (source Đedov izvor) in Radigojno,
- "Suza" (source of Bukovička spring) in Trebaljevo.

The following are the springs used for water supply of Andrijevica and settlements within:



Photo 6-3: Spring in Miravcine on the M 19 Road (source Paseco)



Photo 6-4: Spring in Gnjili Potok (Source Paseco)



Photo 6-5: Spring in Kralje (Source Paseco and google imagery)

With the route change, water supply sources for the settlements of Kralje, Gnjili Potok and Sjenozeta are protected as the Route change moved the highway below these settlements downhill below the

lowest point of water demand. However, the locations as reported by the local communities in July 2024 will be kept in this baseline to ensure impacts to water supply are avoided as part of the prevention plan:

- Only lower plain areas of Prisoje, Slatina and Trešnjevo are supplied from the public water company in Andrijeviča,
- Kralje is dependent on one community reservoir (captaza) satisfying demand for a substantial share of the 50 households living in Kralje,
- Gnjlji potok has a community reservoir but the number of households it supplies was not specified,

During community meetings the representative of the Settlement of Kralje explained that on December 4, 2024 the entire settlement experienced water supply disruption for the first time ever, which lasted almost 24 hours, and was not caused by human activities, but poses a concern on sustainable water supply.

The key issue in protection of population water supply is discharge of waste waters and other substances during construction, and construction of controlled system of drainage and purification of atmospheric waters. These are matters regulated by EBRD PR 3 and connected EU standards and regulations, and so part of EIA analysis. Additionally, *any use of water from local water supply systems, either for technical water for construction purposes or for workers accommodation on the construction sites should be previously analysed for its capacities and agreed with proper stakeholders, so that it doesn't cause problems of fresh water supply to local population.*

Local communities particularly in Bare Kraljske have highlighted that groundwater is an important resource in terms of abstraction for household use. Domestic water supplies is obtained from groundwater and private springs or boreholes. Some of the springs are charted including the catchment area however for some of the springs not even the local communities are certain of their location. The locations particularly important are in Mateševu. While during the community meetings undertaken during September 2024 it was requested that the exact locations of the springs and boreholes are provided to MONTEPUT the December 2024 site visit confirmed that such list was not prepared.

Settlements and villages Mateševu, Sunga and Bare Kraljske along the route have individual small reservoirs (captivated / retained springwater) which transports water through private water supply system from the spring to the homes.

6.14.3 Sewage system

Not all households are connected to the sewage system and use individual (or building) underground septic tanks which are usually porous (intentionally), so the wastewater are partially discharged to the underground without any purification. This add to the pressure on pollution of groundwater and the trend has been in a significant increase in the past decades, which is mainly due to the unbalanced or the absence of an integral approach in the system wastewater disposal.

The length of the existing sewage network in the municipality of Andrijeviča is approximately 3 km. About 1,000 users are connected to it, while commercial buildings and schools are not connected to the network but have their own septic tanks. The collector located on the bank of the river Zlorečica does not perform its function, so in the end the wastewater flows into the rivers Zlorečica and Lim without any treatment. The rest of the population uses septic tanks, many of which are not properly constructed. Pipe blockages are common, and are mostly caused by solid waste disposal, sludge build-

up and small diameters. Drains do not have an opening in which sludge and heavier materials would settle. As in street sewers, blockages are common in residential buildings as well.

The wastewater collection system in Kolašin is managed by Vodovod i kanalizacija doo Kolašin who maintains it. ViK is a public company owned and controlled by the Municipality of Kolašin. The wastewater collection system in the city of Kolašin is about 25 years old. The first collectors were built at the beginning of 1995, and the existing network was mostly completed in the period from 1995 to 2000. The sewage system was mainly built in the vicinity of the central square, and the estimated number of inhabitants currently connected to the network is 850 (275 sewage connections according to the data ViKa). Every household connected to the sewage network is also connected to the water supply system. The system was conceived and constructed as a separate one, with a separate atmospheric sewer that is in operation.

None of the villages along the route are connected to the sewage system. Also, there are no sewage networks built and managed locally, at the village level. There are plans for limited extensions of the network to certain semi-suburban settlements in the immediate vicinity of the city, such as Smailagića Polje, Bašanje brdo and Babljak. The existing sewage network in Kolašin collects wastewater from about 850 inhabitants, which is about 8.5% of the total number of inhabitants living in the municipality.

The sewage system is formed by two collectors marked as pipelines "A" and "B", which together form the main collector with a diameter of 500 mm near the bus station.

There is no other significant infrastructure facility in the sewage system.

Similar to waterworks issues, constraints of the sewage system should be kept in mind when organizing worker accommodation or other process that could strain the local sewage system. As discharging industrial and construction site waste waters into the sewage system that doesn't have proper purification system, or directly to river waters is common practice in Montenegro, additional control measures of contractors and sub-contractors on construction waste waters discharge must be deployed. Also, organized mobile toilets must be available to construction workers and employees at remote construction sites.

6.14.4 Waste management

According to the official reports on the implementation of the National Waste Management Plan in Montenegro, the quality of data on the quantities of municipal waste produced in the territory of a number of municipalities of Montenegro is not at a satisfactory level. The calculation takes into account that the citizen of Montenegro in average produces about 0.86 kg per day.

One of the largest problems is the extremely low level of awareness among citizens regarding this issue, as well as the lack of inspection and control from the relevant public management companies. In Podgorica, a significant number of illegal landfills are registered (where municipal waste, car tires, garbage, and construction materials, etc.) are deposited. Additional problem is the percentage of the construction waste produced during the construction and reconstruction of the transport infrastructure. Development of transport infrastructure generates large quantities of construction waste on one side, and on the other, leads to intensive exploitation of natural resources (building stone and aggregate). Adequate management of construction waste reduces the amount of waste in general, while also reducing the excessive exploitation of natural resources, which also entails space degradation (quarries).

The key discrepancies between GIP and national practices are not found in legally proclaimed gaps, but in tendency not to uphold the proclaimed standards and regulations. These issues need to be addressed by enforcement practices and standards by organizational measures by the Project

Promoter to control contractors and sub-contractors arrangements and implementation on several issues mentioned in this section: water waste, solid and construction waste management, on-construction site conditions and equipment (solid waste containers, mobile toilets etc.) which needs to be embedded in the ESMP and strenuously executed during works. In addition, education and instruction for workers and employees of such standards, procedures and measures must be organized.

The project area hosts unregulated waste areas on more than 10 locations including a domestic waste area in Andrijevića with a total coverage of 4000m². The waste areas contain both hazardous and inert waste. Collection of municipal and non-hazardous construction waste, in accordance with the Law on Management

Waste management is the responsibility of the local self-government unit.

Municipal waste collection is entrusted to DOO Komunalno Andrijevića. The company has 40 containers with a volume of 3m³, 50 containers with a volume of 1.1m³, 50 buckets of 240 l and 100 buckets of 50 l, and for carrying out work within its jurisdiction, it has the following vehicles: Mercedes atego, year of production 2015, for containers of 3m³ and Volvo year of production 2012, for containers 1.1m³. The company employs 24 workers (two with VSC diploma, three with VŠS, nine with SSS, five with NK and five KV). Waste collection is mainly carried out by entities located in the urban part of the municipality, while the rural parts of the municipality are poorly covered by this type of service. For this reason, informal waste disposal sites appear in certain locations in rural areas. Considering that tourism is one of the priority directions of development of the municipality, the local self-government and the utility company should use a series of measures to solve the problems of waste disposal in rural areas as soon as possible. All waste is stored at the temporary location "Sućeska", which is 5 km from the city, and is located along the main road Andrijevića-Plav. In addition to this, there are 18 informal waste disposal sites in the Municipality.

Table 6-15: Waste disposal areas

Waste areas ≥100m ³ to 1000m ³	Type of waste	Volume of waste
Glavica Rive	Household waste	700 m ³
Prla	Wood and wood debris	900 m ³
Gnjilišta	Wood and wood debris	900 m ³
Bojoviće	Wood and wood debris	800 m ³
Waste areas ≥ 1000m ³		
Odlagalište Sućeska	Mixed household waste	3.000m

In Kolašin organized waste collection is carried out on 80% of the territory of the urban area - from the inner city area to the extent of about 98%, while in the above-mentioned suburban urban settlements that percentage is lower and amounts to about 47%. The reason for the lower level of waste collection services in suburban settlements lies in the fact of poor road infrastructure, an insufficient number of containers, as well as an insufficient and inadequate number of means of transport at the disposal of PUC. Collection in urban areas is done daily, while in suburban areas it is done 2-3 times a week. Waste is collected in containers with a volume of 1.1 m³ and the utility company owns 240 containers older than 10 years. Both specialized vehicles with a press are used to transport waste to the landfill. The existing system is quite old and is not sufficient to cover the urban area with waste collection services. According to the utility company's data, about 1,700 t/year is collected. There is no precise data on the amount of waste collected in the area of the municipality of Kolašin, since no measurement system has been introduced, so in the Master Plan for waste management at the national level for the Northern Region, a criterion on the amount of generated waste of 0.60 kg/inhabitant/day has been

adopted. Considering that it is a municipality that does not have a developed industry and is developing its perspective on winter tourism, waste is exclusively communal, mostly composed of organic waste with admixture of paper, plastic, glass, and metal. In the total amount of deposited waste, there is a significant amount of construction waste due to the increased volume of construction works in 2006 (works on the reconstruction of the main road Podgorica - Kolašin, which the investor deposited at the existing landfill). The system of selective disposal does not exist in the territory of the municipality of Kolašin. Since 1984, waste has been disposed of at an unsanitary landfill at the Baković location, 3 km from the city on the main road Kolašin - Mojkovac. The location is at an altitude of 945 m, on the bank of the river Plasnica, a tributary of Tara, with an area of 3ha. Waste is disposed of without separation and recycling. The landfill is fenced and there is a lockable gate at the entrance, which prevents unauthorized access. Once a month, the waste is levelled and covered with a layer of soil to prevent it from being blown away. There are ongoing plans for closure and recultivation of this area.



Photo 6-6: Baković landfill (source)

6.14.5 Telecommunications and information network

According to World Bank report⁴¹, since 2016 Montenegro reached 100% access to electricity supply, in both urban and rural areas.

The current situation in telecommunications is determined by the Law on telecommunications and Law on radio diffusion as well as by actions of two regulatory agencies (Agency for telecommunications and Agency for Radio-Diffusion). Five land line operators with licenses for providing telecommunication services through landline and land-line wireless access operate in the area. Due to development of mobile technology the number of land-line prescribers is dropping, now reaching around 153.000 subscriptions nationwide or only 24 subscriptions per 100 inhabitants. Mobile telephony network is operated by 3 operators with adequate licenses has more than 1,000,000 users (or 163 subscriptions per 100 inhabitants⁴² making Montenegro one of the countries with highest

⁴¹ Source: <https://data.worldbank.org/indicator/EG.ELC.ACCS.RU.ZS?locations=ME>

⁴² Source: CIA World Factbook; estimation 2017.

number of mobile phone users per inhabitant⁴³). Territory coverage by mobile telephony services is approximately the same for all operators and it exceeds 95%.

Broadcast (57 radio stations and 19 TV stations⁴⁴) cable and wireless operators for distribution of radio and TV programs to final users includes transmission and distribution of radio and TV signal for purposes of public broadcasting services. Radio Program's signals cover 97% of population. However, it should be kept in mind that only 77.2% of households have a radio receiver (including car receivers), but 97.2% of households possess a TV set, making TV announcements more effective way of passing on information to the general public.

The number of internet users is estimated to be around 450000 inhabitants, or close to 70% of the population⁴⁵ (includes using internet only once or twice of week). Data show that 49.2% of households has a personal computer at home, and 44% has an internet connection⁴⁶. However, 72% of persons aged between 55 and 64 years and 96.6% aged over 64 years never used the internet. What was observed during the 2024 site visits is that in some of the rural settlements like Bare Kraljske often power outage is experienced which then affects other means of communication and the internet.

There are also four (there are actually five - Vijesti, Dan, Pobjeda, Dnevne novine and Monitor) nationwide delivered printed daily newspapers, with 63 more national and local newspapers with periodical editions (weekly, monthly)⁴⁷.

The estimation of the telecommunication and information network coverage is very important when it comes to the method of outreach and communicating information about the Project to the general public, local communities and persons affected by the Project.

A number of service providers are present at the two municipalities under impact. They differ in the service they provide. Crnogorski Telekom (ADSL, VDSL, FTTx (networks with optical fibers), M:Tel HFC-KDS, WiMAX), Orion Telekom (WiFi), Telenor (WiMAX), SBS Net Montenegro (satellite internet), RDC (DVB-T2), Telenor.

6.14.6 Educational system and literacy

Early childhood education and care in Montenegro services are provided through pre-school institutions, state (public) or private. In Montenegro, in school year 2022/2023 there were 21 public preschool institutions, with a network of 122 education units (separate locations part of one system), which organized 626 different age educational groups. Data by regions are Northern Region – 10 preschool institutions with 35 educational units; Central Region – 5 preschool institutions with 54 educational units; South Region – 6 preschool institution with 33 educational units. 95,3% of all enrolled children attend public pre-school institutions. Private preschool institutions (a total of 33¹⁴ institutions operate under the licenses issued by the Ministry of Education) exist in urban environments and includes small number of pupils (only 4.7% of the total number of pupils). Montenegro has a relatively low enrolment rate of children aged 3–6, at 52.4%, well below the EU target of 95% by 2020 and in contrast with the high enrolment rates in primary and secondary education (98% and 85%, respectively).

Children are enrolled in primary school at the age of six. Primary education is compulsory. The elementary education cycle lasts nine years and is divided into three phases: the first cycle of basic

⁴³ Source: World Bank statistics; https://data.worldbank.org/indicator/IT.CEL.SETS.P2?year_high_desc=false

⁴⁴ Source: Monstat: <https://monstat.org>; data for 2016.

⁴⁵ Source: CIA World Factbook; estimation 2016.

⁴⁶ Source: Monstat: <https://monstat.org>; data for 2015.

⁴⁷ Source: Monstat: <https://monstat.org>; data for 2016.

education (pre-primary), second cycle (1st to 4th grade) and the third cycle of basic education (from 5th to 8th grade). In the lower grades, students are randomly divided into classes and have only one teacher - and one classroom for all subjects. The only exception are classes of foreign languages and religious education, for which children have different teachers. Due to the small number of pupils, in rural settlements so called “district schools” are organized covered the first to the fourth grade. Children attending 5th to 8th grade in elementary schools located in the municipal centre, who live in smaller and more remote settlements depend on organised school transport and its regularity or on public transport. In some cases, pupils are travelling close to 10 kilometres every day to attend the primary school. During the Highway construction phase, it is essential that the road routes of school buses and kindergarten vans are kept open during pick up and drop off of children, usually between 7 to 8 am, 12 to 2 pm. The school was reconstructed in 2024.



Photo 6-7: Primary School Dr. Radoslav Jagos Vesovic

The Primary School “Risto Manojlovic” in Kolašin was established in 1880. while in 1962 the curriculum was continued. In the settlement Bare Kraljske the above depicted Primary School “Dr. Radoslav Jagos Vesovic”, is offering education since 1897 while the current facility was built in 1925. The school operates a school bus and provides regular daily transport. During the December 2024 site visit it was observed that the school was completely refurbished.

The Primary School in Kralje i within the homeland museum



Photo 6-8: The School in Kralje

In Andrijevica two elementary schools are operating – “Bajo Jojic” and “Milic Keljanovic”. The former was established in 1863, as the first state school in the region of Vasojevici. The school has a separate facility in the village of Kralje (operating since 1857). The School “ Bajo Jojic” in Andrijevica is located on the Branka Deletica street, on the M9 road, next to the 110/35kV electricity power substation. The snapshot on picture 86 shows the location of the school and its relation to the proposed new route of the highway.



Photo 6-9: Substation in Andrijevica next to the Elementary School “Bajo Jojic”



Photo 6-10: Elementary School “Bajo Jojić” and Secondary school in Andrijevica (red rectangle) and distance from the planned Highway (indicative layout yellow highlight)

The school in Gnjili Potok has been operating since 1945 and has less than 10 pupils. In 2017/2018 it had only 3 while it is expected the school might even close in 2025/2026. The Route change has relocated the highway below the school downhill Avoiding the need for pupils to use underpasses to cross the highway.



Photo 6-11: The School in Gniji Potok during winter picture taken during December 2024 (Source Paseco)

Due to the negative natural increase and the negative migration balance, the number of children in elementary schools in **Andrijevac** in the period 2011-2019 decreased by 133 or by 25.6%.

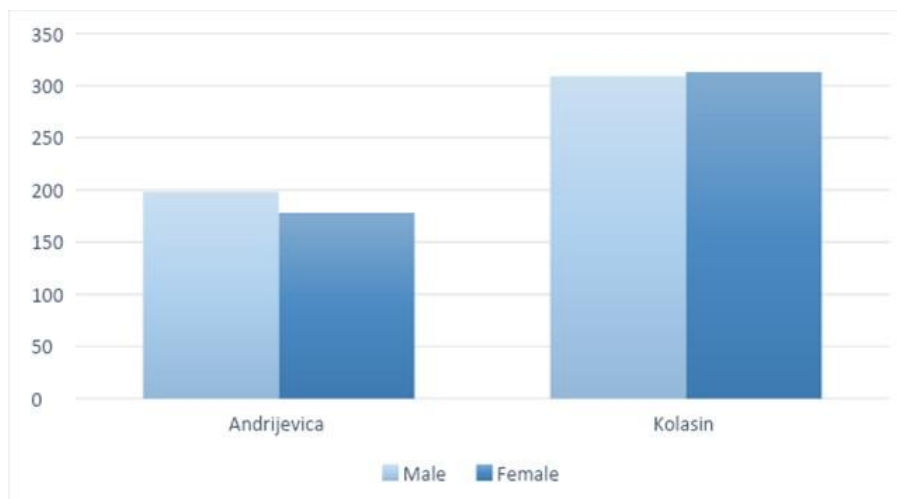


Figure 6-11: Children enrolled in primary schools in Andrijevac and Kolašin

Number of enrolled pupils in the elementary schools in the impacted local communities is very low.

Table 6-16: Number of classrooms and enrolled students in elementary education (2017/2018)

Settlement	Number of Enrolled Students	Number of classrooms
Andrijević (urban)	377	27
Tresnjevo	13	3
Slatina	13	2
Gnjili Potok	3	2
Kralje	18	2

Considering the demographic decline of rural settlements and the decreasing number of students enrolled in primary school, there is a constant dilemma whether to keep the primary school in the rural settlement, regardless of the number of students enrolled, or to organize the transportation of children to school in the municipal centre. Proponents of keeping the school in a rural settlement, regardless of the number of students, state as a key argument that the existence of a primary school is an integrative factor and a key condition for the survival of the settlement. In other words, that the termination of the school also means the closure of the settlement, i.e. its accelerated demographic disappearance.

The census of 2011⁴⁸ has shown that literacy rate in Montenegro reached 98.8% of total population, or 98.5% of all population over 10 years of age. Of 8149 illiterate persons in Montenegro (men 1559, and 6590 women) nearly 60% of them are over 65 years of age, making elderly women illiterate index over 90% of all elderly illiterates. The 2022 Census data on literacy were not available During December 2024.

UNICEF supported the Institute for Public Health to finalize and present a comprehensive situation analysis of water, sanitation and hygiene (WASH) in schools covering most schools in the country, followed by the implementation of a concrete action plan and guidance for improvements in the area of WASH planning and budgeting as well as capacity building of school staff and children, with a specific focus on menstrual hygiene management and WASH accessibility for children with disabilities. With this support, more than 60 schools were reached with hygiene supplies and information materials.

6.14.7 Health facilities

Although lagging behind EU countries, Montenegro has an increase of key health care index during the recent years. There were 3 physicians / 1000 inhabitants (2022) in Montenegro and 4 hospital beds / 1000 inhabitants (2012)⁴⁹. Number of inhabitants per one physician fell from 476 in 2012 to 340 in 2022, whilst the number of hospital beds per inhabitant remained the same⁵⁰. The Ministry of Health is the primary administrative, regulatory and governing authority in the health sector. The Health Insurance Fund (HIF) is the single purchaser of health services. The Institute for Medicines and Medical Devices is responsible for pharmaceutical policy. Health services are provided through the network of publicly owned health facilities and contracted private facilities. The network of certified providers aims to ensure equal geographical access to health care. The main documents regulating health care are the Health Care Law ("Sl. List RCG", 3/16, (...) 8/21)2021) that stipulates that everyone has equal access to health care; the Health Insurance Law (2021) that sets out that everyone has the right to health services under statutory health insurance; and the Master Plan for the Development of the Health System in Montenegro 2015–2020 that defines the strategic priorities for health.

⁴⁸ Source: Monstat: <https://monstat.org>; population census 2011.

⁴⁹ Source: CIA World Factbook;

⁵⁰ Source: Monstat: <https://monstat.org>; Yearly statistical book 2017.

Health care of citizens in MNE is organized on three levels: (i) primary (health centres). (ii) secondary (general and special hospitals) and (iii) tertiary (Clinical Centre of Montenegro).

The most important state health institution, the Clinical Centre of Montenegro, as an institution at secondary and tertiary level of health care, is located in Podgorica and it also provides services on secondary level for the population of Podgorica, but also to closer municipalities of Danilovgrad and Kolašin, both located north from Podgorica. The Clinical Centre of Podgorica, located in the Podgorica city, provides secondary health care close to 220.000 persons. Around 32,000 patients are annually hospitalized at the Clinical Centre, with the capacity of 778 hospital beds, around 10,000 surgeries are performed, 3,000 births, 9,000 dialysis, 32,000 CTs diagnostics, 10,000 MR diagnostics and numerous other diagnostic and therapeutic procedures⁵¹.

The health system of Montenegro is based on a social health insurance system, with more than 95% of the population being covered by social health insurance. Additional funds come from the state budget, as well as substantial out-of-pocket payments, with the latter amounting to 40% of current health expenditure in 2018. In 2022, Montenegro switched to a fully tax-funded health insurance system. Revisions to the Health insurance law in 2017 made residency an additional basis for entitlement to health benefits, extending population coverage to close to 100%. Montenegro suffers from outmigration of health professionals. Important push factors are low earnings, lack of protocols and work standards, underdeveloped continuous medical education, and provider payment mechanisms that are not linked to performance and quality of care.

The municipality of Kolašin has a Health Center (Dom zdravlja), with three health points (outpatient clinics) in the local communities of Manastir Moraca, Dragovica Polje and Bare Kraljske. In 2022, the total number of employed physicians in the Municipality was 11, while there were no employed dentists and pharmacists. According to the Director of the Health Centre, visits/doctor's work is organized once a week in these rural outpatient clinics. Two village' outpatient clinics (in Dragovica Polje and Manastir Moraca) have been completely reconstructed, and reconstruction is necessary for the outpatient clinic in Bara Kraljski. In addition to working in outpatient clinics, the doctor visits rural elderly households and performs basic examinations and gives advice in their homes. It is planned that the teams of the Health Centre will visit the population in the katuns on the mountains of Bjelasica, Sinjajevina, Komovi and Javorje. Within the Health Centre, it is planned to reorganize the inpatient unit (stacionar) (which was abolished 25 years ago), with about 10 beds in the first phase, which will significantly facilitate receiving therapy, especially for patients from remote rural areas.

Municipality of Andrijevisa has a Health Centre and a total of four employed physicians in 2022. Health care is provided through the Health Centre in the municipal centre of Andrijevisa.

A vast majority of expats relocation to Montenegro depend on a Montenegro expect health insurance plan for their health insurance requirements. Influx of workers by itself could induce potential impact in increased demand for health services. The influx will be minor and will not impose pressure to the health services. The capacity of existing health facilities is able to absorb without major disruption any potential demand for care and attendance to acute conditions of the influx workers (in case of curative or emergency cases). The Clinical Centre in Podgorica is 45-65 km away, as the largest medical centre and is substituting the missing capacity of the two receptor communities.

Medical and health care of the workers to be engaged during the Project construction gravitates towards the Health Care Centre Kolašin located in the local Medical Health centre in Bare Kraljske. There is a need for open daily routes for emergency patients, dialysis and elderly patients that can be influenced by Project construction (delays, local road closure etc), even more so considering that

⁵¹ Source: Spatial plan of Podgorica until 2025, published 2014.

Podgorica is a regional secondary and tertiary health care centre. The contractors and third parties working on the Project should try to avoid delays and closure that can significantly influence those routes and promptly communicate the health facilities and general and local public about delays, closure, alternative routes etc. Also, contractors and third parties involved in construction works for the Project should communicate with local health centres and hospitals for health issues and include their specific capacities in ESMP, including them into Health and Safety plans, health emergency procedures, health protection in case of influx of workers on the Project, information about endemic infectious diseases, establish a system to regularly monitor the health of employees and cooperate, as appropriate, on mitigation measures and plans for community health and safety.

6.15 Housing

The focus of the chapter on housing is the difference between the number of households and the number of dwellings. The assumption is that the majority of dwellings that are not used for permanent housing refers to dwellings that are used occasionally (during vacations, holidays, or for rent to tourists). At this time, there are not data on the characteristics of the housing stock (area, year of construction, building materials, equipment, etc.), but we point to its potential capacity in the prospective economic, social, and tourist revival of these settlements and the overall development of the Northern Region due to the construction of the new Highway. As can be seen from the table below, the number of dwellings is several times greater than the number of households, that is, the number of permanently inhabited dwellings.

Table 6-17: Numbers of households and dwellings in impacted Local Communities

Settlement	Number of households	Number of dwellings	Difference in no.of households and no.of dwellings
Municipality of Kolašin	2418	5631	3213
Bare Kraljske	28	129	101
Mateševo	20	91	71
Municipality of Andrijeviča	1435	3325	1890
Gnjili Potok	20	70	50
Kralje	50	100	50
Sjenozeta	16	30	14
Slatina	5	74	69

6.16 Source of income and poverty

In 2021, 21.2% of households in MNE were at the risk of poverty, while relative at risk of poverty gap was 29.5%. Gini coefficient was 32.5. Males and females have almost the equal risk of poverty rate (21.1 and 21.3). The highest risk of poverty rate was among the age contingent 0 – 17 years (30.5%), and the lowest among the oldest generation (65 and over – 13.8%). Poverty rate is significantly higher in rural areas (29.8%) compared to urban (16.6%). The highest poverty rate in 2021. is recorded in the Northern Region (40.8%), and the lowest in South Region (10.5%). Poverty rate is in correlation with the level of education – among those with primary schools and/or less than completed primary school it is 33.8%, and among those with higher education it is 6.5%. At risk of poverty are 38.9% of those in socially deprived and excluded groups.

Montenegro has a dependency ratio of 47.8 (persons that are likely to be dependable on support per 100 inhabitant working age inhabitants). This number consists out of two groups: young people

dependency (children 0-14 years of age) 27.3 per 100 working age inhabitants, and elderly persons (age 65+) of 20.5 per 100 working age inhabitants. Compared to the regional countries average (Croatia - total dependency ratio: 50.9; youth dependency ratio: 22.4; elderly dependency ratio: 28.5; Bosnia and Herzegovina - total dependency ratio: 43.3; youth dependency ratio: 20.7; elderly dependency ratio: 22.5; Serbia - total dependency ratio: 49.2; youth dependency ratio: 24.9; elderly dependency ratio: 24.3; Macedonia - total dependency ratio: 41.6; youth dependency ratio: 23.8; elderly dependency ratio: 17.7;)⁵² Montenegro has a younger population than most of the countries in the region.

However, this structure seems less favourable when considering that out of 422900 population between 15-64 years of age, active population consists of 280000 persons (66.2%), out of which 239600 are employed (56.6%) and 40400 persons are unemployed, or 10.4% out of working age population. There is a higher number of active men population than women population: 157600 men to 122400 women (56.2% to 43.8%) but the unemployment rate of this active population is higher in men (15.1% men and 13.4% women out of active population)⁵³.

The table⁵⁴ below shows monthly average household income and consumption in Montenegro:

Table 6-18: Monthly Average income and consumption of households in Montenegro

	Montenegro	Urban area	Rural area
Monthly average per household in %			
Total income source	100.0	100.0	100.0
Earnings and wages	58.7	63.5	48.4
Pensions	28.3	27.4	30.3
Social aid	1.7	1.6	1.9
Agriculture income	2.9	0.4	8.2
Small business income	3.0	3.1	2.8
Property income	1.4	1.3	1.7
Support and other gains	2.6	1.9	4.1
Other	1.4	0.8	2.5
Total consumption	100	100	100
Consumption from income	95.9	99	89.2
Food and beverages	33.2	34.1	31.6
Alcohol and tobacco	3.3	3.3	3.3
Clothing and footwear	9.8	10.3	8.8
Lodging, water, electricity	14.9	15.8	12.8
Furniture, household equipment and maintenance	4.4	4.4	4.4
Health costs	4.9	5.0	4.5
Transport	9.1	8.8	9.7
Communication	6.1	6.4	5.3
Recreation and culture	1.7	1.9	1.3
Education	1.3	1.3	1.2
Restaurants and hotels	2.6	3.1	1.6
Other	4.5	4.8	3.7
Consumption from own production	4.1	1	10.8
Food and beverages	3.5	0.7	9.5

⁵² Source: CIA World Factbook; estimation for 2015.

⁵³ Source: Monstat: <https://monstat.org>; employment data for 2018.

⁵⁴ Source: Monstat: <https://monstat.org>; data for 2021.

Alcohol	0.1	0	0.3
Wood for heating	0.5	0.3	1

Although it has been shown that Montenegro has a younger population than other countries in the region, pensions still make a significant part of nearly one third of an average household income. The average pensions are significantly lower than wages, reaching an average of monthly 511 EUR in 2024. Also, as much as agriculture is less developed in Montenegro, an average income (income + own consumption) deriving from agriculture reaches 17.7%, meaning that Project impact on agriculture land in certain cases can significantly influence household quality of life. The lodging, water and electricity costs are lower, as is the case in many ex-Yugoslavia countries, most households own their own home, and electricity and water prices are socially protected categories. Recreation and culture consumption are low, as is consumption for hotels and restaurants (vacations). Education costs are also low, but that come as a result of a free of charge state school and university system⁵⁵.

The rate of poverty risk is the proportion of persons (in the total population) whose equivalent income is less than the relative poverty line⁵⁶.

The absolute and relative poverty rate is consistently higher in rural areas relative to urban areas, but the majority of households below the poverty line, as well as those in the bottom 40 percent of poverty risk live in urban areas. The figure⁵⁷ below shows absolute poverty rate in urban and rural areas (left axis) and percentage of population below poverty line (right axis).

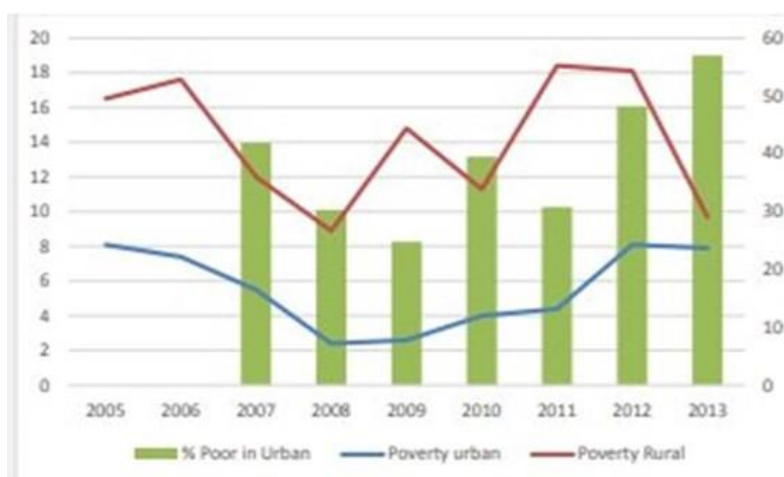


Figure 6-12: Poverty in urban and rural areas of Montenegro

⁵⁵ Source: own cross-reference analysis;

⁵⁶ Relative poverty is defined independently of the absolute minimum necessary to meet human needs, but rather as relative to average living standard of the country. Relative poverty represents the inability to meet the needs that are part of an acceptable life country standards.

⁵⁷ Source: World Bank document "Achieving Sustainable and Inclusive Growth in environmental volatility", published March 2016.

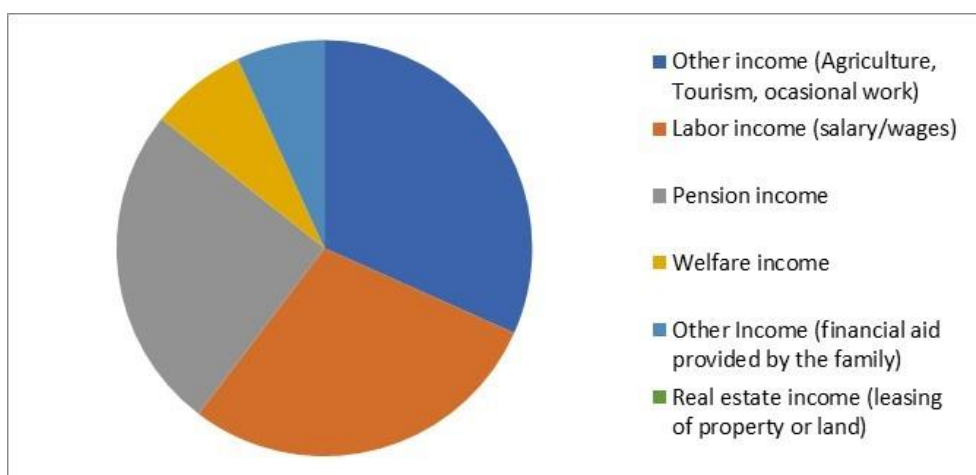


Figure 6-13: Income sources in the project area

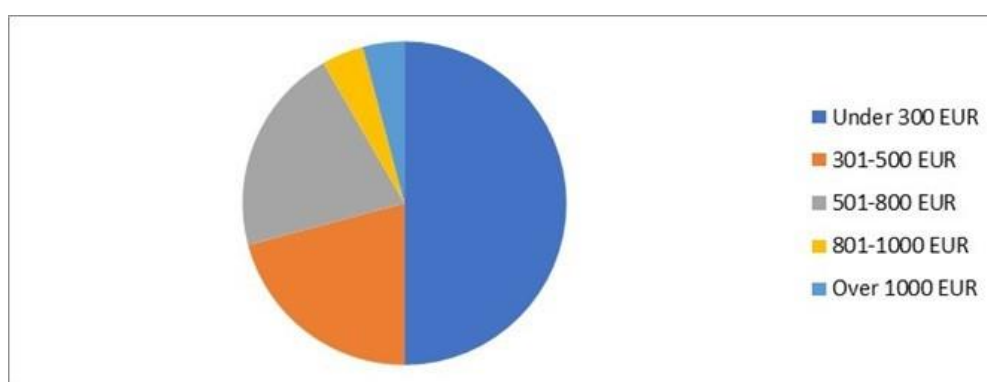


Figure 6-14: Income clusters in the project area

Data on the number of beneficiaries the Social support in the both municipalities in 2022 are presented in the table below (Sources: Statistical Yearbook 2023 / Review by Municipalities, MONSTAT)

Table 6-19: Number of beneficiaries of social support in the two Municipalities in 2022

Municipality of Andrijevac:	
Material support	66 families with 242 members;
Personal disability allowance	22 persons
Care and help allowance	158 persons
Child allowance	250 households with 425 children
Municipality of Kolašin:	
Material support	147 families with 378 members
Personal disability allowance	47 persons
Care and help allowance	300 persons
Child allowance	382 households with 610 children

The ESIA process has conducted a preliminary vulnerability assessment and has assessed to the extent feasible at this point vulnerability in the specific context of the project induced resettlement and the wider environment. The census has not been completed as mentioned above due to early planning stages to initially understand the vulnerability among affected people and how resettlement could impact on their lives and thus design assistance measures to involve them in resettlement planning and benefit from development opportunities. Data have been triangulated between the Baseline of the ESIA, the information and data shared by relevant authorities active in the area of social work and social assistance which has generated the below drivers of vulnerability in the project area:

- (i) Municipality of Kolašin. The centre for Social Work in Kolašin has confirmed a total of 3 categories of vulnerability support: monetary support for low-income families (families below the poverty line.), disability support, home care support.
- (ii) Municipality of Andrijevića. The centre for Social Work in Andrijevića has confirmed a total of 3 categories of vulnerability support: monetary support for low-income households (below the poverty line), disability support, family care support.

The following have been identified to reside in the project area:

Table 6-20: Social support in the two municipalities

Settlement	Low-income Monetary support	Disability support	Home care
Municipality Kolašin			
Bare Kraljske	2	1	13
Mateševu	0	1	2
Municipality Andrijevića			
Gnjili Potok	2	/	4
Sjenožeta	2	1	5
Kralje	3	/	24

However, confirmation whether these vulnerable persons are also affected by involuntary land acquisitions and resettlement will be determined in the LARP.

For these persons compensation itself may not allow restoration of livelihood to pre-Project level and tailored assistance will be designed following the socio-economic survey in development of the LARP.

6.17 Vulnerable groups

Based on EBRD Policy Requirements, vulnerable groups refer to people who, by virtue of gender identity, ethnicity, age, disability, economic disadvantage or social status may be more adversely affected by project impacts than others and who may be limited in their ability to claim or take advantage of project benefits. The PIU will take necessary actions to ensure that vulnerable groups are not disadvantaged in the resettlement process or when under other impact of the Project, and are fully informed and aware of their rights, and are able to benefit equally from the resettlement opportunities and benefits. Vulnerable individuals have initially been identified through every step of the process of environmental and social assessment, and drivers of vulnerability are seen amongst:

- Children in the households living below poverty line or at risk of poverty:
- Elderly households living in remote rural settlements
- Families with dependent member(s) in need of permanent care and surveillance

During the Project social impact assessment and implementation of resettlement policies special care and measures must be applied to all vulnerable individuals.

The section of persons in risk of poverty shows that elderly, retired persons are at rates of poverty risk lower than some other social groups at national level. According to some studies, intergenerational transfers are quite high in Montenegro, where children stay with the elderly in the same household, share the property and income that are accumulated and generated by the older generations⁵⁸.

⁵⁸ Source: World Bank document "Achieving Sustainable and Inclusive Growth in environmental volatility", published March 2016.

However, due to unfavourable trends in migrations of younger working age population from rural to urban areas, or to other countries, many rural households are left with only elderly people. This trend can be clearly analysed when comparing agricultural households working force

Refugees and "internally displaced persons":

Most refugees and "internally displaced persons"⁵⁹ came to Montenegro during the 1991-99 wars in ex-Yugoslavia countries. Montenegro had to provide shelter for refugees and IDPs, of whom one third (12,130) have found shelter in Podgorica. In 2005, Montenegro accommodated 26,521 refugees and displaced persons. According to the latest data (dan.co.me/vijesti/kasni-zbrinjavanje-35-izbjeglikih-porodica) (Dan, January 13, 2024) there are currently around 15.000 IDP,

At the end of the new route, just before the planned interchange a small group of residential buildings is located consisting of approximately 25 residential structures. These are outside of the physical footprint of the project. The complex is colloquially referred to as "Refugee settlement" as initially in the 1990s the structures were provided to internally displaced persons from the former Yugoslavia including Kosovo* as they fled from the war affected territories. Today, no evidence was found on particular vulnerability different from other local communities that will be indirectly affected during the duration of the construction of the Highway. During the site visits in December 2024, it was observed the houses were continuously extended, horizontally and vertically, and no other distinct features were identified. Community meetings nor key informant interviews have singled out any distinctive areas of concern specifically and exclusively related to this habitat.



⁵⁹ Internally displaced persons is a term used from the 90', as most of the refugees from war in ex-Yugoslavia countries came during the time it was still considered to be one country, so it was not appropriate to use the internationally defined term "refugees".



Figure 6-15: Location of the “refugee settlement” presented on the render of the future highway with the new route and structure on route (not part of the “refugee settlement” and abandoned)

6.18 Cultural heritage

Montenegro as a whole, has ample cultural heritage comprising 357 archaeological, historical, artistic, building, ethnological and technical monuments of culture. The first category (monuments of exceptional significance, there are 35 of these) includes monuments of culture of exceptional significance, monuments registered in the List of World Cultural Heritage etc. Category 2 (monuments of great importance) entails of 135, while the third category (monuments of local significance) protects a total of 187 monuments.

Regardless of the abundance and importance of cultural heritage monuments, as well as of its influence on the most important economic branch in Montenegro - tourism and touristic offer, immovable and movable cultural heritage in Montenegro can be regarded to be in a very bad condition and unfavourable position, due to the fact that at its larger part, as well as at its most important monument units, basic monument values have been jeopardized, with the tendency of the further change of integrity, loss of the monument values and historical origins. The monuments of culture, i.e. some monument units which are not brought to their purpose, are in the neglected or ruined state, and due to the lack of organized and designed protective activities, they are left to the direct and unavoidable influence of the time and vandal actions of individuals. Documentation basis and permanent research are of crucial importance for the protection of immovable cultural heritage, and based on that, new documentation is formed and the existing is also supplemented with information on monument values and identity of monument units. The state of documentation indicates a need for exploring all monuments of culture, and especially of archaeological locations. Expert researches are the only right way to confirm foreseen monumental characteristics and to justify with material proofs their putting under the protection regime. In scope of that, it is necessary to create conditions that the documentation database is made in digital form and in line with European standards in this field⁶⁰.

Archaeological investigations of the Institute for the Protection of Monuments from Cetinje in 1956 established that traces of material culture from the Neolithic era exist in the Ivangrad basin. In addition, traces of Illyrian material culture were found, so it can be assumed that the area around Andrijevića was the ecumenical space of all ancient peoples. Numerous sites of Roman settlements were discovered, not only in the Ivangrad basin where the Roman town of Municipium existed, but also in the vicinity of Andrijevića. Several monuments were found in Roman necropolises. The monument in the village of Zabrd below Žoljevica is especially well preserved. Based on this evidence, it can be concluded that the territory of the municipality of Andrijevića has been socially and economically active since ancient times.

Identified areas of importance at the broader project area are show in the Tables below and are kept within the baseline.

Table 6-21: Memorial plaques

	Cultural property	Coordinates	Cadastral District	Distance from axis m
1	Memorial - plaque on the site of the battle against the invaders; (Decree on the Protection No. 91/52 of 31 January 1952)	42°42'8.52"N 19°46'31.70" E	Andrijevića	3920

⁶⁰ Source: Spatial plan of Montenegro until 2020, published March 2008.

	Cultural property	Coordinates	Cadastral District	Distance from axis m
2	Memorial plaque at the site of first battles in July 1941 (Decision on the protection no. 2351 of 23 February 1952)	42°42'8.52"N 19°46'31.70" E	Andrijevića	1600
3	Memorial plaque on the building of the former party school (Decision on the protection no. 08-372/1 of 5 April 1963)	42°44'1.22"N 19°47'35.18" E	Andrijevića	1320
4	Memorial plaque on the building from which 20 patriots were led out and executed in 1943 (Decision on entry in the Register No. 08-375/1 of 5 April 1963)	42°44'1.22"N 19°47'35.18" E	Andrijevića	1320
5	Memorial plaque; (Decision on entry in the Register No. 08-386/1 of 5 April 1963)	42°45'17.05"N 19°46'49.93"E	Slatina	840
6	Memorial plaque; (Decision on entry in the Register No. 08-373/1 of 5 April 1963)	42°45'48.33"N 19°47'43.20" E	Trešnjevica	975
7	Memorial plaque; (Decision on entry in the Register No. 08-389/1 of 5 April 1963)	42°43'13"N 19°47'04.5"E	Andrijevića 1 and 2	2300
8	Memorial plaque at the site where national hero Milic Keljanovic was killed; (Decision on the protection No. 233/52 of 23 November 1952)	42°44'14.77"N 19°41'9.47"E	Gnjili potok	175
9	Memorial plaque (Decision on entry in the Register No. 08-388/1 of 5 April 1963)	42°45'43.14"N 19°46'55.73"E	Zabrdje	1340

Table 6-22: Sites with potential cultural and historical value

	Site	Coordinates	Municipality	Cadastral District	Distance from axis m
1	Mark's cave	42°45'09.31"N 19°45'01.18"E	Andrijevića	Sjenozeta	1220
2	Slatina	42°45'31.13"N 19°47'46.75" E	Andrijevića	Trepča	440
3	Memorial complex on Knjazevac	42°44'10.85"N 19°47'17.93"E	Andrijevića	Andrijevića	900
4	Church St. Lazar and St. Vid	N 42°46'451"E 19°36'223"	Kolašin	Vranjestica	2390
5	Cave on Mount Cuke	N 42°46'540" E 019°36'745"	Kolašin	Vranjestica	2545
6	Macure	N 42°42'144" E 19°39.264"	Kolašin	Kraljske Bare	3700
7	Bjelega	N 42°42'091"E 19°39'006"	Kolašin	Kraljske Bare	3830

6.19 Burial grounds and memorial days

At all locations of formally designated burial areas impact has been avoided, Cemeteries as a specifically demarcated, internally ordered space (often a grid) where grave plots are precisely located, clearly delineated and identified by markers with specific living families and their individually named and departed kin represent cultural landscape on one hand and highly sensitive area on the other hand when assessing the social impact. During the screening of impacts, five cultural burial landscapes of importance have been identified. Pictures below depict the specific locations. All burial grounds are orthodox cemeteries, which are accompanied by a nearby church and chapel for funeral and memorial services.

Within the entire route including in the location of the route change from Tunnel Trešnjevica to Andrijevića all affects, direct or indirect, access issues etc. have been avoided. The Detailed design will

ensure continued and unhindered access were required through underpasses, and restoration of existing roads (example on figure 6-17 below – restoration of existing road in purple line).



Figure 6-16: Burial ground 1 - Cemetery Mateševsko – no impacts



Photo 6-12: Burial ground 2 - Cemetery Bare Kraljske and the chapel



Figure 6-17: Burial ground 3- Cemetery Gnjili Potok after Route change

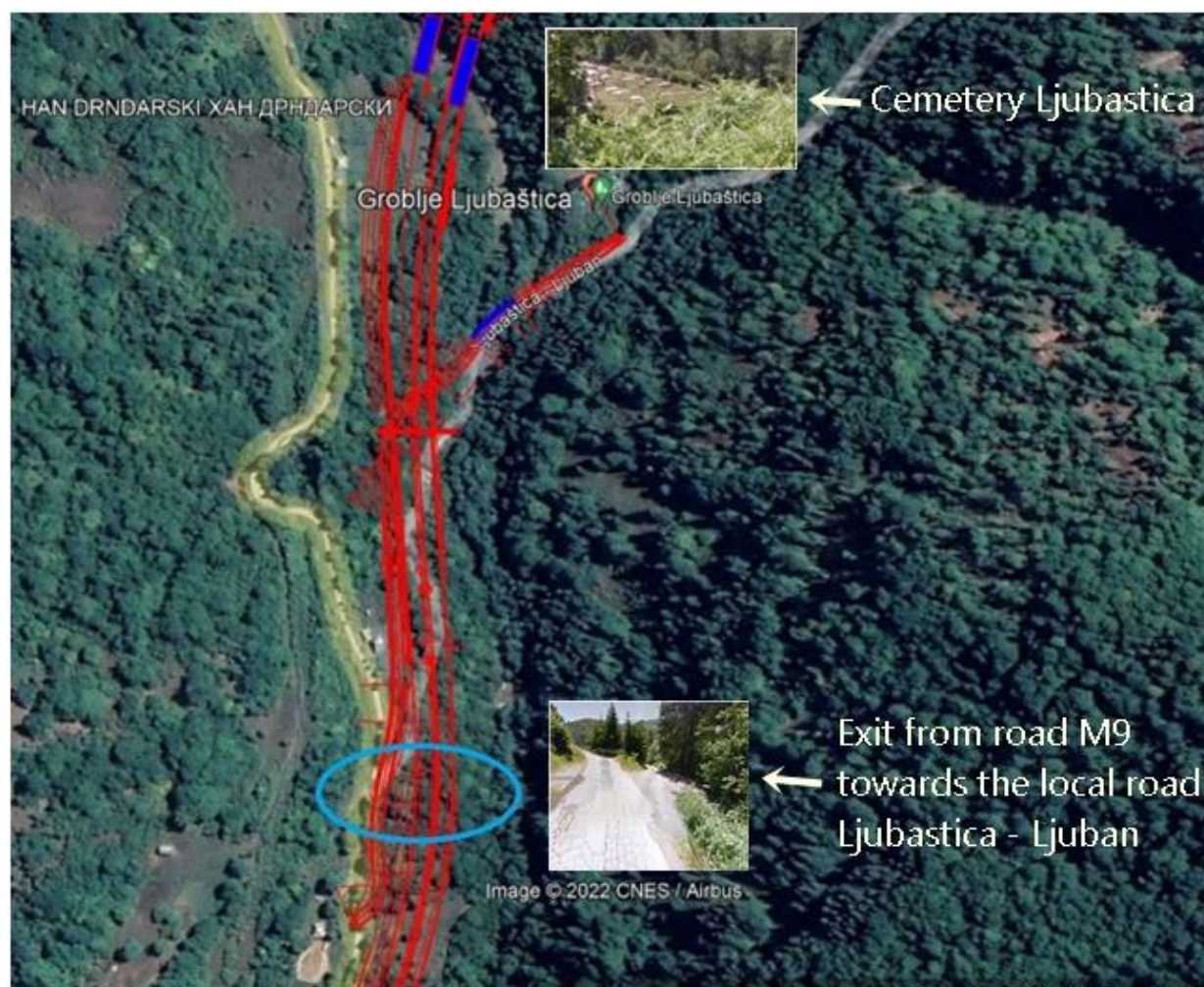


Figure 6-18: Burial ground 4 and 5 - Cemetery Slatina



Figure 6-19: Burial ground 5- Cemetery Ljubaštica near Han Drndarski

Cemetery Ljubaštica is located at a distance of 102m from the future alignment. However, the location is constrained by a single access route road Ljubastica-Ljuban which separates from the Road R19 Mateševo-Andrijeva.



7 Environmental and social impact assessment

7.1 Environmental Impacts

7.1.1 Topography, landscape and land use

In the **construction phase** landscape scenery will be altered temporarily by the presence of construction machinery, construction camps and other auxiliary facilities. The main activities of the construction phase having short term impacts on the landscape include:

- The construction site itself, where the presence of workers, heavy machinery (including tunnel boring machinery), earth movements, deposits of construction material excavated from tunnels and/or needed for embankment construction, temporarily deposited construction waste will have a temporary adverse impact on the local landscape, especially for nearby residents. This impact on landscape will disappear as the construction front advances to other areas.
- The construction camps for workers (this is still not determined as it will depend on the Contractor's decisions and number and type of workers) and will likely occupy a vacant area. This type of camps will also be perceived as a temporary adverse impact on the landscape at a local scale
- Ancillary areas for vehicle and machinery maintenance and the installation of other temporary structures which may have an adverse visual impact due to their size and height.

With a view to the detectable but minor change to the landscape conditions (which are deemed to be tolerable and reversible due to the temporary nature of construction), the magnitude of the landscape impacts in the construction phase is considered low.

The section in question passes through mostly hilly terrain with large spatial limitations and through mostly undeveloped and uninhabited areas, predominantly forest areas, including the river courses and valleys mentioned above. Considering the magnitude of impacts, the sensitivity of the landscape receptors as well as the duration of the construction related impacts, the initial significance of this adverse impact, without mitigation measures is Moderate.

Temporary and permanent landscape and visual impacts from land take and above-ground structures, are temporary for the working strip, as camps and yards which will be reinstated to pre-construction conditions once construction is completed. Sections with potentially significant landscape impacts include mountain ridges or elevated terrain and old growth and mature forests.

The construction of the highway results in an irreversibly loss of land, which, as a rule of thumb, can never be used for another purpose again. Land acquisition for highway construction can be divided into two basic categories: areas that are permanently used for the needs of the highway, and the areas that are used temporarily, only during the construction phase. Areas that are irreversibly used include: the highway surface itself, highway elements, supporting facilities, and other areas (land within the expropriation zone).

The existing land purpose and areas to be used for highway construction are shown in the table below:

Table 7-1: Uptake of land for the Mateševu Andrijevića section construction

Existing land purpose	Municipality Kolašin (ha)	Municipality Andrijevića (ha)	Total land area planned for acquisition (ha)	Percentage (%)
Construction land	8.24	42.12	50.36	28.92
Arable land	36.77	19.68	56.45	32.91
Other agricultural land	1.15	4.78	5.93	3.40
Forests	20.21	25.04	45.25	25.98
Water areas – rivers	0.08	1.21	1.30	0.74
Other natural areas	0.90	13.10	14.00	8.04
Total	67.35	105.93	173.28	100.00

Therefore, total area of the land to be irreversibly occupied for the needs of the Mateševu-Andrijevića highway section is 173.28ha.

The areas of agricultural and other land that will be affected by the construction of the highway can be divided into three levels:

- The narrowest strip is considered to be up to 60 m wide (30 m to the left and right from the axis of the road to the embankments or shoulders) will be completely "attacked", either by the highway surface itself or by facilities and machinery during its construction. It is not a small loss, but unfortunately not the only loss, and it is not only a loss caused by the construction of the highway, but also by construction of other infrastructure facilities.
- A slightly wider strip is considered to be 200 m wide (100 m to the left and right from the axis of the road). Along with the previous one, this is considered a zone of direct impact of the highway traffic and is mostly owned by the concessionaire of the road or the state. In general, all protection measures apply to this belt.
- The widest zone is considered to 500 m wide (250 m to the left and right from the axis of the road, or 150 m in extension of the previous zone). This belt includes areas that are directly physically damaged and consumed soil (up to 30 m from the road axis on both sides), areas along the highway that are directly affected by traffic (from 30 to 100 m from the road axis on both sides) and areas that are indirectly affected by traffic (from 100 to 250 m from the road axis on both sides).

Project implementation will result in the conversion of land, whereby the cadastral parcels within the project area will be converted from the existing purpose to the road zone. That area includes 56.45 ha of arable agricultural land of excellent quality, as well as 5.93 ha of other agricultural land. This represents 36.31% of converted land.

Construction of Mateševu-Andrijevića highway section will not block any special deposits of mineral raw materials.

Apart from the fact that the landscape will be changed by the newly built highway and buildings, the construction activities also have a significant impact on the landscape, however it is only temporary. The construction works on the highway section will have a significant local influence in the areas of works on the open route, viaducts, interchanges, bridges and tunnels.

The fact is that construction works will cause a series of adverse impacts on the landscape, among which the most significant are the following:

- the execution of works on the open route will harm the existing landscapes in those locations, affecting their harmonization and leading to their visual disfiguration;
- generation of noise and dust from the construction works, that will have a negative visual impact
- Temporary impacts during the construction period include adverse impact to the landscape (disruption of visual continuity) and degradation of cultural resources.

7.1.2 Air quality

7.1.2.1 Construction phase

Possible and expected impacts on the environment inevitably arise from construction works on open routes and road facilities. The highway section in question is characterized by changes in topography and geological composition. Such a situation requires a large volume of construction works and construction of road facilities (tunnels, bridges, viaducts, culverts, retaining walls, etc.). Each of these facilities has its own specifics and potential negative impacts on the environment during construction. Considering the scope and type of works that are stated at the level of the available project documentation of the subject section of the highway and the amount of work on excavations of rock material, there will be impacts on the environment through emissions and concentrations of pollutants.

The execution of construction works represents a significant source of air pollution, both due to the use of a large number of construction machines that use fossil fuels for propulsion, and also due to the execution of mining works, drilling mine holes and blasting. During earthworks, large amounts of dust are emitted into the atmosphere, which can cause negative consequences for the surrounding population, flora, fauna and employed workers.

In the specific case, the area where construction works are carried out is far from the residential area. The Bar-Boljare highway corridor, the wider area of the Mateševu-Andrijeviča section is mostly sparsely populated, with the exception of the part that passes through the settlements in the Drčka and Kraštica river valleys.

The main activities contributing air pollutants to ambient air are:

- Tunnel construction
- Construction of cuts, incisions and embankments
- Vehicle and Machinery traffic

Tunnel construction

Works in the tunnels will be carried out according to the procedures of the Main Projects Specifications on the construction of tunnels. It is designed to construct one of two-tube type tunnel on the section of the Mateševu-Andrijeviča highway. The length is 3895m long in the left tube and 3945m in the right tube. Which is 7840 m in total, with an excavation volume of about 1 million m³.

During tunnel excavation, the following air pollution emissions occur:

1. Emissions of air pollutants from drilling and mining works,
2. Emissions of air pollutants from working machines during loading and removal of excavated rock mass.

Basic works during tunnel excavation are drilling and mining works, loading and removal of excavated rock mass.

Basic characteristics of drilling and mining works are:

- Bore diameter 45–48 mm.
- Borehole length IV rock category (flysch complex of sediments) 1.5 m;
- Construction of the calotte in two phases: I phase of the calotte – 50 m² and II phase: foot vault – 18 m².
- Blasting is carried out with cartridges of ammonium nitrate explosives of the reinforced Amonal type.

The mining and technical characteristics of the explosive Amonal are given in the following table.

Table 7-2: Characteristics of AMONEL

Characteristics	Values
Density, kg/dm ³	1.10 – 1.15
Detonation speed, m/s	4 400 – 4 500
Detonation transmission, cm	4 – 9
Trautl's trial, cm ³	380 – 390
Impact sensitivity, kgm	4
Oxygen balance, % wt.	+0.24
Gas volume, dm ³ /kg	963
Heat of explosion, kcal/kg	1 015
Explosion temperature, °C	2 564
Work factor, kgm/kg 103	433
Spec. energy dm ³ at/kg	9635
Detonation pressure, daN/cm ²	56 019

Table 7-3: Calculation of drilling and blasting in rock mass of category IV

	Calotte (total)	Foot Vault (total)	Calotte (simultaneous)	Foot Vault (simultaneous)
Amount of explosives, Kg	76.6	27.4	6	3.6
Gas Volume, lt	73766	26386	5778	3467
NOx emissions, Kg	28.72	10.27	2.25	1.35
NOx Conc. mgr/lt	389	389	389	389

Generated polluting substances during tunnel excavation work refer to dust, gasses during the detonation of explosives and gasses during the operation of machines during the loading and transport of demined material. Excavation technology requires that the tunnel pipe be ventilated for 30 to 60 minutes after the detonation of the explosives.

Based on mining regulations and considering the power of the fan, the quantities of air for diluting the pollutants is concluded that the gaseous concentrations obtained at the exit will be below the MDK values.

Considering that dust particles smaller than 5 microns do not settle but are carried out with the air flow through the ventilation pipe into the outside environment. The proportion of suspended particles emitted from rock blasting is about 2%, which represents an emission of 510mg/s. The calculation of dust concentrations in the immediate vicinity of the ventilation opening, was made only for cases where there are rural buildings in the immediate vicinity.

It can be concluded that the dust concentrations are slightly higher than the legally prescribed values (by the Decree on determining the types of pollutants, limit values and other air quality standards ("Official Gazette of the Republic of Montenegro", no. 25/12). value for suspended particles PM₁₀=50µg/m³. During dedusting at the tunnel: Tunnel 1, we have exceedances of suspended

particles at the buildings in the immediate vicinity (entrance of Tunnel 1, exit of Tunnel 1), so it is necessary to install dust collectors.

It should be taken into account that the ventilation of the tunnel after blasting, in other words the emission of suspended particles is time-limited, and that the chemical composition of the dust does not differ from the chemical composition of the geological environment.

Construction of cuts, incisions and embankments

The execution of construction works on the creation of cuts, incisions and embankments takes place in the natural environment, causing the degradation of narrower and wider areas in the zone of the highway section in question. Under the context of the technological processes in the creation of cuts, incisions and embankments from stone materials of rock mass III-VI category, the following stages of work take place:

1. Clearing vegetation, removing and disposing of the humus layer (if any),
2. Loading, transport and disposal of the disintegrated layer of rock mass that is not suitable for building an embankment,
3. Drilling and blasting,
4. Excavation, transport and loading of rock mass into the reception bunker of the mobile crushing plant,
5. Crushing (primary),
6. Sifting and possible secondary crushing,
7. Removal of crushed material and construction of embankments or removal to landfills or warehouses.

During the execution of the mentioned works, various chemical substances are emitted into the atmosphere from different sources, from the rock mass, the operation of construction machinery in the form of exhaust gasses or from technological processes, such as blasting. A sequence of works performed are namely:

1. Drilling - drilling set as a point source of pollution. Drilling mine holes is a source of fine respirable dust, and the favourable circumstance is that the drilling work is periodic and short-lived. Dust that occurs as a result of the drilling rigs operation is "caught" with a hose and taken to a storage facility that is an integral part of the drilling rigs (this dust is later used to fill boreholes),
2. Blasting – a surface source of pollution. This phase is carried out periodically and is sometimes long-lasting, so to speak, of an impulse character,
3. Operation of construction machinery - excavators and/or loaders as point sources - loading of demined rock mass.
4. Truck transport of demined rock mass to a crushing plant or to a landfill - as a line source (subject of the next chapter).
5. Machines and devices for rock mass crushing and screening are point sources (crusher, vibrating grid, vibrating sieve, belt conveyors),
6. Wind erosion - work on open levels of cuts, cuts and embankments, landfills and warehouses of finished products (fractions) are significant surface sources. The effect of wind, especially in dry periods, is a significant source of dust,
7. Pollution originating from exhaust gasses released during blasting,
8. Pollution resulting from the operation of engines of construction machines and means of transport such as: excavators, loaders, bulldozers, dump trucks, compressors (subject of the next chapter).

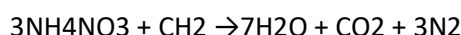
Assessment of gaseous emissions from blasting

The blasting of the rock mass during the construction of the highway on the section in question is a source of air pollution, since due to the composition of the explosives, when it is activated, significant amounts of gasses are emitted into the atmosphere. The composition and quantity of blasting products depends primarily on the type of explosives used, that is, on the oxygen balance and the amount of explosives used in the minefield.

Commercial explosives will mainly be used for blasting on the subject section of the highway. The decomposition of ammonium nitrate takes place according to the formula:



Basically, ammonium nitrate explosives are a mixture of granular porous ammonium nitrate and fuel oil in a certain relation: 94% ammonium nitrate, which has an oxidant component and 6% diesel fuel. The stoichiometric ratio is 94.5% AN and 5.5% fuel oil, but a ratio of 94:6 is used to ensure a complete chemical reaction of ammonium nitrate:



The products of the explosion are toxic, but CO and NO₂ occur in very small amounts. The composition and amount of gasses during the detonation of 1 kg of Amonex 1 and Amonex 4 explosives was taken from the manufacturer (Trajal, Kruševac).

Table 7-4: Composition and quantity of gasses per 1 kg of explosives

Type of explosive	Type and quantity of gasses during detonation of 1 kg of Amonex				
	CO ₂ (kg)	H ₂ O (kg)	N ₂ (kg)	O ₂ (kg)	CaO (kg)
Amonex 1	0.2003	0.4245	0.326	0.0489	0.0003
Amonex 4	0.234	0.360	0.326	0.0489	0.0003

Table 7-5: Characteristics of used explosives

Type of explosive	Amonex 1	Amonex 4
Density (g/dm ³)	1.06	1
Detonation speed (m/s) min.	4100	3200
Cartridge diameter, mm	70	70
Cartridge length, mm	368±14	390±16
Cartridge weight, g	1500	1500
Oxygen balance (%)	+0.13	+0.17
Gas volume (dm ³ /kg)	975	1004

Air pollution during the construction of cuts and embankments

The amount of pollutants released into the atmosphere during the construction of cuts, incisions and embankments depends on a number of different factors. For each individual construction machine, the emission depends on the following factors:

- type and power of engine,
- type and composition of fuel,
- sulphur content in diesel fuel,
- engine maintenance level,
- engine temperature - a cold engine works with a lower degree of utilization,
- the age of the engine.

When making cuts, incisions and embankments, it also depends on:

- number of machines and trucks working simultaneously,
- operating mode,
- properties of the rock mass and properties of access or transport roads, i.e. their maintenance,
- climate conditions during the execution of works.

The impact zones have a local nature, are limited to the work site only.

Regarding the gaseous concentrations, according to the recommendations of NIOSH (National Institute of Occupational Safety and Health), do not lead to health consequences, with very short stays, when distance from the source is 60 m for NO₂ and 40 m for CO. Since there are no residential buildings in the immediate vicinity at distances that are close to the above, it can be concluded that the products of detonation during the creation of cuts and incisions won't have significant consequences to air quality.

The emission of mineral dust during regular work on the construction of the highway section in question represents one of the more significant negative impacts on the environment. The dust that is emitted during regular work is composed of small carbonate particles and has the same composition as the rock mass on which construction works are carried out. This dust has a high percentage of CaCO₃, while other impurities are in the form of microelements - MgO, SiO₂, Al₂O₃, Fe₂O₃. Considering the chemical composition, the dust that will be emitted during construction is not toxic to the environment, because it does not belong to substances that are poisonous, toxic, carcinogenic, teratogenic, mutagenic, explosive, flammable and ecotoxic. The negative impact of dust is reflected through its physical effect, and above all on the flora in the vicinity of the construction site.

Based on the technological processes applied during the creation of cuts, incisions and embankments in the rock mass and the construction machines that will work on the construction site, it is possible to obtain approximate data on the amount of dust that will be generated and the possibilities of transport over certain distances. During blasting, the dust cloud created by detonation, depending on a large number of parameters, generally dissipates in a period from 5 to 20 minutes.

Based on previous experience and literature data, it is possible to expect that dust particles created by construction works in limestone rock masses with a diameter greater than 50 µm will settle at distances closer than 50m, and they generally make up 90% of the total mass of emitted dust. Dust particles up to 20 µm are deposited at a distance of up to 200 m in the direction of prevailing winds, and dust particles up to 10 µm are blown by the wind and can reach a distance of more than 500 m. The concentration of dust in the air also decreases with the distance from the working floors, primarily due to the natural barriers in the space formed by topography and vegetation.

In a corridor of 300-500 m, the local environment will be exposed to the negative effects of dust. Dust can affect a zone 300-500 m wide from the work zone, which is mostly forest land. Accumulated dust on leaf surfaces, in addition to having a negative effect on plant tissue, also leads to visual degradation of landscape.

The dust that occurs during the operation of the engaged mechanization for the installation and planning of stone material, loading and transport, affects first of all the work location, the immediate environment and the narrower road strip through which the transport is carried out.

Assessment of dust emission from the working floors of cuts and incisions

The upraising and emission of dust from the surfaces of access roads and other open areas under the influence of wind can represent a significant source of environmental pollution. The process of raising dust from the surfaces of access roads, temporary disposal sites for excess rock mass, working surfaces such as cutting slopes, embankments and incisions or the surrounding land under the influence of wind is very complex. The lifting of dust under the influence of the wind occurs only in the case when the effect of the aerodynamic force of the wind on the dust particle is greater than the effect of all other

forces that also act on it, such as the gravitational force (particle weight), the force of adhesion, etc. That is why the process of raising, emission, concentration and immission, i.e. distribution of dust in the environment is very complex and depends on the dispersed composition and shape of dust particles, its mineralogical and chemical composition, density, size of the working surface or their exposure to wind of a certain direction and strength and the amount of dust on those surfaces.

The raising of dust from the open surfaces of access roads (especially if the roads are macadam), cut slopes, embankments and incisions and flat working surfaces is considered as a linear source of emissions points. To determine the emission or specific rise of dust (mg/s/m²) from open surfaces under the influence of wind speed, its concentration within the scope of dust dispersion, the range of dust concentration above the GVI in the environment and specific emissions (mg/s/m²) on the wind axis can be used formulas from professional literature.

The analysis includes:

- dry surfaces on active working surfaces of cuts, incisions and embankments,
- potential sources of air pollution with suspended particles (mineral dust) have been identified: for truck transport during the construction of cuts, incisions and embankments,
- construction machines and technological equipment on the active working surfaces of cuts, incisions and embankments (drilling rig, bulldozer, excavator).

The amount of dust that will be emitted, its transport through the air environment and the impact on the environment depend on a large number of parameters.

A particularly important characteristic of emitted dust is its dispersed composition. It is, in fact, the content of particles according to their size, the size of the diameter of the "grains" in the dust aerosol. According to the degree of dispersion, there are three categories of dust:

- dust with particles larger than 10 µm, which has the ability to settle with increased speed in conditions of absence of air flow,
- dust with particles from 10 to 0.1 µm, which has the ability to settle at a constant rate in the absence of air flow (according to Stoke's law),
- dust with particles below 0.1 µm, which does not have the ability to settle (according to Brun's law of motion).

Sources of dust that affect air pollution on the working floors of cuts, incisions and embankments, as well as in the immediate environment, can be internal and external. Internal sources of air pollution are: drilling rigs, construction machines, means of transport and working floors (wind erosion). Apart from means of transport, whose effect is general pollution, the operation of construction machinery on working floors has the character of local pollution and only in the summer period with strong wind, without application of wetting and dewing of access roads can affect the environment.

According to research and literature data, it is possible to form a general balance of the individual impacts of internal sources on air pollution in the area of the working floors, as shown in the following table.

Table 7-6: Balance of origin of pollutants in the atmosphere of working floors

Pollution source/process	Share in pollution of working floors %
Drilling	5 – 10
Blasting	20 – 25
Loading	5 – 15
Transportation	15 – 35
Wind Erosion	25 – 35

In addition to the above, air pollution in the area of working floors of cuts, incisions and embankments can be general or local. External sources contribute to an increase in general pollution, while the effect of internal pollution is mostly local. The effect of the operation of excavators, bulldozers and other construction machinery has the character of local pollution, transport has the character of both local and general pollution, while the lifting of deposited dust by the effect of wind has the character of general pollution.

Table 7-7: Table: Possible internal sources of pollution and character of pollution

Sources of pollution	Harm	Character of the pollution
Blasting	Gasses and dust	Local and general
Transport by trucks	Gasses and dust	Local and general
Lifting of accumulated dust by wind action	Dust	General
Drilling mine holes	Dust	Local
Work of excavators, bulldozers, etc. construction mechanization	Gasses and dust	Local

Air pollution is mostly possible at a distance of up to 200 meters around construction machinery in operation, and to a much lesser extent it occurs as general pollution.

As a very intensive pollutant, there is the lifting of deposited dust, wind erosion, which on average produces about 30% of the general pollution, and it is possible that it is significantly more. This situation occurs at wind speeds greater than 2 m/s.

Regardless of the high values of local pollution, the general pollution of the working floors ranges from 0.3–5 mg/m³, which is usually within the limits of the permissible working environment.

The analysis of dust dispersion from the working surfaces of cuts, incisions and embankments, and the possible impact on the environment was made taking into account the following conditions:

- the emission is maximum and implies the simultaneous operation of one drill and one loader,
- work of two trucks,
- wind speed of 3.5 m/s,
- the critical wind direction is towards the wind rose
- the weather is sunny and dry,
- the working floors are of the height type

Taking into consideration the common technological process, the following emission sources can be estimated during simultaneous operation:

- one drilling rig, total emission: 300 mg/s
- one loader, total emission: 2,000 mg/s
- one truck, total emission: 3,500 mg/s
- wind erosion, on 1/3 of the total area of the working floor

at a wind speed of 3.5 m/s approx. 20,000 m² 20,000 mg/s

- Total superimposed emission: 25,800 mg/s

By applying appropriate protection measures, such as wetting and moistening, the stated total dust emission from work surfaces can be reduced up to 15-20 times. Then the emission of dust from the working surfaces of cuts, incisions and embankments in the most unfavourable case for environmental protection would amount to: E = 1,290 mg/s.

The permitted concentration of dust in the environment is determined in accordance with the Regulation on determining the types of pollutants, limit values and other air quality standards (Official Gazette of Montenegro, No. 25/12). A high level of dust concentration in the environment can occur occasionally, depending on the direction, strength and frequency of a particular wind in the area where the works are being carried out. Data on average particles and wind speeds for the area (wind rose) were analysed. But what is fundamentally important is that the direction and strength of the wind is influenced by the local relief of the terrain, so it is best to use meteorological data from the locality of the areas exposed to the wind.

Also, atmospheric phenomena can lead to different phenomena, such as, for example, small concentrations of pollution in the immediate vicinity of the working floors on open parts of the route, and larger ones at a considerable distance, or even concentric pollution in a wider area. The transport of pollution can be conditioned by the configuration of the terrain and the position of neighbouring buildings, of which we have few in this particular case. From all of the above, it can be concluded that the quantification of suspended particles and their transport in the zone of influence of the corridor depends on all relevant local factors.

In the active part of the construction site where excavation and transport work is taking place, a water sprinkling procedure is planned to prevent the emission of dust from the dry substrate. A system will be applied to tanker trucks and a built-in sprinkler device. Regular application of this sprinkling procedure with the use of available technical possibilities for increasing humidity, achieves satisfactory effects of preventing dust emissions and air protection in the working and living environment, and doesn't complicate the technical conditions for carrying out construction work and transport. In the event that the Contractor does not have a sufficient amount of use water for spraying the access roads and work floors, apply one of the available chemical agents available on the market for dust suppression (Aquastatin or any other biodegradable substance).

Vehicle and machinery Exhaust emissions

Exhaust gases emitted from the operation of worksite machinery are mainly carbon monoxide (CO), hydrocarbons (VOC), nitrogen oxides (NO_x) and sulphur oxides (SO_x). The emission factors for the construction equipment and fuels shown in the following table have been derived from EMEP/EEA emission inventory guidebook 2019 (1.A.4 Non-road mobile sources – machinery GB2013, Tier 1 emission factors). Total air emissions from the worksite are calculated by the fuel consumption of each equipment type multiplied by the emission factors. For the assessment a typical synthesis of worksite equipment has been assumed and worksite operation of approx. 10 hrs/day is assumed.

Table 7-8: Emission factors for off-road machinery

Fuel type	CO	NO _x	PM10	CO ₂
	g/kg	g/kg	g/kg	kg/kg
Diesel	10.7	32.7	2.1	3160

Note: PM10 are all PM2.5

Table 7-9: Typical composition of worksite equipment

Equipment	No of machinery / vehicles	Fuel	Fuel consumption (lt/h)
Tracked Excavator (20 t)	2	Diesel	19.0
Compressor / Pneumatic breaker	2	Diesel	3.5
Dozer (200 KW)	2	Diesel	17.0
Tracked loader (60 KW)	1	Diesel	19.0

Equipment	No of machinery / vehicles	Fuel	Fuel consumption (lt/h)
Road surfacing (asphalt spreader, chip spreader, road roller, lorry)	1	Diesel	35.0
Road roller	1	Diesel	7.0
Truck mixer	1	Diesel	20.0
Truck 20 t	4	Diesel	8.0

Based on the above emission factors and construction machinery composition the total air pollutants emissions for the worst-case scenario of simultaneous operation of all equipment are shown in the Table below:

Table 7-10: Emissions from work site equipment

Pollutant	Emission (g/h)	($\mu\text{g}/\text{m}^3$)	Limit ($\mu\text{g}/\text{m}^3$)
CO	1636,90	0.05	10
NOx	5036,85	8.34	30
PM10	320,41	0.50	40

As it can be concluded from the above calculations, air emissions from the operation of the worksite equipment are low and therefore their distribution in the surrounding area will concern negligible concentrations. Therefore, the operation of the construction machinery may have a minor effect on air quality and it is not expected that any nuisance will occur.

Dust emissions

According to US EPA (AP-42; 13.2.4), the quantity of particulate emissions generated by either type of drop operation, per kilogram (kg) (ton) of material transferred, may be estimated using the following empirical expression:

$$E = k \times 0.0016 \times \frac{(U/2.2)^{1.3}}{(M/2)^{1.4}} \text{ (kg/t)}$$

where:

E = emission factor k: particle size multiplier (for particles < 30 μm , k= 0.74)

U: wind speed (assumed 5 m/s) M: material moisture content (assumed 10%)

Particulate emissions are calculated as E= 0.36 g particulates/ t material.

Particulate emissions from movement of construction vehicles (paved roads)

Particulate emissions occur whenever vehicles travel over a paved surface such as a road. In general terms, re-suspended particulate emissions from paved roads originate from, and result in the depletion of, the loose material present on the surface (i.e., the surface loading). In turn, that surface loading is continuously replenished by other sources. The movement of vehicles is associated with construction worksite operations, such as transfer of materials and equipment.

According to US EPA (AP-42; 13.2.1), the quantity of particulate emissions from resuspension of loose material on the road surface due to vehicle travel on a dry paved road may be estimated using the following empirical expression:

$$E = k \times (sL)^{0.91} \times (W)^{1.02}$$

where k : particle size multiplier depending on particle size range (g/ Vehicle Kilometer Travelled)

sL : Silt loading, (0.06 g/m² for paved roads).

W : average weight (tons) of the vehicles traveling the road (5 t)

Particulate emissions (PM_{2.5} and PM₁₀) are calculated in the following table taking into account the aforementioned.

Table 7-11: PM emissions from movement of construction vehicles

	k (g/VKT)	sL (g/m ²)	W (t)	E (g/VKT)
PM 2.5	0.15	0.06	5	0.06
PM 10	0.62	0.06	5	0.25

It can be concluded from the table above that the particulate emissions from the movement of construction vehicles on paved roads is 0.06 g/Vehicle Kilometer Travelled for PM_{2.5} and 0.25 g/Vehicle Kilometer Travelled for PM₁₀.

Consequently, the impacts will be moderate, negative, direct / cumulative since dust and combustion gases are generated by the construction activities, reversible, of local character and short-term since at each location air pollution will last the time the construction activity takes place.

7.1.2.2 Operation phase

Air pollution during the operation of the highway mainly originates from traffic, ie. from exhaust gases of different types of vehicles. Emissions of pollutants depend on traffic intensity, structure and type of traffic vehicles as well as meteorological conditions.

Gases that are emitted from the internal combustion engines of the vehicles include CO, NO_x, NMVOCs, greenhouse gases (CO₂, CH₄, N₂O), acidic substances (NH₃, SO₂), solid particles (PM_{2.5}), carcinogenic compounds (PAHs and POPs), toxic substances (dioxins and furans) and heavy metals. Exhaust gases have an impact on the humans, flora, fauna, as well as on material and cultural goods.

Emission standards for passenger cars and light commercial vehicles are determined in the form of grams of emitted matter per kilometre travelled, on average for a typical (normal) driving cycle. Emission standards for heavy goods vehicles (trucks, trucks with trailers, buses, etc.) are defined as grams of emitted matter per kWh.

For the purposes of the ESIA, air pollution is estimated using a suitable Atmospheric Dispersion Model. Atmospheric dispersion modelling is the mathematical simulation of how air pollutants disperse in the ambient atmosphere. It is performed with computer programs that solve the mathematical equations and algorithms which simulate the pollutant dispersion. The dispersion models are used to estimate or to predict the downwind concentration of air pollutants or toxins emitted from sources such as industrial plants, vehicular traffic or accidental chemical releases.

All the calculations of the dispersion of gas and dust are made with the following software: IMMI Premium 2021, license number S72/354, according to the Gaussian model (TA Luft 1986 [6]), using the emissions defined from §4.5 - Road traffic air pollution sources and dissipation.

Calculations were made for the launch year and year 2057. The quantitative estimation is accomplished by focusing on the main pollutants from road transport, SO₂, NO_x, CO and particulates (PM₁₀ +PM_{2.5}).

The results are shown in the following tables and figures. Concentrations are in (µg/m³)

Table 7-12: Area exposure for SO₂ concentrations

Area	launch year	2057
1+300 - 1+700	0.91	2.69
Bare Kraljske	1.65	4.84
Gnjili Potok	1.71	5.04
Kralje	3.66	10.77
Andrijevica (north)	3.12	9.19

Table 7-13 - Area exposure for NO_x concentration (µg/m³)

Area	launch year	2057
1+300 - 1+700	32.98	97.01
Bare Kraljske	59.40	174.72
Gnjili Potok	61.85	181.91
Kralje	132.15	388.70
Andrijevica (north)	112.84	331.89

Table 7-14 - Area exposure for CO concentration

Area	launch year	2057
1+300 - 1+700	113.85	334.88
Bare Kraljske	205.06	603.15
Gnjili Potok	213.49	627.96
Kralje	456.20	1341.85
Andrijevica (north)	389.52	1145.73

Table 7-15: Area exposure for PM concentration

Area	launch year	2057
1+300 - 1+700	1.74	5.12
Bare Kraljske	3.13	9.21
Gnjili Potok	3.26	9.59
Kralje	6.97	20.50
Andrijevica (north)	5.95	17.50

In all cases the emissions are below the acceptable limits. An increment is noted for the scenarios of the future projections due to the increase of road traffic.

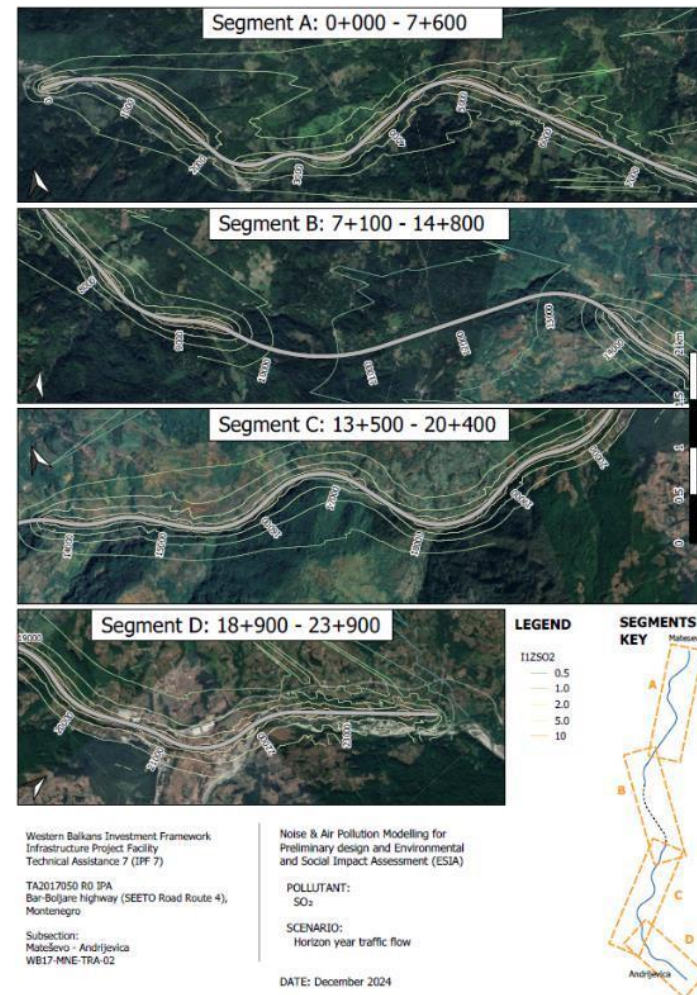
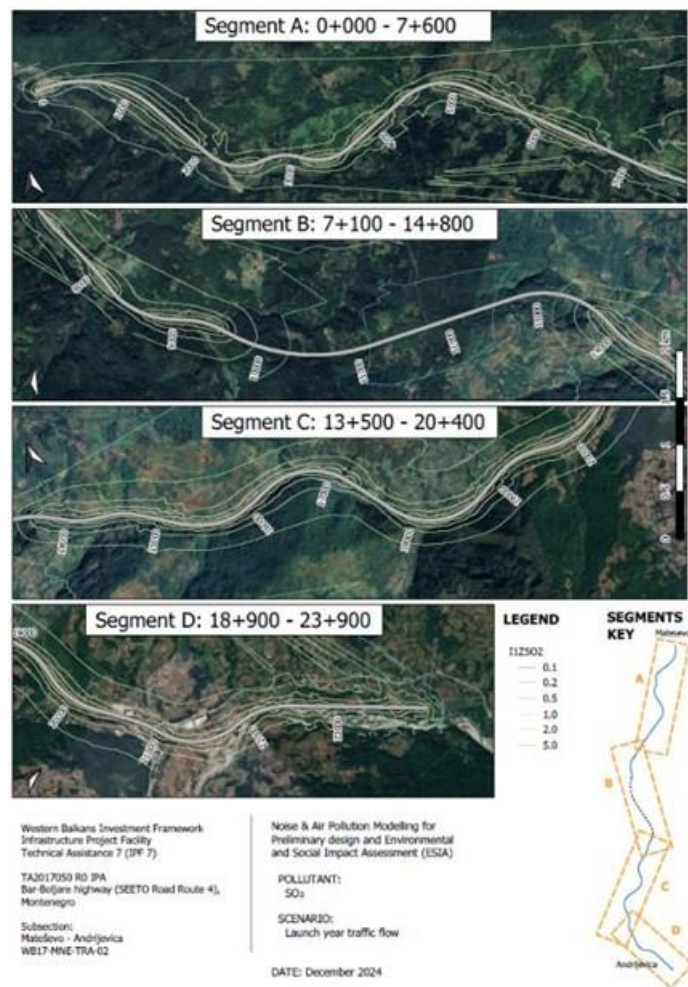


Figure 7-1: Air quality simulation - SO₂ concentrations in launch year (left) and the horizon year (right)

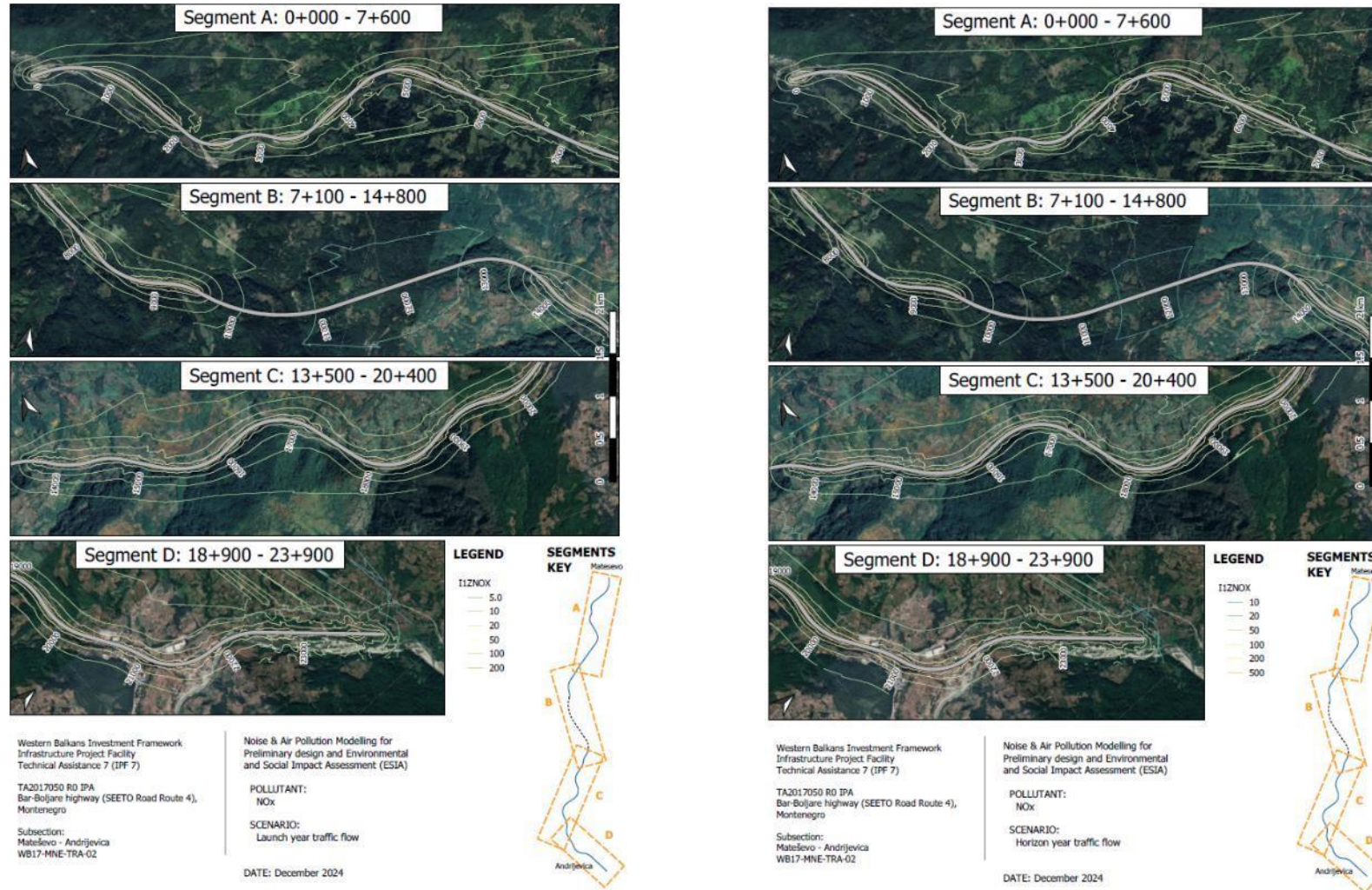


Figure 7-2: Air quality simulation - NOx concentrations in the launch year (left) and the horizon year (right)

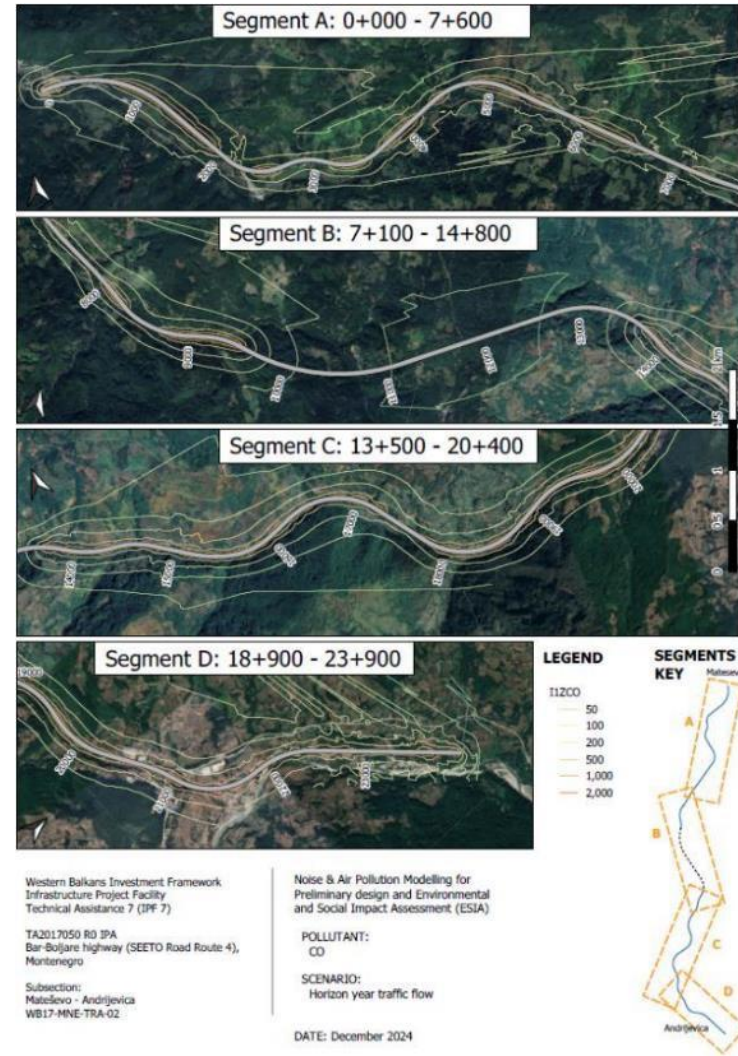
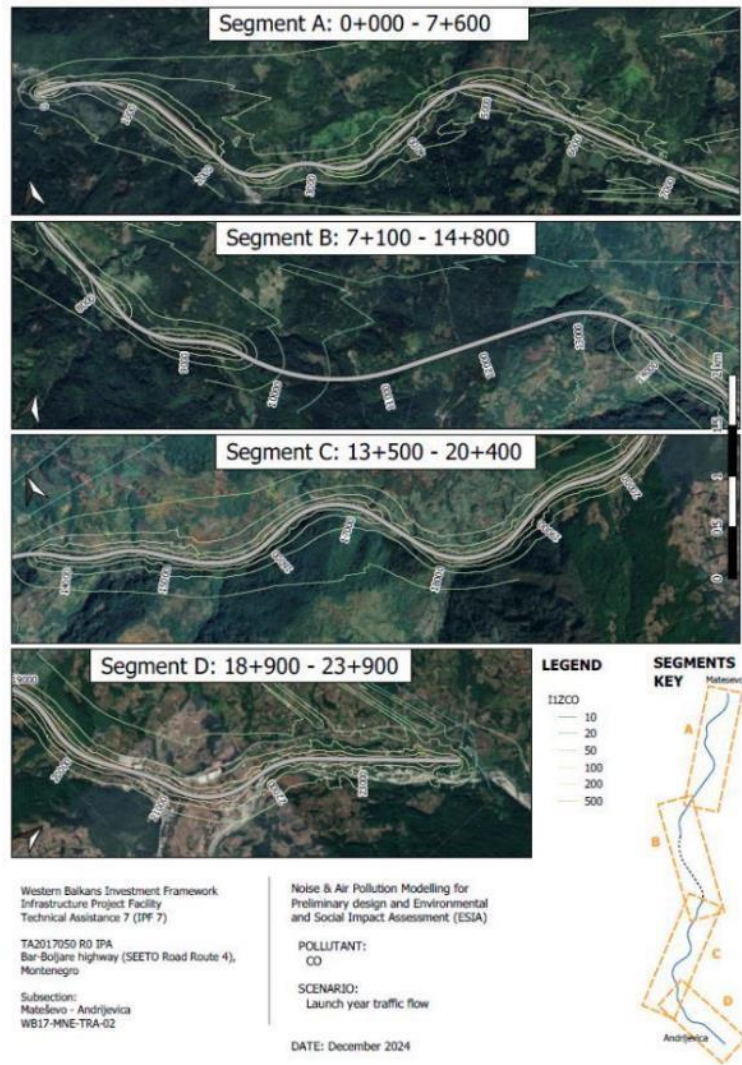


Figure 7-3: Air quality simulation - CO concentrations in the launch year (left) and the horizon year (right)

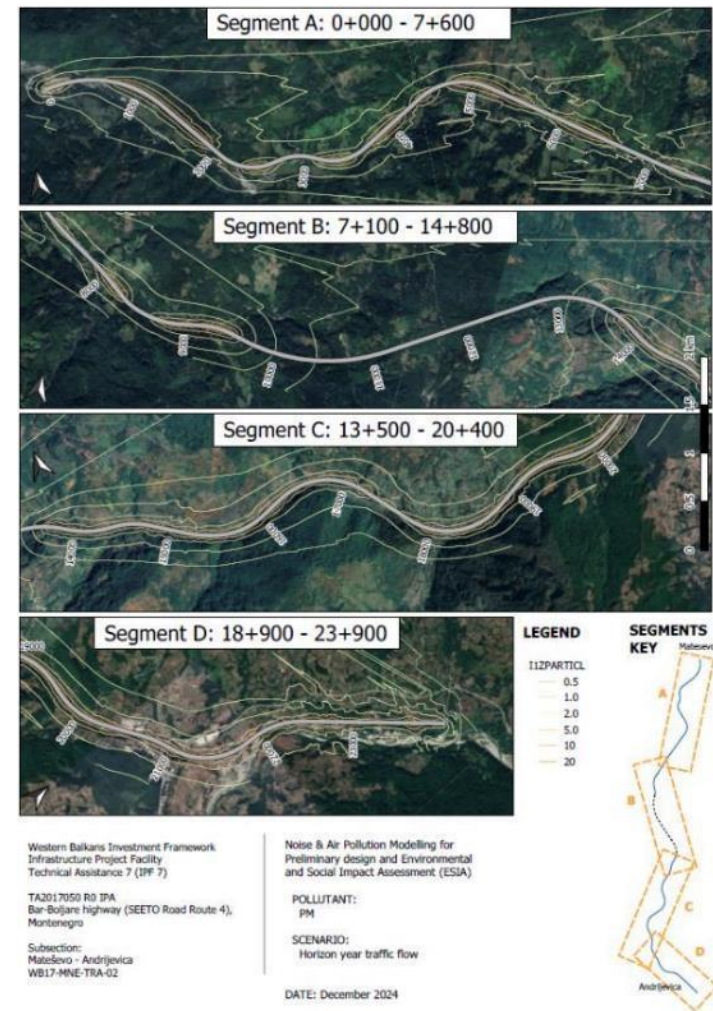
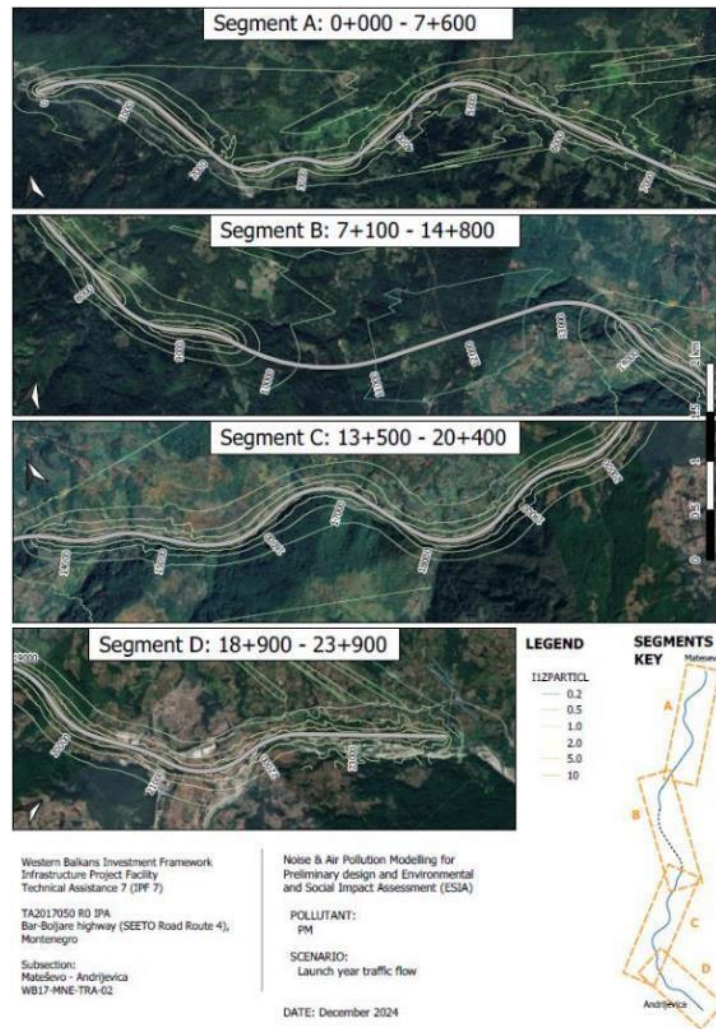


Figure 7-4: Air quality simulation - PM concentrations in the launch year (left) and the horizon year (right)

7.1.3 Climate and Climate change

7.1.3.1 Impacts on climatic conditions

The Matešev – Andrijevi section can have only micro-line impact on meteorological elements, it means on the micro-climate. This impact will be reflected primarily in higher air temperature. It is well known that asphalt surfaces and car exhaust have the characteristic of artificial heat sources. However, it should be noted that it is almost exclusively micro effect – only along the route of the future road. From the standpoint of climate, these objects do not have a significant impact on the wider, regional area.

7.1.3.2 Impacts on climate change

During **construction phase** GHG emissions are expected due to fuel combustion of the construction equipment. However, considering the limited construction period the significance of these emissions to the total national emissions is considered minor.

GHG emissions are emitted from the traffic during the **operation** of the road. An estimation of the GHG emissions was performed, based on the same traffic data and assumptions derived from the traffic study, and the emission factors of the IPCC 2006 Guidelines. The results of the estimation are presented in the following table:

Table 7-16: Annual GHG emissions during operation

Vehicle	CO ₂ (tn)	CH ₄ (tn)	N ₂ O (tn)	CO ₂ e (tn)
Passenger cars	22,879.48	8.25	2.64	23,810.50
Heavy duty vehicles	6,602.79	0.35	0.35	6,704.62
TOTAL	29,482.27	8.60	2.99	30,515.12

According to the estimation, the traffic on the road contributes accounts for about 0.9% of the national GHG emissions of 2021. However, it must be noted that not all this traffic is newly generated but diverted from the existing road network. Additionally, as for the case of air quality, the foreseen travelling speeds are more efficient in terms of energy consumption. Furthermore, the estimations do not take into account changes in the technology of the vehicles and the use of other sources of energy (e.g. electricity)

7.1.3.3 Climate change vulnerability

The vulnerability and risk assessment of the Project to climate change is assessed according to the approach described in the Commission notice “Technical guidance on the climate proofing of infrastructure in the period 2021-2027”. The main steps of the approach are:

- Phase 1 – Screening: Vulnerability = Sensitivity x exposure
- Phase 2 – Risk (subject to Phase 1): Risk = Likelihood x impact
- Phase 3: Adaptation: Options, Appraisal, Planning

Vulnerability assessment (sensitivity x exposure) identifies the relevant climate hazards for the given specific project type at the foreseen location. The analysis is broken down into three steps, comprising of a sensitivity analysis, an assessment of current and future exposure, and then a combination of the two for the vulnerability assessment.

- **Sensitivity analysis** identifies the relevant climate hazards for the given specific type of project, irrespective of its location. For example, sea level rise is likely to be an important hazard for most

- **Exposure analysis** identifies the relevant hazards for the foreseen project location, irrespective of the project type. The exposure analysis is split in two parts: exposure to current climate and exposure to the future climate. Exposure is also classified as low, medium and high.

The vulnerability is categorized as follows:

		Exposure (current + future climate)		
		High	Medium	Low
Sensitivity	High	High	High	Medium
	Medium	High	Medium	Low
	Low	Medium	Low	Low

low medium high

Risk level results from likelihood and impact analysis (Risk = Likelihood x Impact).

The scale for assessing the likelihood of a climate hazard is shown in Table 7-18.

Term	Qualitative	Quantitative
Rare	Highly unlikely to occur	5%
Unlikely	Unlikely to occur	20%
Moderate	As likely to occur as not	50%
Likely	Likely to occur	80%
Almost certain	Very likely to occur	95%

Impact (consequence) is also assessed in a 5-step scale as Insignificant, Minor, Moderate, Major and Catastrophic, as follows:

Magnitude of consequence	Risk areas	
	Asset damage / Engineering / Operational	Health and Safety
Insignificant	Impact can be absorbed through normal activity	First aid case
Minor	An adverse event that can be absorbed by taking business continuity actions	Minor injury, medical treatment
Moderate	A serious event that requires additional emergency business continuity actions	Serious injury or lost work
Major	A critical event that requires extraordinary / emergency business continuity actions	Major or multiple injuries, permanent injury or disability
Catastrophic	Disaster with the potential to lead to shut down or collapse or loss of the asset / network	Single or multiple fatalities

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Table 7-20: Risk assessment matrix

		Consequence				
		Insignificant -1	Minor -2	Moderate -3	Major-4	Catastrophic -5
Likelihood	Rare -1	1	2	3	4	5
	Unlikely -2	2	4	6	8	10
	Moderate -3	3	6	9	12	15
	Likely -4	4	8	12	16	20
	Almost certain -5	5	10	15	20	25

1-4	5-9	10-16	17-25
Low	Medium	High	Extreme

For the hazards that the above analysis results to high and extreme risk, options to respond to these risks are identified and proposed.

(a) Vulnerability assessment

Regarding **sensitivity**, climate induced hazards for motorways, irrespective of the location may be:

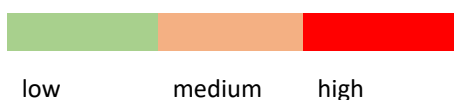
Table 7-21: Impacts of climate hazards on road infrastructure

Climate hazard	change	Impact on road infrastructure
Heat		- Buckling of roads, and bridges due to thermal expansion - Heat induced damage to pavements and other material - Failures of power lines - Slope instabilities due to the thawing of permafrost in alpine regions
Cold		Buckling of roads, and bridges due to thermal contraction
Drought		N/A
Extreme rainfall		- Flooding - Instability, embankment failure, landslides (see next) - Road closure - Infrastructure damage - Increase of accident risks
Landslides		- Structural damages - Disruption of services
Flooding		- Reduction of structural integrity of surface and subgrade material - Structural damages of auxiliary facilities - Increased deterioration of infrastructures that lack a fouling-resistant design against salt water. - Flooding of drainage systems, tunnels, increased scour of bridges. - Risk of weather-related delays - Accidents
Sea level rise		- Corrosion of materials due to salinity - Erosion of roadways - Saltwater intrusion into groundwater, leading to subsurface flooding.
Windstorms		- Structural damages to transport facilities (bridges, flyovers, street lighting and signs) due to wind pressure or debris impact. - Potential traffic disruption - Short-circuiting along electrical cables - Obstruction of roads due to fallen vegetation
Wildfires		- Deterioration of roads - Disruption of services

The sensitivity is presented in the following table:

Table 7-22: Sensitivity of roads / motorways to climate change impacts

Climate change hazard	Sensitivity		
	Road	Bridges	Tunnels
Average temperature			
Extreme heat			
Extreme rainfall			
Landslides			
Sea level rise			
Drought			
Wildfires			
Flooding			
Windstorms			



Source: Forzieri, G. et al. (2015).

Regarding **exposure**, according to the 3rd National Communication of Montenegro⁶¹, the country is prone to several hydrometeorological hazards, including floods, drought, heavy rainfall, as well as or snowfall, windstorms, heat waves, landslides, and forest fires. Regarding floods, particularly sensitive areas for heavy rainfall are Ulcinj Field (at the River Bojana's high-water levels), the zone from Vladimir to Veliki Ostros, and from Sutomore to Virpazar, the area of the old town of Kotor, Sutorina, Herceg Novi, Crkvice, and part of the Luštica Peninsul. The project is not within these areas.

As there are no detailed data on the climate hazards in the area, the ThinkHazard! Tool developed by the Global Facility for Disaster Reduction and Recovery (GFDRR) was used⁶². The tool provides a general view of the hazards, for a given location, that should be considered in project design and implementation to promote disaster and climate resilience. It is noted that the tool does not provide explicit results for sea level rise (which is, however, non-applicable for the case of the present project), while it provides an assessment of secondary climate changed induced hazards such as wildfires and landslides. The available information of the project area is presented in the following table.

Table 7-23: Climate hazards in the project area

Administrative unit	River flood *	Urban flood**	Landslide	Wildfire	Heat	Water scarcity
Kolasin	Very low	Medium	Medium	High	Low	Very low
Andrijevića	Very low	High	Very low	High	Low	Very low

* River flood occurs when intense precipitation over an extended period of time causes a river to exceed its capacity, triggering the overflow or breaching of river embankments and ultimately causing the submersion of natural and human soil in the floodplains, ** Urban flood is triggered by the saturation of the urban drainage system, causing water to flow out into the streets

⁶¹ Ministry of Sustainable Development and Tourism (MSDT), United Nations Development Programme (UNDP) in Montenegro, 2020, Montenegro Third National Communication on climate change.

⁶² <https://thinkhazard.org/en/>

By combining the existing hazards and the prediction for future climate in the country, the exposure for current and future climate is presented in the following table.

Table 7-24: Exposure analysis for the project area

	Drought	River flood	Urban flood	Fire	Landslide	Heat	Wind	Sea level rise
Current climate								N/A
Future climate								
Highest score, current + future								



Based on the above, the vulnerability of the Project is as shown in the following table. Sea level rise is not included in the assessment, as the project is not in a coastal area, and flooding mainly refers to river flooding as the project is not in urban area.

Table 7-25: Climate change vulnerability of the project during operation phase

Element	Climate hazard	Sensitivity	Exposure	Vulnerability
Road	Average temperature	Medium	Medium	Medium
	Extreme heat	Medium	Medium	Medium
	Extreme rainfall	Medium	Medium	Medium
	Landslides	Medium	Low	Medium
	Drought	Low	Low	Low
	Wildfires	Medium	High	High
	Flooding	High	Low / medium	High
	Windstorms	Low	Low	Low
Bridges	Average temperature	High	Medium	High
	Extreme heat	High	Medium	High
	Extreme rainfall	Medium	Low	Medium
	Landslides	Medium	Low	Medium
	Drought	Low	Low	Low
	Wildfires	Medium	High	High
	Flooding	High	Low / Medium	High
	Windstorms	High	Low	Medium
Tunnels	Average temperature	Medium	Medium	Medium
	Extreme heat	Medium	Medium	Medium
	Extreme rainfall	Medium	Low	Medium
	Landslides	Medium	Low	Medium
	Drought	Low	Low	Low
	Wildfires	Medium	High	Medium
	Flooding	Medium	Low / medium	High
	Windstorms	Low	Low	Low

For the hazards in which the project has a medium to high vulnerability, a risk assessment is performed (see Table 7-26)

Table 7-26: Risk assessment

Climate Hazard	Consequence (impact)	L	C	R	Justification of L & C rating	L	C	R	Justification of L & C rating
		Current climate				Future climate			
Heat	Heat induced damage to pavements and other material	2	3	6	L: No significant heat waves in the area C: Emergency maintenance may be needed	3	3	9	L: According to the 3 rd NC, up to 2040, a relatively uniform change in the number of summer and tropical days in the entire territory of Montenegro can be expected, and their number is expected to increase by 100%, i.e. twice as many compared to the reference period 1971–2000. The number of days with tropical nights is expected to increase by about 50% over most of the territory, while the change in the southeast may be up to 100% C: Emergency maintenance will be needed.
	Buckling of roads, and bridges due to thermal expansion	2	3	6	L: No significant heat waves in the area C: Emergency maintenance may be needed	3	3	9	L: As above C: Emergency maintenance will be needed.
	Excessive heat stress on staff working on the road	1	4	4	L: No significant heat waves in the area C: Heat stress reduces productivity of workforce and may slow down maintenance activities. Heat strokes of staff may occur	2	4	8	L: As above C: Heat stress reduces productivity of workforce and may slow down maintenance activities. Heat strokes of staff may occur
	Failure of power lines	2	3	6	L: Such failures are rare at current climatic conditions. C: Signaling may be disrupted resulting to increased risk of accident. Emergency actions should be taken	3	3	9	L: The possibility to have such phenomena may increase due to heat waves. C: Signaling may be disrupted resulting to increased risk of accident. Emergency actions should be taken
Rainfall / Floods	Reduction of structural integrity of surface and subgrade material	2	2	4	L: Project is partly located in a flood-prone area C: Design has considered future climate	3	2	6	L: According to 3 rd NC, although a decrease in the number of days on which rainfall exceeds 20 mm is expected, the intensities i.e. accumulations during these days may be higher C: Hydraulic modelling and design have considered extreme events
	Structural damages of auxiliary facilities	2	3	6	L: Project is partly located in a flood-prone area	3	3	9	L: Extreme precipitation that can lead to dangerous events is foreseen.

Climate Hazard	Consequence (impact)	L	C	R	Justification of L & C rating	L	C	R	Justification of L & C rating
		Current climate				Future climate			
					C. Additional emergency maintenance may be needed				C. Additional emergency maintenance will be needed
	Flooding of drainage	2	2	4	L: Project is partly located in a flood-prone area C. Hydraulic modelling and design has considered future climate. Adverse effects can be absorbed if regular operation actions are performed	3	2	6	L: Extreme precipitation that can lead to dangerous events is anticipated. C. Hydraulic modelling and design has considered future climate. Adverse effects can be absorbed if regular operation actions are performed
	Disruption of services	2	3	6	L: Project is partly located in a flood-prone area C. Flooding can cause delays and even disruption of services. Additional measures must be taken	3	3	9	L: Extreme precipitation that can lead to dangerous events is anticipated. C. Flooding can cause delays and even disruption of services. Additional measures must be taken
	Accidents	2	4	8	L: Project is partly located in a flood-prone area C. Flooding of the road can be the cause of accidents that may result to serious injuries or even fatalities	3	4	12	L: Floods are expected to intensify. C. Flooding of the road can be the cause of accidents that may result to serious injuries or even fatalities
Landslides	Structural damages	3	2	6	L. There is risk of slope instability and landslides in the broader area.	4	2	8	L. Short-term heavy rains may cause landslide that can jeopardize the earthworks
	Disruption of services	3	2	6	C. The design includes adequate provisions of constructing and arranging slopes to minimize landslides	4	2	8	C. The design includes adequate provisions of constructing and arranging slopes to minimize landslides
	Accidents	3	2	6		4	2	8	
Wildfires	Asset deterioration	3	3	9	L. The vegetation layer alternates between large fragments of forest assemblages, pastures and meadows. According to the 3 rd NC, the area is exposed to fire risk. C. Wildfire is considered as a serious event that requires emergency maintenance measures	4	3	12	L. Wildfires are anticipated to intensify due to high temperatures and drought. c. Wildfire is considered as a serious event that requires emergency maintenance measures
	Disruption of services	3	4	9	L. as above C. In case of wildfire the operation of the road may be disrupted due to firefighting	4	4	16	L. Wildfires are anticipated to intensify due to high temperatures and drought.

Climate Hazard	Consequence (impact)	L	C	R	Justification of L & C rating	L	C	R	Justification of L & C rating
		Current climate				Future climate			
					activities. The event requires emergency/ extraordinary measures				C. In case of wildfire the operation of the road may be disrupted due to firefighting activities. The event requires emergency / extraordinary measures
	Accident	3	4	9	L.as above C. Confinement of road passengers in the road in case of fire can have serious impacts on H&S respiratory problems, injuries, even death)	4	4	16	L. Wildfires are anticipated to intensify due to high temperatures and drought. C. Confinement of road passengers in the road in case of fire can have serious impacts on H&S respiratory problems, injuries, even death)

7.1.4 Noise and vibrations

The project is expected to have negative impacts on the acoustic environment both during construction and operation phase.

For the assessment of the sensitive areas regarding noise and air pollution, the following criteria were considered:

- The distance of schools, health institutions, religions institutions and other relevant institutions
- The distance of residential houses, population density and recreation places
- The distance of agricultural farms and plantations with proposed alignment
- The distance of industrial activates with the study area

Based on the above, the sensitive receivers are clustered in five main locations along the alignment, (1) at 1+300 - 1+700, (2) Bare Kraljske settlement at 5+400 - 8+000, (3) Gnjlji Potok settlement at 13+850 - 17+140, (4) Kralje village at 17+350 - 18+750 and (5) Andrijeviča (north) at 20+200 - 23+100.

The following table summarizes axis distance of the sensitive receivers mentioned above.

Table 7-27: Axis distance (m) of sensitive receivers

Sensitive Receivers	Average (m)	Min (m)	Max (m)
1+300 - 1+700	203.28	114.46	256.61
Bare Kraljske	80.21	28.09	188.02
Gnjlji Potok	60.21	15.16	103.23
Kralje	65.78	26.66	91.83
Andrijeviča (north)	70.28	37.90	203.13

7.1.4.1 Construction Phase

During construction phase, increased noise levels are expected due to construction equipment and heavy vehicles carrying construction materials.

The assumptions regarding the worksite are the same as in the case of air quality. The Leq noise from the operation of the equipment to be used during the construction of the project, based on the directive of Defra (UK Department for Environment, Food and Rural Affairs) "Noise database for prediction of noise on construction and open sites" is presented in the following table. Construction activities investigated include Site clearance works, Topsoil strip works, Earthworks, Pavement and surfacing works, Construction works and Piling works. The worst-case scenario investigates simultaneous operation of the work machinery and the construction trucks, assuming a $L_w = 98$ dB noise source distributed within the site at a height of 2m from the ground and a $L_w = 91$ dB point power noise source at a height of 20 m from the ground.

Table 7-28: Noise emissions from worksite equipment

No	Equipment	Average noise level in 10m distance from source, L_{eq} [dB(A)]	Site clearance	Topsoil strip	Earth-works	Pavement & surfacing	Structures	Piling
1	Excavator	70	✓	✓		✓		
2	Excavator loader	76	✓	✓	✓	✓		✓
3	Grader	86	✓	✓	✓	✓		
4	Tractor - compressor	80	✓	✓	✓	✓	✓	✓
5	Compressor	65	✓	✓	✓	✓	✓	
6	Cylinder	73	✓	✓	✓	✓	✓	
7	Dump truck	86	✓	✓	✓	✓		✓
8	Crane	76			✓	✓	✓	✓
9	Fixed-base crane or mobile crane	68				✓	✓	
10	Concrete pump	66				✓	✓	✓
11	Concrete mixer	79				✓	✓	✓
12	Ground compressor	78	✓		✓	✓	✓	✓
13	Telescopic loader	71	✓		✓	✓	✓	✓
14	Drilling rig	89						✓

The predicted construction noise levels at noise sensitive receptors for each construction activity are shown in the following table:

Table 7-29: Predicted construction noise level L_{Aeq} (dB) at the façade, per activity

Distance band	Site clearance	Topsoil strip	Earthworks	Pavement and surfacing	Structures	Piling	Worst-case scenario
20m	71	70	70	67	70	71	74
40m	65	64	64	61	64	65	68
80m	59	58	58	55	58	59	62
160m	53	52	52	49	52	53	56
320m	47	46	46	43	46	47	50

Within a buffer zone of 40m, the impact of the construction noise is considered debatable for the nearby sensitive acoustic receivers, where more than 65 dB(A) is expected. When sensitive receivers lie in this buffer zone from the noise sources, then the contractor should monitor for any noise nuisance incidents and apply the mitigation measures proposed in Chapter 8.

7.1.4.2 Operation phase.

Under the scope of the ESIA, in order to quantitatively assess the emitted noise levels by the operation of the Highway, a noise simulation model was developed using specialised computer software. The calculations and the resulting noise maps were performed using the specialized noise prediction and noise assessment software IMMI Premium 2021 by Woelfel MebSysteme GmbH. The software fully covers the requirements of European Noise Directive including its 2015 amendment, while it provides -through the QSI data Structure (DIN 44687)- the possibility of transferring projects and data to and from other noise prediction and evaluation software. In this way, full compatibility with other relevant software is achieved and the data is usable over time.

For calculating road transportation noise, the model uses the European Commission developed Common NOise aSSessment methODS (CNOSSOS-EU). The method calculates the sound power of the vehicles based on their type, their speed, their frequency and the pavement type and condition. Then the dissipation of the noise level from the highway to the sensitive receiver is calculated considering the distance, the topology and the sound absorption of the terrain, the environment (temperature, relative moisture, wind) and any obstacle (i.e. noise barrier, other buildings) that comes between the source and the receiver.

For the modelling, the estimates of the traffic flows of the Traffic Study elaborated in the framework of the Project were used.

Table 7-30: Traffic flows

AADT ⁶³ veh/day						
From	To	2022	2027	2032	2037	2057
Mateševu	Andrijeva	2 688	3 558	4 585	6 009	7 906
Andrijeva	Mateševu	2 786	3 688	4 753	6 228	8 195
Heavy veh/day						
From	To	2022	2027	2032	2037	2057
Mateševu	Andrijeva	101	113	126	140	198
Andrijeva	Mateševu	104	117	131	145	205

The following tables present maximum noise levels generated in each identified sensitive receiver cluster from the calculation of road operation for the launch year and year 2057. Exceedances of the legislation limits are marked in red.

Table 7-31: Estimated Noise levels during Project's operation: launch year

Sensitive Receivers	L_{day} (12h) [dB(A)]	$L_{evening}$ (4h) [dB(A)]	L_{night} (8h) [dB(A)]	L_{DEN} [dB(A)]
1+300 - 1+700	58.7	51.0	45.6	57.5
Bare Kraljske	66.7	59.0	53.6	65.5
Gnjili Potok	66.5	58.8	53.4	65.3
Kralje	67.5	59.8	54.3	66.2
Andrijeva (north)	68.1	60.4	55.0	66.9

Table 7-32: Estimated Noise levels during Project's operation: 2057

Sensitive Receivers	L_{day} (12h) [dB(A)]	$L_{evening}$ (4h) [dB(A)]	L_{night} (8h) [dB(A)]	L_{DEN} [dB(A)]
1+300 - 1+700	63.6	55.9	50.4	62.3
Bare Kraljske	71.5	63.9	58.4	70.3
Gnjili Potok	71.4	63.7	58.3	70.2
Kralje	72.4	64.7	59.2	71.1
Andrijeva (north)	73.0	65.3	59.9	71.8

The calculated noise levels results have been evaluated against the noise limit values set by the legislation. As expected, the results of the model indicate that noise levels in the study area are quite elevated close to the road, and in some cases above the limits (60 dB(A) for L_{day} & $L_{evening}$ and 55 dB(A) for L_{night}).

The following tables present the areas that require protection considering also the background noise.

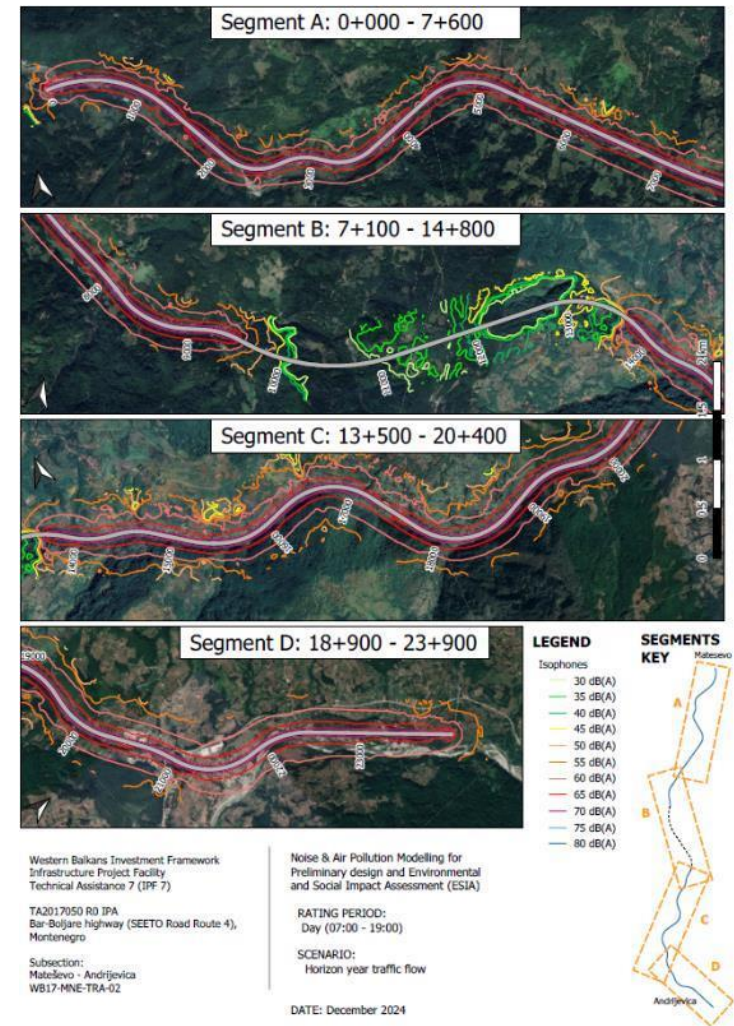
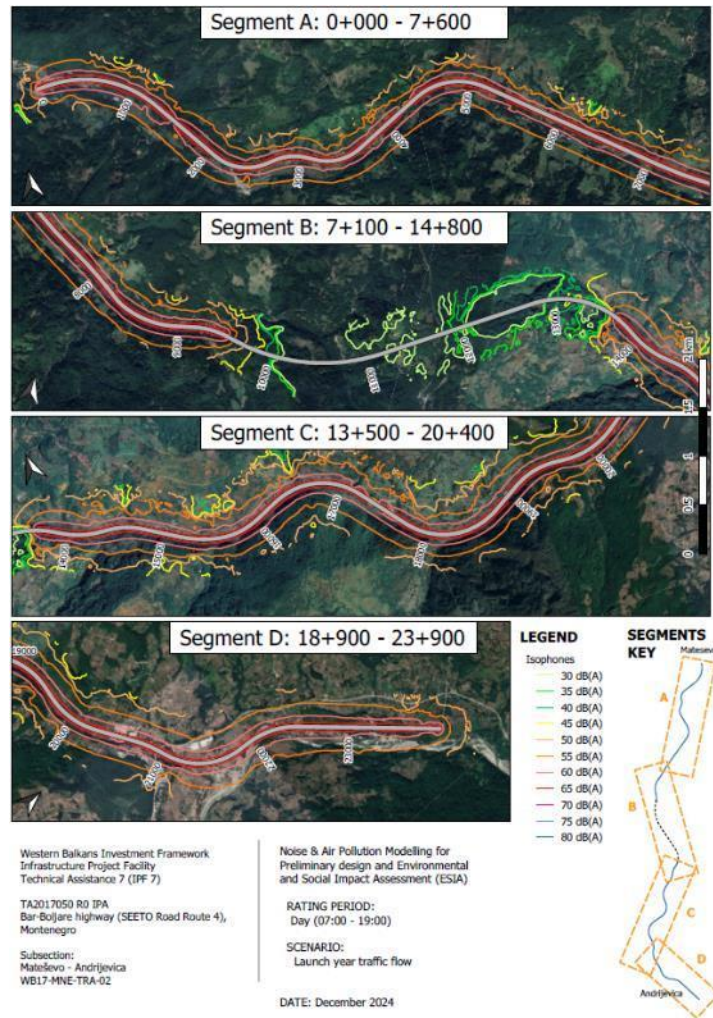
⁶³ Annual Average Daily Traffic

Table 7-33: Areas requiring noise protection – day results [dB(A)]

Sensitive Receivers	Bar-Boljare highway	Background noise	Cumulative Noise	Limit
Bare Kraljske	66.7	55.0	67.0	60.0
Gnjili Potok	66.5	57.5	67.0	60.0
Kralje	67.5	60.0	68.2	60.0
Andrijevica (north)	68.1	61.0	68.9	60.0

Table 7-34: Areas requiring noise protection – night results [dB(A)]

Sensitive Receivers	Bar-Boljare highway	Background noise	Cumulative Noise	Limit
Bare Kraljske	53.6	53.0	56.3	55.0
Gnjili Potok	52.3	48.5	54.6	55.0
Kralje	53.7	44.0	54.7	55.0
Andrijevica (north)	52.3	53.5	57.3	55.0



1.

Figure 7-5: Simulated noise results - Day noise for the launch year (left) and the horizon year (right)

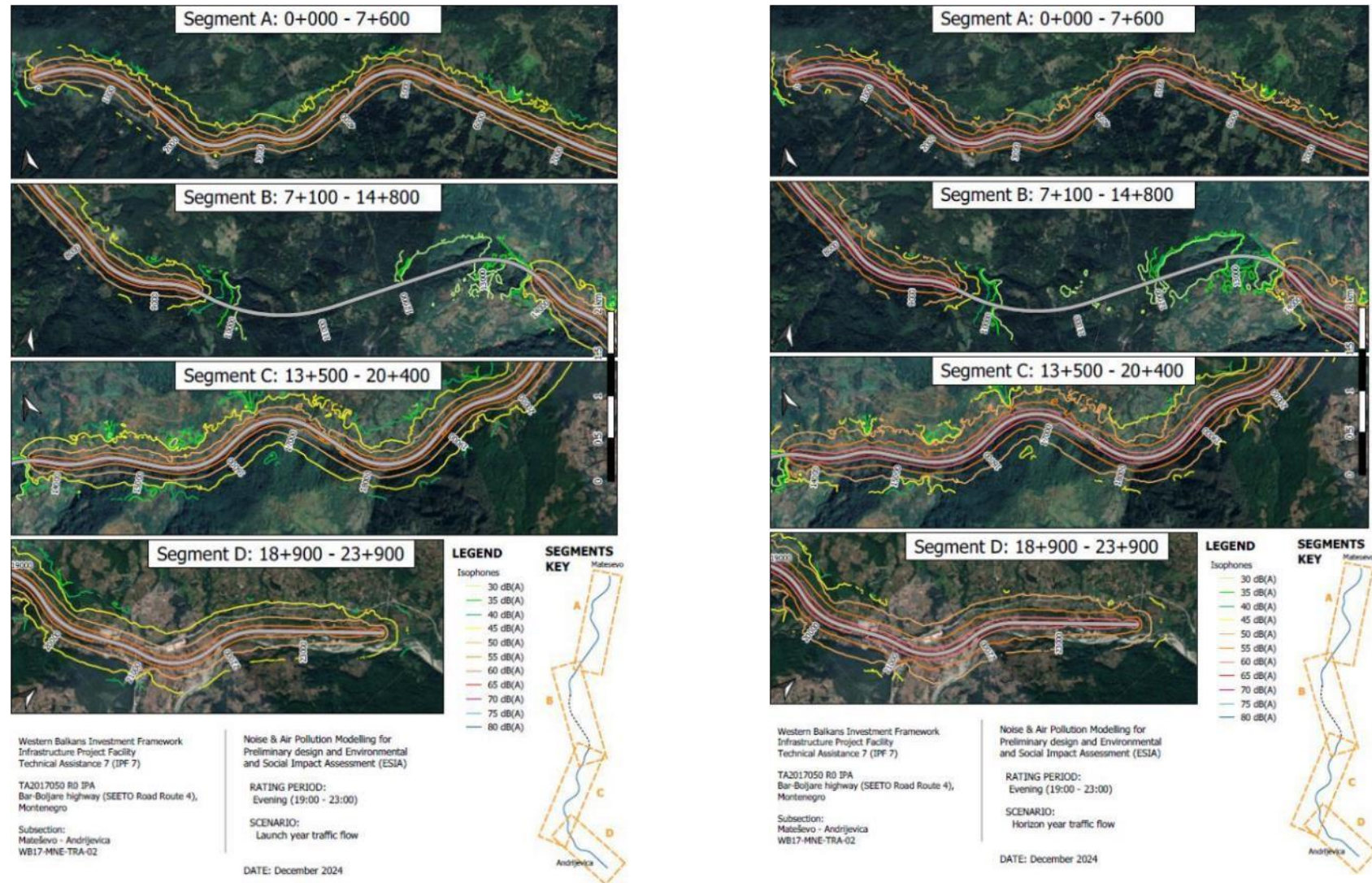


Figure 7-6: Simulated noise results – Evening noise for the launch year (left) and the horizon year (right)

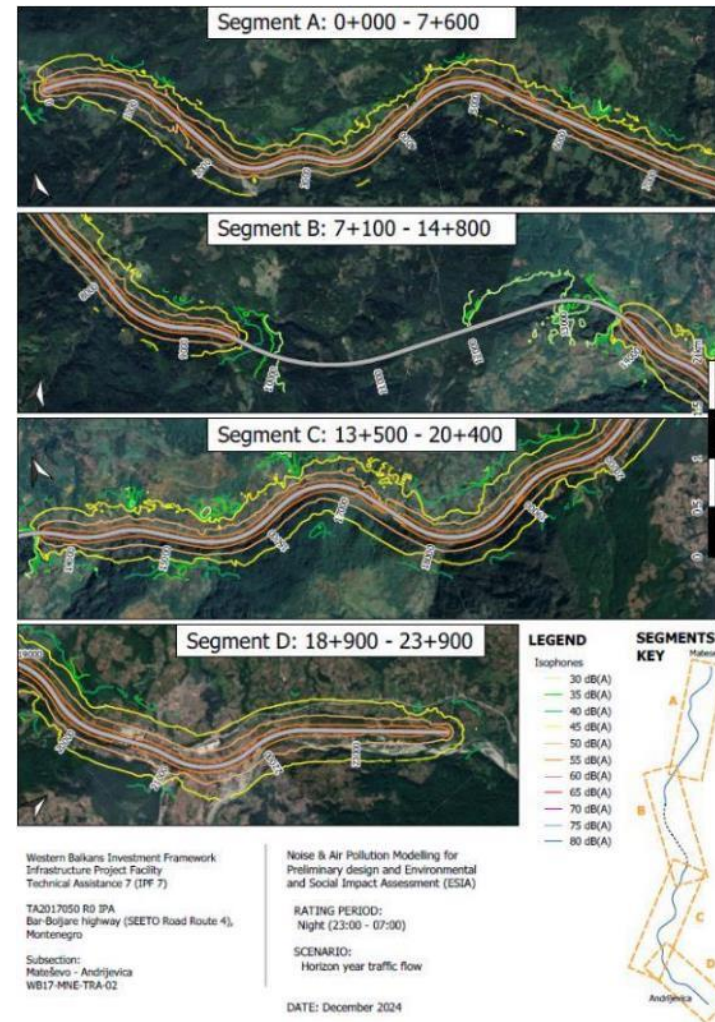
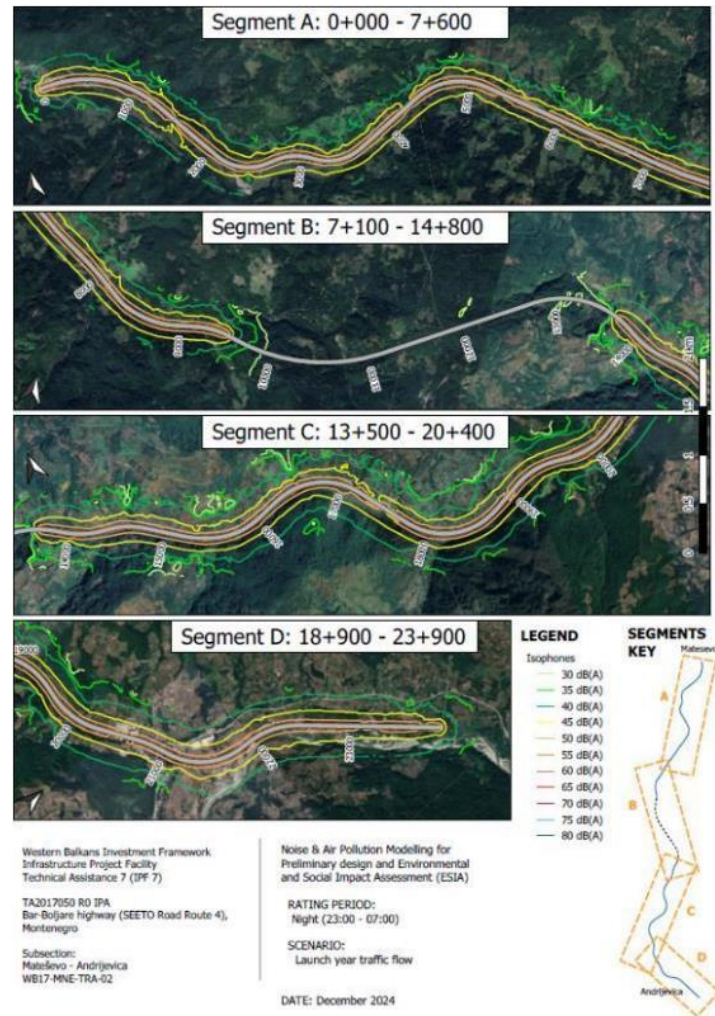


Figure 7-7: Simulated noise results – Night noise for the launch year (left) and the horizon year (right)

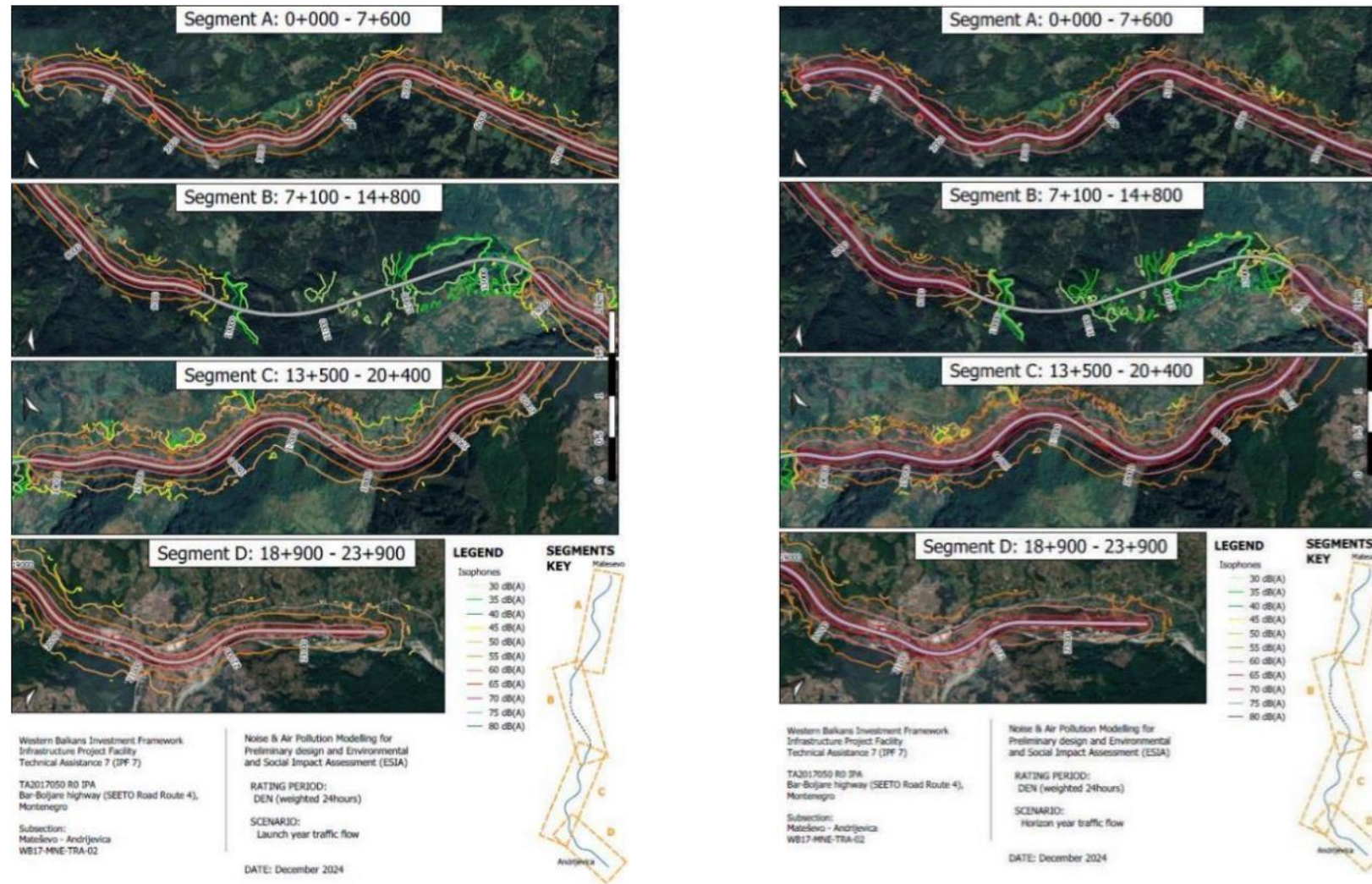


Figure 7-8: Simulated noise results – DEN (weighted 24 hours) for the launch year (left) and the horizon year (right)

7.1.5 Geology and soil

7.1.5.1 Construction

Physical impact

Based on the available data, the total area of land that is temporarily/permanently occupied by the construction of the highway and for which expropriation will be carried out is 173.28 ha, of which 67.35 ha in the Municipality of Kolašin and 105.93 ha in the Municipality of Andrijeviča.

The stability of the terrain in the corridor zone of the Mateševu-Andrijeviča highway is different, all depending on the geological structure. The stability of the terrain for carrying out works on the open route and tunnel are relatively stable. They are built from flysch conglomerates. The part at the beginning and end of the route passes through sediments on the river terraces, in the part next to the river itself.

Cutting down the forests creates conditions for intensive erosion, washing and destabilization of the terrain. This is one of the serious impacts of highway construction to the natural environment, and eventually to the infrastructure and housing facilities as well.

As described in section 4.11, a detailed geotechnical investigation campaign has taken place during the previous phase of the project (prior to ch 9+800 where the variation between the proposed and the former variant commences) and several potential hazardous zones have been identified, along with retaining structures proposed.

However, it is important to note that in order to define more precisely the necessary measures and cut slope angles it is necessary to perform detailed engineering geological mapping and exploration works in order to separate the zones where the sliding process is more intensive, i.e. for the separation of zones where activation of the process may occur during the excavation of the slopes.

Potential soil and groundwater contamination

Construction works will induce a heavy traffic of vehicles and machinery which may potentially cause inadvertent leaks of fuels and oils. Similarly, storage of hazardous materials and wastes may potentially cause contamination of soil and groundwater. During the construction of the highway, certain concentrations of dust will be generated, and it will settle somewhere. The deposited dust will have the same chemical composition as the surrounding area and most often will originate from flysch sediments. For this reason, the dust will not have an adverse impact to the surrounding soil.

At this preliminary stage of design location and formation of construction sites and areas designated for material and waste storage are unknown and Construction Environmental Management Plan (CEMP) is not available, significance of this impact can only be assessed with significant uncertainty. With a view to the limitation of construction activities in time and space and assuming application of proper machinery and works done in accordance with strict technological discipline, the magnitude of these impacts is considered minor. Considering the sensitivity of soils, the initial significance of this adverse impact, without mitigation measures is Moderate.

Soil erosion may occur during construction due to clearance of vegetation and earth movements; it is assumed however that designs and CEMP to be prepared at later stages will address this issue by appropriate technical measures.

7.1.5.2 Operation

During the operation of the highway, there are no significant elements to cause erosion or changes in the existing topography of the surrounding terrain, while the risk of landslides is present.

Impacts during operation phase refer mainly to contamination of soil and groundwater due to contaminated run-off water as well as spillages and leaks from vehicles.

7.1.6 Biodiversity, flora & fauna

7.1.6.1 Flora and habitats

Impacts on flora and vegetation will include different degrees of disturbance caused by activities, mainly in the construction phase of the road, when the greatest impacts are expected. These impacts would be significantly reduced in the project operation phase.

The source of possible negative impacts on the flora and vegetation of the project area are the following activities:

- Cleaning of the location, removing of the green layer of vegetation for the purpose of establishing of the construction site, construction of access roads and temporary facilities, setting up camps for workers, organization of temporary landfills for excavated material and necessary construction materials;
- Removal of forest vegetation for the road corridor;
- Movement of mechanization and workers within the defined construction site; and
- Generating, disposal and discharge of solid and liquid waste.

Issues that may affect the plants and habitats are the following:

Habitat loss, conversion, degradation and simplification - Removing a layer of vegetation, or, habitat loss can have a negative impact on significant plant species. Based on the conducted field research, a number of protected plant species were found (mostly from the Orchid family; most of these species are found in meadow habitats in the Vranještica river zone), but these are not species that are not extremely rare. Also, a number of endemic species are found in the zone of riparian vegetation (e.g. *Lactuca pancicii*) or on alpine meadows (e.g. *Silene sendtneri*), but it is assumed that the interventions will not have a major negative impact on the total populations of these species.

Fragmentation - The construction and use of the road will affect the habitat fragmentation of some plant species. This could, in the first place, apply to species that are protected and rare as well as their habitats (eg *Myricaria germanica* - it is protected by national legislation as a species). Additional measures to reduce the impact on this species are necessary: direct - through maximum restraint of works in places where it is located, and, indirectly - prevention of disposal of construction materials or waste in the Lim River zone where it is present to avoid disturbing the physical parameters of coastal habitats of this species.

Changes in water conditions (hydrological impacts) - The proposed scheme requires a limited number of water crossings. Appropriate pollution prevention measures will be put in place at each crossing and vegetation cover will be retained on the banks where possible to retain habitat and minimize soil exposure. Silt fences will be used to prevent silt from travelling downstream, and banks will be restored to pre-construction contours to the extent practical using temporary erosion control measures (such as straw bales, silt fence, etc.). In order to reduce the impact of outflows, good industrial practices should be used. Changes in water conditions (hydrological impact) will have a negative impact on

coastal habitats (it has already been mentioned here that the most obvious example is the habitat / species *Myricaria germanica*). Also, negative consequences of changes in water conditions would have on other ripar habitats (*Salicetum eleagni*, *Alnetum incanae*, etc.). Additional measures are needed to reduce the impact on these habitat types.

Habitat pollution including deposition and runoff - In order to reduce the impact of outflows, good industrial practices should be used. For particularly sensitive watercourses, the highest quality mitigation and monitoring measures will be used to ensure that there are no significant adverse effects. The impact of dust (with occasional wetting of the area and other mitigation measures) can be reduced to a distance of 25 m from the site, and is not expected to be significant.

Spread of non-native or invasive species - The distribution of invasive plant species was determined by visiting the terrain, and the subsequent treatment of these species, which are not natural for the habitat, will prevent their spread. Monitoring post-construction will ensure that newly restored areas are not inundated with non-native species from adjacent areas.

Road construction will lead to the permanent loss of a number of natural and modified habitat types, and will contribute to habitat degradation and fragmentation. The impact will refer to the entire length of the road route where the physical removal of vegetation is planned, as well as around watercourses and for the needs of building bridges.

As already described in section 5.9 the road zone of influence is within the the Regional Park Komovi, identified as Important Plant Area and Candidate Emerald site, which enters the zone of influence at the area of the rivers Crnja and Ljubaštica, while reaches the Lim valley (also candidate Emerald site and Important Plant Area) .

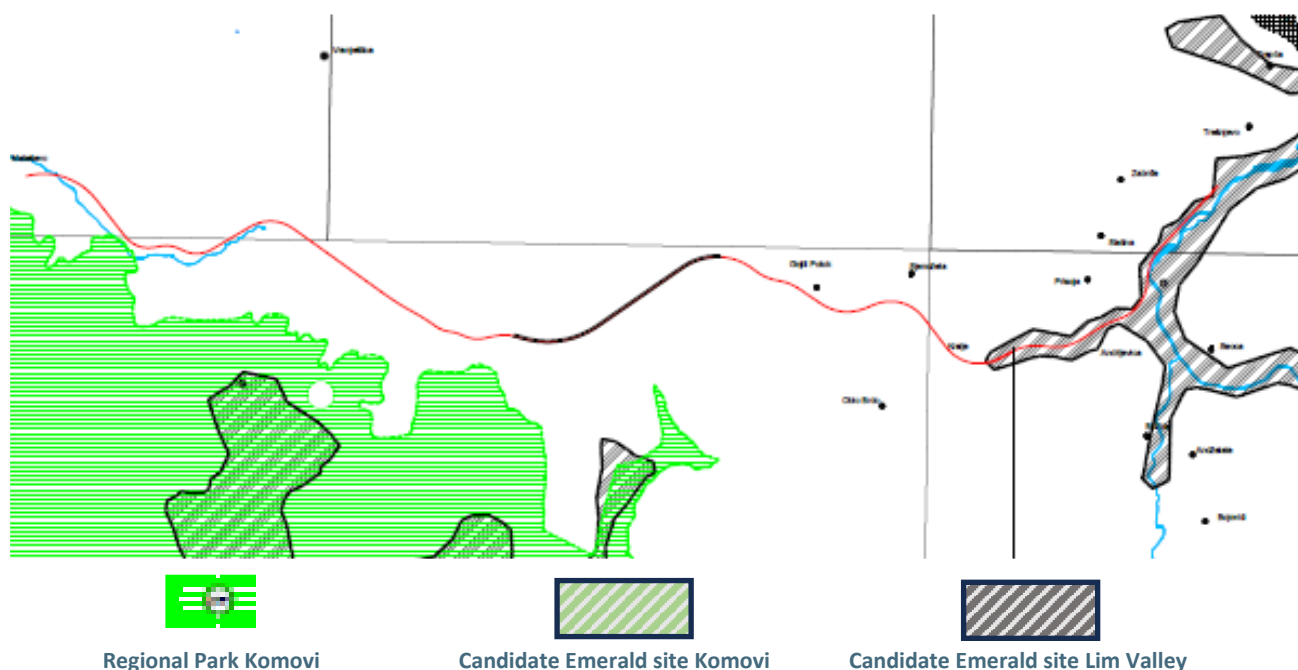


Figure 7-9: Highway alignment and Emerald sites

A summary of the sensitive habitats that will be affected is shown below.

Location and Type of habitat	Sensitivity	Magnitude of Fragmentation
Mateševo - Trešnjevik part		
Mateševske strane, acidophile beech forests above right bank of the Drcka River. Total surface of the habitat on Mateševske strane is	High	Middle (adverse)

Location and Type of habitat	Sensitivity	Magnitude of Fragmentation
around 967 ha. Permanent loss due to to implementation of the project is around 10 ha.		
Drcka Bridge - River Drcka with willow scrub of <i>Salix eleagnos</i> , total surface of habitat is around 8.7 ha. Permanent loss due to implementation of the project is around 1.2 ha	High	Middle (adverse)
Drcka Bridges - River Drcka, along with riparian vegetation, whereby the total surface of habitat is around 200 ha. Permanent loss due to implementation of the project is around 2.6 ha	High	Middle (adverse)
Vranještica - Bridge Vranještica River covered with riparian vegetation whereby the total surface of the habitat is around 76 ha. Permanent loss due to implementation of the project is around 1.8 ha.	High	Middle (adverse)
Ravni brijeg covered with beech forest, mountain meadows and part of RP Komovi, total surface of the habitat is around 777 ha of forest and 2.7 ha of meadows. Permanent loss due to implementation of the project is around 17 ha of forests and 2.5 ha of meadows.	High	Middle (adverse)
Ljubaštica - River Ljubaštica with riparian vegetation along the bank, total surface is approximately 21 ha. Permanent loss due to implementation of the project is around 0.7 ha.	Medium	Minor (adverse)
Ljubaštica - Alkaline fens characterized by low sedges and brown moss that form peat. Total surface of habitats is around 15 ha, at the distance of around 500 m from the project impact area.	No change	Negligible
Trešnjevik-Andrijević part		
Rajovića river – Rajovića river, along with riparian vegetation. Total surface of habitats is around 100 ha and under impact caused by the project will be around 1.2 ha.	High	Middle (adverse)
Kraštica River, along with riparian vegetation. Total surface of habitats is around 30 ha and under impact caused by the project will be around 15 ha.	High	Major (adverse)
Lim River - habitat with willow <i>Salix eleagnos</i> . The total habitat area is about 5 ha; the area that will be affected by the project is about 3.5 ha . - habitat with <i>Myricaria germanica</i> . The total habitat area is about 3 ha; the area that will be affected by the project is about 1ha . - habitat with <i>Calamagrostis pseudophragmites</i> ; The total habitat area is about 3 ha; the area that will be affected by the project is about 1 ha .; -habitat of ripar vegetation <i>Alnetum incanae</i> and gallery <i>Alnetium glutinosae</i> s. l. (Lugovi-Sitna Luka) The total area of the habitat is about 17 ha; the area that will be affected by the project is about 10 ha.	High	Major (adverse)

The overall impact related to the loss of these specific habitats during construction is considered as a high impact.

7.1.6.2 Ichthyofauna, Benthic fauna and aquatic microinvertebrates

The highway construction can impact aquatic organisms in rivers in two ways and with very different intensity. In general, it can be stated that all living organisms, regardless of habitat type are directly or indirectly affected by roads, in this case the highway. The direct impacts are easier to determine, i.e. to identify, and therefore it is easier to propose and implement possible protection measures. Indirect

impacts are difficult to detect, especially in poorly investigated areas or ecosystems. All these impacts can be manifested during the construction phase of the highway, as well as its operational phase.

The possible impacts that may arise during preparatory work and construction phase are described in the following paragraphs.

The greatest impact on the fauna of fishes is at the sites of bridge construction over the rivers, and since this section of the highway does not cross the riverbed, this impact will not occur.

A great impact on ichthyofauna also occurs in cases where the motorway route is built in the immediate vicinity of the riverbed, especially when direct construction works are carried out on the shores, for example, in order to prevent riverbanks collapse or at least their reinforcement for the purposes of stability of the highway. Due to the construction work and excavation, the natural habitat and appearance of the riverbanks are altered and even the riverbed morphology is changed. These actions have a direct impact on habitat degradation and even habitat loss for aquatic organisms. This impact on habitats in the water or on the bank (ecotone) affects the entire living world of rivers, and for fish, it results in a decrease in biomass and production.

The construction works affect several other variable characteristics of water, such as turbidity, pollution, or vibration during construction. All recorded species from the salmonid group (*S. labrax*, *H. huho*, *T. thymallus*) are sensitive to turbidity, and turbidity that lasts more than three days causing suffocation and death of species, especially young individuals and embryos. This is common knowledge, so fish farms are not built near rivers that have longer turbidity periods. In addition to trout, other species from the salmonid region are sensitive to high and long-lasting turbidity.

Beside the lethal effect, water turbidity has additional negative effects such as:

- reduced light transmission, which directly reduces photosynthesis and decreased production of periphyton, which reduces the food base for many animals, including fish
- with decreasing light transmission, visibility is reduced, which is especially important for predators whose sense of sight is the main organ in orientation, which is a large number of fish (most of them mentioned in this study), some birds (*Cinclus cinclus* - feed mainly on aquatic invertebrates) and mammals (*Lutra lutra* - mainly feeds on fish and crustaceans) (both species were recorded in the Lim River area under investigation, and *C. cinclus* and along the entire watercourse of Drcka River)
- suspended particles have impact on reduction of dissolved oxygen
- suspended particles increase the temperature of the water, which disrupts natural conditions and adversely affects cold-water organisms;
- suspended particles directly or indirectly affect biological processes, for example the speed of embryonic development (may be lethal), the growth of fish (the growth is slow down), and even the taste of meat (make it worse);

Construction works can significantly affect changes in the water regime that in many indirect ways affect the living world, such as habitat loss, the problem of finding shelter, changes in physicochemical characteristics, such as temperature increase, changes in gas regime, pH, etc. For example, increased acidity slows growth, development of fertilized eggs and embryos (also causes mortality), then increases the toxicity of heavy metals (cadmium, mercury, aluminum, iron, copper, etc.), that affect the morphological changes in gills that have a lot of significant functions in fishes (breathing, release of decomposition products, osmoregulation, etc.).

Disturbances in the water regime can result in significant disturbances in the fish reproduction cycle, from site selection, spawning time, etc. and may lead to mismatches with other natural processes in the aquatic environment (development of other communities). In conditions of increased calcium content in water, the effect of heavy metals is mitigated (see Marić, 2019).

During construction works, especially during the operation of large machines, a great noise and vibration is created, and this directly affects fish populations. This impact is only manifested if the works are performed directly in a water body or in the immediate vicinity of water bodies. It is known that fish avoid or remove away from the sources of these factors, thereby altering their behaviour (due to stress) and under such conditions some forms of fishing cannot be practiced (sport fishing - fishing). Stress in fish changes the physiological functions that can significantly change their condition state over time (fish are frightened and eat much less).

Construction works that are carried out near water bodies can cause accidents such as the outflow of harmful chemicals into the environment, e.g. petroleum products, etc. Such substances in large quantities cause the fish die-off and die-off of all organisms that are in the affected area.

One of the possible negative impacts of construction sites (recorded in Tara River) is the introduction of larger quantities of particles originating from concrete into the river system. The presence of fine particles (suspended in water) originating from concrete and concreting leads to their deposition in deeper layers of sand and gravel, their binding into solid conglomerates that prevent the development living organisms in sand and gravel. It is known that for the hyporheic interstitial (stigmatal), the composition of the sand particles is much more important than the chemical composition of the water, so disturbances in the substrate structure significantly alter the structure of biocenoses. These particles can lead to the complete closure of the lower layers (concreting) and / or inhibiting the circulation of oxygen. Both processes disable the development of living organisms.

In addition to the above potential impacts in the aquatic environment, the fish and their environment can also be affected by changes in the surrounding land in a narrow and wider area. By cutting larger forest areas the absorption of the terrain reduces, causing surface runoff, and it influences, in rainy periods, an increase of the speed of water flow, causing destabilization of the banks and erosion processes. This leads to changes in the characteristics of the watercourse in terms of its hydrology, the shape of the river channel, the amount of suspended matter, the chemistry and the biological properties of the water. All this can directly and indirectly affect fish population, and cause habitats loss for some species of fish and other organisms. Increased runoff from the surrounding terrain and more significant runoff from the pavement creates torrents that result in similar effects to the occurrence of high level of suspended matter due to works on highway construction. By this effect, the increased water speed acts erosively on the substrate and on living organisms. It should be noted that these effects are manifested during both, the construction and operation phase of the highway.

Possible risks for ichthyofauna during **operational phase** of highway.

After completion of the works and commissioning of the highway, some of the above risks may also occur at this stage (operational phase). During operational phase of the highway, a new threat to the aquatic living world arises, which is the flashing of atmospheric waters from the road, which introduces suspended matter and various pollutants (mainly petroleum products) into the aquatic recipient. Of course, this impact is possible if highway is built near river flows. Based on the enclosed documents, maps, these risks can be expected in several places because the envisaged route of the road from Mateševo to Andrijevisa intersects a number of small streams, several bays, and in some positions passes in the vicinity of larger water bodies (Drcka River, for example).

The drainage of water from the highway in a larger amount will affect the change in the water quality of the recipient, its physical and chemical characteristics, which will directly affect the living organisms. The fish population will be affected directly and indirectly (through other communities). Changes in water quality will be caused by inorganic particles that are flushed out causing turbidity. In the long term, inorganic particles in larger quantities and for a longer period can also alter the physical characteristics of the riverbed at the deposition point in the water.

During operational phase the highway, fish population can be mostly affected by decrease of water quality due to the flushing of atmospheric water from the pavement lane. This aspect of influence has been elaborated earlier in the text.

Increased turbidity, as a physical factor of water adversely affects several environmental factors such as: light level, oxygen level, water temperature, change of pH value, may cause embryo die-off. These negative impacts are also earlier elaborated.

7.1.6.3 Terrestrial invertebrates

The most significant negative impacts on the local environment during the project will occur primarily during the construction phase. These impacts include habitat loss and degradation, fragmentation, pollution, and other disturbances.

Habitat loss and degradation. The removal of the topsoil and vegetation layer will result in the loss of crucial "food sources" for various species, particularly insects. In addition, invertebrates living in the vegetation and soil will be displaced or destroyed, along with any underground nests, eggs, or larvae. The operation of heavy machinery may also damage specific vegetation, particularly around puddles, which are essential for the life cycle of certain species. If puddles, sinkholes, or depressions are filled with excavated soil, this may have further negative effects on local species.

Fragmentation. Construction activities can fragment habitats, affecting the continuity of populations. This could result in the loss of plants that serve as food and shelter for certain species and create barriers that hinder the movement of species across the landscape.

Pollution. Pollution from construction machinery, such as dust emissions, could harm sensitive species. Additionally, accidental spills of fuel, oil, or other toxic substances may occur, as well as potential fires due to careless handling of equipment. Solid and liquid waste generated by workers could also contribute to habitat pollution.

Changes in water conditions. The construction of the highway will be carried out near or across several rivers and streams (e.g., the Kraštica river). This may result in changes to water quality, turbidity, and increased sedimentation due to riverbed excavation, gravel dumping, or waste disposal. These changes could negatively affect aquatic invertebrates and species whose life cycle is tied to water.

Direct mortality. Direct mortality of species could occur due to trampling and burial by heavy machinery.

Noise, Vibration, and Light Disturbance. Construction activities will generate noise and vibration, which may disturb the behavior of certain species, possibly displacing them. Artificial lighting could also attract some insects, making them more vulnerable to predation.

7.1.6.4 Amphibians and Reptiles

Key risks during **construction** are:

- Habitat loss and degradation due to excessive vegetation removal for the construction of the road, elimination of the natural characteristics of the land within the paved area and adjacent roadsides, soil compaction due to operating machinery
- Habitat fragmentation
- Pollution due to waste and soil disposal can impact both amphibians and aquatic/semiaquatic reptiles and their food supply
- Direct mortality

- Visual, noise and vibration disturbance

The impacts on batracho- and herpetofauna related to the **loss and degradation of natural habitats** are: excessive vegetation removal for the construction of the road; elimination of the natural characteristics of the land within the paved area and adjacent roadsides; soil compaction due to operating machinery. These actions can adversely affect amphibians and reptiles both directly - by limiting their home ranges, changing their foraging ability and strategy reducing the places that may be used as refugia and hibernacula and indirectly – affecting prey availability.

The construction of a long tunnel and a number of bridges and crossings reduce the width of the area of permanent habitat loss. Also, most of the detected terrestrial species often occupy man made, altered or habitats under anthropogenic impacts. Therefore, post-mitigation significance of risks related to habitat loss and degradation are expected to be low to moderate.

Habitat fragmentation caused by road construction can directly and adversely affect amphibian and reptile species by disruption of their movements through the landscape and increasing mortality of animals who try to cross the road. Considering that the Project includes the construction of bridges over the rivers and streams, crossings and tunnels, movement corridors and habitats are not expected to be disrupted if the necessary measures of protection and mitigation during the project construction phase are applied. Potential fragmentation can be expected with regard to terrestrial habitats of amphibians and reptiles. The risks related to habitat fragmentation are expected to be of short-term duration and their significance after implementation of adequate mitigation measures are expected to be low to moderate.

An increase of sedimentation and turbidity within the project's sensitive riparian area caused by disposal of removed soil and waste along the banks of the rivers and streams, direct disposal into aquatic and wetland habitats and emission of dust during construction phase, may adversely directly and indirectly impact both amphibians and aquatic/semiaquatic reptiles and their food supply (fish, aquatic invertebrates). In-river works and gravel extraction can also result in sediment deposition. After application of necessary mitigation measures this impact is expected to be of short-term duration and of low-moderate significance.

Inadequate or untimely application of protection measures can lead to **contamination of aquatic and terrestrial habitats by emissions of dust**, waste and pollutants by construction vehicles and wastes from working camps. Pollutants can have direct and indirect adverse effects on both amphibians and reptiles and their prey items and long-term consequences on their habitats. The contaminants (such as heavy metal and nitrogen pollution) may cause direct mortality of individuals resulting from exposure, developmental anomalies, increased metabolic rates, which all may result in demographic shifts causing detrimental effects on amphibian and reptile populations (e.g. Todd et al., 2010; Egea-Serrano et al. 2012). After application of necessary mitigation measures this impact is expected to be of short-term duration and of low-moderate significance. Otherwise, especially in areas near watercourses, unmitigated effects of run off would be regarded as high impact with potentially long-term duration.

Amphibians and reptiles **may be affected** by collision with construction vehicles during habitat clearance, deliberate killing by construction workers due to fear (e.g. snakes) or accidental trapping in pits and excavations. It is expected that animals will try to avoid the project area due to presence of people, noise and vibration from construction machinery. The potential adverse impact of direct mortality is expected to be of short-term duration and post-mitigation significance would be low.

Displacement of individuals as a reaction to visual, noise and vibrations disturbance during construction is expected to be localized and of short-term duration. Sufficient data are not yet available to identify anthropogenic noise as the critical variable affecting vocalization or reception systems of amphibians and reptiles and their courtship and reproductive behaviour (Simmons and Narins, 2018).

Also, most of the species detected during the field surveys were found close to the main or side roads and are already habituated to the certain degree of noise.

Key risks during **the operations and maintenance**:

- Habitat degradation and fragmentation
- Habitat pollution
- Direct mortality
- Noise, light and vibration disturbance

The highway-induced habitat **fragmentation** may prevent amphibians and reptiles to reach suitable habitats for feeding, breeding and hibernation and make them more visible to predators when crossing the gaps. The risks of habitat fragmentation are possibly related to open sections of the road along the hilly slopes of the Project zone. However, the greater diversity and abundance of amphibians and reptiles have been recorded in lower parts of the area along watercourses. Considering that the project includes the construction of a number of bridges and crossings over the rivers and streams, species movement corridors and habitats are not expected to be disrupted. Therefore, it is expected that the impact could be of long-term duration along the open ground sections and its initial significance, without mitigation measures could be low to moderate.

Pollution from operational road includes water runoff and accidental spillage of chemicals, such as gasoline, oil and various toxic compounds, and would have impacts similar to those from construction. The effects of pollutants on amphibians and reptiles are described above. This impact could be of long-term duration and its initial significance, without mitigation measures could be moderate. Post-mitigation significance is expected to be low.

Collisions between amphibians/reptiles and cars cause **direct mortality** of these animals. Therefore, the operational road represents significant risk to amphibians and reptiles which crossroad for the purposes of choosing new habitat, finding a food source or reproduction. Some of them are also attracted to road surface for thermoregulation.

There are no literature data on road-kill rates of amphibians and reptiles on main and local roads in the surroundings of the Project area, as well as in the area itself. Sporadic road kills of amphibians and reptiles were detected along the main road Mateševsko-Andrijevička during field work. Road kills were detected in *B. bufo*, *R. graeca*, *P. muralis*, *A. fragilis*, *Z. longissimus*, *C. austriaca*. During operation phase, this impact may be permanent, but it is not expected to be high for toads and other amphibians due to the position of the open part of the route along elevated terrain above the valleys and gorges, construction of bridges/crossings over the rivers and streams and a long tunnel through the Trešnjevnik pass. The impact may be moderate to high for some species of reptiles. However, field research has not identified obvious reptile corridors and precise locations at proposed open ground sections of the projected routes where the construction of animal passages would be required. The position of the open part of the route at elevated slopes above watercourses, construction of bridges and crossings and the road tunnels reduce the risk of direct road mortality.

Insects may be attracted to the lighted road increasing collision risk for their predators – e.g. some nocturnal species of amphibians (e.g. toads). Also, exposure to artificial light can cause nocturnal frogs to suspend normal foraging and reproductive behaviour (Buchanan, 1993). Impacts of noise and vibrations are described above. Most of the species detected during the field surveys were recorded close to the main or local roads and are already habituated to the certain degree of noise. They also may become accustomed to highway transportation. Therefore, these impacts are expected to be of minor importance.

7.1.6.5 Birds

The species that will be particularly affected are the breeding residents, those that are permanently tied with all life cycles to the corridor route and which, at the beginning of construction, will be forced to seek and conquer new territories. These are, in the first place, residents from the groups of **owls and woodpeckers**. Destruction of their habitat through which the road corridor will pass, and its permanent transformation from natural habitat to infrastructure extremely unsuitable for their survival, will affect in such a way that there will be no compensatory measures to mitigate this impact. The species will have to conquer new territories. Given the breeding density, probably easier than on other routes of the highway corridor in the north of the country.

Impacts during construction phase

The corridor of the highway starts from Mateševu to Bare Kraljske along the riverbank of the Drcka river or via the river viaduct to the Trešnjevik tunnel.

Activities that will have a **significant impact** are:

- Cutting down trees and shrubs to trace the corridor
- Permanent loss of space by highway construction
- Construction of side, service roads of temporary character
- Construction of temporary parking spaces for machines
- Removal and disposal of the upper layer of soil near the planned road

The corridor of the highway below the **Trešnjevik** pass passes through a tunnel, which is favourable from the aspect of preserving the habitat above the tunnel, but, on the other hand, unfavourable due to the necessity of depositing materials and destroying the habitat. As this is done on both sides of the tunnel, the impact of this activity can be large.

Activities that will have a **significant impact** are:

- Digging a tunnel and creating a landfill of excavated material
- Construction of side, service roads of temporary characters
- Channelling water from the tunnel
- Construction of temporary parking spaces for machines
- Turbidity of river water by wastewater
- Backfilling of watercourses with debris

For part of the route **from the Trešnjevik tunnel to Andrijevića**, it goes along the riverbank of Kraštica to the confluence with Lim and Andrijevića. Activities that will have a **significant impact** are:

- Cutting down trees and shrubs to trace the corridor
- Permanent loss of space by highway construction
- Construction of side, service roads of temporary character
- Construction of temporary parking spaces for machines
- Removal and disposal of the upper layer of soil near the planned road

Throughout the alignment other impacts include:

- Minor impacts
 - Noise as a consequence of machine operation.
 - Disturbance of birds
- Indirect impacts:
 - Dust as a consequence of machine operation and dusting of vegetation
 - Noise as a consequence of machine operation.
 - Vibrations as a consequence of machine operation

- Soil and water pollution by washing machines, rinsing concrete or incidental oil spills

Impacts during operation phase

- During the operation phase, direct impacts to birds include:
 - Barrier effect (noise barriers, pylons on the viaduct, cables, etc.)
 - Collisions with cars
 - Noise disturbance

Additionally, surface water pollution (due to washing away of polluted water from the road) has indirect impacts to birds.

- Indirect impacts are:
 - Surface water pollution washing away of polluting water from the road

7.1.6.6 Mammals

Possible impacts during construction phase include fragmentation, disturbance by noise and light, as well as direct mortality.

The works during construction phase imply an increased presence of construction machinery, and therefore an increased level of noise. Fauna living in the area of micro locations will temporarily leave their habitats and migrate to the surrounding areas (this applies especially, and to the greatest extent, to the fauna within the zone of direct impact of planned works). This adverse impact is of a temporary nature, during the time of highway construction. The experience has shown that otters move in the immediate vicinity of bridges, which was observed near the bridge on the river Lim, in the village of Seoce during the research of ichthyofauna. This indicates that after the completion of the works, this species will inhabit previously abandoned habitats and also means that there will be no permanent impact on this rare, endangered and protected species.

During operation main impacts are the barrier effect and habitat fragmentation, disturbance by noise and light, as well as direct mortality.

7.1.6.7 Bats

Transport infrastructure projects can significantly impact bat populations during both the construction and operational phases, with cumulative effects arising from multiple factors. Although individual impacts may be minor, their combined influence can be substantial. The timing of each type of impact also varies:

- Immediate Impacts: During construction, the destruction of roost sites, habitat loss, and habitat degradation cause immediate harm to bats.
- Ongoing Pressures: Once the road becomes operational, bats face constant pressures from noise and light pollution, while vehicle collisions increasingly threaten bat populations over time.
- Long-Term Effects: Habitat fragmentation and barrier effects from the road may disrupt bat populations across generations, delaying the full impact on their population status for many years.

7.1.7 Water resources

7.1.7.1 Construction phase

Construction works on highway and accompanying facilities will impact ground waters and sources of potable water only in case of accidental situations.

During construction works on the highway, there are certain activities that can potentially have adverse impacts to the flow regime and surface water quality. In this regard, the greatest potential danger is represented by:

- construction works (blasting, deep excavations, demolition and removal of the surface layer, etc.). These works can disrupt the natural channels of water flow, and at the same time they remove the surface layer thus creating new catchment areas.
- construction machines - potential danger of leakages or accidental spills of oil and oil derivatives, inadequate management of waste oil, batteries and other waste.
- uncontrolled deposition of excavated material, and establishment of machinery maintenance bases near surface watercourses.
- use of inadequate construction materials.

Construction works can be a source of pollutants, as precipitation runoff can carry suspended particles off the construction site, or they can be accidentally released during the construction of road structures, waste disposal, or equipment cleaning. Discharge from cement plants or concrete mixer trucks can be particularly harmful due to the highly alkaline character of fresh concrete. Discharge of significant amounts of sediments into watercourses can also cause changes in the pattern of watercourses.

During construction hydrocarbons, lubricants, paints, solvents, resins, acids may also be released upon accidental leaks and spills from machinery and material storage sites thus can contaminate surface water. Contamination of the water body may occur either directly (e.g. if the construction site is taking place very close to the river or stream) or indirectly, through soil and groundwater transport to the surface water body.

Possible significant impacts to the quality of surface and underground water can occur especially on locations of bridges over water courses. ,:

Additional detailed (hydrological and ecological) surveys of the site are required to enable effective planning during the Detailed design and careful planning in implementation of on-site excavation and construction. This involves a full understanding of the whole site to determine orientation, location, access and borrow pit requirements. Adequate water and silt management to avoid pollution of groundwater and surface water.

Given that the locations of borrow pits are now yet known including the depth to which it will be excavated to access suitable construction material poses a risk which cannot be assessed at this stage. . As with other excavations, lowering the water table during the creation and operation of borrow pits may cause impact to ground water and uncharted springs .During the Detailed Design Stage once the location of borrow pits are identified a Borrow pit risk assessment and management plan will be developed by the EPC Contractor to identify the risks to water supply and take into account Method statements during excavation that will help manage impacts to uncharted springs This should include monitoring of groundwater levels pre, post and during construction activities.

It is noted that the selected EPC Contractor will undertake planned survey / monitoring (i.e. surveying of groundwater mapping, water quality monitoring of groundwater, local springs, etc.) to inform detailed design and address adverse impacts during construction. In addition, monitoring of key

receptors shall be extended through the construction phase to ensure that any adverse impacts on groundwater are identified. Following the surveys he will be required to incorporate mitigation measures in the design and the method statement for types of works that could potentially affect the level of groundwater.

Impacts. Elevated risk to groundwater is possible, primarily during the construction and decommissioning phases. Potential sources of pollution include but are not limited to the following:

- Spills of fuels and oils in plant stored at the site.
- Use of cementitious material in foundations, as well as disposal of water used as washdown of equipment/vehicles used to transport batched cement.
- Generation of turbid runoff from disturbed land. While typically not a groundwater issue, control of these pollution sources in a karstic environment is necessary to preclude impacts to groundwater

Such impacts are controlled through the implementation of general best practice housekeeping measured expected to be implemented by the selected EPC Contractor. These practices include following the Construction Health and Safety Plan, staging of work areas, provision of washout/washdown facilities with filter/neutralization prior to discharge, installation of silt fencing, erosion and sediment control, excavation and grading containment, provision of spill response equipment, etc.

All charted and known springs and water supplies have been included.

With a view to this potential change in surface water quality requiring significant intervention to return to baseline, the magnitude of surface water pollution during construction is considered major. Considering the magnitude of impacts and the sensitivity of the surface water recipients, the initial significance of this adverse impact without mitigation is Major.

7.1.7.2 Operation phase

During the operation of the road, water pollution can occur due to the following processes: deposition of particles from exhaust gases, tire wear, car body failure and cargo filtration, pouring of cargo, rejection of organic and inorganic waste, atmospheric deposition, deposition of wind-borne particles and their transmission due to passing of vehicles.

Pollution that occurs as a consequence of these processes, according to their temporal characteristics can be permanent, seasonal and accidental. Permanent pollution is primarily related to the scope, structure and characteristics of the traffic flow. Traffic causes the permanent deposition of harmful substances on the road surface and the accompanying elements of the cross section, which are washed away by atmospheric precipitation. This is primarily deposition of harmful substances from exhaust gases, oils and lubricants, tire and road wear, car body wear and so on.

Seasonal pollution is related to a certain period of the year. A typical example of this type of pollution is the use of salt to maintain the road in the winter months (this phenomenon is not common). This type of pollution is characterized by the fact that in a very short period of time high concentrations of sodium chloride occur. Accidental pollution most often occurs due to the transport of hazardous materials. Most often oil and its derivatives are spilled, although it is not uncommon that vehicles transporting very dangerous chemical products collide. Special problem in this case is the fact that these are very high concentrations, which cannot be predicted in time or space. From the point of protection, very wide belts must be protected, especially water supply zones and high-category surface waters. Harmful substances are also present in the waters that flow from the road surfaces. They

contain fuel components such as hydrocarbons, organic and inorganic carbon, nitrogen compounds (nitrates, nitrites and ammonia). Special groups of elements are heavy metals, such as lead, cadmium, copper, zinc, mercury, iron and nickel. Solids of different structure and characteristics that occur in the form of precipitating, suspended and soluble substances are also significant. It is also possible to register substances that are a consequence of the use of corrosion protection materials. Special groups of highly carcinogenic materials are polyaromatic hydrocarbons (benzo-a-pyrene, fluoranthene) which are the product of incomplete combustion of fuel and used engine oil. To indicate the present pollutants that occur in dissolved and undissolved form, there are macro indicators such as pH, electrical conductivity, suspended and sedimentary substances, COD (chemical oxygen demand), BOD (biochemical oxygen demand), fats and oils, etc.

Out of the listed pollutants, the greatest influence on the type and concentration have traffic volume, atmospheric sediment (dry and wet) as well as local conditions (land use, road surface, maintenance method, etc.).

However, in accordance with the adopted concept of drainage, which provides controlled collection of atmospheric water from the road and their treatment in oil separators (siphons for sediment filtration) to the required quality for discharging into the recipient, negative effects of newly designed road on surface and groundwater quality are decreased. The impact is minor.

Total water consumption along the highway section was calculated on the basis of planned water consumption, for each facility separately or their combination.

Table 7-35: Water needs for the operation of the Highway

Facility	Location	Required water capacity (m ³ /day)	Average flowrate (l/s)	Max flowrate (x 1.6 l/s)
Mateševu: - Rest area, petrol station and service station at both sides - Motel	5+100	2*62+74~200	5.5	8.8
Andrijevića: - Petrol station at both sides - Motel	TBD*	2*64+74~200	5.5	8.8
Maintenance station (Andrijevića)	TBD	~9	0.5	0.8
Pay toll (Andrijevića)	TBD	2.5	0.3	0.48
Total		411.5	11.8	18.88

* to be defined in the detailed design

A water tank of 120 m³ volume (station 9+500) is designed at the tunnel portal, for the water supply of the tunnel's fire protection system.

7.1.8 Waste

7.1.8.1 Construction phase

Solid waste. Impact on the environment (e.g. soil, water resources, biodiversity) may occur in the event of uncontrolled disposal of the generated solid waste on land or water resources. The impacts have been described in the relevant chapters. The following types of waste are generated during construction works of the highway and supporting facilities:

- Inert waste

- communal waste,
- packaging waste from explosives,
- packaging waste from concrete additives, which can be hazardous waste, i.e. hazardous packaging waste.

Types, quantities and labels of waste will be known only after the Main design of the highway section is completed and construction methods and technology selected. Regardless, all types of waste shall be treated in accordance with relevant legislation.

During the construction of the highway, in the areas of portals of tunnels, bridges, cuts and incisions on the open route, significant amounts of vegetation-wood mass will inevitably be removed. According to the Rulebook on waste classification and waste catalogue, the closest definition is group 02 - waste from agriculture, horticulture, aquaculture, forestry, hunting and fishing, food preparation and processing. The subgroup of this waste group is labelled as 02 01 07 - waste from forest exploitation. According to the Law, the producer of the waste or a legal entity or individual who owns the waste is responsible for handling the waste. In the end, the Forestry Administration sets forth the Instructions on handling wood mass and determines the location for its storage.

The volume of vegetation that should be removed will be determined in the detailed design.

Wastewater. Impacts on the environment (e.g. soil, water resources, biodiversity) may result from:

- leaks of petroleum and lubricants (accident situation),
- leaks related to the use of construction site machinery (accident situation)
- rinsing waters of the construction machinery bins
- municipal wastewater of construction site workers
- storm water runoff

These impacts have been described in the relevant chapters.

7.1.8.2 Operation phase

During operation phase, solid waste may be produced during the maintenance activities as well as by the road users (municipal waste).

7.2 Social Impact assessment

Infrastructure development has both negative and positive impacts from a socio-economic standpoint.

This section of the impact assessment assesses the direct and indirect social impacts of the Project. In order to explain the cause of the expected impacts of the Project for socio-economic standpoint of view, each subsections in the impacts assessment has been clustered and generated from data deriving from the baseline studies (Chapter 6 of the ESIA Report) to emphasize on the existing conditions of the AoI. In that aspect, given the baseline conditions and the impacts are summarized to the different topic discussed in below.

The impact assessment:

- Health and access to health services,
- Infrastructure, facilities and public services,
- Traffic and accessibility,

Land Acquisition and Resettlement,

- Employment, Labour and Working Conditions ,
- Occupational Health and Safety ,
- Community Health and Safety, and
- Cultural heritage and burial grounds.

The group of receptors from the baseline that will not be adversely impacted by the Project have been omitted from presentation in the impact assessment. The ESIA has not identified people or groups of people who may be more adversely affected by the overall and general Project impacts than others by virtue of characteristics such as their gender, gender identity, sexual orientation, religion, ethnicity, age (including children, youths and the elderly), physical or mental disability, literacy, political affiliation, or social status. However, at the household level of persons impacted by involuntary land acquisition and resettlement certain types of vulnerability might be identified during the socio-economic survey, which is yet to be conducted for the development of the LARP. These groups will receive additional support as determined by the Entitlement Matrix presented in the Land Acquisition and Resettlement Framework (LARF).

The assessment has a summary of impacts presented as per methodology provided in chapter 1.2.3 and therefore this section does not repeat the quantification of types of impact, their significance a quantification of the nature, extent, duration, and magnitude and receptor sensitivity as a separate narrative conclusion.

7.2.1 Health and access to health services

7.2.1.1 Construction phase

The assumption is that access to health services will not be directly adversely affected by the construction activities itself and the route. There might be indirect impacts through an increased demand for health services from the workers of the EPC Contractor while the works are ongoing but more likely in the first 6 months of the construction, although without significant additional strain. The EPC Contractor will be encouraged to hire Project workers locally where possible, those residing in the project area or from Podgorica and other cities, who are already are in the health care systems, hence accounted for within the current health care capacities. Past construction experience in the area, suggests EPC Contractors even if foreign, subcontract up to 30% of their works to local companies who employ local workers. What form these arrangements will exactly take was not known at the time of the ESIA as the tender for election of the EPC Contractor was in its Pre-qualification stage where no such information was available. Nonetheless, non-resident project employees are expected, whose temporary influx will moderately increase demand on local health services. The health care centres in Kolasin (with its outpatient clinic in Bare Kraljske) and Andrijeviča respectively, are at pre –project conditions able to provide care for all population categories (urgent care, general medicine, health care for women and children, health visitor service, laboratory and other diagnostics, occupational medicine and physical medicine and rehabilitation). Dental care is largely provided by private dental clinics with sufficient capacity. For complicated diagnostics, life threatening and severe cases of accidents and injuries the health care facilities in Podgorica provides surge care, which the EPC Contractor is also expected to include in his emergency response plans. The risk from reduced and timely access to health services could especially at the beginning of the construction period be exacerbated by temporary road closure and thereby associated traffic disruption, which will be managed by adequate traffic management plans and their implementation.

7.2.1.2 Operation phase

No adverse impacts are expected during the operation phase. The construction of the highway will contribute to improved mobility and connectivity to Podgorica including the secondary and tertiary health care centres.

7.2.2 Infrastructure, facilities and public services

7.2.2.1 Construction phase

The establishment of workers accommodation camps is not yet determined for the reason explained in above section (stage of the tender for selection of EPC Contractor). If camps are established, they may lead to temporary increased pressure and potential cuts of utility supply such as electricity, water supply, and waste management, in particular for settlements located closer to the project facilities and activities. Disruption to utilities could result in impacts to livelihood or quality of life and if unmanaged could result in health impacts.

The EPC Contractor should be encouraged to utilize land at the beginning of section in Mateševo, a location of a former workers accommodation camp used to accommodate workforce from the section Smokovac Mateševo. This camp was dismantled, with physical infrastructure removed, but the land is vacant and should be considered for use should set-up of an accommodation camp be required.

According to Key informants interviews and community meetings, electricity cut offs occur often in some of the affected local communities, specifically closer to Mateševo, as does the internet disruption. Recently, natural spring water supply disruption was reported in Kralje because of decrease level of groundwater which and construction works might further affect the water supply in areas of unchartered springs.

The project will generate minimal solid waste during both construction and operation phases, including construction debris and general municipal waste. These small quantities can be easily managed and are negligible compared to the daily waste handled by facilities. The selected EPC Contractor must ensure proper coordination with municipal landfills or hire competent private contractors to handle and transport both construction and solid waste to approved landfills.

7.2.2.2 Operation phase

Transport infrastructure, in particular, is linked with improvements in an emerging market's economy through reduced transportation costs and increased accessibility. These two factors not only impact directly on productivity and growth but also indirectly impact by enabling higher levels of private investment. The Project aims to improve the quality of life, create the conditions for demographic renewal, and encourage people to return in Project region. The Project is expected to contribute improve transportation within the region and improve transit and intermediary links between pan-European infrastructure corridors as well. The Project is expected to indirectly lead to an increase in economic activities such as tourism, infrastructure services, agricultural and industry, real estate investments and employment levels, over time. The Project will provide the local residents with better accessibility to social, health and educational services in Podgorica and other larger cities. In terms of impacts on infrastructure, establishment of auxiliary facilities, such as motels, rest areas, gas stations, tolling station etc. will increase the demand for water, power, sewerage and waste facilities, and telecommunications. The current assessment was not able to take into account these incremental needs since the details for these facilities were not known.

7.2.3 Traffic and accessibility

Traffic disruption may result in negative impacts on day-to-day activities, livelihood and overall quality of living if not managed properly. Which is why impact to traffic on the R19 and the local network in Mateševu and Andrijevića are amongst the most prominent impacts. The assumption is that construction traffic increasing the average daily road users, in the already sub-standard condition of the R19 road (in particular) may lead to disruption in daily traffic, or even at times lead to complete traffic stop, as a result of planned or unplanned transport activities. Road closures for safety reasons are expected during transport of exceptional transport of large size and weight (pre-cast elements for bridges), concrete, asphalt, or transport of hazardous materials such as explosives. The locations of the batching plant facilities, potential asphalt plants, pre-casting yards, deposit areas and borrow areas where not known at the time of this assessment. The risk assessment corresponds to the concerns of stakeholders as noted during community meetings. Considering the importance of the road network to ensure mobility between settlements along the Social Aol and access to municipality centres, services (i.e. education, health, etc.), and considering that the regional R19 road is the only road connecting Mateševu and Andrijevića impact to traffic is amongst one of the most important issues to be mitigated with the most effective mitigation measures and in consultations with authorities and local communities

The Project can impose low risk in temporary seizure in access to private land in absence of designed road underpasses or preserved access where these exist. The implemented route change in its current state has only one point of conflict with the regional road R19, while its integrity and functionality is preserved. The common risk as stated by almost all communities is that the underpasses may not be located close enough ensure continued access, and this may cause increased transportation costs and require more time for access. Furthermore, some of the local businesses were concerned that during the construction of the Project, their businesses may not be accessible to the customers. Impacts to the local road network is one of the greatest concern of all the stakeholders. Local roads especially the regional road R19 from Mateševu to Andrijevića are already in a substandard condition with extreme pressure from overloaded heavy vehicles that observe neither speed nor weight road limits. There are plans for the local road to be rehabilitated at a later stage independently from the Project but no imminent plans have yet been reported nor formalized. The conditions and impacts vary significantly throughout the seasons. The winter period especially in the area of mountain Trešnjevik imposes difficult road conditions, with an observed insufficient maintenance due to a combination of underlining reasons. At one hand, there is insufficient resources human and assets to ensure adequate winter maintenance, which often leads to complete traffic disruption due to road closure. These although expected to be at Municipal level represent a major concern and require enhanced monitoring and remedial measures. With the implementation of proposed mitigation measures, the extent of the infrastructure related impacts are expected to be reduced from Municipal to Project Site with the compliance of international good practices and adequate monitoring.

The new route change from tunnel Tresenjevnik to Andrijevića has avoided cases of intersection with the regional road R19 as the alignment has been moved to the south parallel to the regional road, hence the above impacts only might occur in the section from Mateševu to entrance to Tunnel Trešnjevik. The key sources of impacts are deterioration of the R19 road from construction traffic in areas where no access/haulage routes can be established and road safety impacts adding.

A transport survey still needs to be undertaken once the specific models of trucks, machinery and equipment is known at the time the EPC Contractor is selected. This will ensure that any changes to the likely impacts along the traffic routes are identified.

The impact is assessed as negative, spanning over both Municipalities Andrijevica and Kolašin, with short-term duration with its peak in the first two years of construction, moderate in magnitude, with a receptor sensitivity of medium sensitivity, with a high probability of impacts occurring.

7.2.4 Land Acquisition and Resettlement

The Project runs through two administrative municipalities, Kolašin and Andrijevica respectively, and the expropriation spans across 8 Cadastral Municipalities depicted on Figure 2 (left hand side before the entrance to the Tunnel Trešnjevik and right hand side after the Tunnel exit i.e. Route change).

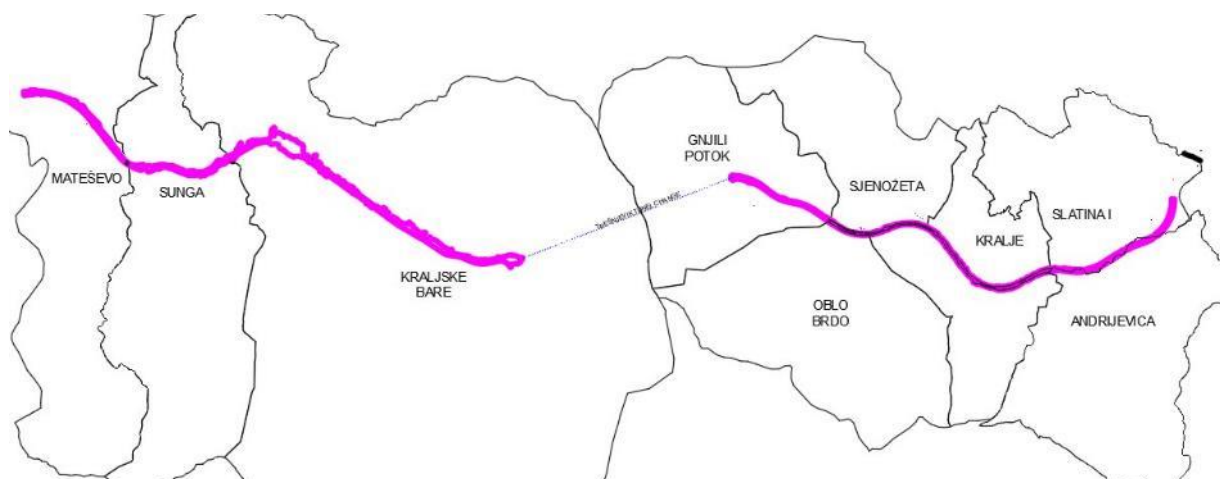


Figure 7-10: Overview of Cadastral Municipalities

The tables below provide comparative overview of estimated involuntary land acquisition and resettlement impacts based on the Preliminary design prior to Route change (Table 7-36) and Preliminary design after Route change (Table 7-37).

Table 7-36: Estimated impacts from involuntary land acquisition and resettlement based on the Preliminary design before Route change

Municipality	Cadastral Municipality	Expropriation cases (number)	Land plots (number)	Area of land (m2)	Number of PAPs (title holders)	Physical displacement (permanent residence)	Physical displacement (seasonal use and abandoned)
Kolašin	Mateševo	10	35	85.326	46	0	1+ 1*
	Sunga	12	63	105.959	26	0	2
	Bare Kraljske	44	167	412.062	73	3**	1
Sub-total I		66	265	603.347	145	3	5
Andrijevica	Gnjili Potok	38	108	146.409	46	1	7
	Sjenozeta	29	82	190.681	47	0	3
	Kralje	59	139	137.251	89	5	6
	Slatina 1	83	260	274.603	169	9	9
Sub-total II		209	589	748.944	351	15	25
Total (I+II):		275	854	1.352.291	496	18	30

*One of the two identified structures has been already acquired for the footprint of the preceding section Smokovac –Mateševo but was not demolished and appeared in the inventory (please refer to figure 1 in Annex 5)

**One of the three structures is required for the footprint of the rest area to avoid impact to the residential structure. In addition, during the Detailed design phase, the route optimization will be additionally investigated and it is already anticipated that further avoidance of displacement impacts in Bare Kraljske is to be implemented.

Table 7-37: Estimated impacts from involuntary land acquisition and resettlement based on the Preliminary design after Route change in August 2024

Municipality	Cadastral Municipality	Expropriation cases (number)	Land plots (number)	Area (m ²)	Number of PAPs (title holders)	Estimated Physical displacement impacts (permanent residence)	Estimated number of Physical displacement (seasonal use)
Kolašin	Mateševo	10	35	85.326	46	0	1+ 1*
	Sunga	12	63	105.959	26	0	2
	Bare Kraljske	44	167	412.062	73	3**	1
Sub-total I		66	265	603.347	145	3	5
Andrijeva	Gnjili Potok	33	73	78.635	45	0	0
	Sjenožeta	17	38	53.683	25	0	0
	Kralje	37	61	100.771	52	0	1
	Slatina 1	25	57	61.768	41	0	0
	Andrijeva ⁶⁴	18	31	33.607	36	1***	0
Sub-total II		130	260	328.464⁶⁵	199	1	1
TOTAL:		196	525	931,811	344	4	6

* One of the two identified structures has been already acquired for the footprint of the preceding section Smokovac –Mateševo but was not demolished and appeared in the inventory (please refer to figure 6 in Annex 5).

**One of the three structures is required for the footprint of the rest area planned to be re-designed to avoid impact to the residential structure. In addition during the Detailed design phase the route optimization will be additionally investigated and it is already anticipated that further avoidance of displacement impacts in Bare Kraljske is to be implemented refer to Annex 5 Legend RA.

***Structure is approximately 2 m outside the expropriation border.

Table below lists physical structures outside the expropriation boundary but fronting the highway up to 100m. These structures shall be further investigated during the detailed design to apply commensurate technical protection measures in consultation with the PAPs or expropriated at the owners` request.

Table 7-38: Structures fronting the highway in a distance up to 100m from the carriageway

Municipality	Number of structures (residential, seasonal or abandoned)	Distance from highway (m)
Kolašin	2	≥15
	4	16-30
	4	31-50
	2	50-100
Sub-total I	12	
Andrijeva	1	≥15
	3	16-30

⁶⁴ The Route change included a small area of CM Andrijeva due to change of the location for the interchange (from CM Slatina to CM Andrijeva).

⁶⁵ The estimation is given based on the Conceptual design which is less detailed and will vary

	2	31-50
Sub-total II	6+1*	
* the distance for this structure is currently not know as it is located above the future exit portal of Tunnel Trešnjevnik which will be determined by the Detailed Design		

In addition to all of the above, there are 5 structures, which are not required for the footprint of the alignments, but are adjacent to or potentially required for relocation and deviations of certain parts of the regional road R19. For these structures, MONTEPUT has indicated that the Detailed Design will be required to explore alternative solutions to avoid impacts.

Following the Route change physical displacement impacts appear were reduced from 38 cases (18 for permanent residence) to 10 (4 for permanent residence). Details on the Project history and avoidance impacts are provided in Chapters 1.1.1, 1.1.2 that have been factored in the MCA. Extensive description of the course of the decision making process and the course of engaging with the local communities is presented in the Stakeholder Engagement Plan (SEP) particularly in its Annex 10. What remains as a conclusion is that the dialogue with the local communities, including the individuals and groups in opposition of the new route, remains as the crucial tool in building a supportive environment.

All land acquisition, either permanent or temporary, will be done in compliance with the relevant Montenegrin legislation and EBRD requirements. The impacts is considered long term and is not anticipated to have residual impacts if the LARF and subsequently the LARP is implemented compliantly. To mitigate these risks a standalone LARF has been developed commensurate to the magnitude and scale of impacts stemming from the project land and resettlement needs. Therefore, the methodology of risk assessment adopted in this ESIA is not considered relevant and has not been utilized in assessment.

The economic displacement impacts could not have been quantified in the impact assessment section as the socio-economic survey at the individual household level was not undertaken. Nonetheless, the social assessment related to land acquisition was informed also by key informants interviews and discussions with persons who will experience direct impact from land acquisition and livelihood impacts. The preliminary conclusion is that loss of assets (including land) or access to assets that leads to loss of income or means of livelihood because of project-related land acquisition or restriction of access to natural resources is expected to be minor. The modification of the route has avoided the earlier identified cases of significant economic displacement impacts especially in Slatina (meeting July 23, 2024).

7.2.5 Employment, Labour and Working Conditions

The baseline conditions have established that the national legal framework provides a high level of protection for both national and migrant workforce. The Implementation In the framework of the ESIA, the local pool of workforce was assessed (although not all information was available) including skills and likely numbers of workers needed over the project cycle. The approach to hire will depend on the selected EPC Contractor with labor and working conditions guided by the national law and EBRD PR2. If the EPC Contractor provides accommodation for workers, requirements for labour conditions and accommodation facilities compliant with the EBRD PR 2 and ILO Conventions shall apply. The contractor shall develop and submit for review and acceptance a Workers accommodation option plan, which shall be part of the obligations under the Contract. The EPC Contractor and each sub-contractor will be required to follow the LMP as appended in Annex III of this ESIA.

The selection of EPC Contractor will follow **Standard Tender Documents** that have been prepared by the **EBRD** for use by the Bank's clients for the procurement of **works** and services which assess during the selection the Environmental, Social, Health and Safety (ESHS) experience and past performance. This assumes that selected EPC Contractor will be a reputable firm with positive record of accomplishment in managing *inter alia* Labour, employment and working conditions.

The fact that Montenegro ratified 75 International Labour Standards (conventions), including all eight fundamental conventions and embodied their principles in national laws contributed to the assumptions in the risk assessment. Labour Law (OfG.49/08) and Law on Protection at Work (OfG.79/04) include provisions including promoting fair treatment, non-discrimination and equal opportunities for workers. All laws include legal penalties (Pecuniary Fines for Authorities and Responsible Persons or in some cases, criminal charges) breach of law provisions. There are no significant gaps between fundamental principles and rights of workers as defined by ILO conventions or accepted international rules of law and those proclaimed by national laws of Montenegro. If there is a gap between national laws and the ratified ILO conventions, according to article 9 of the Constitution that ratified and published international agreements and generally accepted rules of international law shall make an integral part of the internal legal order, shall have the supremacy over the national legislation, and can be applied directly.

The most prominent risk is the risk from informal work. In the absence of appropriate mitigation, this impact can seriously deteriorate the overall wellbeing of workers. The most important element of the wellbeing wheel is by far health care. Without formal registration of the employment workers will be deprived of health care in government supported health facilities and would have to rely on more expensive less accessible, for economic reasons, private sector health care providers. This is brought up since the informal employment is largely present in Montenegro especially with small companies and in the receptor community consumes 20% of the overall employment (compared to the 25% on State level). The informal labour was mentioned as a concern on all levels of consultations.

Details about the labour procedures and management, and construction camps, are not yet known. However, it is expected that contractors will comply with the Montenegro Labour law and GIP and will ensure that all employees, permanent and temporary, will be provided with labour contracts. (formal employment) It is also expected that the Project will comply with the Labour Code on working hours, working condition, occupational health, safety, and management of non-employee relations and grievances. Where the Labour Code does not cover the full range of working conditions, GIP will be followed. If not managed in accordance with the national legislation and GIP, there could be significant impacts associated with labour grievances, supply chain issues, occupational health and safety, child and forced labour.

The construction phase (at least preparatory works) of the Project is expected to start in 2025, with an duration of 60 months, and the peak period of the Project will likely be in 2027 and 2028. During the peak period, the number of the direct and contracted workers will be reasonably high, and influx of workers will lead to low adverse social impacts on local communities, especially in the most rural and smallest communities. The direct impact zone of the population influx will be the settlements located in the close vicinity to workers accommodation sites (MONTEPUT has not been able to confirm if accommodation camps will be set up, as it depends on the EPC Contractor and the pre-qualification is not). It is currently not known whether workers accommodation will be established.

Gender Based Violence risks have not been found to be an exceptional risk area. There have been no incidents reported falling under GBV including SEA and SH in the most recent comparable infrastructure Projects (Smokovac- Mateševo) which was double in size of project workers and its scale. Based on all parameters this infrastructure project is not considered large although complex from the technical point given the construction of Tunnel Trešnjevik. The social norms in Montenegro

and the area in general do not nurture pre-existing conditions that could be exacerbated with the influx of workers, expected to be dominantly male. Even without the knowledge of whether dedicated accommodation camps for workers will be established, the influx will not be directed to the smallest communities and but rather towards Andrijeviča and Kolasin. There are no remote locations were limited resources to report potential GBV incidents. Presence of security personnel has been factored into the assessment but given the regulatory framework described in the baseline personnel is scrutinized before hiring to exclude engaging personnel with historical abuse of power and status. Informal work will be adequately prevented so such informality does not create vulnerability and exposure to GBV due to their shadow status.

Risks are assessed as negative, limited to the project site, short term in duration and low in magnitude with moderate medium sensitivity receptors and with low probability of occurrence

7.2.6 Occupational Health and Safety

7.2.6.1 Construction phase

Occupational health and safety are considered primarily in terms of potential exposure to pollutants from various media (air, water, soil, other) and accident occurrence (direct and indirect) in relation to on-site workers and/or operators during both the construction and operation phases. In the context of the Project, risks and their assessment can be distributed across three main area of construction: the open road sections, construction of tunnel Tresnjevik, and bridges and overpasses. There are common denominators for these works such as Industrial Vehicle Driving and Site Traffic, Working Environment Temperature, Ergonomics, Repetitive Motion, Manual Handling and Lone and Isolated Workers.

Open road construction works bear significant risks for workers, such as:

- Over-exertion, and ergonomic injuries and illnesses, such as repetitive motion, over-exertion, and manual handling, are among the most common causes of injuries in construction and decommissioning sites
- Falls from elevation associated with working with ladders, scaffolding, and partially built or demolished structures are among the most common cause of fatal or permanent disabling injury at construction or decommissioning sites.
- Fall-related accidents. Main causes are unprotected sides, edges, and holes, improperly constructed walking/working surfaces, improper use of access equipment, failure to properly use personal fall arrest systems, slips and trips due to poor housekeeping.
- Struck-by accidents caused by vehicle and equipment strikes, falling or flying objects.
- Caught-in-between accidents caused by trench or excavation collapse, rotating equipment, unguarded parts, equipment rollovers, poor equipment maintenance
- Electrocution caused by contact with overhead or underground utility lines, contact with live circuits, poorly maintained cords and tools, lightning strikes
- Confined spaces and excavations risks
- Exposure to hand-arm vibration from equipment such as hand and power tools, or whole-body vibrations from surfaces on which the worker stands or sits,
- Eye Hazards
- Work involving the assembly or dismantling of heavy prefabricated component

The Tunnelling works

- involves the general construction risks as well as risks that are specific to tunnelling environment, such as cramped working space, wet and slippery flooring, artificial lighting, inadequate ventilation, existence of obnoxious gases, unseen weaknesses of rock, handling of explosives, hauling muck vibration, Eye Hazards etc, leading to accidents., use of explosives, risk of burial under earth falls, where the risk is particularly aggravated by the nature of the work or processes used or by the environment at the place of work or site

Risks associated with construction works on Brides include:

- Work on heights
- Risks during loading and unloading of heavy pre-cast elements for bridge structures
- Crane operations,
- Fall related risks
- Injury from being trapped, entangled or struck Rotating and Moving Equipment
- Exposure to vibration
- Exposure to faulty electrical devices
- Welding / Hot Work
- Eye Hazards

Construction workers on the Project are vulnerable to risks to their wellbeing and H&S on a daily basis. However, the labour and OHS legislation of Montenegro and H&S standards provide some protection of the labour force against main risk. The standard Bidding documents assessing past performance of potential bidders will ensure reputable firms are engaged. Stringent supervision which includes monitoring of the labor conditions and daily inspections of the site and H&S safety observations are inter alia embedded into the Terms of Reference for the supervision services. The national labour inspectorate will play an important role in supervising the Contractor and ensuring through its remit that the labour and ohs regulatory provisions are adhered to. All sub-plans part of the C-ESMP related to labor and OHS will be reviewed and approved by the supervising engineer. The workers grievance mechanism will allow that unsafe working conditions as well as lack sub-standard implementation of the specific management plans are reported.

With the baseline conditions and the supervision and oversight measures the risks are assessed as negative, limited to the Project site and for off-site activities extended to Municipal level, short term during the construction period, moderate in magnitude with medium sensitivity, and low probability.

7.2.6.2 Operation phase

Occupational health and safety risks during operation phase mainly refer to the risks to road maintenance personnel. The common operation phase risks include:

- Injuries or death in result of collision with vehicles and road accidents;
- Physical and mental hazards (noise, dust and increased concentration of exhaust gas, hot or cold weather);
- Conflicts with local communities caused by traffic jams or troubles of road operation in result of maintenance works;

- Injuries due to natural hazards – fall of stones at mountain sections of the road;

Health and safety risks for the operational staff working on the road will be related to their work responsibilities and should be properly assessed by the employing companies responsible for the maintenance.

The operational and maintenance workers are considered to be of medium sensitivity, as they will not be exposed to hazardous conditions. It was reported by the road operator on the preceding section Smokovac – Mateševac that there were no accidents, injuries and ill health during regular maintenance activities.

7.2.7 Community Health and Safety

7.2.7.1 Construction phase

The project carries typical risks of community exposure to health, safety and security issues in construction in mountainous areas with scarce alternative routes for transport of material and construction traffic. These were confirmed and specifically highlighted by the local communities. Community safety and security risks during the construction phase will be quite similar to the risks the workers are exposed to should no measures be taken to protect construction sites and prevent unauthorized access of local residents to the sites.

The baseline study has identified key areas of risks affecting the community health and safety a number of which are common denominators for environmental and social risk (such as noise, vibration, air quality, waste and water) and are covered under the environmental impacts assessment sections in chapter 7.11 to 7.1.8, while the OHS risks are covered in chapter 7.2.6.

The local communities up to Tunnel Tresnjevik were the closest to the sources of impacts from the construction activities on the preceding section Smokovac – Mateševac. Their testimonies on historic interaction with the local and foreign workers created the assumption that risks from social conflicts and tensions between the host local communities and the construction workers are not likely. The local communities are well equipped to handle the presence and occasional interaction with project workers with their peak in the first 3 years of construction.

Four most prominent risks remain beyond the ones covered in the preceding chapters:

- Traffic and road users' safety. Road safety risks from increased traffic on local roads (delivery of vehicles, equipment, goods, materials including hazardous, and transport of workers to the construction sites causing road accidents, injuries or death in result of collision with vehicles).. Indirect changes to traffic flow or volume on the R19 existing road will put at risk day-to-day activities and interfere as explained in 7.2.1 with access to health centers. Communities affected by traffic and road safety issues include those alongside, bisected, or fragmented by a road associated with the project. Selection of unsafe mounting roads to avoid driving near of construction sites and traffic jams are cases of incidental risks. Shops, hospitalities, and residential properties may all be affected, along with people present on the road itself, nonmotorized (pedestrians mainly as very few cyclists have been observed) or motorized (on motorcycles, tractors and other agricultural equipment, or in cars, trucks, or buses). The R19 road is used also by pedestrians but not frequently, and has no pedestrian lanes exposing the pedestrians to greater risks.
- Safety during excavation and blasting in the vicinity of existing physical structures associated with risks of injuries, risk from inadequate information sharing and messaging and evacuation of people when and if needed, physiological stress, and damages to assets. Especially structures

identified in table 7.38 fronting the highway up to 100 m at the entrance and exit portals of the Tunnel Tresnjevik which are outside the physical footprint.

- Trespassing and injuries. Engagement activities prior to construction will ensure that local stakeholders are informed of the risks and consequences of entering the site.
- Security around the Project and interaction with security personnel. The national regulations provide a stringent protocol for selection and engagement of security personnel.

The Grievance Mechanism for the Project will capture all grievances raised in relation to security and safety issues. These will be addressed promptly, and actions will be taken.

Traffic and road safety and safety during excavation and blasting impacts are negative, extended over municipalities, short term, very high in magnitude, with a high level of sensitivity.

Site trespass and thereby associated accidents are assessed as negative with an indirect extent as the impacts related to haulage routes and borrow areas have been included in the assessment, are short term in duration, with a low magnitude and a medium receptor sensitivity.

Risks from interaction with security personnel are negative in nature, extended to the project site, short term in duration, with minor magnitude and low receptor sensitivity.

7.2.7.2 Operation phase

Community health and safety risks (both for drivers and pedestrians) during the operation phase will be related to the personal behaviour in most cases (violation of road rules, road signs and lights), and violation of road rules and unsafe driving habits of other road users. All these risks can significantly affect human health and life. The convenience, sufficiency and safety grade of crosswalks, safety of sidewalks, the need for road markings, road signs and traffic lights, speed limits, must be defined or agreed with the traffic police.

Other operational risks of the planned road will be associated with increased dust and exhaust gas emission, and increased level of noise.

Specific risks are related with the tunnel operation. These include:

- Serious accidents inside the tunnel
- Power failure
- Ground collapse at the tunnel face
- Water or mud inflow leading to flooding
- Explosion, perhaps due to the concentration of a naturally occurring gas such as methane
- Oxygen deficiency
- Fire in the shaft of tunnel

On the other hand, the highway will provide the communities with better accessibility to social services and facilities; improve communication with other regions in Montenegro and other countries.

7.2.8 Cultural heritage, burial grounds and memorial days

Potential cultural heritage impacts may be associated with the disturbance or loss of either:

- Tangible resources, i.e. physical sites, structures, features, objects and parts of the natural landscape that have historical, ethnographic, spiritual, and cultural value (including archaeological, palaeontological and man-made assets).
- Intangible cultural heritage, including traditional skills, practices, customs, rituals, spiritual ceremonies and knowledge. It describes the proposed method of assessment for identifying likely significant environmental effects. The historic environment includes all physical remains of past human activity (whether visible, buried or submerged, landscaped or planted or managed flora). Those aspects of the historic environment that hold value to this and future generations because of their historic, archaeological, architectural or artistic interest are called 'heritage assets'.

Although no cultural heritage areas of significance have been identified to date, potential areas of receptor concerns are from any undiscovered cultural heritage, archaeological or palaeontological objects or features may potentially be disturbed because of ground intervention activities associated with construction of the Proposed Project. It is foreseen that potential impacts may only arise during construction activities, as no sites of cultural heritage have been identified within the area. Noise and vibrations associated with traffic and aircraft take-off and landing may affect the 'sense of place' and potentially result in impacts to areas of cultural heritage significance. No impacts to archaeological or palaeontological features are anticipated during operation. The data gathered from the desktop review and site visit but most importantly from the relevant Institute of protection of monuments o Cultural heritage have been interpreted to provide the areas of archaeological, cultural or heritage importance. The likely impacts predictions on the areas of archaeological, cultural or heritage importance from the Proposed Project will be quantified during the construction, installation, commissioning and operation phases based on the general methodology contained.

Impacts regarding burial grounds and memorial days refer mainly to disturbance and potential impacts of access.

The impact to cultural heritage is limited to potential chance finds. The impact is assessed as negative in nature, constrained to municipality, with an immediate duration, minor in magnitude, and a low receptor sensitivity, with a medium probability.

7.3 Cumulative impacts

As mentioned in Table 1-1, cumulative impacts refer to those environmental consequences created as a result of the combination of the project evaluated in the current project together with other projects causing related impacts.

Cumulative impacts on air quality, greenhouse gas emissions, noise and water quality could arise in case the construction of the section coincides with the construction of other sections or other development projects in the area. There are no other identified major projects that are under development for the area, while the section Andrijeviča Bolare is under design. Consequently, no cumulative effects due to other projects are expected.

A cumulative impact of the Mateševo – Andrijeviča section mainly concerns the residential development of the wider area as highways often promote urban expansion and lead to:

1. Environmental impacts

- **Loss of natural habitat:** As residential areas expand, they can encroach on natural habitats, leading to habitat destruction, fragmentation, and a loss of biodiversity.

- **Altered Ecosystems:** Increased development can disrupt local ecosystems, affecting wildlife, water cycles, soil health, and vegetation.
- **Pollution:** Residential areas often contribute to pollution through construction activities, vehicle emissions, waste generation, and the use of chemicals like fertilizers or pesticides. Over time, these pollutants can accumulate in local air, water, and soil.
- **Water Resources Depletion and Contamination:** With increased population and development, the demand for water resources rises. Additionally, improper management of wastewater and stormwater runoff can lead to contamination of local water bodies, further exacerbating environmental strain.
- **Climate Change Contribution:** Increased energy demand (from heating, cooling, transportation) can lead to higher greenhouse gas emissions, contributing to global warming and local climate change effects.

2. Social and Economic Impacts

- **Increased Traffic Congestion:**
- **Demand for Public Services:** Increased population density raises the demand for essential public services, such as schools, healthcare, transportation infrastructure, sewage, and emergency services. If these services are not adequately expanded to meet the growing demand, residents can face reduced quality or access to them.
- **Loss of Community Spaces:** As residential development expands, public spaces such as parks, open areas, and recreational centers may be reduced, affecting social cohesion and residents' well-being.
- **Housing Affordability and Market Stability:** Over time, the influx of new homes can impact the housing market, either by increasing property prices (if demand exceeds supply) or leading to market instability if there is oversupply.

7.4 Summary of environmental and social impact assessment (before mitigation)

The assessment of the social impacts according to the methodology described in section 1.2 is summarised in the tables below.

Table 7-39: Assessment of environmental impacts before mitigation

Phase	Impacts	Nature	Extent	Duration	Magnitude	Receptor Sensitivity	Significance Criteria (SC)	Likelihood (L)	Overall Rating (IA) Scull
Topography & landscape									
C	Landscape and visual impact	-1	2	2	3	3	-2.50	5	-13
Air quality									
C	Exhaust emissions (heavy vehicles and construction equipment)	-1	1	2	2	2	-1.75	5	-9
C	Dust emissions	-1	1	2	2	2	-1.75	5	-9
C	Emissions from tunnel construction	-1	1	1	3	3	-2.00	5	-10
C	Emissions from construction of cuts, incisions and embankments	-1	1	1	3	3	-2.00	5	-10
O	Exhaust emissions (traffic)	-1	3	4	2	3	-3.00	5	-15
Climate change									
C	Exhaust emissions (heavy vehicles and construction equipment)	-1	1	2	1	3	-1.75	5	-9
O	Exhaust emissions (traffic)	-1	1	4	1	1	-1.75	5	-9
Noise									
C	Noise due to construction works	-1	1	2	3	3	-2.25	5	-11
O	Noise due to traffic	-1	1	4	2	3	-2.50	5	-13
Geology and soil									
C	Physical impact & erosion	-1	1	2	3	3	-2.25	4	-9
C	Contamination	-1	1	1	3	3	-2.00	3	-6
O	Contamination due to spills and leakages	-1	2	1	2	3	-2.00	2	-4
Water quality									
C	Run-off of pollutants during construction activities	-1	3	2	3	5	-3.25	3	-10
O	Run-off of pollutants	-1	3	2	3	5	-3.25	2	-7
Ecological resources and biodiversity									
Vegetation & habitats									
C&O	Habitat loss	-1	3	5	4	5	-4.25	4	-17
C&O	Fragmentation	-1	3	5	3	5	-4.00	4	-16
C&O	Pollution	-1	3	5	3	5	-4.00	3	-12
C&O	Spread of non native or invasive species	-1	3	5	3	5	-4.00	2	-8
C&O	Fish								
C&O	Disturbance due to noise & vibration	-1	3	5	3	5	-4.00	3	-12
C&O	Pollution	-1	3	5	3	5	-4.00	3	-12
C&O	Changes in watercourse	-1	3	5	3	5	-4.00	3	-12

Phase	Impacts	Nature	Extent	Duration	Magnitude	Receptor Sensitivity	Significance Criteria (SC)	Likelihood (L)	Overall Rating (IA) Scull
	Amphibians and reptiles								
C&O	Habitat loss & degradation due to excessive vegetation removal	-1	3	5	4	5	-4.25	4	-17
C&O	Habitat fragmentation	-1	3	5	3	5	-4.00	3	-12
C&O	Pollution	-1	3	5	3	5	-4.00	4	-16
C&O	Direct mortality	-1	1	5	3	5	-3.50	4	-14
C&O	Disturbance due to noise & vibration	-1	1	2	3	5	-2.75	4	-11
	Birds								
C&O	Loss of habitat	-1	3	5	4	5	-4.25	4	-17
C&O	Disturbance due to noise & vibration	-1	1	2	3	5	-2.75	4	-11
C&O	Barrier effect	-1	1	2	3	5	-2.75	4	-11
C&O	Pollution	-1	1	2	3	5	-2.75	4	-11
	Mammals								
C&O	Fragmentation	-1	1	2	3	5	-2.75	4	-11
C&O	Disturbance due to noise & vibration	-1	1	2	3	5	-2.75	4	-11
C&O	Barrier effect	-1	1	2	3	5	-2.75	4	-11
Waste									
C	Impacts due to uncontrolled waste disposal	-1	2	2	2	4	-2.50	4	-10
C	Leaks, runoff	-1	2	2	2	4	-2.50	4	-10
O	Waste from maintenance activities	-1	2	2	2	4	-2.50	4	-10

Table 7-40: Assessment of social impacts before mitigation

Phase	Impacts	Nature	Extent	Duration	Magnitude	Receptor Sensitivity	Significance Criteria (SC)	Likelihood (L)	Overall Rating (IA) SCxL
Health and access to health services									
C	Impact on Health services capacities	-1	3	2	2	2	-2.25	2	-4.5
Infrastructure, facilities and public services									
C	Water supply disruption	-1	1	2	4	5	-3	3	-9
O	Pressure during operation activities	-1	4	4	1	1	-2.5	1	-2.5
Traffic and accessibility									
C	Disruption of traffic and accessibility	-1	4	2	4	5	-3.75	5	-18.75
C	Deterioration and of existing roads	-1	4	2	3	5	-3.5	5	-17.5
O	Improvement of traffic conditions and accessibility	1	5	4	3	1	3.25	5	16.25
Land acquisition and Resettlement									
C	Permanent land acquisition	-1	3	5	3	3	-3.5	5	-17.5
C	Temporary land acquisition	-1	1	2	2	3	-2	3	-6
C&O	Restrictions in land use	-1	4	5	3	3	-3.75	5	-18.75
C	Physical displacement	-1	3	5	5	5	-4.5	5	-22.5
Employment, Labour and Working Conditions									
C	Workers Accommodation	-1	1	2	2	1	-1.5	2	-3
C	Labour conditions	-1	1	2	3	5	-2.75	3	-8.25
C	Gender Based Violence (SH and SEA)	-1	2	2	1	3	-2	2	-4
Occupational health and safety									
C	Accidents, injuries and ill-health I	-1	1	1	2	3	-1.75	2	-3.5
C	Unsafe and unhealthy workplace	-1	1	1	2	3	-1.75	2	-3.5
O	Accidents, injuries and ill-health	-1	1	1	1	1	-1	1	-1
Community health and safety									
C	Traffic and road safety	-1	2	4	5	5	-4	4	-16

Phase	Impacts	Nature	Extent	Duration	Magnitude	Receptor Sensitivity	Significance Criteria (SC)	Likelihood (L)	Overall Rating (IA) SCxL
C	Site Trespass and Accidents	-1	3	2	2	3	-2.5	2	-5
C	Safety during excavation and blasting	-1	2	4	5	5	-4	4	-16
C	Security Personell	-1	1	2	1	1	-1.25	2	-2.5
O	Health and safety risks during operation	-1	1	1	1	1	-1	1	-1
Cultural heritage and burrial grounds									
C	Chance finds	-1	1	1	1	1	-1	3	-3

8 Mitigation measures

8.1 Environmental mitigation measures

The highway section must be planned, designed and built in a way that:

- ensures its normal functioning and
- reduces the potential impact on the state of the environment at the site and its surroundings.

General protection measures include all activities prescribed by development plans and legislation, which are in line with the overall global strategy for the preservation and improvement of the environment.

In that sense, it is necessary:

- Adhere to all guidelines that are determined according to the general principles of development of Montenegro, and which are concretized through development plans and strategies;
- Given the importance of the facility, both in terms of its safety and in terms of protection of people and property, during the design and construction it is necessary to comply with all applicable laws and regulations governing the subject matter;
- Comply with all regulations (domestic and European) that are related to the limit values of the intensity of certain factors such as primarily noise levels, air , water and soil pollution. Safeguards should bring certain impacts to the level of allowable intensity within a specific investment venture;
- Make a monitoring plan on the state of the environment by organizing services for specific monitoring of parameters in the field, for the necessary segments of the environment;
- Make a plan for the maintenance of the facility during the year; and
- Make a plan for maintaining the planned elements.

Administrative protection measures include all those activities that need to be taken so that certain phenomena that may jeopardize the desired expectations and legal norms do not occur later.

Protection measures include:

- Providing certain professional supervision during the execution of works, in order to control the implementation of the prescribed protection measures by professional staff for all phases; and
- Provide instruments, within the contractual documentation formed by the Investor and the Contractor, on the need to comply with and implement the prescribed protection measures.

The following are also necessary:

- The contractor is obliged to make a special study on the arrangement of the construction site and work on the construction site with the specified safety measures at work according to applicable regulations and standards;
- Before starting the construction, the contractor is obliged to get acquainted with the geological and hydrogeological characteristics of the terrain;
- In order to meet the required stability and functionality of the structure, it should be selected according to the regulations for this type of facility; and
- It is necessary to make the right choice of materials and equipment, according to technological requirements, with the necessary certificate attached documentation.

8.1.1 Topography and landscape

The project area is located in the eastern part of Montenegro, bordered by the Bjelasica mountains to the north and the Komovi mountains to the south. It stretches in an east-west direction and mainly follows the valley of the Kraštica River, along with its tributaries (Rajovića Potok, Dubokalj, Novovića Potok, Prisojački Potok, Durački Potok, Gnjili Potok), all of which flow into the Lim River near Andrijevića.

Considering the aesthetic and ecological values of the space itself, it is recommended that the selection of types of vegetation around the corridor be indigenous in order to restore the balance of vegetation components in the space as soon as possible by establishing the earlier phytocenoses disturbed by the construction of the route.

The existing flora in the surroundings of the facility should be protected in order to establish a natural situation for animal migration as quickly as possible.

A range of plant material is planned especially for the potential passages of animals, from small trees and shrubs to herbaceous plants or grasses, which would be planted in a way that simulates the natural process of creating a plant community whose properties and profile correspond to the nutritional and other needs of the associated zoocenosis.

Further refining of the section during the next design stages shall aim to minimise disturbance to existing local landforms and landscape settings along the alignment by:

- avoiding highly valuable landscape and areas visible from long distance for locating construction camps;
- reflecting existing landform as much as possible in earthworks by aesthetic integration of the structural parts of viaducts and bridges (e.g. deck, pillars) and noise walls, using construction materials with colours and textures that blend well with those of the surrounding landscape as much as possible.

For retaining walls, cladding of bridge columns, river flow regulation, slopes, etc., use natural stone wherever possible instead of regular concrete, considering that natural stone is dominant in Montenegrin architectural tradition.

Special attention should be paid to the improvement of surrounding local roads, such as "panoramic routes", which should be treated as means of touristic development. Additionally, the number of new viewpoints with vistas along the highway (rest areas) is important for the tourism development of the entire region.

Measures to minimize visual impacts include:

- Minimize impact wherever possible (e.g., narrower working strip).
- Restore pre-construction conditions as much as possible (e.g., re-vegetation of the working strip) through Vegetation/landscape restoration Plan and Landscaping design.
- Locate new roads, temporary access routes, and camps away from sensitive landscape areas.
- Arrangement of the slopes, access roads, the bases of bridges and interchanges after construction - landscape architecture design.
- The working strip, camps, locations of new roads, and temporary access routes shall not be placed within the visual impact zone of the cultural landscape of RP Komovi.

8.1.2 Air quality

8.1.2.1 Pre-construction /Construction phase

Prior to construction a Construction Air Quality and Dust Management Plan and a Construction Traffic Management Plan shall be developed by the Contractor, with guidelines and measures for dust and traffic management.

Measures to reduce impacts on air quality during the construction phase include the following:

- Hoardings shall be constructed around the construction sites to minimize the spread of dust;
- Accesses and construction sites shall be kept moist to reduce dust formation. Water sprays shall be implemented during drilling and excavation activities.
- Dust-generating activities shall be slowed down (or stopped) in days of strong wind.
- In windy and dry conditions, earth stockpiles shall be moistened to prevent the lifting of dust particles.
- Ground shall be moistened during loading and unloading of aggregates in trucks.
- Truck dumpers carrying spoil or other dusty materials shall be covered with tarps.
- Vehicles and construction machinery shall be properly maintained to comply with relevant emission standards.
- No unnecessary idling of construction vehicles at the construction sites shall be allowed.
- Construction truck traffic shall be optimised.
- Truck routes shall be planned appropriately to avoid peak traffic hours or routes with heavy traffic.

Compliance to the Construction Air Quality and Dust Management Plan and the Construction Traffic Management Plan shall be ensured and supervised during the construction works.

Air quality is proposed to be monitored at the most sensitive receptors (i.e. inhabitant areas) during the construction works.

8.1.2.2 Operation phase

Air quality is proposed to be monitored at the most sensitive receptors (i.e. inhabitant areas) during the operation. In case of exceedances, speed limitations may be imposed.

The axis distance of the sensitive receptors is presented in **Table 7-27**.

8.1.3 Mitigation measures related to climate change

8.1.3.1 GHG emissions mitigation measures

During **construction** period, measures to mitigate GHG emissions include the following:

- Vehicles and construction machinery shall be properly maintained to comply with relevant emission standards.
- No unnecessary idling of construction vehicles at the construction sites shall be allowed.
- Construction truck traffic shall be optimised.
- Truck routes shall be planned appropriately to avoid peak traffic hours or routes with heavy traffic.

Furthermore, it is recommended that, where possible, electric equipment is used.

Regarding **operation**, respecting the set speed limits, as well as awareness of drivers regarding energy efficient driving would help mitigating GHG emissions. Furthermore, it is proposed to install photovoltaic devices on the lighting in order to reduce the carbon footprint of the road operation.

8.1.3.2 Measures to enhance climate change resilience

During **pre-construction phase** (detailed design by the EPC contractor) measures to enhance climate resilience of the highway, include the climate adapted design, aiming at the creation of asset to withstand environmental conditions anticipated in the future. This includes measures such as:

- Adequate construction material (concrete, asphalt) that are resilient to the future climatic conditions (temperature and precipitation).
- Design of the bridges that considers future temperature. The preliminary design of the bridges has considered temperature calculations, as specified in the EN 1991-1-5. The temperature ranges that have been considered are consistent with the forecasts regarding future temperatures.
- Dimensioning of drainage infrastructure considering future precipitation patterns. In the preliminary design a 50-year return period was considered for the highway culvert design. It is suggested to re-examine whether a 100-year return period should be considered (although no extreme precipitation events are foreseen).

During construction phase, the Contractor shall adopt the necessary measures for preventing and responding to impacts due to extreme weather events.

The main measures to enhance the climate change resilience refer to the frequent and effective maintenance:

- Asphalt conditions should be checked regularly, and cracked and distressed areas should be timely sealed.
- Road drainage should be kept in good condition
- Bridges and structures must be inspected regularly as well as after flooding events

Materials to be used during maintenance activities should be resistant to anticipated temperature and precipitation conditions.

Furthermore, Emergency Preparedness & Response Plan for both construction and operation should be in place.

Finally, and following the risk assessment (section 7.1.3.3) additional adaptation measures are proposed for minimising residual risk and increase the climate change resilience of the motorway and its operation. They are summarised in the following table and are under responsibility of the road operator.

Table 8-1: Additional adaptation measures

Climate hazard	Measure	Scope	Description
Heat	Develop a policy that includes measures to reduce the health risk to workers during heat waves	To reduce risk of heat stroke for personnel working in road maintenance activities	The policy shall provide procedures and instructions for the protection of personnel from extreme weather conditions. Indicatively: – programming of maintenance activities considering weather forecast, in order to avoid anticipated heat waves,

Climate hazard	Measure	Scope	Description
			- provision of suitable personal protective equipment (hats, long sleeve shirts, sunscreen, etc.), - drinking water and access to airconditioned areas for personnel (if possible), - breaks at appropriate intervals for those working etc.
All extreme climate hazards	Adoption of asset management practices	Close monitoring of the state of the road infrastructure	- Develop and implement operation and maintenance strategy. - Implementation of strict maintenance schedule for all motorway assets - Standardisation of record keeping with respect to monitoring and maintenance of assets.
	Emergency planning	To reduce the impact of emergencies such as floods and wildfires and ensure a rapid recovery from such events	Procedures for preparing for an imminent emergency event. Indicatively: - Procedures for close-down of service of the motorway - Extreme event warning systems - Ensuring there is provision for emergency access and redundancy. - Priorities and procedures for clean-up and restoring operations following the event
	Climate proofing	To update climate proofing activities	Develop and implement Climate Resilience Action Plan including procedures to - Update data regarding climate change - monitor of climate change impacts / risks - Incorporate lessons learned from events during operation. - Select / adopt additional measures.

8.1.4 Noise and vibrations

8.1.4.1 Pre-construction / construction phase

Prior to construction a detailed noise and vibration study shall be completed to determine noise levels generated by the revised traffic and to revise sensitive receptors (i.e. inhabitant areas), as well as to finetune and rerun the noise model calculations in order to update the present preliminary noise assessment. Based on this revision noise mitigation measures might need to be updated especially in the areas with proximity with sensitive receptors. Furthermore, a detailed design of noise barriers shall be completed, including revised height and length of noise barriers, taking into account maintenance and emergency access considerations, drainage (where appropriate), as well as aesthetics and land acquisition requirements.

Regarding construction related noise Construction Traffic Management Plan shall establish speed limits for construction vehicles and machinery at the construction site and the access roads used and organise traffic so as to avoid inhabited areas as much as possible.

Prior to starting any construction activities which may cause vibration impacts at the buildings nearby it is strongly recommended to survey the technical conditions of the buildings potentially affected.

Key mitigation measures to reduce noise and vibration levels during **construction** shall be, as follows:

- All vehicles and machinery used at the construction sites shall be subject to regular maintenance;
- Wherever possible all construction equipment shall comply with the requirements of EU Directive 2000/14/EC on noise emission in the environment by equipment for use outdoors. All the equipment shall bear the CE marking and the indication of the guaranteed sound power level and shall be accompanied by an EC declaration of conformity;
- Construction works should generally not be permitted during night. In case of carrying out noisy works at night or during a period longer than one day at a given site, temporary noise barriers shall be erected around the working area;
- Location of noisy equipment shall be chosen as far as possible from sensitive receptors. When near sensitive receptors, construction works shall be scheduled and provided with the necessary resources so that the time of exposure is as short as possible;
- Good management practice shall be followed to distribute heavy noise equipment along the route so as to avoid the cumulative effects of noise;

During the construction activities, it is necessary to envisage a noise levels periodic monitoring to determine noise levels accurately. Procedures and the endangered population protection measures should be defined following such measured noise levels.

Monitoring of vibrations during the performance of critical work processes (e.g. tunnel boring, foundations of the bridge) shall be undertaken in buildings which are within a distance of 20-50 meters from the area where these works take place. These are presented in Table 7-38, while locations are available in the design.

8.1.4.2 Operation phase

Based on positive experiences from European practices and considering the landscape characteristics of the area through which the Bar-Boljare highway route passes, specifically the Mateševu-Andrijevića section, it is recommended noise protection structures on the terrain to be designed using natural materials, such as wood-concrete. Wood-concrete is a durable, proven material with a guaranteed lifespan of 40 to 50 years. It is resistant to frost, road salt, fire, and stone impacts according to ZTV LSW 06. It consists of natural materials, specifically shredded wood pieces without tree bark, which are mixed with water and cement in a special process and shaped in a stationary finishing machine. The shredded wood pieces can be of local origin.

For residential buildings, where the application of noise protection structures is not justified due to technical and economic reasons, alternative protection measures are provided to reduce noise levels to legally allowed limits. It is possible to apply special materials for sound insulation of the facade and replace windows, which will ensure that noise levels inside the building remain within legally permissible limits. When installing new windows, care must be taken to ensure that sufficient amounts of fresh air are provided in these buildings while the windows are closed. Additionally, one of the possible measures is relocating the buildings to a new location where noise levels are at legally acceptable levels. In any case, before taking any action, it is necessary to conduct noise monitoring, which will determine the actual noise levels after the highway is released for operation. If significant exceedances of measured noise levels are detected, it is necessary to develop a proposal for measures to reduce them, depending on the level of exceedance.

For the areas where noise levels during operation exceed the limits (see section 7.1.4), the introduction of noise barriers at the roadside was investigated. The height of the barriers was gradually increased

in order to achieve the target values in both L_{day} and L_{night} indices, up to a height of 4.5 meters, since above 4.5m structural limitations render the noise barrier installation incompetent. Where there are residential areas on both sides of the road, absorptive type noise barriers are assumed, to avoid causing reflection of noise to receivers on the opposite side.

The noise limits are 60 dB(A) for daytime and 55 dB(A) for nighttime. However, when the cumulative noise is higher than the above values, the noise emissions are still acceptable if the impact to the background noise from noise emissions of the new project is equal or less than 3 dB.

The resulting noise levels after the proposed mitigation measures are applied, are presented in the following tables. From the results, it can be seen that the noise levels from the new highway can be restricted in all control points to project's target values set by national regulation.

Table 8-2: Noise modelling barrier optimisation results – day

Sensitive Receivers	Bar-Boljare highway [dB(A)] (1)	Background noise [dB(A)] (2)	Cumulative Noise [dB(A)] (3)	Impact on background noise [dB] {(3) – (2)}
Bare Kraljske	59.8	55.0	61.1	6.1
Gnjili Potok	57.3	57.5	60.4	2.9
Kralje	59.7	60.0	62.9	2.9
Andrijeva (north)	60.4	61.0	63.7	2.7

Table 8-3: Noise modelling barrier optimisation results – night

Sensitive Receivers	Bar-Boljare highway [dB(A)] (1)	Background noise [dB(A)] (2)	Cumulative Noise [dB(A)] (3)	Impact on background noise [dB] {(3) – (2)}
Bare Kraljske	46.7	53.0	53.9	0.9
Gnjili Potok	43.1	48.5	49.6	1.1
Kralje	45.9	44.0	48.1	4.1
Andrijeva (north)	44.6	53.5	54.0	0.5

Based on the results, it is believed that no extra noise mitigation measures, such as porous asphalt, speed-limit restrictions, etc. will be needed in order for the highway to reside within the noise limits and no general public annoyance is expected when the project will start to operate.

The proposed mitigation measures consist of the following noise barriers:

Table 8-4: Noise barrier length and area per segment

Location	NB length (m)	NB area (m ²)	NB avg height (m)
7+000 - 8+100/ left side	1 100	3 300	3.0
14+050 - 14+800/ left side	750	2 250	3.0
14+930 - 15+650/ left side	720	2 160	3.0
16+000 - 16+600/ left side	600	1 800	3.0
17+300 - 17+500/ left side	200	600	3.0
18+500 - 19+250/ left side	750	2 250	3.0
19+450 - 19+750/ left side	300	900	3.0
20+450 – 22+500/ left side	2 050	6 150	3.0

Location	NB length (m)	NB area (m ²)	NB avg height (m)
20+200 - 20+600/ right side	400	1 200	3.0
20+950 - 22+100/ right side	1 150	3 450	3.0
21+300 - 22+000/ right side	700	2 100	3.0

8.1.5 Geology and soil

8.1.5.1 Pre-construction / construction phase

Prior to construction a Construction Environmental and Social Management Plan (CESMP) is to be prepared, covering safe management of hazardous materials, spill prevention/ management plan, soil erosion and waste management plan. As part of the spill prevention plan the following issues shall be addressed (note that some of the bullets below serve the protection of surface waters, too):

- Keep all roads and hard standings clean and tidy to prevent the accumulation of fuels, oils and dirt that may be washed into a watercourse or drain in case of heavy rainfalls;
- Keep spill kits close to the construction sites in case there is an incidental spill off, so that it can be immediately cleaned up;
- Do not carry out any refuelling, storage or maintenance of equipment in the vicinity of drainages, water courses or other sensitive environmental resources. If these activities have to be done at the construction site, all precautionary measures shall be taken to prevent leaks or spills from reaching the soil or nearby watercourses. Wherever possible these activities shall take place in construction camps adequately prepared for these purposes (adequately lined for preventing any soil and groundwater contamination, and equipped with culverts along the perimeters to collect water runoff that will be directed to wastewater treatment facilities);
- Ensure proper handling and storage of materials as well as proper usage of construction equipment;
- Minimize the storage of hazardous materials and waste on the construction sites. Ensure that these are stored in adequate places, far from sensitive areas (e.g. watercourses, habitats with a rich biodiversity) and adequately equipped to prevent any soil, surface water or groundwater contamination);
- In case of accident, related to leakage of hazardous substances, carry out remediation and restore the area to its original state, prepare a report and take corrective and preventive measures,
- If in the future there is a need to use materials that have hazardous properties, such substances/materials should be stored and disposed off in accordance with law, in order to prevent environmental pollution,
- Undertake regular preventive maintenance of vehicles and construction machinery so as to reduce leakages of lubricants, motor oil and fuel.

In order to reduce effects of erosion, majority of the works should be completed during the dry season. To avoid destabilization of the terrain, the process shall be kept under constant monitoring, and the necessary protection measures shall be applied already during the execution of works by the Contractor. It is recommended that an erosion control plan is in place. As part of the erosion control plan the following issues shall be addressed:

- Wherever possible areas which are prone to erosion should be left undisturbed and undeveloped. Entrance and exit points for runoff should be protected from erosion and equipped with sediment control devices;
- Extent of the disturbed area and the duration of exposure shall be minimised, and disturbed areas are to be stabilised as soon as possible;
- Use of heavy equipment and techniques shall be minimised, especially on unstable slopes;
- Drainage and runoff controls shall be established before starting the site clearance and earthworks. Existing vegetation should be retaining as much as possible;
- Runoff velocity shall be kept as low as possible;
- Effective erosion control devices shall be implemented such as i) temporary seedings, ii) temporary mulching, iii) permanent sodding, iv) temporary or permanent erosion control blankets, v) permanent vegetative buffer strips;
- Efficient sediment control devices shall be implemented such as: i) site fencing, ii) straw bales, iii) sediment basins or traps, iv) storm inlet traps, vi) rock check dams and v) interception berms / swales;

During construction any contamination of soil and groundwater is to be managed in accordance with the CESMP. To prevent soil contamination, it may be necessary to minimise the quantity of uncontaminated stormwater entering cleared areas by constructing diversion banks and intercept drains around the sites while ensuring that the water discharging from such banks or drains is disposed of without causing erosion. It may also be necessary to reduce water velocities by minimising continuous slopes where flowing water could scour.

8.1.5.2 Operation phase

Assuming proper design as pre-construction / construction measures (as presented above) no further mitigation measure is deemed to be required in the operation phase. Immediate action must be taken in the event of an accident to prevent any contamination from spillages (coating the leak area with absorbent material, collecting and handling the mixture as hazardous material).

8.1.6 Biodiversity, flora and fauna

Measures to protect flora and fauna during construction work are aimed at minimizing or completely eliminating negative impacts, both during construction of the highway section include the following:

- before the start of construction works, places for the disposal of construction and other waste materials, places for temporary parking and manipulation of construction machinery, fuel transfer stations, etc., should be carefully chosen, all for the purpose of protecting the plant cover,
- in the area of the route, wherever possible, preserve older specimens of trees,
- limit the movement of construction machinery as much as possible during the construction of the highway, that is, use the existing network of local or access roads, which should be repaired after the completion of the works,
- Pits and excavations should be filled in as soon as possible after work is completed. The excess material from the excavation should be incorporated into embankments or deposited at official and approved locations, never "plan and scatter" over natural vegetation, in order to reduce and prevent the further spread of weed and neophyte species,
- Locations for depositing excavated material should have the least impact on meadows, forests and watercourses.
- Limit clearing of natural vegetation strictly to the necessary extent

- negative impacts on forests and forest land that may occur during highway construction can be minimized by careful work and compliance with prescribed protection measures. This primarily applies to damaged trees and their root systems at the edges of cuts and incisions. In order to minimize these impacts, it is necessary to establish a forest order immediately after cutting the route, i.e. remove stumps and export all cut timber. At the same time, strict care should be taken to cut down and remove all damaged and broken trees, so that they do not become a source of infection. This is especially true for black pine crops, which are particularly susceptible to injury. By establishing a forest order, the remaining trees, especially those on the newly created edges of cuts and incisions, will be enabled to build a new protective ridge more quickly,
- works on clearing bushes and cutting trees in the area of the highway route can only be carried out when they comply with the following requirements: that a storage place for felled logs is provided, that measures are provided to prevent the access of unemployed persons to the place of tree cutting, that facilities are built and space for storing dangerous substances and materials (petroleum derivatives, etc.), that the method of marking and securing dangerous zones on the construction site has been established, that safety measures have been defined during the felling of trees near buildings, access and local roads, electric lines, etc. , that the method of organizing the information service and the service for providing first aid and emergency medical assistance at the construction site was defined, that other measures necessary for the protection of forestry workers were determined.
- it is recommended that those carrying out work on forest cutting perform the work in autumn and winter, if possible, and thus prevent possible fires. All employed workers should be trained in the field of fire protection,
- it is necessary to place warning signs "NO FIRES" in the forest cutting zone, and keep the daily needs of flammable substances, fuel and lubricants in a safe place,
- to reduce as much as possible the number of crossings of forest roads with permanent or occasional watercourses, and where this is unavoidable, crossings should be made at the sharpest possible angle, preferably at 90 degrees, without causing endangerment of migratory routes and habitats important for fish populations,
- it is mandatory to plan and install pipe culverts with the largest possible diameter every 300-500 m of the length of the forest road, in order to ensure the free movement of water. This is significant, as the highway passes through habitats that are characterised as Priority Biodiversity Features (PBF) and is more important at the areas of the Critical Habitat 91E0 to avoid disruption of the ecosystem and affect the wildlife movement. Also, take care of the construction and maintenance of culverts, canals and gutters in appropriate locations in order to eliminate erosion,
- the bridge spans must be wide enough to allow normal hydrologic function (including flooding) without constraining natural flow (i.e. conserve natural flood plain) and natural ecological characteristics of the river (natural substrate and instream habitat features), and they must have sufficient terrestrial habitat around the rivers to allow for unrestricted wildlife movement (bears, wolves) and habitat for amphibians and reptiles.
- Stormwater drainage from the bridges should not be directed into the rivers and streams without some form of pre-treatment (see also section 8.1.7).
- Wood residues or other materials that may interfere with the normal flow of water must not be left in watercourses.
- develop procedures for the management of flammable materials and open flames, especially in the part of the highway route that passes through forested areas, in order to prevent forest fires. During construction, warning signs should be placed for the prohibition of the use of fire, i.e. the possibility of a fire, especially in the summer period,

- Preserve topsoil removed during construction and redistribute it over disturbed areas as soon as possible after disturbance to expedite natural re-vegetation. This will minimize erosion and restore lands to a usable condition for amphibians and reptiles.
- Implement and strictly follow the foreseen pollution prevention measures, as well as noise prevention measures
- in the case of encountering underground objects and underground fauna, at the speleologist's suggestion, excavation work must be suspended, until the team of biospeleologists determines the existing condition and defines its value, as well as the necessary measures to protect the underground fauna and its habitats. It is also necessary to inform the competent state institution about it, i.e. Environmental Protection Agency.
- also, it is necessary to provide a permanent possibility to monitor and control the state of underground fauna and habitats discovered during the tunnelling works (which biospeleologists consider significant), and to include the necessary measures to protect underground fauna and habitats,
- during the construction of bridges and viaducts, it is mandatory to affect the habitats as little as possible, because even during construction the existing migration corridors will be used for the passage of animals,
- together with the hunting associations working in the corridor of the future highway, to consider and analyse the existing game trails, in order to take all measures in time to prevent damage that can be caused by vehicle collisions with game and to properly mark such places with warning signs,
- define and mark road routes and corridors for the movement of people and vehicles in the highway construction zone, in order to protect existing hunting grounds from unnecessary and uncontrolled entry and movement,
- to increase the capacity of the existing game guard service, in order to prevent possible conflicts between the workers employed on the highway construction and the existing organized life in the hunting grounds, i.e. to prevent the problem of possible physical endangerment and theft of game
- together with hunting associations, relocate the existing facilities on the future route of the highway (checkpoints, feedlots, watering holes, salt pans) to other locations in the immediate vicinity,
- in cooperation with the existing game-keeping services, hunting associations and non-governmental organizations dealing with the protection of wild fauna, set up new hunting breeding facilities such as salt pans and watering holes, and, if necessary, organize shelters for small and large game;
- in cooperation with the existing hunting services, hunting associations and non-governmental organizations dealing with the protection of wild fauna, set up new hunting technical facilities, that is, open and closed observation posts and organize monitoring;
- in the hunting area, it is prohibited to carry out construction works that would disrupt or prevent the smooth performance of reproduction, the stages of which are mating, laying, hatching and rearing of cubs,
- access roads are not allowed to be built over vegetation, nesting sites, den areas, wintering grounds and game pastures,
- routes of all access roads must be at least 100 meters away from places that are particularly important for the survival and feeding of wild game,
- it is strictly forbidden to destroy the nests and carry out construction works until the period of rearing the chicks is over, and after that carefully move the nests in cooperation with the competent authorities of Montenegro,
- it is strictly forbidden to destroy, move, disturb or dispose of any material in the immediate vicinity of bird nests, which are often found at the entrances to caves and pits, ,

- Tree and shrub cutting for corridor alignment should be carried out in the period November - October to avoid disturbing birds during the autumn migration and to prevent the start of nesting in early spring due to lack of vegetation
- in the zones where blasting will be carried out, it is necessary, in cooperation with the competent authorities of the state of Montenegro, to carry out an assessment of the forced migrations of the vertebrate fauna (Vertebrata) and to provide new feeding grounds where additional nutrition will be provided,
- in the case of encountering a stone-endemic plant species during construction works, it is necessary for the biological control (botanist) in cooperation with the competent authorities of the Republic of Montenegro to assess and adequately protect (relocate) the identified stone-endemic plant species,
- ensure the daily presence of biological (botanist and zoologist) supervision during the construction of the highway.

As noted in section 5.9, all habitats are qualified for Priority Biodiversity Features according to IUCN and Bern Convention criteria. If the EU criteria (applicable to EU member states) are followed, the 91E0 habitat (Alluvial forests with *Alnus glutinosa* and *Fraxinus excelsior* (Alno-Padion, Alnion incanae, Salicion albae)) qualifies as Critical habitat as it is a priority habitat type. The best-preserved continuous parts of this habitat type are present in the area of the Rajovića River (Stands with *Alnus incana*) but also along the Lim River in Andrijevića from Sitna Luka downstream with representative representatives of *Alnus glutinosa* in Sitna Luka and with large stands of the *Salix eleagnos* community downstream. Specific measures include:

- Physical removal of habitat should be avoided to the greatest extent possible,
- Avoid removal, destruction or damage to the trees outside the construction zone
- The water regime of the Lim River during construction should be maintained.
- Fence the part of the forest that will not be removed and prohibit access to vehicles and workers
- Young trees in the part that will be cleared can be safely plant out with the presence of supervision engineer and a botanist expert, and the area around the forest should be replanted with these

During pre-construction phase a loss/gain analysis shall be performed (within the Construction Biodiversity Management Plan) to ensure that for the habitats identified in the project area and characterised as PBF, no net loss is achieved, while for the habitat 91E0* and the species that qualify as CH as per EU legislation, net gain is achieved (see section 9.2.1). The loss/gain analysis shall be in compliance with the guidelines of EBRD and be expressed using adequate KPIs, such as:

- Change in Habitat Area (ha or % change).
- Habitat Condition Index (scale-based assessment)
- Biodiversity Offset Ratio (restoration to loss ratio)
- Implementation of Biodiversity Action Plans (% of actions completed)

Special attention should be given to the candidate EMERALD sites in the project area, for which, an Appropriate Assessment should be performed according to the national legislation and EBRD requirements, after the drafting of the Construction Biodiversity Management Plan. The Assessment will define any additional mitigation measures if deemed necessary.

Minimizing habitat loss and maintaining connectivity through vegetation or landscape structures that extend over or pass beneath the infrastructure are essential. This continuity supports natural wildlife movement and helps preserve ecological integrity across fragmented landscapes.

In general, construction activities should be limited to daylight hours to minimize disturbances from noise and artificial lighting. This is important for the case of bats, as noise and artificial lighting significantly disrupt bat activity.

Especially for aquatic environment the following measures are suggested:

- Whenever possible, avoid placing bridge and viaduct piers directly in the riverbed or in close proximity to it. If this is unavoidable, ensure that interventions in the riverbed or its immediate vicinity are carried out in a way that minimizes negative impacts.
- If river diversion is unavoidable for the placement of bridge or viaduct piers, conduct the diversion during higher water levels, over the shortest possible stretch of the river, and without building permanent obstacles.
- Avoid allowing machinery to enter the riverbed whenever possible.
- The river huchen, found in these rivers (young, undersized individuals from this year's spawning and older juveniles suggest the presence of adults, especially in the Lim River), typically outgrows the stream within a year and migrates downstream to the Lim River. Due to the large size of adult fish, they are unlikely to use the upstream sections for spawning because of the stream's small size. Therefore, it is essential to avoid significant sedimentation between April and June, when the eggs of this species are in nests in the incubation stage, and when larvae, which are sensitive to water turbidity, hatch from the eggs.
- While the Bullhead is listed in Annex II of the Habitats Directive and is widespread in Montenegro's Black Sea watershed, it does not require significant protective measures locally. Nevertheless, all measures outlined here aim to preserve the river ecosystem, thus indirectly supporting the conservation of the Bullhead in the riverine ecosystems in the contact areas.
- Stocking of brown trout: If monitoring detects a significant decrease in the brown trout population in the affected river ecosystems after construction, secure brown trout fry of adequate genetics (Da1 haplotype) for stocking. This is important as only one hatchery in Montenegro produces fingerlings of the required genetics.

After completion of the works, fences, discharge and drainage channels will be installed on the highway route, which will enable the unhindered movement of terrestrial species. It should be noted that a large percentage of the highway is in tunnels, as well as over viaducts, bridges and overpasses, which will also allow any vagile species unobstructed pass to the other side. In such areas, it is not necessary to build green paths, because the configuration of the terrain provides natural paths.

During the **highway operation**, presence of vehicles and noise they generate will significantly affect the mammals that live in the immediate vicinity of the road. It should be emphasized that these new habitats in the immediate vicinity of the road will be populated mainly by species from the group of rodents, which are generally well tolerable to anthropogenic habitats and artificial, anthropogenic structures.

Lighting can attract insects at night, which in turn can attract some species of bats, exposing them to road threats such as collisions with vehicles. The designed type of lighting will attract insects to a lesser extent, which will reduce the probability of attracting the bats.

Installing lighting near sensitive areas for amphibians and reptiles should be avoided, unless required for human or road safety. Where lighting is necessary adjacent to these sites, use designs or shades to direct light downward and away from natural areas

Hunting of all kinds of game (birds and mammals) must be prohibited for at least 200 m on both sides of the highway.

Measures for installing bird barriers should be applied in case of frequent direct collisions with vehicles during the operational phase of the future highway. It is prohibited to install transparent noise protection fences; instead, non-transparent materials such as wood, concrete, aluminium, etc., should be used. If the project owner still decides to use transparent panels, they must be adequately marked. By using appropriate signs (vertical markings in bright colours on the outer side of the fence, away from the road, 2 cm wide lines with a 10 cm gap or 1 cm wide lines with a maximum 5 cm gap), it is possible to significantly reduce the number of collisions. The use of predator silhouettes is less effective and only works if they are installed in large numbers. The use of glass and reflective materials is not permitted for transparent fences/walls.

Measures to prevent / mitigate pollution should be strictly followed.

If sections of the route require fencing for safety (e.g., to prevent landslides or large animal mortality), ensure that the fence is gap-free and permanent. The fence should have small mesh holes or additional materials such as hardware cloth at the base to prevent reptiles from passing through and reduce the risk of small snakes getting stuck

For the Mateševu-Andrijevu highway section, educational measures should be planned, aimed at informing the traveling public. Install informational boards with details on the existence and importance of the protected area, basic information on flora and fauna, and the reasons why feeding wild animals, picking plants, littering, etc., should be avoided.

8.1.7 Water quality

8.1.7.1 Construction phase

The construction of bridges in watercourses will be carried out during the dry season. The project will ensure that the physical impacts on watercourses (i.e. the risk of flooding in a given area) during construction are minimized.

Drainage for the construction of bridges and culverts should not result in the entry of turbid water into natural watercourses. It is necessary to ensure that suspended particles in water pumped into natural watercourses do not exceed the appropriate water quality standard.

In the vicinity of watercourses, the area of the construction site will be limited to the minimum necessary in order for the construction works to be performed adequately. It will not be allowed to occupy streambeds or riverbanks, unless there is no alternative to perform construction work.

During the excavation of the rock mass in the tunnels, taking into account the hydrogeology of the terrain, the appearance of water can only be expected during the times of heavy rainfall. Ditches, channels with pumping points and drainage pipes must be regularly cleaned and maintained in good condition. Drainage of the tunnel is carried out in such a way that it does not endanger the supporting structures and the tunnel walls or tunnel lining, does not wash away the rock material from the excavation areas and does not damage equipment and traffic signage. The ground water that flows into the excavation pits should not be closed at the point of penetration, but it is necessary to capture it and take it out of the tunnel with pipes or channels, and later use it for other purposes. Special attention should be paid to prevent the water from the tunnel, which can be polluted, to reach the riverbeds and pollute the surface waters. The closure of the water penetration site can only be carried out when the project has been completed and should include all the measures to ensure that the sealing of the penetration does not cause dangerous or harmful consequences to the workers in the tunnel and to the environment. From the environmental protection point of view, tunnel portals located near watercourses are very sensitive and common places for surface water pollution. All mining works shall be carried out in accordance with the Law on Explosive Substances (Official Gazette

of Montenegro 49/08, 58/08, 40/11 and 31/14) and the Law on Mining (Official Gazette of Montenegro, No. 65/08).

Construction sites will contain portable chemical toilets. Municipal wastewater generated in the construction sites will not be discharged into natural watercourses without prior adequate treatment to reach the required quality for discharge into the recipient, as well as without obtaining a consent from the competent authorities of Montenegro.

8.1.7.2 Operation phase

The runoff from the road will be treated in oil separators (siphons for filtering sediment in the case of water from open parts of the road) before it reaches the surface water collector

Furthermore:

- All elements of the roadway water treatment system that are maintained must be accessible at all times.
- System maintenance must be carried out at least once every six months by experienced personnel.
- Maintenance is carried out in accordance with the manufacturer's instructions, but must include at least the following elements:
 - precipitator - determining the volume of the precipitate,
 - separator
 - measurement of the thickness of the layer of light liquid (light oil derivatives),
 - checking the device for automatic closure of the spout - float,
 - checking the permeability of the coalescing filter, if there is a difference in the water level even after the coalescing cartridge,
 - checking the functioning of the alarm device,
 - sampling shaft,
 - cleaning the drainage channel.
- Waste oil and sediment from the separator should be removed as necessary, by the activity of a specialized company with which the project holder is obliged to enter into a contract on the performance of these tasks. Emptying the separator is recommended when half of the total volume of the precipitator or 80% of the maximum capacity of light liquids is reached. Before putting it back into operation, it is necessary to fill the device with clean water.
- Handle the resulting waste oil and sediment from the separator in accordance with the applicable laws on: waste management, handling of waste oils and the Rulebook on the manner of keeping waste records and the content of waste transport forms.
- At intervals of no more than five years, it is necessary to empty the separator and subject it to a general inspection, checking the following:
 - tightness of the system,
 - structural stability,
 - internal protection if any,
 - condition of internal elements,
 - condition of electrical devices and installations,
 - checking the settings of the automatic closing device, the float.
- The cleaning and maintenance report must be available to inspection services and must contain notes on specific events (e.g. repairs, incidents).

8.1.8 Waste

8.1.8.1 Construction phase

It is obligation of the contractor to manage the waste generated during highway construction, in accordance with the procedures defined in the Construction Waste Management Plan (incl. Hazardous Waste Management Plan), which will be prepared in accordance with the Law on Waste Management (Official Gazette of Montenegro 64/11 and 39/16).

All **general solid waste** generated during the construction phase of the project will be collected and transported to designated temporary storage sites within the construction site, where it will be placed in appropriate bins and / or containers with the care of the construction contractor. The construction contractor will be responsible for timely collection of all waste upon the completion of the construction phase.

Under no circumstances will waste be disposed of in the environment. All general solid waste will be handled with priority given to waste reuse/recycling. All hazardous material will be disposed according to the relevant regulations.

All construction waste generated will be delivered to the construction waste collector in accordance with the Regulation on the treatment and management of construction waste, manner and method for its processing, and conditions and manner for the disposal of asbestos cement waste. (Official Gazette of Montenegro No. 50 / 12). Construction waste will be temporarily stored separately by type of construction waste in accordance with the Waste Catalogue and separately from other waste, in a way that does not pollute the environment. Disposal of construction waste that is not temporarily stored on the construction site or in the facility where the construction works are performed can be disposed in containers placed on the construction site, next to the construction site or next to the facility where the construction works are performed. Construction waste can be temporarily stored on the construction site until the completion of construction works, for a maximum of one year.

It is strictly forbidden to dispose excess materials from the excavation to the beds of streams and rivers, riverbanks and onto the agricultural land.

The Contractor- is obliged to prepare construction waste management plan and obtain the consent from Nature and Environment Protection Agency of Montenegro for the waste that is generated from a facility whose volume together with the excavation is more than 2,000 m³. The CWMP shall address the following issues:

- Identification and classification of different waste types generated at the construction site;
- Segregation of hazardous from non-hazardous and inert waste streams at the construction site;
- Recycle waste as much as possible;
- Establish temporary hazardous waste storage points specifying appropriate handling, labelling, packing, storage, etc.
- Establish temporary disposal sites for excess material.
- At site offices and in the accommodation camp waste shall be segregated before recycling and adequate arrangements shall be made with licensed waste management companies.

The Contractor shall be obliged to dispose the waste generated during the construction in accordance with the Construction Waste Management Plan to which the consent of the Agency has been obtained. The contractor shall keep records on the type and amount of construction waste on a monthly basis.

The packaging of explosives and detonators, after inserting the explosives and detonators in the mine holes, shall be removed from the construction site onto the area designated for waste disposal.

8.1.8.2 Operation phase

Generated municipal waste will be collected, transported and disposed off by Public Utility Company, with whom the Highway operation management concludes a contract.

The system of separate waste collection can be organized in several ways:

- “Green islands”, or collection points, where the primary separation of recyclable components from waste (separation at the point of origin) takes place by setting up separate containers for paper, glass, cans, plastic, etc.
- Recycling yards, where general public can deliver waste, especially bulky waste, construction debris, garden waste, furniture, etc.
- Containers for waste separation placed next to the municipal waste collection container.

The contractors of the maintenance activities shall be responsible for the proper management of any waste resulting from maintenance. All waste shall be segregated and managed according to the respective regulations. The road operator shall be responsible for the management of waste produced by road users.

The runoff from the road will be treated in oil separators (siphons for filtering sediment in the case of water from open parts of the road) before it reaches the surface water collector. With adequate using of these plants, measurable pollution in surface water collectors is not expected to occur, and no special mitigation measures are required during the operation phase.

Waste oil and sediments from separators shall be handled in accordance with the Law on Waste Management (Official Gazette of Montenegro 64/11 and 39/16), the Rulebook on Handling Waste Oil (Official Gazette of Montenegro 48/12) and the Rulebook on the methods of keeping waste records and the content of forms for waste transport (Official Gazette of Montenegro 50/12). Hazardous waste (sediment from separators, etc.) is collected and removed by a licensed company, with which the project owner is obliged to make an agreement for these works

8.2 Social mitigation measures

8.2.1 Health and access to health services

Health and access to health service	▪ Emergency Preparedness and Response Plan (EPRP) will be developed that considers the role of communities and community infrastructure as appropriate in responding to emergency events. ▪ Camp accommodation and site facilities should include first aid and emergency response for safety, fire and environmental hazards and incidents. ▪ Camp accommodation will include a first aid and medical facility for its international workers which is expected to mitigate potential burden on the existing local health infrastructures, and in accordance with the Occupational Health and Safety Law ▪ EPC Contractor to demonstrate arrangements are made and maintained to ensure flexible medical support on the construction sites, including small onsite clinics, mobile medical services, and similar

	Ensure Traffic management Plan secures continued access to health care facilities and even if temporary short term disruptions are needed these will allow uninterrupted access for emergency cases.

8.2.2 Infrastructure, facilities and public services

8.2.2.1 Design, Pre-construction and construction phase

Infrastructure, facilities and public services – mandatory instruction	- During the kick-off meeting, the EPC Contractor shall inform MONTEPUT whether collective worker accommodation is planned. - Efforts shall be made to use the abandoned and vacant site where the contractor working on the preceding section from Smokovac to Mateševu had established the accommodation camp with a capacity for approximately 3000 workers. MONTEPUT shall support the EPC Contractor in making arrangements for use of the land. - The EPC Contractor will be required to develop a Workers' Accommodation Management Plan that considers infrastructure and utility needs for construction sites, accommodation, workshops and warehouses and obtain all permits in line with national regulations.
Infrastructure, facilities and public services	- The EPC Contractor will be required to develop additional Infrastructure and Utilities Management Plan and Emergency Response Plans considering the capacity of communities and current situation of the community infrastructure to respond to emergency events efficiently. - Permitting for establishment of workers accommodation, which includes construction permits for all facilities comprising dormitories, kitchen and other facilities (including approvals from utilities companies) - The EPC Contractor will be required to undertake a baseline survey of the state of the R19 road and factor this in the Traffic Management Plans. The baseline study of the road condition will also ensure that the road is repaired (conditions and requirements to do so are included in the General Conditions of Contract). - The EPC Contractor will make sure the condition of the public roads which are not exclusively used by construction traffic are regularly maintained, and ensure monitoring includes identification of any deterioration of the road conditions preventing safe use by the public. Potholes and damages shall be remedied immediately. - If required to manage any additional nuisance, in areas where transport of material (from and to borrow/waste areas) the EPC Contractor might agree with the local community on the maximum allowed number of trucks and their load to minimize pressure on the infrastructure and manage noise and dust impacts. - Develop a rehabilitation plan for R19 and any other local road used for construction purposes to ensure these roads are handed back to road users

	in an improved condition. This plan will also include the exact areas and stretches the EPC Contractor will use for construction activities, transport of material and equipment. - Wastewater treatment system and septic system will establish in the Project Facilities as a good practice. - When required, coordination with local municipality and electricity companies will be carried out to ensure the need assessment for the electricity and water supply by the Contractor for the construction and domestic usage does not cause the capacity to decrease. - MONTEPUT will assist the EPC Contractor with the cooperation with the local authorities in permitting for setting up any site offices, and the workers accommodation camp (if required) - Since the majority of the neighbouring villages do not have a sewage system, the Workers' Accommodation Management Plan may establish capacity-building measures within the location of camp accommodation areas to prevent any residual impacts. - As part of setting-out after mobilization and as part of the Detailed Design process the EPC Contractor is required to identify and map all charted water sources, and engage with the local communities supported by MONTEPUT to identify and locate any uncharted water spring and water supply source. - The EPC Contractors community relations department is required to announce to local communities through the Presidents of the Local Communities works around these water source locations and will follow up each day with the local community to identify whether disruption in water supply (either through decreased flow or complete cut-off) has been experienced.
<u>Infrastructure, facility -</u>	- The EPC Contractor is required to obtain design condition in writing as part of the permitting process from relevant utility companies in Andrijeviča and Mateševo. The Design shall be informed and take into account the outcome of the pre-design setting-out surveys including the mapping exercise to chart and identify the water springs/sources supplying the communities with potable water. - During the preparation of all plans, engagement with local authorities and utilities companies will be undertaken to ensure continuity of supply to communities. In case of unintentional damage due to unforeseeable ground conditions, the EPC Contractor shall make adequate arrangements with the public utility companies to ensure alternative water supply arrangements are put in place. Cisterns with potable water shall be made available to the communities. - Project will implement a Grievance Mechanism and address infrastructure related grievances in line with the Stakeholder Engagement Plan (SEP) of the Project. - The EPC Contractor will be required to compensate and set off any damage to infrastructure

Mitigation measures at the design and pre-construction phase include:

8.2.2.2 Operation phase

During operation, it is recommended that the highway operator cooperates with responsible authorities in case necessary improvements required for local infrastructure and is in close coordination with the related local authorities to curtail inconvenience to the residents of the Project area.

8.2.3 Traffic and accessibility

<u>Traffic and accessibility</u> <u>Design stage</u>	- Before construction starts a Traffic Management Plan (TMP), Infrastructure and Utilities Management Plan (IUMP) and Emergency Preparedness and Response Plan (EPRP) will be developed and approval obtained by national and local authorities as applicable. - The TMP will be developed in consultation with the Local Communities - Following the survey as required in 8.2.2 alternative routes and roads shall be designed, as necessary included in the Detailed Design
	- Adoption of best transport safety practices across all aspects of project operations with the goal of preventing traffic accidents and minimizing injuries suffered by project personnel and the public. - Speed limits will be introduced and monitored and the TMP will ensure penalty clauses for breach of the requirements are imposed - Road Safety training of personnel during orientation and onboarding as well as regular refresher courses and toolbox talks will be undertaken by the EPC Contractor. In cases of repeated incidents works shall be stopped on the entire Site for awareness raising campaigns and targeted trainings. - The Grievance mechanisms shall be available for uptake of construction related grievances.
<u>Infrastructure, facility -</u>	- The EPC Contractor will emphasize safety aspects among drivers on Improving driving skills and requiring licensing of drivers - Limits for trip duration and arranging driver rosters to avoid overtiredness - Avoiding dangerous routes and times of day to reduce the risk of accidents - Use of speed control devices (governors) on trucks, and remote monitoring of driver actions. - Regular maintenance of vehicles and use of manufacturer approved parts to minimize potentially serious accidents caused by equipment malfunction or premature failure and blocking of the public roads. - Project will implement a Grievance Mechanism and address traffic related grievances in line with the Stakeholder Engagement Plan (SEP) of the Project.

Measures should include: · Minimizing pedestrian interaction with construction vehicles ·

Using locally sourced materials, whenever possible, to minimize transport distances. Locating associated facilities such as worker camps close to project sites and arranging worker bus transport to minimizing external traffic

8.2.4 Land acquisition and resettlement

Measures to mitigate the impacts related to land acquisition and resettlement include the following:

Table 8-5: Mitigation measures regarding land acquisition and resettlement impacts

Impact	Mitigation/Enhancement Measures
Loss of private and public lands due to expropriation	<u>Design</u> - MONTEPUT will investigate further avoidance measures through the Detailed Design to fine-tune project site boundaries, ancillary facilities and construction-related facilities to minimise footprint and displacement - People affected by the Project will be compensated in accordance with the Principles set in the LARF. - As a minimum, LARP will be prepared. It will detail the impacts of the Project on land ownership, land use, property and livelihoods. The LARP will set out the measures needed to address adequately physical and economic displacements due to the Project. - A detailed socio-economic assessment will be undertaken for the RAP to identify impacts on PAPs, including land acquisition impacts and restriction to land use. - A census must be carried out to determine persons to be displaced by the Project, persons that are eligible for compensation and assistance, inventory of affected land and property. <u>Pre-construction</u> - Works are not allowed to commence until the compensation has been paid, - Assistance will be provided to vulnerable persons In line with the LARF, - Additional targeted assistance will be provided and opportunities to improve or at least restore their income earning capacity, production levels, and standards of living to Economically Displaced Persons whose livelihoods or income levels are adversely affected Construction , - The amount of land occupied during the construction will be minimized. - Construction workers will be trained to stay within the border of the construction areas and expropriation corridor and avoid trespass on private land. - For exceptional cases when the privately-owned land has to be used but the compensation has not been paid , no work will be started until bilateral agreements are settled and official consent letters are taken from the legal owners but not in cases of physical displacement. - If complaints related with unauthorized use of privately owned lands, damages on adjacent lands, etc. are received through Project's Grievance Mechanism, evaluation/inquiry will be conducted on a case-by-case basis and where necessary, corrective actions will be planned and implemented.

Impact	Mitigation/Enhancement Measures
	In case of any direct damage on private property as a result of the activities of the Project contractors or subcontractors, the Contractor will ensure that relevant corrective measures (e.g. repair, maintenance, rebuilding, restoration, etc.) are implemented.
Impacts on agricultural land	Pre-construction - Users of land will be timely informed when construction is planned to begin and how lost crops and damages will be compensated. - When displacement cannot be avoided, displaced persons will be provided with appropriate compensation for loss of assets per LARF and LARP at replacement cost. All users of land whose crops are lost or affected by any other damage during the construction will be compensated at a full replacement value, - If compensation alone is not sufficient to restore livelihoods, implementation of livelihood restoration in accordance with EBRD requirements. - Grievance mechanism will be established Construction - Impacts to agricultural and pasture lands will be minimized as far as possible by keeping the Project construction within its footprint, and efficiently restoring any damaged areas
Temporary land allocation	All of the temporary occupied sited will be rehabilitated as appropriate and agreed upon, following the completion of Construction works.
Fragmentation of certain land plots	<u>Construction</u> The viability of the remaining portions of land (orphan land will be assessed) and in cases where the land renders unviable (economically or otherwise) the entire land will be acquired with compensation principles set as in the LARF.
Damage to crops during the construction and operation phase	During construction, - loss of or damage to crops caused by Project activities will be compensated. - minimize damage to crops by minimizing the area of disturbance caused by vehicle movement and other construction activities. - If complaints related with unauthorized use of privately owned lands, damages on adjacent lands, etc. are received through Project's Grievance Mechanism, evaluation/inquiry will be conducted on a case-by-case and where necessary, corrective actions will be planned, and implemented.
Physical and economic displacement of PAPs.	During pre-construction phase - Detailed design shall further reconsider the alignment to apply avoidance measures to the maximum economically and technically feasible extend. - During Stakeholder engagement activities the local communities have expressed their interest to explore alternative solutions with the designers and MONTEPUT at the level of Detailed Design to understand whether access roads, underpasses, rest areas and ancillary facilities or similar could be designed and deployed to avoid land acquisition impacts in cases where restrictions to land and land use is evident. Discussions will be continued during preparation of the detailed LARP. - Community meetings held between July and October 2024 have opened the dialogue with MONTEPUT as the Project owner. Commitments have been made by MONTEPUT to explore viable route alternatives during the next stages of the Project. However even with this commitments there are still voices of opposition and dissatisfaction noted (the detailed analysis and description of the engagement undertaken is provided in the SEP).

8.2.5 Employment, Labour and working conditions

The Project Promoter, contractors and sub-contractors will be obliged to promote higher worker's standards in general, consistent with EBRD PRs, and to ensure, by procurement and contractual requirements, by monitoring, reviews and reporting, that third parties which are under direct influence of the client (contractors, sub-contractor) comply with national laws and fundamental principles and standards of the ILO conventions.

The EPC Contractor will be required to adopt the Labor Management Procedures as appended to this ESIA.

In relation to the workers' camps, it is expected that if required, they will be set up and managed in compliance with EBRD/IFC Guidance Note: Workers' accommodation: processes and standards. Careful consideration will need to be given to any use by contractors of existing capacity in accommodation and other available local amenities to avoid social tensions between locals and contractors. The conditions of the camps will be monitored regularly by the Engineer and audited in line with the ESAP.

Table 8-6: Mitigation measures regarding labour and working conditions

Impact	Mitigation/Enhancement Measures
Labour Risks and Impacts Related to Women Employment and Non-Discrimination and Equal Opportunity	<u>Pre-construction / Construction / Operation</u> — The EPC Contractor will apply equal opportunities to women. — Further measures will be put in place to encourage female participation in indirect workforce, such as providing specific training where required, enabling flexibility and job-sharing opportunities for women with children to participate.
Labour Risks and Impacts Related to Subcontractor and Supply Chain Management (Including Child and Forced)	<u>Pre-construction / Construction / Operation</u> ■ The EPC Contractor will not employ nor permit any subcontractor to use child labour, and in accordance with Montenegrin legislation, any person under the age of 18 may not be engaged in work within the Project. ■ The EPC Contractor will prohibit the use of forced labour by ensuring full compliance with national legislation and the provisions of relevant conventions and other international standards
Worker Conditions and term of employment	<u>Pre-construction / Construction / Operation</u> ■ Workers will have contracts, which clearly state the terms and conditions of their employment and their legal rights. Information will include, but not be limited to: ■ entitlement to wages, hours of work, overtime arrangements and overtime compensation, and any benefits (such as leave for illness, maternity / paternity or holiday) ■ able to join trade unions of their choice and have the right to collective bargaining ■ contracts will be verbally explained in their native languages to all workers where this is necessary to ensure that workers understand their rights prior to any employment contract to be signed. ■ Cultural Awareness Training will be provided an on-boarding requirement to all non-local workers, and in particularly foreign workers. ■ Worker Grievance Mechanism will be developed and will: - be open to all the staff and their contractors, - be publicly advertised by the Project in the workforce in line with the LMP ,

	- be easily accessible by workers - be free of retribution - allow anonymous complaints to be raised and addressed. ■ All Project parties will require all contractors to sign an anti-corruption and responsible procurement policy. ■ For all contractor contracts, the Project will make explicit reference to the need to abide by IFC standards and ILO conventions in relation to labor and welfare standards, freedom of association and reference must be made to child and forced labor. Emphasis will also be placed on anti-discrimination measures. <u>Pre-construction</u> ■ Workers' Accommodation Management Plan will be developed and comply with 'Workers' accommodation: processes and standards, a guidance note by IFC and the EBRD' (2009) ■ Design of the accommodation camp will include measures for managing the camp to ensure adherence to international standard for providing a safe environment that is clean, and adequate sanitary. Measures will include: ■ waste management ■ provision of potable water, ■ provisions of minimum amount of space for each worker ■ laundry facilities ■ cooking facilities (separate area for the foreign personnel, if necessary) ■ provision of first aid and medical facilities ■ provision of heating and ventilation. ■ Camp Management Project will include a Code of Conduct for construction workers, <u>Construction</u> ■ During the construction phase, the Contractor's HSE plans and procedures include requirements for induction and training on expected behaviours and on disciplinary procedures (including dismissal procedures for unacceptable conduct). ■ During the construction phase, the Contractor's HSE plans and procedures include requirements for induction and training on expected behaviours and on disciplinary procedures (including dismissal procedures for unacceptable conduct). ■ In case of a collective dismissal required, Retrenchment Plan will be developed by the Contractor to mitigate adverse effects of job losses on the workers concerned. Retrenchment of workers is likely to be required across the lifespan of the Project, particularly during the transition from construction to operation. Retrenchment of workers will be undertaken in line with national law and international best practices, and will include providing skills to enable individuals to secure alternative employment. ➤ The effectiveness of all retrenchment should be monitored including the timely close out of retrenchment-related grievances <u>Operation</u> Human Resources Policy will be developed and implemented. Under the policy, the project proponent shall provide all employees with information regarding their rights under national labour law, including their rights related to wages and benefits. The policy covers working conditions, right to organize, non-discrimination, grievance mechanisms, child labour, and forced labour.
Health and Safety Risks on Accommodation	<u>Pre-Construction / Construction</u>

	- Worker accommodation will be designed and maintained to meet the standards defined in IFC and EBRD guidance on accommodation. The standards of the rooms or dormitory facilities should be designed to allow workers to rest properly and to maintain good standards of hygiene. This includes cafeteria, medical room, shower and toilets, wastewater treatment plants/septic tanks, water supply facilities (i.e. water well) - Worker accommodation conditions will be maintained to ensure a good standard of personal hygiene and hygiene in canteens need to be ensured to prevent contamination and the spread of diseases, which result from inadequate sanitary facilities and may affect the community health and safety as well. - Medical facilities (first-aid facilities, additional medical facilities) will be maintained to ensure good standards of workers' health and to provide adequate responses in case of health emergencies. - Basic leisure, social and telecommunication facilities will be provided for workers to rest and to socialize during their free time. These requirements at the camp accommodation facilities should be optimized to minimize potential impacts on the workers' welfare and risk of work-related accidents and maximize the overall productivity. - Worker Grievance Mechanism will be established that will provide means for all Project personnel to lodge their complaints. Only concrete plants will be allowed to be located at the Camp Sites; asphalt and mechanical plants will be sited close to the quarries to the extent feasible.
Gender based Violence GBV	<u>Pre-construction</u> - Information tools and hiring women CLOs to access women in the AoI is recommended. During the Women Focus Group Discussion (FGDs), it has been raised by the participants that the women members of the community cannot participate in the decision-making process and they do not have equal roles in the community. - Code of Conduct will be developed in compliance with the legislation. Gender equality, positive discrimination and the sexual harassment issues and approach on gender sensitivity should be included. - All workers (including international workers) will be trained in their native languages about the Code of Conduct. - All workers (including international workers) will receive Project Orientation and Cultural Awareness training that covers sensitive social issues on the local communities. <u>Construction</u> Grievance mechanism will record any gender-based complaints and necessary measures will be taken accordingly.

The requirements for workers camps shall include consideration of a safe and healthy location, application of appropriate construction standards, provision of adequate and sanitary living conditions and provision of appropriate leisure and health facilities.

The Employment Plan shall be materially compliant to the LMP and shall be disclosed and available to workers and communities in accordance to the Stakeholder engagement Plan.

Grievance mechanism for all workers (employees and non-employees) on Project sites should be made available to complement the nationally available panel to raise grievance and seek protection of rights. This mechanism should be commensurate to the number of workers. The contractor will inform the workers of the grievance mechanism at the time of hiring and make it easily accessible to them.

For non-employee workers engaged by the Contractor through sub-contractors or other intermediaries to work on project sites or perform work directly related to the core functions of the project, the reasonable efforts will be used to ascertain that these contractors or intermediaries are reputable and legitimate enterprises; and require that they apply the requirements of human resource management, prevention of child labour, non-discrimination and equal opportunity, prevention of forced labour, wages, benefits and working conditions, workers organization in line with the national legislation and EBRD PR 2 and ILO conventions.

The Contractor and each sub-contractor will be required to adopt the LMP provided in Appendix III of this ESIA and provide Accommodation in line with chapter 9 of the LMP.

8.2.6 Occupational health and safety

The entire Project will implement all reasonable precautions to protect the health and safety of workers. Although the focus is placed on the operational phase of projects, much of the guidance also applies to construction and decommissioning activities. The EPC Contractor and Supervision Consultant shall hire contractors that have the technical capability to manage the occupational health and safety issues of their employees, extending the application of the hazard management activities through formal procurement agreements.

The selected EPC Contractor will implement an Environmental and Social Management System (ESMS) appropriate to control the risks identified for the construction, operations, and maintenance phases of the Project. The system will include development of appropriate policies and objectives, responsibilities and authorities of personnel, ensuring that appropriate and competent resources are available, arrangements for reporting, monitoring, review and corrective actions.

Arrangements are expected to include manual handling/ergonomics, control use of hazardous substances, covering training, application, storage, work at height, excavation safety, confined space safety, use of pressurized systems, equipment guarding, use of personal protective equipment (PPE), use of lifting equipment (including requirements for equipment certification and use of lift plans where appropriate, risk from falling objects), hot work, work with electricity, control of exposure to noise/radiation (including electric and magnetic fields), use of vehicles, security, adverse weather conditions, provision of welfare amenities, etc.

Performance monitoring and measurement will be undertaken regularly, and procedures to monitor, measure and record OHS performance on a regular basis should be developed, established and periodically reviewed. Responsibility, accountability and authority for monitoring at different levels in the management structure should be allocated.

Occupational Health and Safety General requirements	Pre-construction and Construction The Contractor shall: ■ establish Occupational Health and Safety (OH&S) Management Plan with special focus on (but not limited to): movement of vehicles and traffic management, working at heights, working in confined spaces, working with hazardous materials, management of electrical hazards, prevention of unintended ground movements and collapse. OH&S Management Plan will acknowledge and reference to IFC EHS Guidelines for Toll Roads (2007) and IFC General EHS Guidelines (2007). ■ appoint one or more coordinators for safety and health matters for any construction site or its part. This coordinator ensures that a safety and health

	plan is drawn up before setting up a site which will be approved by the Engineer and the national authorities; ▪ communicate a prior notice to national authorities ▪ Emergency Preparedness and Response Plan (EPRP) will be prepared and cover specific project risks such as spill containment and clean-up, flood, working over water, fire, rescue from height ▪ Traffic Management Plans will be prepared
Occupational Health and Safety – prevention principles	Preventive and protective measures shall be introduced according to the following order of priority: ▪ Preventive and protective measures in line with national law with the application of Safety and Health in Construction Convention (1988) ILO, ▪ Eliminating the hazard by removing the activity from the work process. Examples include substitution with less hazardous chemicals, using different manufacturing processes, etc; ▪ Controlling the hazard at its source through use of engineering controls. Examples include local exhaust ventilation, isolation rooms, machine guarding, acoustic insulating, etc; ▪ Minimizing the hazard through design of safe work systems and administrative or institutional control measures. Examples include job rotation, training safe work procedures, lock-out and tag-out, workplace monitoring, limiting exposure or work duration, etc. · ▪ Providing appropriate personal protective equipment (PPE) in conjunction with training, use, enforcement to use and maintenance of the PPE. The application of prevention and control measures to occupational hazards should be based on comprehensive job safety or job hazard analyses. The results of these analyses should be prioritized as part of an action plan based on the likelihood and severity of the consequence of exposure to the identified hazards. Permanent and recurrent places of work should be designed and equipped to protect OHS: ▪ Surfaces, structures and installations should be easy to clean and maintain, and not allow for accumulation of hazardous compounds. ▪ Buildings should be structurally safe, provide appropriate protection against the climate, and have acceptable light and noise conditions. ▪ Fire resistant, noise-absorbing materials should, to the extent feasible, be used for cladding on ceilings and walls. ▪ Floors should be level, even, and non-skid. ▪ Heavy oscillating, rotating or alternating equipment should be located in dedicated buildings or structurally isolated sections The space provided for each worker, and in total, should be adequate for safe execution of all activities, including transport and interim storage of materials and products. Passages to emergency exits should always be unobstructed. Exits should be clearly marked to be visible in total darkness. The number and capacity of emergency exits should be sufficient for safe and orderly evacuation of the greatest number of people present at any time, and there should be a minimum two exits from any work area.
Occupational Health and Safety – pre on boarding requirements	▪ Pre-construction and Construction ▪ The Contractor: ▪ has a duty to evaluate and avoid risks, develop an overall safety policy and provide appropriate training to staff; ▪ appoints someone responsible for the prevention of risks at work; ▪ takes the necessary first aid, fire-fighting and evacuation precautionary measures; ▪ assesses the risks particular workers might face and ensure the necessary protective measures are in place;

	- provides employees and/or their representatives with all relevant information on possible health and safety risks and the measures taken to prevent them; - consults employees and/or their representatives and involve them in all discussions on health and safety at work; - Contractual conditions will ensure that all sub-contractors to follow the OH&S Management Plan. - Organization of the work schedule will include specific risks e.g. flood. - Communication skills across the workforce will be multi lingual. - Enforcement, self-verification & consequence management will be implemented. - Appropriate number of EH&S officers per workforce group (e.g. risk based) will be employed to implement the EH&S program, including risks assessment, training, supervision of high risks tasks, subcontractor induction. - Site-specific factors, which may contribute to excavation slope instability, will be controlled. - During blasting operations, work areas will be evacuated, and blast mats or other means of deflection will be used to minimize fly rock or ejection of demolition debris. - Good cooperation with the local medical services will be ensured. - An OHS system will be established for the reporting and recording of occupational accidents and dangerous occurrences/incidents. - Personal Protective Equipment will be selected based on the specific hazards and risks of the task to be performed and properly maintained to keep them effective and operational throughout their use. - Individuals shall only carry out tasks for which they are competent and authorized to do so. Individuals shall only operate and use plant or equipment for which they are trained and authorized. Copies of all operator certificates will be retained. - Emergency contact numbers will be made available at the work sites. This will include the fire and rescue service and the environmental inspection.
Health and Safety Risks due to Physical and Chemical Hazards	<u>Pre-construction / Construction</u> - The area around which elevated work is taking place will be barricaded to prevent unauthorized access and working under personnel on elevated structures will be avoided - Hoisting and lifting equipment will be rated and properly maintained, and operators trained in their use. - Elevated working platforms will be maintained and operated according to established safety procedures including use of fall protection measures (e.g. railings), equipment movement protocols (e.g. movement only when the lift is in a retracted position), repair by qualified individuals, and installation of locks to avoid unauthorized use by untrained individuals. - Ladders will be used according to pre-established safety procedures for proper placement, climbing, standing, as well as the use of extensions. - When working at height, proper fall protection measures will be implemented. Fixtures will be installed on bridge components. Safety harnesses with proper thickness and of suitable materials, ensuring sufficient strength will be used. Rope safety harnesses will be replaced before signs of ageing or fraying of fibres become evident. - When operating power tools at height, workers will use a second (backup) safety strap. - Personnel exposed to high levels of noise will be required to use personal hearing protection devices/equipment. Where required for specific works, work rotation programs will be implemented to reduce cumulative exposure. - Weather forecasts will be monitored for outdoor work to provide advance warning of extreme weather and schedule the work accordingly. Protective clothing will be used where required

	▪ Properly maintained construction machinery, equipment and vehicles will be used to minimize air emissions. ▪ Engine idling time will be reduced in construction sites. ▪ Direct diesel exhaust will be properly removed to minimize exposure of the operators. ▪ Indoor working areas where vehicles or engines are operated will be ventilated or the exhaust gases will be properly diverted. ▪ Lead-containing paint will be avoided, and appropriate respiratory protection will be used when cutting galvanized steel. ▪ at work sites where dust levels are excessive, relevant personnel will use dust masks
Health and safety risks tunnelling works	Tunnelling involves both general construction risks and risks which are specific to the tunnelling environment and therefore establishing a health and safety plan should be done by competent staff and should include the below preventive measures: ▪ Research of existing historical data, existing regional and site-specific geological data, local engineering expertise etc. ▪ Consultation with national bodies concerned with the natural environment, geology, mineral workings, planning and transport. ▪ Consultation with utility service providers, particularly in urban areas, including the electricity, gas, water, communications, highway and railway authorities and owners of other nearby underground and surface services. ▪ Ground/site investigation by means of seismic methods, boreholes, trial pits, exploratory shafts etc. ▪ An assessment of the hydrogeology of the area. ▪ An assessment of the risk of encountering methane or other hazardous gas in the ground or hazardous substances such as asbestos or industrial waste – solid or liquid. ▪ An estimate of the levels of atmospheric and other contamination in the tunnel during construction e.g. dust from rock drilling, concrete spraying etc. ▪ A thorough review should be made of the ground/site investigation results and how they may affect: - The selection of the most appropriate tunnelling and shaft sinking methods. - The selection of suitable tunnelling machinery. - The selection of appropriate lining methods. - The monitoring scheme to be put in place to evaluate the safety of the working environment during the construction phase ▪ Careful consideration should be given to the design and siting of any temporary works associated with the tunnelling project. These could include temporary access shafts, temporary cofferdams and caissons, thrust pits and walls, any temporary ground support etc along with materials storage areas, working areas and site offices. ▪ The contractor should reduce risk to workers underground through elimination or control of hazardous materials and processes. ▪ The contractor should provide appropriate safety signs in accordance with ISO 3864:2002 ▪ The contractor should provide adequate firefighting equipment ▪ The contractor should provide trained first-aid personnel and equipment along with first aid stations as necessary.

	■ The contractor should provide adequate welfare facilities including washing and toilet facilities along with a supply of drinking water. ■ The contractor should provide adequate atmospheric monitoring and ventilation to ensure a safe and healthy environment. ■ The contractor should provide adequate artificial lighting to ensure a safe environment. ■ Excavation technology requires that the tunnel pipe be ventilated for 30 to 60 minutes after the detonation of the explosives ■ The Contractor shall prepare Blasting management plan prior to construction works to eliminate hazards and reduce potential negative impacts. The Blasting Management Plan should: ■ Set out key national and EU policies, laws and standards related to blasting activities; ■ Define roles and responsibilities; ■ Identify and classify potential risk in construction phase; ■ Define expected blasting area, as well as blasting patterns and specifications; ■ Define blasting process procedure (including measures for environmental protection, as well as protection of population and workers' safety); ■ Define auditing and reporting procedure; ■ Define the maintenance and control of this plan.
Health and Safety Risks due to Emergencies	<u>Design</u> Emergency Preparedness and Response Plan (EPRP) will be prepared and cover specific project risks such as spill containment and clean up, flood, working over water, fire, and rescue from height. The EPRP should include: • Risk assessment, • Location of medical rescue, fire-fighting resources and spill response equipment will be available along the route. • Procedure for staff and subcontractors to report any incidents and the investigation, remediation and preventive actions taken, • Emergency response information and training • Emergency Communication Procedure included in the Stakeholder Engagement Plan (SEP) and the Emergency Preparedness and Response Plan (EPRP) including with local communities and authorities ■ Sub-Contractors will develop and prepare site-specific EPRPs in line with the Contractor overarching plan. ■ Relevant emergency preparedness and response measures will be taken during emergencies arising at the construction/work sites and Camp Sites. ■ During the state of emergency, the employer must enable employees to perform work remotely (i.e. outside of the employer's business premises (teleworking and work from home)), at all workplaces where such work can be organized in line with the general enactment (i.e. the employment rulebook or collective bargaining agreement of the employer, whichever is applicable) and the employment contract. ■ If the general enactment and the employment contract do not provide for the possibility for remote work, the employer may issue a decision allowing for work outside of the business premises, if organizational conditions allow so. Such a decision must contain the duration of working hours and the manner of supervision of the work

	of employees. The employer is obligated to keep records of employees who work outside of the business premises. ■ If the nature of the activity of the employer does not allow for organization of work in the manner provided above, such an employer must adjust its operations to the conditions of the state of emergency as follows: ➤ arrange shift work, if possible and without requiring additional resources, so that as few persons (employees and all other engaged persons) as possible work simultaneously at one premises. ➤ enable that all business meetings are held via electronic or other appropriate means (video link, video call, etc.); ■ In order to ensure the protection and health of employees, engaged personnel and clients, employers must provide all general, special and extraordinary measures related to the hygienic safety of facilities and persons in accordance with the Law on Protection of Citizens from Contagious Diseases. For employees and engaged personnel who are in direct contact with clients or share a workspace with multiple persons, it is necessary to provide sufficient quantities of protective equipment in accordance with special regulations.
Health and Safety Risks due to Construction Traffic	<u>Design</u> ■ Traffic Management Plan (TMP) will be prepared. <u>Pre-construction / Construction</u> ■ Safe work zone will be established to separate workers on foot from the traffic; ■ For the construction works to be conducted at location where traffic exists, safe work zones will be established by taking relevant measures (closure of roads, diversion of traffic, use of protective barriers, cones, warning lights, etc.). ■ Weather forecasts will be monitored to provide advance warning of extreme weather to drivers and schedule the work accordingly. ■ Traffic control supervisors will be assigned with competence in traffic control principles and who will assume overall responsibility for the safety of the work zone setup. ■ Temporary traffic control devices, such as signage, warning devices, paddles, and concrete barriers will be set up where required in a consistent manner throughout the work zone to provide passing motorists with advanced warning of upcoming work zones; ■ Traffic control workers will be trained in topics such as traffic flow, work zone setup, and proper placement of channelizing devices; and All workers will wear high-visibility safety apparel.
Health and Safety Risks – Monitoring	Performance monitoring of the EPC Contractor will be undertaken by the Supervision Engineer and measurement should: ■ be used as a means of determining the extent to which OHS policy and objectives are being implemented and risks are controlled; ■ include both active and reactive monitoring, and not be based only upon work-related injury, ill health, disease and incident statistics; and ■ be recorded. The monitoring feedback on OHS performance; ■ information to determine whether the day-to-day arrangements for hazard and risk identification, prevention and control are in place and operating effectively; and

	- the basis for decisions about improvement in hazard identification and risk control, and the OHS management system Active monitoring should contain the elements necessary to have a proactive system and should include: - monitoring of the achievement of specific plans, established performance criteria and objectives; - the systematic inspection of work systems, premises, plant and equipment; - surveillance of the working environment, including work organization; (d) - surveillance of workers' health, where appropriate, through suitable medical monitoring or follow-up of workers for early detection of signs and symptoms of harm to health in order to determine the effectiveness of prevention and control measures; and - compliance with applicable national laws and regulations, collective agreements and other commitments on OHS to which the organization subscribes. Reactive monitoring should include the identification, reporting and investigation of: - work-related injuries, ill health (including monitoring of aggregate sickness absence records), diseases and incidents; - other losses, such as damage to property; - deficient safety and health performance, and OHS management system failures; and - workers' rehabilitation and health-restoration programmes
Health and Safety Risks – Audit	Arrangements to conduct periodic audits are to be established in order to determine whether the OHS management system and its elements are in place, adequate, and effective in protecting the safety and health of workers and preventing incidents. The audit includes an evaluation of the organization's OHS management system elements or a subset of these, as appropriate. The audit should cover: - OHS policy; - worker participation; - responsibility and accountability; - competence and training; - OHS management system documentation; - communication; - system planning, development and implementation; - prevention and control measures; - management of change; - emergency prevention, preparedness and response; - procurement; - contracting; - performance monitoring and measurement; - investigation of work-related injuries, ill health, diseases and incidents, and their impact on safety and health performance; - management review; - preventive and corrective action; - continual improvement; and - any other audit criteria or elements that may be appropriate.

8.2.7 Community Health and Safety

8.2.7.1 Pre-construction and construction phase

The Project shall implement risk management strategies to protect the community from physical, chemical, or other hazards associated with sites under construction and decommissioning. Risks may arise from inadvertent or intentional trespassing, including potential contact with hazardous materials, contaminated soils and other environmental media, buildings that are vacant or under construction, or excavations and structures which may pose falling and entrapment hazards.

Community health and safety Risk management Plans- influx and security personell	The Contractor will develop the following management plans and policies to deal with community health, safety and security among other topics covered in the Plan : ▪ Construction Workers’ Code of Conduct on the basis of the CoC provided in the LMP; ▪ Community Health & Safety Risk Management Plan (inclusive but not limited to safety strategies, grievance management, communication requirements etc.; ▪ Emergency Preparedness and Response Plan; ▪ Construction Traffic Management Plan for safe access to construction sites with minimum negative impact on the existing roads and to ensure community safety and easy access to their properties (homes, land, gardens). Adoption of best transport safety practices across all aspects of project operations with the goal of preventing traffic accidents and minimizing injuries suffered by project personnel and the public. Measures should include: ○ Emphasizing safety aspects among drivers ○ Improving driving skills and requiring licensing of drivers etc.
Community health and safety Risk management strategies	▪ Restricting access to the site, through a combination of institutional and administrative controls, with a focus on high risk structures or areas depending on site-specific situations, including fencing, signage, assigning observers role within project personell to alert any violation. ▪ Post information boards about public safety hazards and emergency contact information communication of risks to the local community ▪ Removing hazardous conditions on construction sites that cannot be controlled affectively with site access restrictions, such as covering openings, cover access to small confined spaces, ensuring means of escape for larger openings such as trenches or excavations, locked storage of hazardous materials and material in general. ▪ Well fencing of the construction and excavation sites, and warning tape around the blasting works sites; ▪ Twenty-four hours guarding of the construction site; ▪ Night illumination of the construction site; ▪ Prohibition of high-speed driving of vehicles ▪ Adopting limits for trip duration and arranging driver rosters to avoid overtiredness ▪ Avoiding dangerous routes and times of day to reduce the risk of accidents ▪ Use of speed control devices (governors) on trucks, and remote monitoring of driver actions

	▪ Regular maintenance of vehicles and use of manufacturer approved parts to minimize potentially serious accidents caused by equipment malfunction or premature failure. ▪ Minimizing pedestrian interaction with construction vehicles ▪ Collaboration with local communities and responsible authorities to improve signage, visibility and overall safety of roads, Collaborating with local communities on education about traffic and pedestrian safety (e.g. school education campaigns for schools in Andrijeviča and Kolasin) ▪ Coordination with emergency responders to ensure that appropriate first aid is provided in the event of accidents ▪ Employing safe traffic control measures, including road signs and flag persons to warn of dangerous conditions ▪ Collaboration with local communities and responsible authorities to improve signage, visibility and overall safety of roads, particularly along stretches located near schools or other locations where children may be present
Community health and safety Risk management	▪ The Contractor will be required to establish and implement a community grievance mechanism.
Community health and Safety - communication requirements	▪ The information campaign to inform the affected communities on potential adverse impacts associated with changes in traffic regime during construction and impacts of temporary land take, including dissemination of safety sheets containing timetable of hazardous works in the vicinity of the affected communities, pastures, access roads, information of the scheme of the construction site, list of main risks and safety rules, examples of safety signs used at the construction site, contacts of emergency services; ▪ Local communities should be thoroughly informed on the program and sequence of works. In case of using local roads for transportation, repair works will be made in collaboration with the local authorities. The Project developer should cooperate with local authorities on the issue of traffic movement during construction phase. ▪ It is also recommended that a Community Health and Safety Educational Programme be developed. The Project should undertake a series of public relation activities, including school visits and communications, in order to inform local residents, passenger and workers of hazards associated with the operation of the new road, crossing at unauthorized locations, trespass and/or vandalism.
Community health and safety Detailed Design considerations	▪ Community H&S risk must be mitigated through the design process ▪ The Detailed Design should additionally investigate the routes on R19, in Mateševo, Andrijeviča and all of the affected settlements along the route ▪ Road safety fences and noise screens to be implemented during construction should be outlined in the design documentation.
Community health and safety – working hours	▪ Limiting working hours from Monday to Friday 7 a.m. to 7 pm if possible Some flexibility in working hours may be required during delivery of material depending on weather conditions

and transport schedules	▪ The Final time schedule of the transport movements should be clarified with the authorities and communities. Only well-maintained equipment should operate on site
Community health and safety around borrow and deposit areas	▪ Once the Detailed Design has identified the locations of deposit and borrow areas for material the EPC Contractor will meet with the local communities (if any) around the sites of these locations and/or next to the existing transport routes to discuss the Project and nature and timing of transport of construction material ▪ Advance notification of the start of these activities will be provided to these communities ▪ The truck will travel at low speed to lessen generation of noise, vibration and dust if travelling near residential houses ▪ The areas will be fenced appropriately preventing access from unauthorized personnel and if entry to or passage through is required by members of the local community negotiations and protocols will be put in place and a log of these activities kept
Community health and safety – road safety school campaigns	▪ Launch safety campaign for school children raising awareness of the risks from construction traffic at least each year ▪ Provide school with posters and information understandable and readable to highlight the risks and safe behaviour
Community health and safety – transport of hazardous material	The procedures for transportation of hazardous materials (Hazmats) should include: ▪ Proper labelling of containers, including the identify and quantity of the contents, hazards, and shipper contact information ▪ Providing a shipping document (e.g. shipping manifest) that describes the contents of the load and its associated hazards in addition to the labelling of the containers. ▪ Apply the United Nations recommendations on the transport of dangerous goods and the national regulations ▪ limits to the quantity of mining explosives which can be transported in an ordinary vehicle
Community health and safety – transport of extraordinary cargo	▪ Use appropriate and specifically designed vehicle ▪ Ensure transport is licenced and approved ▪ Select route and obtain permits and escort by police ▪ Make sure bridges and overpasses used are checked for stability ▪ Develop a transport plan for extraordinary cargo
Risk of illicit behaviour and crime	▪ Workers will be paid into bank accounts which is a standard in the country. ▪ Worker accommodation facilities will be in accordance with IFC /EBRD standards as provided in section 9 of the LMP and will include leisure areas to reduce the interaction of the workers with the local communities. ▪ Code of Conduct as provided in the Project LMP appended to the ESIA will be adopted Hard copies will be provided in English and the native languages of the workforce. ▪ All workers (including international workers) will be trained in their native languages about the Code of Conduct and dismissal policy in particular in criminal cases.
Risk of social conflict	▪ All workers (including international workers) will be trained in their native languages about the Code of Conduct within the induction.

	All workers (including international workers) will receive Project Orientation and Cultural Awareness training that covers sensitive issues on the local communities.
Influx of additional population	- Recruitment Plan will be prepared and implemented to prevent spontaneous influx of job seekers and at the gate hiring. - Employment capacity and the qualifications required for the construction will be disclosed to the public to prevent unrealistic expectations. - Cooperation will be developed with the local municipalities and local employment agencies to support local employment. Also livelihood diversification will be a part of the program
Increased burden on and competition for public service provision	- Worker accommodation will be established to reduce pressure on the facilities of the local communities. - Workers accommodations will be established in compliance with the Guidance by IFC and EBRD Workers' Accommodation: Processes and Standards to reduce pressure on the facilities of the local communities. The guidance includes but is not limited to 1. Basic collective social/rest spaces are provided to workers. Standards range from providing workers multi- purpose halls to providing designated areas for radio, TV,. 2. Recreational facilities are provided. 3. Workers are provided with dedicated places for religious observance if the context warrants. 4. 5. Internet facilities can also be provided, particularly where large numbers of expatriates/Third Country Nationals (TCNs) are accommodated (IFC, EBRD, 2009)

8.2.8 Cultural heritage, burial grounds and memorial days

<u>Cultural heritage General requirements</u>	<u>Pre-construction and Construction</u> - Need for discipline specialists to be engaged - Where historical remains, antiquity or any other object of cultural or archaeological importance are unexpectedly discovered during construction in an area not previously known for its archaeological interest (which is the case with all the locations on the alignment) the following procedures are - Ensure reconnaissance is undertaken as required by the national law during earthworks - Develop Cultural Heritage Management plan - Include chance finds procedure and implemented in order to provide management measures should an archaeological, cultural or heritage features be discovered. Furthermore, mitigation alternatives for the reduction of impacts upon areas of archaeological, cultural or heritage importance and proposed mitigation measures will be identified where possible - Incorporation of measures within the Detailed Design; - Relocation of artefacts identified in line with instructions from authorities; - Protection measures of areas identified/artefacts observed; - Monitoring of the condition of the identified areas/sites; and - Educating the public with regards to the importance of archaeological, cultural and/or heritage aspects
<u>Cultural heritage – burial grounds</u>	- In order to avoid any impacts during construction works, principles of zero impact measures must be in place to avoid any damages to the location itself from construction traffic. - Where the burial ground interface the construction works implement protective screens and consider adding noise and visual protection barriers

	▪ Engage with local community to respect and adjust working hours and/or specific type of works during (if any) funerals, traditional memorial days which fall differently each year. ▪ Ensure processes are put in place through stakeholder engagement and liaison with relevant church elders to identify the most important days in which the cemeteries are visited by the successors for remembrance.

8.3 Mitigation of cumulative impacts

To manage the cumulative impacts considering potential residential development of the wider area, as described in section 7.3, it is important to:

- Implement sustainable development practices, such as green building standards, energy efficiency measures, and low-impact designs to reduce the environmental footprint.
- Invest in infrastructure expansion and public services to keep pace with development.
- Encourage community engagement to address social concerns and ensure residents' needs are met in the face of growth.

Nevertheless, all cumulative impacts on the wider environment would be mitigated in case all further developments are bounded by the restrictions of the regional spatial plans.

8.4 Assessment of residual impacts

The assessment of the environmental and social impacts after the foreseen mitigation measures is presented in the tables below. Mitigation measures and their effectiveness, including that they are prescriptive and to be applied early on form Detailed Design influenced the assessment of the magnitude of the residual impacts. As shown, with the implementation of the mitigation measures, most of the negative impacts are low. It is noted, the implementation of the Environmental and Social Management Plan as well the regular monitoring of the environmental and social parameters will permit the continuous overview of the environmental and social performance of the Project and the adoption of necessary measures as necessary.

Table 8-7: Residual environmental impacts after mitigation measures

Phase	Impacts	Nature	Extent	Duration	Magnitude	Receptor Sensitivity	Significance Criteria (SC)	Likelihood (L)	Residual Impact
Topography & landscape									
C	Landscape and visual impact	-1	2	2	2	3	-2.25	4	-9
Air quality									
C	Exhaust emissions (heavy vehicles and construction equipment)	-1	1	2	1	2	-1.5	5	-8
C	Dust emissions	-1	1	2	1	2	-1.5	4	-6
C	Emissions from tunnel construction	-1	1	1	3	3	-2	3	-6
C	Emissions from construction of cuts, incisions and embankments	-1	1	1	3	3	-2	3	-6
O	Exhaust emissions (traffic)	-1	3	4	2	3	-3	3	-9
Climate change									
C	Exhaust emissions (heavy vehicles and construction equipment)	-1	1	2	1	3	-1.75	2	-4
O	Exhaust emissions (traffic)	-1	5	4	1	1	-2.75	2	-6
Noise									
C	Noise due to construction works	-1	1	2	2	3	-2	3	-6
O	Noise due to traffic	-1	1	4	1	3	-2.25	3	-7
Geology and soil									
C	Physical impact & erosion	-1	1	2	3	3	-2.25	4	-9
C	Contamination	-1	1	1	3	3	-2.00	2	-4
O	Contamination due to spills and leakages	-1	2	1	2	3	-2.00	1	-2
Water quality									
C	Run-off of pollutants during construction activities	-1	3	2	3	5	-3.25	2	-7
O	Run-off of pollutants	-1	3	2	3	5	-3.25	1	-3
Ecological resources and biodiversity									
Vegetation & habitats									
C&O	Habitat loss	-1	3	5	3	5	-4.00	2	-8

Phase	Impacts	Nature	Extent	Duration	Magnitude	Receptor Sensitivity	Significance Criteria (SC)	Likelihood (L)	Residual Impact
C&O	Fragmentation	-1	3	5	3	5	-4.00	2	-8
C&O	Pollution	-1	3	5	3	5	-4.00	1	-4
C&O	Spread of non native or invasive species	-1	3	5	3	5	-4.00	2	-8
C&O	Fish								
C&O	Disturbance due to noise & vibration	-1	3	5	3	5	-4	2	-8
C&O	Pollution	-1	3	5	3	5	-4	2	-8
C&O	Changes in watercourse	-1	3	5	3	5	-4	2	-8
	Amphibians and reptiles								
C&O	Habitat loss & degradation due to excessive vegetation removal	-1	3	5	3	5	-4	3	-12
C&O	Habitat fragmentation	-1	3	5	3	5	-4	2	-8
C&O	Pollution	-1	3	5	3	5	-4.00	2	-8
C&O	Direct mortality	-1	1	5	3	5	-3.50	2	-7
C&O	Disturbance due to noise & vibration	-1	1	2	3	5	-2.75	2	-6
	Birds								
C&O	Loss of habitat	-1	3	5	3	5	-4	3	-12
C&O	Disturbance due to noise & vibration	-1	1	2	3	5	-2.75	2	-6
C&O	Barrier effect	-1	1	2	3	5	-2.75	2	-6
C&O	Pollution	-1	1	2	3	5	-2.75	2	-6
	Mammals								
C&O	Fragmentation	-1	1	2	3	5	-2.75	2	-6
C&O	Disturbance due to noise & vibration	-1	1	2	3	5	-2.75	2	-6
C&O	Barrier effect	-1	1	2	3	5	-2.75	2	-6
Waste									
C	Impacts due to uncontrolled waste disposal	-1	2	2	3	4	-2.75	1	-3
O	Leaks, runoff	-1	2	2	2	4	-2.50	1	-3
O	Waste from maintenance activities	-1	2	2	2	4	-2.50	1	-3

Table 8-8: Residual social impacts after mitigation measures

Phase	Impacts	Nature	Extent	Duration	Magnitude	Receptor Sensitivity	Significance Criteria (SC)	Likelihood (L)	Overall Rating (IA) SCxL
Health and access to health services									
C	Impact on Health services capacities	-1	1	1	1	1	-1	1	-1
Infrastructure, facilities and public services									
C	Water supply disruption	-1	1	1	1	1	-1	1	-1
O	Pressure during operation activities	-1	3	4	3	1	-2.75	1	-2.75
Traffic and accessibility									
C	Disruption of traffic and accessibility	-1	1	1	1	1	-1	2	-2
C	Deterioration and of existing roads	-1	1	1	1	1	-1	2	-2
O	Improvement of traffic conditions and accessibility	1	1	4	3	1	3.25	5	16.25
Land acquisition and Resettlement									
C	Permanent land acquisition	-1	1	1	1	1	-1	2	-2
C	Temporary land acquisition	-1	1	1	1	1	-1	1	-1
C&O	Restrictions in land use	-1	4	4	5	1	-3.5	2	-7
C	Physical displacement	-1	1	5	4	1	-2.75	1	-2.75
Employment, Labour and Working Conditions									
C	Workers Accommodation	-1	1	2	1	1	-1.25	2	-2.5
C	Labour conditions	-1	1	2	3	3	-2.25	2	-4.5
C	Gender Based Violence (SH and SEA)	-1	1	1	1	3	-1.5	1	-1.5
Occupational health and safety									
C	Accidents, injuries and ill-health	-1	1	1	2	3	-1.75	2	-3.5
C	Unsafe and unhealthy workplace	-1	1	1	2	3	-1.75	2	-3.5
O	Accidents, injuries and ill-health	-1	1	1	1	1	-1	1	-1
Community health and safety									
C	Traffic and road safety	-1	1	1	1	3	-1.5	2	-3

C	Social tension from Influx of workers	-1	1	1	1	3	-1.5	1	-1.5
C	Gender based violence	-1	1	1	1	3	-1.5	1	-1.5
C	Site Trespass and Accidents	-1	1	1	2	1	-1.25	2	-2.5
C	Security Personell	-1	1	1	1	3	-1.5	1	-1.5
O	Health and safety risks during operation	-1	1	1	1	1	-1	1	-1
Cultural heritage and burrial grounds									
C	Chance finds	-1	1	1	1	3	-1.5	1	-1.5

9 Environmental and social management and monitoring

9.1 Environmental and social management plan

An Environmental and Social Management Plan (ESMP) is developed to address the identified environmental and social impacts and other performance improvement measures to meet the EBRD PRs, taking into account the findings of the environmental and social assessment process and the results of the stakeholder engagement.

The ESMP presents the actions that are envisaged for implementing the environmental and social mitigation measures for the project. Specific objectives of the ESMP are to:

- Provide a structured list of actions to be undertaken during the project lifecycle (pre-construction, construction and operation) to ensure that the environmental and social risks identified during the ESIA process are addressed according to the national requirements and the international good practices and standards
- Provide assurance to third parties that their requirements regarding environmental and social performance will be met.

The ESMP, which is annexed to the present ESIA report, has been prepared in line EBRD Environmental and Social Policy.

The ESMP specifies:

- The potential impacts per environmental and social topic as identified in the ESIA
- Proposed mitigation measures as identified in the ESIA
- Parties responsible for undertaking the proposed E&S actions.
- Cost (where applicable and/or possible to estimate at current stage)
- Indicators that can be used to assess performance of the mitigation measure
- Monitoring procedures

9.2 Environmental monitoring

Pursuant to the Law on Environment ("Official Gazette of Montenegro 52/2016"), an entrepreneur who uses facilities that pollute or may cause environmental pollution is obliged to conduct monitoring in accordance with special regulations. Monitoring of the state of the environment is a legal obligation. The state environmental monitoring program is implemented by the Environment Protection Agency of Montenegro through authorized institutions.

In addition to monitoring of the state of the environment carried out by the Environment Protection Agency, according to the Law on Environment ("Official Gazette of Montenegro No. 52/16) the polluter (legal entity or entrepreneur who uses plant that pollutes the environment) is also obliged to monitor the state of the environment and to submit registered data to the Environment Protection Agency.

Monitoring of the state of the environment is carried out by measuring, testing and evaluating indicators of the state of the environment and include monitoring of natural factors, changes of the state and characteristics of the environment. The parameters based on which the impact of some facility on the environment are defined by environmental legislation.

The design and implementation of environmental quality monitoring in the Mateševu-Andrijevića section, will provide information that will enable the assessment of the effectiveness of the proposed protective measures, definition and undertaking of additional protective measures to prevent or reduce further deterioration of environmental quality, and the establishment of a system for early warning and introduction of necessary improvements.

The environmental impact monitoring program includes programs for monitoring environmental impacts during the construction phase and the operational phase of the highway.

To meet environmental requirements during construction, it is necessary for the contractor, through a consulting company, to hire specialists in environmental protection (ecological experts), biologists, speleologists, geologists, hydrologists, chemists, and technologists. This ensures the multidisciplinary approach required for environmental protection. These specialists will oversee the construction methods and provide instructions for improving environmental conditions.

One of the fundamental rights of every individual, as established by the Constitution of Montenegro, is the right to live in a healthy environment. Data on the state of the environment, including its essential elements, should be accessible to all citizens. All reports on environmental quality testing and monitoring results during the construction and operation phases of the highway should be submitted by the contractor and by the highway operator, respectively, to the Environmental Protection Agency and to the local environmental authorities in the municipalities of Kolašin and Andrijevića.

In addition to the project owner, relevant ministries and responsible institutions, the results of these tests should also be communicated to the public, especially to the residents of settlements affected by the planned activities. This notification can be carried out through printed and electronic media, at least once a year. The obligation to inform the public lies with the project owner, including the obligation to publish the reports on their own website.

9.2.1 Flora & fauna

During the **construction** of the road (in consultation with experts), it is necessary to monitor the populations of species that are defined as particularly important for monitoring in the localities that are designated as their habitats. An authorized and accredited ecosystem research organization or a multidisciplinary team of biologists/ecologists should carry out monitoring.

Monitoring of forests and timber, during the construction of the highway, are the subject and an integral part of the overall Monitoring process, and the deposition of timber is the subject of location selection and a dedicated project. The basis for forest monitoring on the highway route are: Law on Forests (Official Gazette of Montenegro 74/10, 40/11 and 47/15), Law on Waste Management (Official Gazette of Montenegro 64 /11 and 39/16), Rulebook on waste classification and waste catalogue (Official Gazette of Montenegro 59/13 and 83/16).

After the construction of the highway, all the necessary recultivation and reclamation of the terrain shall be carried out, in the scarp zone and in the protective belt of the highway. Reclamation and recultivation is carried out with the vegetation, and where necessary, also with special measures and/or protective facilities.

As mentioned in section 8.1.6, during pre-construction phase a loss/gain analysis shall be performed to ensure that for the habitats identified in the project area and characterised as PBF, no net loss is achieved, while for the habitat 91E0* and the species that qualify as CH as per EU legislation, net gain is achieved (see section 9.2.6). The loss/gain analysis shall be in compliance with the guidelines of EBRD and be expressed using adequate KPIs, such as:

- Change in Habitat Area (ha or % change).
- Habitat Condition Index (scale-based assessment)
- Biodiversity Offset Ratio (restoration to loss ratio)
- Implementation of Biodiversity Action Plans (% of actions completed)

During **operation**, the highway operator is obliged to monitor the fauna, specifically the impact of highway operation to the migratory routes of reptiles, amphibians, large mammals and birds during the first three years of operation. The scope and methodology of monitoring is shown in the following table:

Table 9-1: Scope and methodology of fauna monitoring during operation

Scope	Methodology
Animal casualties	• Roadkill Surveys: Regular patrols along the highway to document dead animals, noting species, location, and time. • Citizen Reporting Systems: Engaging local communities, drivers, and maintenance crews to report roadkill incidents via mobile apps or hotlines.
Threats to endemic, strictly protected, and protected animal species	• Periodic surveys to assess population size, behavior, and health of key species. • Assessment of the air quality, noise, water quality monitoring results
Impeded migration of certain animal species (mating, search for food and water, etc.),	• Monitoring wildlife crossings, overpasses, and underpasses to track usage. • Regular inspections to ensure fences are intact and do not inadvertently trap animals.
Reduction in biological diversity	• Seasonal surveys

The findings shall be documented and reported to the environmental authorities. Reporting shall include:

- Monitoring objectives and legal obligations.
- Methodology applied
- Results
 - Quantitative and qualitative findings
 - Comparison with baseline data and previous monitoring periods.
 - Analysis of patterns and trends if any
- Recommendations and mitigation measures
- Conclusions

The highway operator should also monitor the ecological structure of the landscape, i.e., the visual characteristics of the landscape, one year after the completion of construction, and then every five years thereafter.

In accordance with the Law on Forests ("Official Gazette of Montenegro" number: 74/2010, 40/2011 and 47/2015), the Investor is obliged to contact the competent state authority for forest management with the aim of preparing study on felling trees within Project area, which would define the quantity, types and quality of cut trees in the Project area.

9.2.2 Air quality

Air quality measurements must be carried out during the execution of the works and during the operation of the road. Monitoring is performed by an authorized organization accredited according to the MEST ISO 17025 standard.

Construction phase

The pollutants to be monitored during construction phase are SO₂, NO₂, PM₁₀, PM_{2.5}, CO, C₆H₆. The locations are proposed to be the ones where the surveys during the ESIA process were conducted. Additionally, air quality monitoring shall be conducted during periods of intense activities that may have impacts, such as blasting, drilling of mine holes and tunnel portals.

Operation phase

Monitoring of the air quality in the highway impact zone during its operational phase is mandatory, in accordance with the Law on environmental protection (Official gazette of Montenegro 52/16), the Law on air protection (Official gazette of Montenegro 25/10, 40/11 and 43/15), the Rulebook on the method and conditions of air quality monitoring (Official gazette of Montenegro 21/11), and the Regulation on determining the types of pollutants, limit values, and other air quality standards (Official gazette of Montenegro 25/12).

Air quality measurements must be evenly distributed throughout the year. This includes the following possibilities:

- 24-hour measurement once a week throughout the year, on a randomly selected day or
- measurement during eight weeks (evenly distributed throughout the year) so that it is representative of different climatic and other conditions, ie, the criterion of a minimum time of 14% on an annual level is met.

It is recommended that air quality measurement should be carried out at the same measuring were measurements for the baseline were performed. In this way, the impact of the road on the environment will be monitored.

In the national EIA it is recommended that the development of the air quality monitoring program should be gradual. In the first phase of targeted measurements, concentrations of sulphur dioxide, nitrogen dioxide and nitrogen oxides, suspended particles (PM₁₀; PM_{2.5}), lead, benzene, carbon monoxide, ground-level ozone, arsenic, cadmium, mercury, nickel, benzo(a)pyrene (as a marker for polycyclic aromatic hydrocarbons) and fluorides should be measured. If measurement results do not indicate exceedance of the limit values prescribed by the Regulation on determining the types of pollutants, limit values, and other air quality standards (Official gazette of Montenegro 25/12), the list of pollutants can be narrowed to the measurement of nitrogen dioxide (NO₂) and suspended particles (PM₁₀; PM_{2.5}) concentrations.

It is necessary to measure meteorological parameters for the measuring location: wind direction, speed, and strength; air temperature; humidity; atmospheric pressure; precipitation; visibility; cloud cover; cloud type, cloud base height, insolation, etc. Additionally, during the sampling period, traffic count shall be conducted, to provide data of traffic load by vehicle categories (PA, TV) during the measurement period.

The air quality monitoring network should cover all settlements in the impact zone of the highway section, as well as the entrance and exit portals of tunnels.

If the results of periodic measurements indicate the need for more detailed air quality monitoring, more frequent air quality monitoring should be conducted.

During the first phase of monitoring, which should last for 5 years, periodic air quality monitoring (one month per season) is necessary, because measurement data for at least five consecutive years are required in order to determine air pollution trends. Only if the results of periodic measurements indicate the need for further air quality monitoring, should continuous air quality monitoring be conducted, i.e., the second phase of monitoring should be implemented.

9.2.3 Surface waters

During the **execution of the works**, and especially during the operation of the road, it is necessary to monitor quality of the surface waters. Monitoring is performed by an authorized organization accredited according to the MEST ISO 17025 standard.

During construction, it is necessary to monitor the quality of surface and groundwater at specific locations which will be determined in the detailed design. Priority shall be given to locations where works are in vicinity with water courses, and especially where particular activities are performed e.g., asphalt production plants, concrete plants, crushing plants and camps.

Monitoring of surface waters shall be performed according to the national legislation: Water Law ("Official Gazette of Montenegro" No. 27/07 and "Official Gazette of Montenegro" No. 32/11, 47/11, 48/15 and 52/16), Regulation on quality and sanitary-technical conditions for wastewater discharge, manner and procedure of testing wastewater quality and content of the report on determined wastewater quality ("Official Gazette of Montenegro" No. 056/19), Regulation on the method and deadlines for determining the status of surface waters (Official Gazette of Montenegro No. 25/19).

In order to monitor the impact of the **operation** of the highway on surface water, surface water quality monitoring should be carried out at the same measuring points as in the baseline analysis. Monitoring is carried out by an authorized organization accredited according to the MEST ISO 17025 standard.

During the operation of the project, it is mandatory to test the quality of wastewater from the biological purifier.

9.2.4 Land quality

The highway operator shall monitor the condition of soil, surface and groundwater, and test the content of hazardous and harmful substances within, in accordance with the Law on environmental protection (Official gazette of Montenegro 52/16), the Law on waters (Official gazette of Montenegro 27/07, 22/11, 32/11, 47/11, 48/15, 52/16, 55/16, 2/17, 80/17, and 84/18), the Law on agricultural land (Official gazette of Montenegro 15/92, 27/94, and 32/11), the Rulebook on permissible concentrations of harmful and hazardous substances in soil and methods for their testing (Official gazette of Montenegro 18/97), and the Regulation on classification and categorization of surface and ground waters (Official gazette of Montenegro 2/07).

In addition to the basic parameters and indicators of soil quality (pH value, organic carbon content, cation exchange capacity, conductivity, dry matter content, particle size distribution and density), it is necessary to monitor specific pollutants, i.e., the total concentrations of the following elements: Cadmium (Cd), Lead (Pb), Mercury (Hg), Arsenic (As), Chromium (Cr), Nickel (Ni), Fluorine (F), Copper (Cu), Zinc (Zn), Boron (B), Cobalt (Co), Molybdenum (Mo), Mineral oils and Polycyclic aromatic hydrocarbons (PAH).

Preliminary soil quality monitoring in the impact zone of this highway section should last at least five years, with sampling conducted once every three months. After preliminary testing, if necessary, a plan for further research is made. For this purpose, the sampling location is first defined. The number of samples depends on preliminary testing, related to the subject of examination.

9.2.5 Noise

During the construction phase of the project, the increased noise level in the environment will occur. The Investor is advised to measure the noise level during the execution of preparatory works, as well during earthworks. In addition, during the operation of the road, there will be an increased noise level due to the large impact of the road, so it is necessary to monitor the noise even during the operation of the road. Noise level monitoring is performed by an authorized organization accredited according to MEST ISO 17025 standard that has a permit for measuring noise levels in the environment issued by the Environment Protection Agency.

Noise monitoring shall be in conformity with the Law on Protection from Noise Pollution in the Environment ("Official Gazette of Montenegro", No. 28/11, 28/12, 01/14), Rulebook on limit values of noise in the environment, the manner of determining noise indicators and acoustic zones and methods of assessing the harmful effects of noise ("Official Gazette of Montenegro", No. 60 /2011).

Monitoring of the noise level produced by vehicles on the road should be monitored on a quarterly basis for the first three years after the construction (commissioning) of the road, and then every three years in residential areas. The obtained results are compared with the measured data stated in the zero-state report and with the legally maximum allowed noise levels per zone for the period of day, evening and night. The measurement interval (reference time - as the time range to which the relevant noise level refers) is determined according to the type of noise. The minimum measurement interval must be long enough to include the entire cycle of changes in noise level in the observed area. In the case of variable noise, the level is measured during the day in at least two measurement intervals, during the evening hours in one measurement interval, and during the night in two intervals, whereby each interval lasting at least 15 minutes. The maximum measurement interval for the day is from 7:00 a.m. to 7:00 p.m., for the evening from 7:00 p.m. to 11:00 p.m., and for the night from 11:00 p.m. to 7:00 a.m.

The noise level tests should be carried out at the same measuring points as for the baseline study.

9.2.6 Environmental monitoring plan

The Environmental monitoring Plan is summarized in the following table:

Table 9-2: Environmental Monitoring Plan

Parameter	Location	Means	Timing	Objective	Estimated cost	Responsibility
Construction						
Air quality SO ₂ , NO ₂ , PM ₁₀ , PM _{2.5} , CO, C ₆ H ₆	Sensitive receptors (1) at 1+300 1+700, (2) Bare Kraljske settlement at 5+400 8+000, (3) Gnjili Potok settlement at 13+850 - 17+140, (4) Kralje village at 17+350 - 18+750 and (5) Andrijevisa (north) at 20+200 - 23+100.	Mobile equipment	Twice per month	To monitor impacts on air quality	Within construction cost	Construction contractor
Noise Lday, Levening and Lnight	- Construction sites boundaries - As per air quality monitoring	Mobile equipment	- Weekly - Once per month	To monitor impacts on acoustic environment	Within construction cost	Construction contractor
Water Quality Temperature, pH, - NH ₄ , NO ₂ , NO ₃ , pH, BOD ₅ , COD, phosphates, suspended matter, total mineral oils (TPH), oils and fats, PAH (polycyclic aromatic hydrocarbons).	Water quality: Locations to be determined during detailed design. Priority to locations where works are in vicinity with water courses.	Sampling and chemical analysis in laboratory	Quality: Once per month Quantity: continuously	To monitor impacts on water quality and quantity	Within construction cost	Construction contractor

Parameter	Location	Means	Timing	Objective	Estimated cost	Responsibility
Water quantity continuous and systematic measurement of the volume of extracted water .	specific locations, e.g., asphalt production plants, concrete plants, crushing plants and camps. Water quantity: intake points					
Solid waste management Construction and demolition waste quantities SW quantities	Construction site	Quantity measurement	Once per month		Within construction cost	Construction contractor
Habitats	In areas PBF and CH	Survey	I. Pre-construction II. End of Construction	I. To perform loss/gain analysis II. To ensure that no net loss / net gain are achieved	Within construction cost	Construction contractor
Birds	Determine bird breeding locations	Survey	Twice per year	To minimise adverse impacts	Within construction cost	Construction contractor
Mammals	Monitor population of mammals	Survey	Twice per year	To minimise adverse impacts	Within construction cost	Construction contractor
River ecosystem condition	River flows in the contact zone of construction activities	Observation	Monthly	Assess river ecosystem condition	Within construction cost	Construction contractor
Fish fauna	Drcka River (42°45'9.72"N 19°34'15.65"E), Zlorečica River	Sampling using electrofishing equipment. Transects 50 to 150	i. Pre-construction	i. To confirm baseline population ii. To assess adverse impacts	Within construction cost	Construction contractor

Parameter	Location	Means	Timing	Objective	Estimated cost	Responsibility
	(42°43'47.62"N 19°47'41.20"E), Lim River (42°44'35.63"N 19°47'35.16"E), Kraštica (42°44'6.34"N 19°46'22.46"E)	m in length, depending on the river flow; CPUE and NPUE calculated, and analysis of the investigated populations (age structure) performed	ii. Annually during low water period			
Benthic fauna	Drcka River (42°45'9.72"N 19°34'15.65"E), Zlorečica River (42°43'47.62"N 19°47'41.20"E), Lim River (42°44'35.63"N 19°47'35.16"E), Kraštica (42°44'6.34"N 19°46'22.46"E)	Hand net collection of benthic fauna washed off from the substrate and rocks; semi-quantitative manual sampling technique from all available microhabitats; Margalef Index calculation	Annually during low water period	To minimise adverse impacts		
Aquatic microinvertebrates	Gnjili Potok	Survey	Quarterly	To minimise adverse impacts	Within construction cost	Construction contractor
Bats	recorded roost sites	observation, netting, acoustic detection	Summer before construction	To assess pre- construction conditions	Within construction cost	Construction contractor
Operation						
Air quality SO ₂ , NO ₂ , NO _x , PM ₁₀ , PM _{2.5}), Pb, C ₆ H ₆ , CO, O ₃ ,	Sensitive receptors (1) at 1+300 1+700, (2) Bare Kraljske settlement	Mobile equipment	One month per season for the first 5 years of operation	To ensure good ambient quality and minimise disturbance	9000 per campaign	operator to procure measurement campaigns

Parameter	Location	Means	Timing	Objective	Estimated cost	Responsibility
metals (As, Cd, Hg, Ni), BaP, fluorides	at 5+400 8+000, (3) Gnjlj Potok settlement at 13+850 - 17+140, (4) Kralje village at 17+350 - 18+750 and (5) Andrijeviča (north) at 20+200 - 23+100. Entrance and exit of the tunnel		Continuous in case of exceedances			
Noise L _{day} , L _{evening} and L _{night}	Sensitive receptors (1) at 1+300 1+700, (2) Bare Kraljske settlement at 5+400 8+000, (3) Gnjlj Potok settlement at 13+850 - 17+140, (4) Kralje village at 17+350 - 18+750 and (5) Andrijeviča (north) at 20+200 - 23+100.	Mobile equipment	Four times a year during the first three years of highway operation, and later at least once a year.	To ensure good acoustic environment and minimise disturbance	12000 per campaign	operator to procure measurement campaigns
Water quality Surface water: Chemical Oxygen Demand (COD), Biochemical Oxygen Demand (BOD ₅), pH, Water temperature, Heavy metal	Drcka River (Mateševu) and Kraštica River	Sampling and chemical analysis in laboratory	As per existing automatic stations	To assess impacts on water quality		Operator to assess the monitoring results

Parameter	Location	Means	Timing	Objective	Estimated cost	Responsibility
content, Electrical conductivity, Mineral oil content, Chlorides (Cl^-) and Sulphates (SO_4^{2-}). Groundwater: Dissolved oxygen, pH, Nitrates (NO_3^-), Ammonia (NH_4^+) and Electrical conductivity. Heavy metals (Pb, Cu, Ni, Cd), Total content of fats and oils, Content of mineral oils, Chemical Oxygen Demand (COD), Biochemical Oxygen Demand (BOD_5), Chlorides (Cl^-), Sulphates (SO_4^{2-}).						
Wastewater quality	1.at each outflow, before the wastewater mixes with the recipient water	Sampling and chemical analyses	Once a month	To ensure that wastewater is of proper quality before entering recipient		operator to procure measurement campaigns
For reptiles, amphibians, large mammals and birds - Animal casualties, - Population of species - Impeded migration of certain animal species (mating, search for food and water, etc.), - Reduction in biological diversity.	Highway zones, migratory routes	Patrols, Observations, Inspections, Field surveys	During the first three years	To assess operation impacts to flora / fauna and take additional mitigation measures if required		Operator staff to perform patrols and inspections Operator to procure measurement campaigns

Parameter	Location	Means	Timing	Objective	Estimated cost	Responsibility
Bats	Recorded roost sites Underpasses	Rapid assessment, observation Observation & recording	summer and autumn spring, summer, and autumn	To observe bat presence in the roosts To observe any carcasses around underpasses		Operator
Fish Fauna Survey	Same as in construction	Sampling using electrofishing equipment. Transects 50 to 150 m in length, depending on the river flow; CPUE and NPUE calculated, and analysis of the investigated populations (age structure) performed	First, third and fifth year after finishing of construction phase	To assess the conditions and mitigate any identified deficiencies		operator to procure measurement campaigns
Benthic Fauna Survey	Same as in construction	Hand net collection of benthic fauna washed off from the substrate and rocks; semi-quantitative manual sampling technique from all available microhabitats;	First, third and fifth year after finishing of construction phase	To assess the conditions and mitigate any identified deficiencies		operator to procure measurement campaigns

Parameter	Location	Means	Timing	Objective	Estimated cost	Responsibility
		Margalef Index calculation				
Land quality General parameters: pH value, organic carbon content, cation exchange capacity, conductivity, dry matter content, particle size distribution and density Specific pollutants: Cd, Pb, Hg, As, Cr, Ni, F, Cu, Zn, B, Co, Mo, Mineral oils and (PAH)	Bare Kraljske (5+150) Gnjlji Potok – Miravčine (15+680).	Sampling and chemical analysis in laboratory	once every three months for the first five years of operation	To ensure that soil quality is not deteriorated		operator to procure measurement campaigns
Landscape the visual characteristics of the landscape	Throughout the alignment	Visits, satellite and photographic documentation	One year after the completion of the construction and then once every five years			

9.3 Social monitoring

Social monitoring is designed as a set of systematic and ongoing process of collecting, analysing and using information about the progress of programs and activities over time, and their strengths and limitations, to help guide and improve performance and assess outputs and activities.

Given some of the sensitive issues identified it needs to be developed in partnership between the primary stakeholders i to collaboratively design and systematically implement an M&E process, develop tools, set objectives and indicators, and share concerns, experiences and learnings.

Monitoring of social impacts will have the following structure:

Table 9-3: Monitoring of social impacts

	What (is the parameter to be monitored?)	Where (is the parameter to be monitored?)	How (is the parameter to be monitored?)	When (Define the frequency / or continuous?)	Why (Is the parameter being monitored?)	Cost (if not included in project budget)	Who (Is responsible for monitoring?) Implementation/reporting Monitoring
PRE-CONSTRUCTION PHASES							
1.	Alignment of the Detail Design with the requirements to minimize displacement impacts	-	By reviewing Detail Design and including adaptive design management	During development of Detail Design and before beginning of construction works	To ensure alignment with the mitigation hierarchy	Included in project budget	EPC Contractor ENGINEER
CONSTRUCTION PHASE (monitoring according to Metrics for Reporting)							
GENERAL CONDITIONS							
2.	Obtaining permits and certificates	On construction site	By inspecting the site and keeping written records, Supervising Engineer report	At the start of construction works	To ensure workers safety and minimize the risks of accidents	Included in project budget	EPC Contractor Supervising Engineer MONTEPUT
3.	Site organization	On construction site	By inspecting the site and keeping written records, Supervising Engineer report	Monthly	To ensure workers safety and minimize the risks of accidents	Included in project budget	EPC Contractor Supervising Engineer PIU's Environmental and Social Specialists
OCCUPATIONAL HEALTH AND SAFETY AND COMMUNITY SAFETY							
4.	Worker's safety	On construction site	By inspecting the site and keeping written	Daily	To ensure workers safety	Included in project budget	EPC Contractor Supervising Engineer

	What (is the parameter to be monitored?)	Where (is the parameter to be monitored?)	How (is the parameter to be monitored?)	When (Define the frequency / or continuous?)	Why (Is the parameter being monitored?)	Cost (if not included in project budget)	Who (Is responsible for monitoring?)
							Implementation/reporting Monitoring
			records, Supervising Engineer report				PIU's Environmental and Social Specialists
5.	Discrimination against women/vulnerable groups in the hiring process of workers	On construction site	By inspecting the site and keeping written records, Supervising Engineer report	Monthly	To ensure workers and community safety	Included in project budget	EPC Contractor Supervising Engineer PIU's Environmental and Social Specialists
6.	Labor influx	On construction site	By inspecting the site and employment records, keeping written records, Supervising Engineer report	Monthly	To ensure workers and community safety	Included in project budget	EPC Contractor Supervising Engineer PIU's Environmental and Social Specialists
7.	Sexual Exploitation and Abuse (SEA)/ Sexual Harassment (SH)	On construction site	By inspecting the site and keeping written GRM records, Supervising Engineer report	Monthly	To ensure workers and community safety	Included in project budget	EPC Contractor Supervising Engineer Building contractor and PIU's Environmental and Social Specialists
8.	Community safety	On construction site	By inspecting the site, GRM records, and keeping written records,	Monthly	To ensure community safety	Included in project budget	EPC Contractor Supervising Engineer PIU's Environmental and Social Specialists

	What (is the parameter to be monitored?)	Where (is the parameter to be monitored?)	How (is the parameter to be monitored?)	When (Define the frequency / or continuous?)	Why (Is the parameter being monitored?)	Cost (if not included in project budget)	Who (Is responsible for monitoring?) Implementation/reporting Monitoring
			Supervising Engineer report				
ACCIDENT AND EMERGENCIES							
9.	Accident/incident	On construction site	By inspecting the site and keeping written records, Supervising Engineer report	Monthly	To ensure workers and community safety	Included in project budget	EPC Contractor Supervising Engineer PIU's Environmental and Social Specialists
10.	monitoring related to labour and occupational health and safety (OHS) including occurrence of fatalities, serious or permanent injuries	On and off Construction site	OHS Monthly Reports	Monthly	To implement preventive measures and prevent recurrence and ensure safe workplaces	Included in Project Budget	EPC Contractor Supervising Engineer PIU's Environmental and Social Specialists
CULTURAL HERITAGE							
11.	Potential chance finds	On construction site	By inspecting the site and keeping written records, Supervising Engineer report	During earthworks	To protect cultural heritage	Included in project budget	EPC Contractor Supervising Engineer PIU's Environmental and Social Specialists
STAKEHOLDER ENGAGEMENT							
12.	Social conflicts arising from presence	On construction site	By interviewing the Contractor	During construction	To keep records of all complaints	Included in project budget	EPC Contractor Supervising Engineer

	What (is the parameter to be monitored?)	Where (is the parameter to be monitored?)	How (is the parameter to be monitored?)	When (Define the frequency / or continuous?)	Why (Is the parameter being monitored?)	Cost (if not included in project budget)	Who (Is responsible for monitoring?)
							Implementation/reporting Monitoring
	of construction personnel and construction works		and Supervising Engineer and keeping written records				PIU's Social Specialist
13.	Contractor's GRM	On construction site	The Contractor will be required to prepare and enforce a Code of Conduct for workers and report on regularly basis all related incidents that occur during the construction works.	During construction	To raise workplace concerns	Included in project budget	EPC Contractor Supervising Engineer PIU's Social Specialist
IMPACT TO LAND							
14.	Land Acquisition and involuntary resettlement	Along the alignment	In line with Table 5 of the LARF	Continuous	Ensure compliance with LARF, and EBRD PR 5 a	Included in Project Budget	MONTEPUT
15.	Encroachment beyond land acquired for the Project	On Construction Site	Visual inspection Project GRM	Continuous	Avoiding damages to private land and assets	Included in Project Budget	Supervising Engineer PIU's Social Specialist

	What (is the parameter to be monitored?)	Where (is the parameter to be monitored?)	How (is the parameter to be monitored?)	When (Define the frequency / or continuous?)	Why (Is the parameter being monitored?)	Cost (if not included in project budget)	Who (Is responsible for monitoring?)
							Implementation/reporting Monitoring
16.	Land lease and reinstatement by EPC Contractor for camp facilities etc.	On Construction Site	Inspecting the Lease agreements GRM Stakeholder interviews	Continuous	Ensuring land is leased and reinstated in line with the LARF entitlement Matrix	Included in Project Budget	Supervising Engineer PIU's Social Specialist

It is obvious that some of the features of the Project design might undergo changes during the Detailed Design Phase. The Monitoring tools are complemented by the GRM. The social monitoring shall include monitoring of the following indicators:

- Community and Occupational health and safety hazards (during construction and operation)
 - Construction site management plan with adequate sanitary facilities
 - Fencing of construction sites and marked with high visibility
 - Contractor periodic reports
 - Danger warning signs
 - EHS training records
 - Use of PPE
 - Records on Community Sensitisation records on construction related risks
- Social conflicts (throughout the project cycle)
 - Grievances and complaints recorded
- Loss of land (at pre-construction / construction phase)
 - Land Acquisition Plan and Records
 - Compensation and Relocation Assistance records
 - Livelihoods Restoration Plan
 - Complaints recorded and addressed
- Cultural property (Preconstruction/construction phase)
 - Chance Find procedures implementation records

10 Selected Bibliography and Data sources

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