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Volume 1: Environmental and Social Impact Assessment Report

Chapter 6 Biodiversity

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Chapter 6 Biodiversity

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The Infrastructure Project Facility (IPF) is a technical assistance instrument of the Western Balkans Investment Framework (WBIF) which is a joint initiative of the European Union, International Financial Institutions, bilateral donors and the governments of the Western Balkans which supports socio-economic development and EU accession across the Western Balkans through the provision of finance and technical assistance for strategic infrastructure investments. This technical assistance operation is financed with EU funds.
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8	31/12/2025	ESIA Report – Chapter 6 Biodiversity	Team of experts	Irem Silajdžić	Richard Thadani

CONTENTS

List of tables

List of figures

6 Biodiversity

6.1 Introduction

This chapter reports findings of the assessment of the baseline conditions and potential impacts on biodiversity of the Project during both the construction and operational phases.

The assessment of the Project has been undertaken through a desktop study and extensive field surveys of habitats, flora, and fauna (invertebrates, fish, amphibians, reptiles, birds and mammals).

Where appropriate, this chapter also identifies proposed mitigation measures to minimise or control likely adverse effects arising from the project.

The biodiversity assessment of the Project is presented in a number of interlinked documents that discuss different aspects on biodiversity issues that must be a part of the ESIA.

This Chapter should be read in conjunction with the following ESIA Chapters:

Chapter 1	Introduction
Chapter 2	About the Project
Chapter 3	Detailed Project description
Chapter 4	Policy, legislative and institutional context
Chapter 5	Assessment methodology
Chapter 17	Cumulative impacts
Chapter 18	Residual impacts
Chapter 19	ESMP.

Additionally, biodiversity topics are referred to in other documents of the 2025 ESIA disclosure package as well:

- Annexes A to C-5 Annexes provide detailed information about performed surveys, findings, photographs, maps
- Annex D Critical Habitat Assessment
- Annex E Appropriate Assessment
- Volume 3 ESAP
- Volume 4 Biodiversity Management Plan

6.2 Baseline Conditions

6.2.1 Ecologically Appropriate Area of Analysis

The first step in planning and conducting surveys is determination of study area. Initial observed area was the Project layout and 1,000 m-wide buffer around the motorway. However, in order to gather reliable data, acquire a better general picture and provide basis to adequately assess impacts on biodiversity, further refinement of the area was needed. The ecologically appropriate area of analysis (EAAA) is determined to include the "wider distribution of potentially affected biodiversity features and the ecological patterns, processes and functions that

are necessary for maintaining them throughout this distribution"[1]. The project area of influence reflects ecological characteristics of the area and biology of found biodiversity features based on conducted field research, characteristics of surrounding habitats and ecosystems (e.g., habitat type, land use, natural barriers), literature data, known distribution and expert opinion for each individual species.

Determination of EAAA is done separately for every biodiversity receptor, unless species belonging to a certain group have significant EAAA-overlap and EAAAs can be aggregated. In case of uncertainty around distribution, conservative approach was applied and EAAA slightly enlarged as a part of precautionary measures. Further evaluation of EAAA was done with regard to extent of occurrence (EOO) based on IUCN data (if available) and expert inputs to facilitate critical habitat assessment (CHA).

Taking into consideration the above, the area of aggregated EAAAs relevant for the Project is estimated at approximately 41,378 ha. It was designed to include EAAAs of species and habitats of conservation concern such as:

- localities where endangered or geographically restricted flora species listed in Annex A: Habitats, vegetation and invasive species were found: Podporim/Porim, Kuti-livac, Humi, Podgorani, Ovcari, Koritna Draga, Podgorani and Polje Bijela;
- habitats listed in Annex I of Habitats Directive, with focus on (*) priority habitats: Ovcari and Mt. Zlatar, area east of northern portal of Prenj tunnel, north of Mostar, Polje Bijela;
- habitats of invertebrates of conservation concern, including Podgorani, Polje Bijela, Humilisani, Kuti-Livac, Podporim and Rakov Laz;
- natural salmonid spawning grounds which are situated on the river Neretva from the mouth of the river Krupac to the Old bridge in Konjic and from the Old Bridge to the mouth of the river Tresanica;
- habitats important to endangered amphibians and reptiles, as well as amphibians' breeding sites near river Tresanica, two periodical streams in Ovcari, Podvrabac stream in Mladeskovici, Klenovik spring, ponds Zelenika and Bosnjaci, unnamed stream on Repovica;
- territories of (i) great cormorant (*Phalacrocorax carbo*) and common kingfisher (*Alcedo atthis*) in Konjic, (ii) middle spotted woodpecker (*Dendrocopos medius*) in Konjic, Polje Bijela, Mladekovici, Zelenika and Humi, (iii) black woodpecker (*Dryocopus martius*) in Rakov Laz, (iv) white-backed woodpecker (*Dendrocopos leucotos*) located parallel to the motorway on chainages between 10 + 200 km and the Prenj tunnel, (v) male turtle dove (*Streptopelia turtur*) on chainage between 26+800 and 26+950 and (vi) abandoned nest of golden eagle (*Aquila chysaetos*) in Klenova Draga;
- Konjicka Bijela due to highest bat diversity among surveyed sites;
- identified speleological objects.

[1] EIB Guidance Note for Standard 3 on Biodiversity and Ecosystems, 2018

6.2.2 Assumptions and Limitations

The current level of preparedness of the project documentation, e.g., the lack of the Main Design, may be considered as a limitation factor with regard to some environmental and social aspects, while in general for biodiversity aspect the level of preparedness of the project documentation may be considered as somewhat beneficial since all requirements, potential avoidance and mitigation measures of this ESIA and BMP may be included during development of the Main Design. However, all essential information regarding access roads, interchanges and disposal sites are available. Any limitations regarding (potential) borrow pits will be outlined in the ESMP as those locations are not yet known.

Although Consultant experienced few limitations during the field work (Table 6-1), mainly caused by lack of existing data, this has been compensated with data collection in field surveys and other sources (by engaging and consulting experienced local biodiversity experts that are/were included in various biodiversity surveys in the project area an wider region of Herzegovina). Amount and quality of data collected during 2020, 2021 and 2022 was deemed satisfactory for the purpose of completing this ESIA. Biodiversity Management Plan based of experts' findings and recommendations has been written and published along with this ESIA Study. Upon implementation of mitigation and monitoring measures, including additional verification surveys and monitoring focused on species of conservation concern, BMP should be updated with potential new findings, disclosed and agreed with the Lenders, to ensure all provisions of EBRD PR 6 and EIB Standard 4 are fully implemented.

Table 6-1: Assumptions and limitations

Issue	Brief description
Precision of Project documentation	In the absence of Main Design, exact locations of (potential) borrow pits are not known. Limitations regarding the locations will be highlighted as a part of the ESMP so they are in line with EBRD PR 6 and EIB Standard 4.
Access to impassable terrain and private properties	Some parts of the site (screes and garrigue) were not accessible due to impassable terrain, so the survey had to be done by observing the area with binoculars and through extrapolation based on observations and comparison with adjacent habitats. In some cases, it was not possible to access private properties due to fencing, where only a part of the species visible from the local road could be identified.
Mines	Land mine-infested areas are well known for Mt. Prenj. The mines are present in the area south of Polje Bijela towards north portal of Prenj tunnel. They are located east of the planned motorway route and are the closest to the route in the wider area of Mladeskovici. The limitation was not major and was overcome by extrapolation from adjacent habitats.
Assumptions and limitations related to investigation of habitats and flora	The areas under mines presented a negligible limitation for biodiversity surveys due to marginal position in relation to the project's area of influence. Binoculars were used to estimate habitat conditions along with comparison with accessible adjacent habitats.

Issue	Brief description
Assumptions and limitations related to investigation of fauna	The Consultant assumed no assumptions or limitations except impassable terrain, private properties, landmines, the scarce data on faunal diversity available for the project area. The limitation was minor and were successfully overcome by observations of adjacent habitats. Capturing of bats by using mist nets has not been undertaken since the administrative permission from the Federal Ministry of Environment and Tourism is needed for these activities. This is a negligible limitation as the bat surveys was performed using bat detectors and identification of roosting sites.
Assumptions and limitations related to data on protected areas, potential Natura 2000 sites, candidate Emerald sites	BiH ratified the Bern Convention in 2008 and is obligated to follow the requirements for designation of Emerald sites and conservation of habitats and species protected by the Convention. It is important to note that the Government of BiH/FBiH has not yet proclaimed candidate Emerald sites and there is no official protection nor management of these sites. Nonetheless, as the candidate Emerald sites will be affected, assessment of impacts on the habitats, species and integrity of the area is required. In BiH, the Habitats Directive does not apply and therefore there are no officially proclaimed Natura 2000 sites. Consequently, there are no formal *Qualifying Interests* or *Conservation Objectives* for the sites of European nature conservation interest. This means that directly applying the appropriate assessment process is very difficult. However, there are lists of habitats and species that are of concern registered within potential Natura 2000 sites. These habitats and species will be the *Qualifying Interests*. In the absence of Conservation Objectives for the sites, the objectives for the key species and habitats in a wider European context should be established - they will form equivalent *Conservation Objectives* and can then be the basis upon which to assess the significance of impacts the Project will have on them. The objectives were met through undertaking desk study, consultations with experts and field survey to establish the baseline and then conducting the appropriate assessment.

6.2.3 Flora and Fauna of the Motorway

6.2.3.1 Habitats

The detailed historical scientific research with regard to habitats has not been done in the project area. Local EIA prepared in 2016[2] identifies five priority habitats from Habitat Directive:

- 4070 Bushes with Pinus mugo and Rhododendron hirsutum

[2] Zagrebinspekt "ZGI" d.o.o. Mostar. (2016). Environmental Impact Study. Section: Konjic (loop Ovcari) - Mostar North, L = 36.50 km. Mostar.

- 6110 Rupicolous calcareous or basophilic grasslands of the *Alysso-Sedion albi*
- *9180 Tilio-Acerion forests of slopes, screes and ravines
- *91E0 Alluvial forests with Alnus glutinosa and Fraxinus excelsior (Alno-Padion, Alnion incanae, Salicion albae)
- 9530 (Sub-) Mediterranean pine forests with endemic black pines.

It is assumed that the list was made based on the literature review and data presented in the reports made in the framework of the project *Support to the Implementation of the Birds and Habitat Directives in BiH* (Federal Ministry of Environment and Tourism, 2012-2014) for the potential Prenj-Cvrsnica-Cabulja Nature 2000 site (more information is provided in Chapter 6.2.7). Some of the listed habitats are limited to sub-alpine and alpine areas and are unlikely to be found in the project area due to climate conditions. In addition to the priority habitats, local EIA briefly lists different types of general habitat types that may be of importance for the protection of biodiversity near the project area: meadows, rocky, habitat inland waters, forests, bushes, underground habitats, cultivated non-forest areas and habitats with ruderal vegetation and constructed and industrial habitats (villages and towns).

For the purposes of this ESIA, habitat diversity in the project area was determined on the basis of information provided in the Field Guide to Natura 2000 habitat types in Bosnia and Herzegovina[3], as well as on the results of conducted field surveys. The vegetation surveys were undertaken on 58 sample points (Table 6-2) during 28.09 - 01.10.2020, 24.10 - 25.10.2020, on multiple occasions in the period from March to June 2021, as well as June of 2022. The location of each sample point was recorded by GPS coordinates mobile application (version 4.52). The species were identified in the field, or, if that was not possible, specimens were collected and/or photographed to be identified later using the relevant botanical literature.

Table 6-2: Overview and coordinates of the survey sites

Wider locality	Narrow locality	Coordinates
Kuti-Livac	Dubrava	43°23’12.23” N 17°53’7.00” E
	Dubrava_2	43°23’19.66” N 17°52’37.04” E
	Komic	43°22’51.79” N 17°53’43.17” E
	Buđevci	43°22’56.75” N 17°53’26.37” E
	Susica	43°23’9.90” N 17°53’36.95” E
	Kuti	43°23’17.51” N 17°54’18.64” E
	Kuti_1	43°23’26.17” N 17°53’57.87” E
	Kuti_3	43°23’3.77” N 17°54’8.72” E
	Kutilivac	43°23’41.53” N 17°53’45.98” E
	Livac	43°24’11.60” N 17°53’26.72” E

[3] Milanovic, D., Brujic, J., Dug, S., Muratovic, E., Lukic Bilela, L. (2015). Vodic kroz tipove stanista BiH prema Direktivi o stanistima EU. Saradnja za Naturu. Natura 2000, Podrska za provodenje Direktive o pticama i Direktive o stanistima u Bosni i Hercegovini, Prospect C&S s.a., Brusseis.

Wider locality	Narrow locality	Coordinates
	Orlov kuk	43°24’4.56” N 17°53’35.69” E
	Orlov kuk_2	43°24’47.91” N 17°53’48.07” E
Koritna Draga	Koritna draga	43°23’22.56” N 17°54’42.32” E
	Orlinka	43°23’10.89” N 17°54’34.94” E
	Dobrusa	43°23’39.39” N 17°54’44.95” E
	Dobrusa_2	43°23’51.11” N 17°54’51.32” E
	Kuti_2	43°23’35.71” N 17°54’26.74” E
	Dobrusa_3	43°23’28.11” N 17°54’54.83” E
	Dobrusa_4	43°23’46.15” N 17°54’42.90” E
Humi	Lisani	43°25’29.40” N 17°54’1.86” E
	Lisani_2	43°25’6.15” N 17°54’38.46” E
	Lisani_3	43°25’26.69” N 17°54’27.95” E
	Lisani_4	43°25’39.85” N 17°54’56.20” E
	Lisani_5	43°25’43.99” N 17°54’23.48” E
	Humi	43°26’7.13” N 17°53’49.68” E
	Humi_2	43°26’30.84” N 17°54’2.85” E
	Humi_3	43°26’9.90” N 17°54’32.64” E
	Humi_4	43°26’6.12” N 17°54’54.02” E
	Humi_5	43°26’21.12” N 17°54’45.37” E
	Humi_6	43°26’39.65” N 17°54’47.16” E
	Humi_7	43°26’47.87” N 17°54’25.54” E
Podgorani	Dolac	43°27’26.05” N 17°54’23.79” E
	Dolac_2	43°27’14.55” N 17°54’2.50” E
	Dolac_3	43°27’33.70” N 17°54’2.55” E
	Podgorani	43°27’34.23” N 17°53’20.29” E
	Podgorani_2	43°27’39.50” N 17°53’34.03” E
	Podgorani_3	43°27’46.95” N 17°53’45.20” E
	Podgorani_4	43°27’52.48” N 17°53’43.47” E
	Podgorani_5	43°27’54.06” N 17°53’11.79” E
	Podgorani_6	43°28’4.82” N 17°52’58.37” E
	Podgorani_7	43°28’22.39” N 17°52’59.06” E
	Podgorani_8	43°28’4.42” N 17°53’18.78” E
	Podgorani_9	43°28’4.99” N 17°53’34.78” E
Ovcari	Ovcari_1	43°40’1.35” N 17°59’11.77” E
	Ovcari_2	43°40’11.43” N 17°58’49.51” E
	Ovcari_3	43°40’2.52” N 17°58’58.34” E
	Ovcari_4	43°39’42.07” N 17°58’26.06” E
Polje Bijela	Polje_Bijela_1	43°38’5.64” N 17°58’55.69” E

Wider locality	Narrow locality	Coordinates
	Polje_Bijela_2	43°38’7.04” N 17°58’23.60” E
	Polje_Bijela_3	43°37’43.89” N 17°58’16.12” E
	Polje_Bijela_4	43°37’17.71” N 17°58’22.78” E
	Rakov_laz	43°34’14.25” N 17°55’38.71” E
Zlatar	Zlatar_1	43°38'55.67" N 17°58'13.09" E
	Zlatar_2	43°38'55.82" N 17°58'57.09" E
Konjic bypass*	Repovica_1	43°39'54.18"N 17°58'9.18"E
	Repovica_2	43°39'45.39"N 17°57'36.19"E
	Donje Selo	43°39'39.44"N 17°57'4.55"E
	Drecelj	43°39'43.85"N 17°56'35.58"E

*Due to habitat connectivity, it is difficult to separately observe two adjacent areas that might be under the impacts of similar nature and intensity. For clarity, habitats present in Konjic bypass area will be presented in chapter on the bypass itself.

EUNIS database was used for habitat mapping, and GIS computer programme has been used for digitalisation of identified habitats in the area of influence. In order to adequately assess impacts on habitats surrounding the project area, initial AoI was extended at some locations as to reflect the ecology of identified habitats. The research was not carried out at the high altitudes of Mt. Prenj, due to the fact that no impacts caused by the motorway construction and operation are expected at elevations above 1000 m asl[4].

Based on the available literature data and field research, **20 EUNIS habitat types have been identified** within the surveyed area around motorway route (Table 6-3). Concerning Prenj Tunnel, the habitats found 500m south of the northern portal and north of the southern portal of the tunnel in the AoI were included on the list.

Table 6-3: Habitat types identified in the surveyed area

EUNIS code	Description
C1	Surface standing waters
C2	Surface running waters
E1.5	Eastern sub-Mediterranean dry grassland
E4.1	Vegetated snow-patch
E5.2	Thermophile woodland fringes
F5	Maquis, arborescent matorral and thermo-Mediterranean brushes
FB.4	Vineyards
G1	Broadleaved deciduous woodland
G2.1	Mediterranean evergreen *Quercus* forest
G3	Coniferous woodland

[4] Typical EUNIS habitats found at higher altitudes of Mt. Prenj are E1.5 Mediterranean montane grassland, F2 Arctic, alpine and subalpine scrub and F7 Spiny Mediterranean

EUNIS code	Description
G4	Mixed deciduous and coniferous woodland
H2	Screes
H5.5	Burnt areas with very sparse or no vegetation
I1	Arable land and market gardens
I1.3	Arable land with unmixed crops grown by low-intensity agricultural methods
I2.2.2.	Subsistence garden areas
J1	Buildings of cities, towns and villages
J1.2	Residential buildings of villages and urban peripheries
J2.3	Rural industrial and commercial sites still in active use
J3	Extractive industrial sites

The spatial distribution of identified habitats is shown in Figure 6-1 and Figure 6-2.

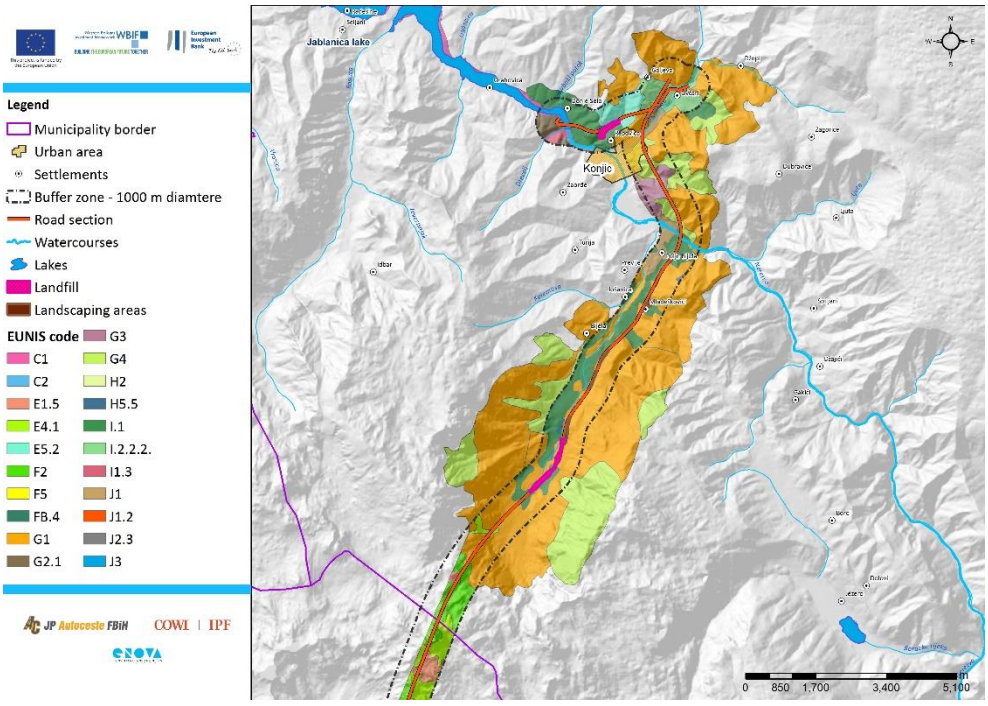

Figure 6-1: Map of EUNIS habitat types in the surveyed area north of Prenj Tunnel

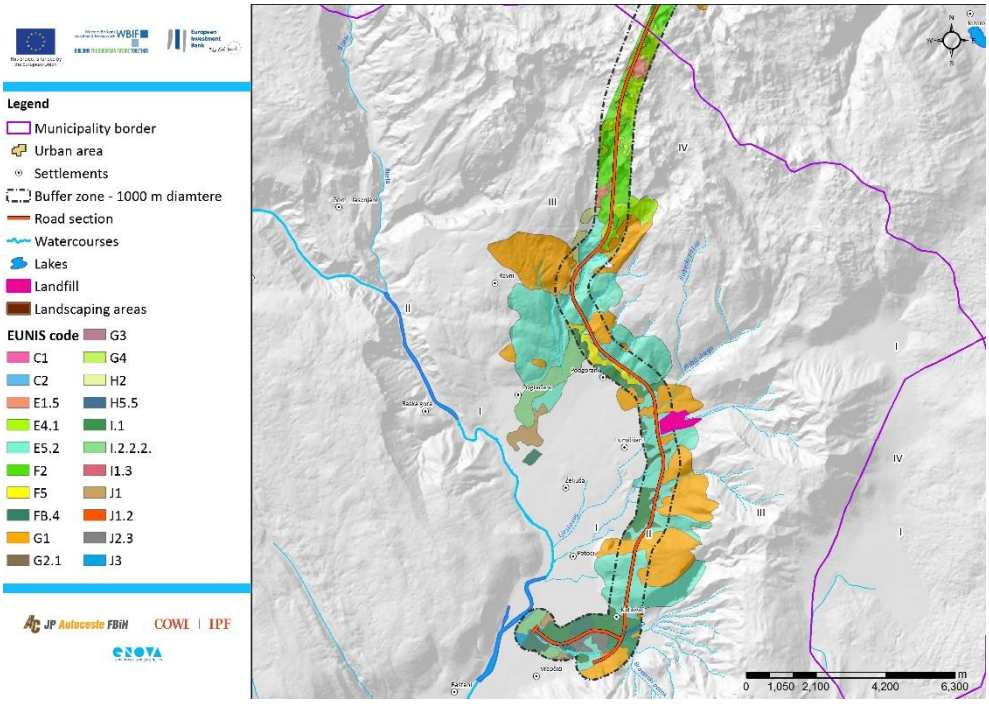

Figure 6-2: Map of EUNIS habitat types in the surveyed area south of Prenj Tunnel

The calculations of habitat types under direct impact was done based on available designs of the road alignment, access roads and disposal sites. These structures were all described under direct impact. Out of the 170.50 ha, which is the land permanently taken by the project construction (project footprint), 58.14 ha is under EUNIS habitat type G1 (Broadleaved deciduous woodland), 56.04 ha is EUNIS habitat type E5.2 (Thermophile woodland fringes), and 17.28 ha is EUNIS habitat type I1 (Arable land and market gardens). The construction of the motorway will also directly affect approx. 1.58 ha of Coniferous woodland (G3) and 5.03 ha of Mixed deciduous and coniferous woodland (G4), which are, along with E5.2, the most valuable and best-preserved vegetation types in the area. The full list is given in Table 6-4. An additional area of 9,483.46 ha (size of all EAAAs) will potentially be indirectly affected, and possibly prone to the invasion of alien plant species as a consequence of the disturbance caused by construction works and later use of the motorway.

Table 6-4: Area under specific habitat types directly and indirectly affected by the project (values are in ha)

EUNIS code	Direct	Indirect	Total
C1	0.52	1,271.18	1,271.7
C2	0.00	20.47	20.47
E1.5	2.44	23.74	58.82
E4.1	8.19	116.04	298.56
E5.2	56.04	1,808.98	1,865.02
F5	0.97	60.17	61.14
FB.4	1.23	78.59	79.82
G1	58.14	3,858.52	3,916.66

EUNIS code	Direct	Indirect	Total
G2.1	0.90	28.27	29.17
G3	1.58	60.03	61.61
G4	5.03	747.59	752.62
H2	2.60	67.14	69.2
H5.5	0.00	1.36	1.36
I1	17.28	789.14	806.42
I1.3	0.00	13.81	13.81
I2.2.2.	6.46	309.19	315.65
J1	5.45	160.91	166.36
J1.2	0.00	0.41	0.41
J2.3	0.99	45.35	46.34
J3	2.68	22.57	25.25
Total	**170.50**	**9,483.46**	**9,653.96**

As a conclusion, based on the comprehensive analysis of available literature data and field research, possible presence of a total of 19 Annex I habitat types in the Project area is established (Table 6-5).

Table 6-5: Overview of habitats of European importance possibly present in the Project area

Code	Habitat name
3240	Alpine rivers and their ligneous vegetation with *Salix elaeagnos*
4030	European dry heaths
5130	*Juniperus communis* formations on heaths or calcareous grasslands
***6220**	Pseudo-steppe with grasses and annuals of the *Thero-Brachypodietea*
***6110**	Rupicolous calcareous or basophilic grasslands of the *Alysso-Sedion albi*
6210	Semi-natural dry grasslands and scrubland facies on calcareous substrates (*Festuco-Brometalia*)
62A0	Eastern sub-Mediterranean dry grasslands (*Scorzoneratalia villosae*)
6430	Hydrophilous tall herb fringe communities of plains and of the montane to alpine levels
8140	Eastern Mediterranean screes *Drypidetalia spinosae*
8210	Calcareous rocky slopes with chasmophytic vegetation
8310	Caves not open to the public
9140	Medio-European subalpine beech woods with *Acer* and *Rumex arifolius*
9180	*Tilio-Acerion* forests of slopes, screes and ravines
91K0	Illyrian *Fagus sylvatica* forests (*Aremonio-Fagion*)
91R0	Dinaric dolomite Scots pine forests (*Genisto januensis-Pinetum*)
***91E0**	Alluvial forests with *Alnus glutinosa* and *Fraxinus excelsior* (*Alno-Padion, Alnion incanae, Salicion albae*)

Code	Habitat name
9250	*Quercus trojana* woods
95A0	High oro-Mediterranean pine forests
***9530**	(Sub-) Mediterranean pine forests with endemic black pines

(*) denotes priority habitats according to the Habitats Directive

Out of 19 possibly present habitat types, six were confirmed during extensive field surveys carried out in both AoI and EAAA, of which two are (*) priority habitats listed in Annex I of Habitats Directive:

- Freshwater habitat types:
  - **3240 Alpine rivers and their ligneous vegetation (*Salix eleagnos*)** found in only one locality north of Bijela, spatial coverage of this habitat type is approx. 0.59 km^2 in surveyed area.

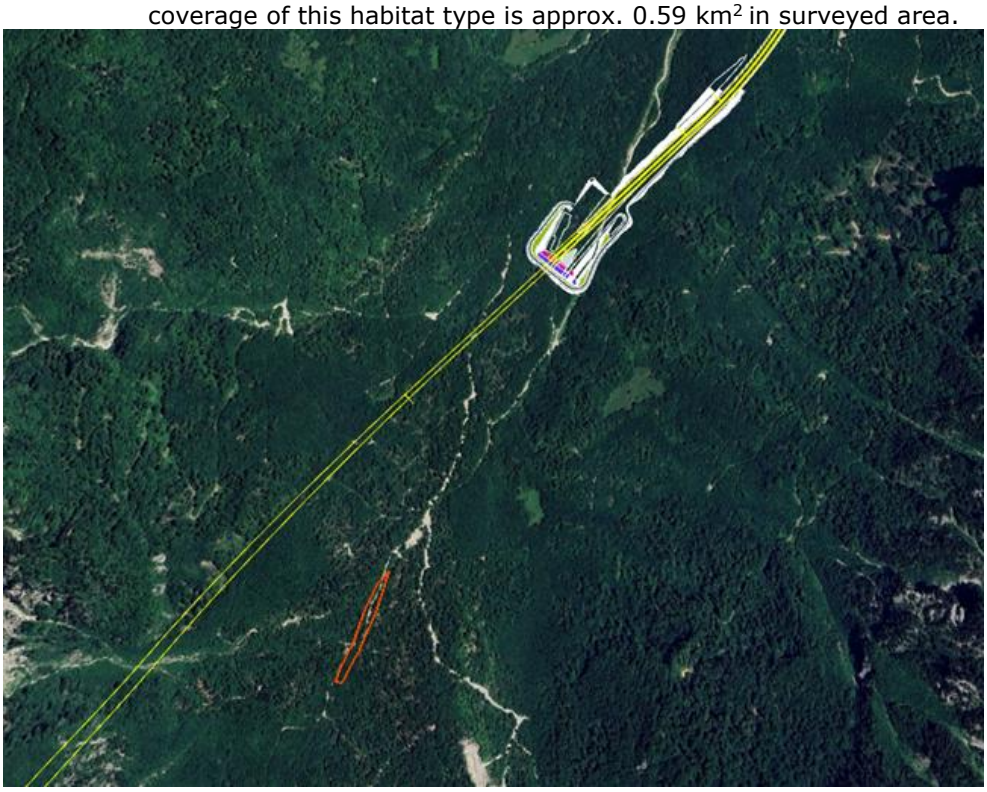

Figure 6-3: Habitat type 3240 in relation to the motorway route

- Natural and semi-natural grassland formations:
  - ***6220 Pseudo-steppe with grasses and annuals of the *Thero-Brachypodietea*** – found around Mostar and Ovcari, spatial coverage of this habitat type is approx. 2.77 km^2 in surveyed area.

*Figure 6-4: Habitat type *6220 in relation to the start of the motorway section (Ovcari)*

*Figure 6-5: Habitat type *6220 in relation to the motorway route (Kutilivac)*

- **6210 Semi-natural dry grasslands and scrubland facies on calcareous substrates** – present within the area around Konjic (Ovcari). The spatial coverage of this habitat type is approx. 0.83 km^2 in surveyed area.

Figure 6-6: Habitat type 6210 in relation to the motorway route

- **62A0 Eastern sub-Mediterranean dry grasslands** – present in a number of localities within the study area: south of Podgorani and in the area around Konjic. The spatial coverage of this habitat type is approx. 3.45 km^2 in surveyed area.

Figure 6-7: Habitat type 62A0 in relation to the motorway route (Podgorani)

Figure 6-8: Habitat type 62A0 in relation to the motorway route (Kutilivac)

- Forest habitat types:
  - **95A0 High oro-Mediterranean pine forests** – valuable forests of Bosnian pine (*Pinus heldreichii*) present at higher altitudes of Mt. Prenj but have marginal presence east of the section prior Prenj tunnel, spatial coverage of this habitat type is approx. 17.30 km^2 in surveyed area.

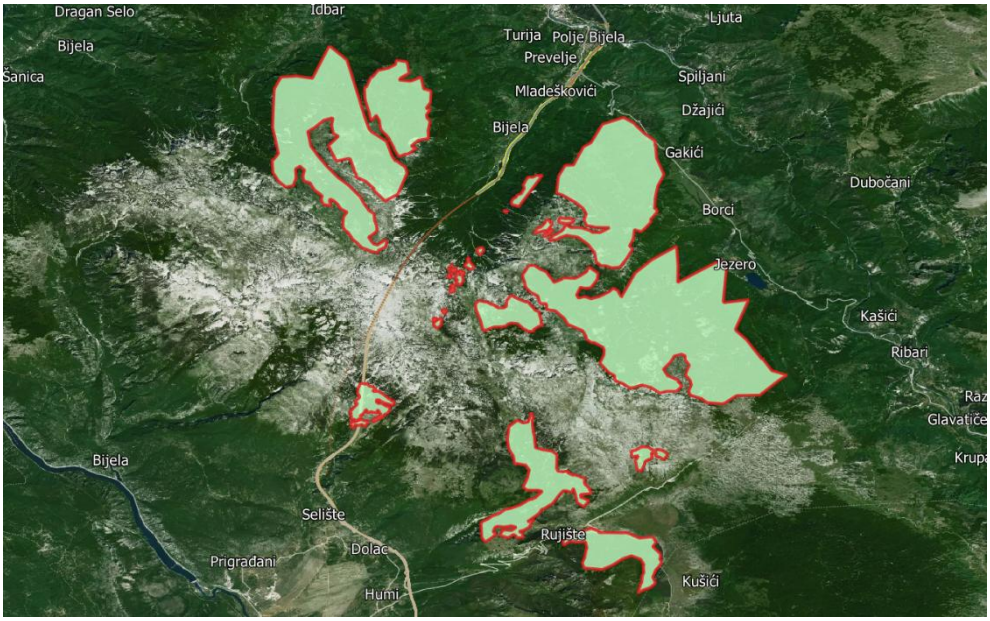

Figure 6-9: Habitat type 95A0 on Prenj mountain

- ***9530 (Sub-) Mediterranean pine forests with endemic black pines** – present in northern part of the planned motorway, spatial coverage of this habitat type is about 3.27 km^2 in surveyed area.

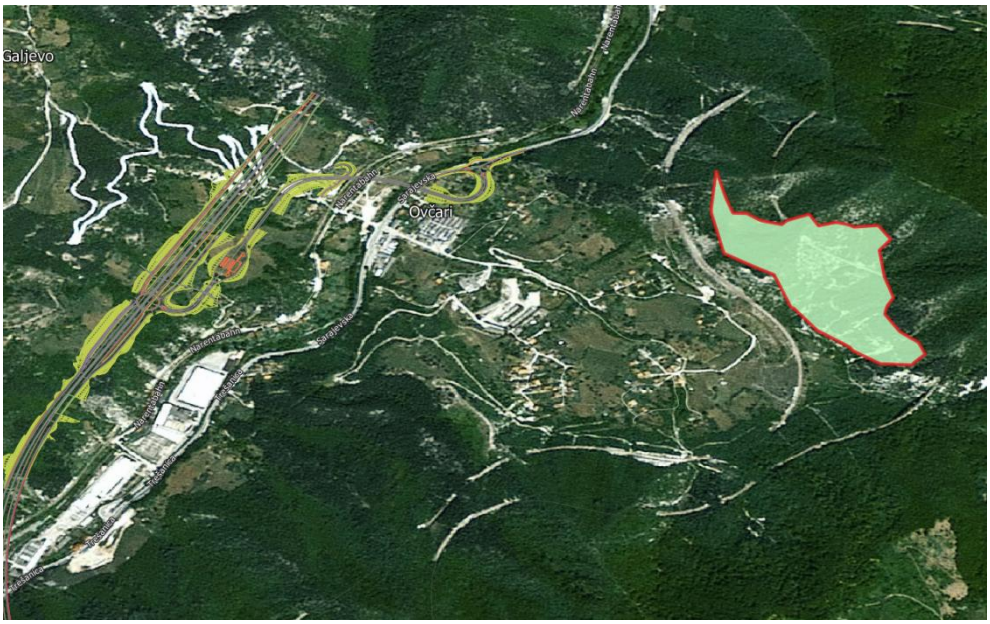

*Figure 6-10: Habitat type *9530 in relation to the motorway route (Ovcari)*

Literature review also suggested presence of other habitats on Mt. Prenj including *4070 Bushes with *Pinus mugo*, 4060 Alpine and boreal heaths, 4080 Sub-Arctic *Salix* sp. scrub, 6170 Alpine and subalpine calcareous grasslands and 8120 Calcareous and calcschist screes of the montane to alpine levels (*Thlaspietea rotundifolii*); however, they were excluded from further assessment due to their natural presence at altitudes of 1000 m asl and higher which is out of the project's area of influence.

6.2.3.2 Flora

The local EIA from 2016 provides information on the dominant species that can be found in the general area of Konjic and Mostar. According to the 2016 EIA, vegetation in Ovcari is represented in the form of the degraded black pine with *Erica* class *Erico-Pinetea* Ht. 59, vegetation on rocky class *Thero-Brachypodietea* Br-Bl. 1947 and vegetation of rock crevices class *Asplenietea rupestris* (H. Meier) Br-Bl. on the right bank of the river Tresanica. Edificator species in this area are: *Pinus nigra*, *Erica carnea*, *Sedum album*, *Melissophylum mellitus*, *Campanula rotundifolia*, *Carex digtata* and others. Ruderal community classes *Plantaginetea maioris* and order *Bidentetalia tripartite*, with typical species: *Inula viscosa*, *Bidens subalternans*, *Foeniculum vulgare*, *Chenopodium* sp., *Rumex* sp., *Solanum* sp. *Datura stramonium*, et al. In the area of the interchange Ovcari - Borovci, vegetation is represented in the form of the class *Erico-Pinetea* Ht. 1959 dominated by black pine (*Pinus nigra*) and vegetation on rocky class *Thero-Brachypodietea* Br-Bl.47.

Local EIA also points out that drastic degradation of thermophilic leafy deciduous forest of oak streaked with stands of pine on dolomite is present on the part of section around Konjic. Moving toward the Neretva River, Herzegovinian forests of Hungarian oak and Turkey oak (*Quercetum confertaecerris hercegovinicum*) are present as well as including *Oxytro-pidion prenje*, *Carici-Dianthetum freynii*, *Gentianetum dinaricae hercegovinicum*, *Seslerietum juncifoliae hercegovinicum*, *Amphoricarpi-Campanuletum hercegovinae*, *Elyno-Edraianthetum serpyllifolii-hercegovinicum*, *Festucetum pungentis hercegovinicum*, *Saxifragetum prenjae hercegovinicum* and others. In the sub-section Prenj Tunnel-Mostar South, the route enters the sub-Mediterranean part leaning on association Ostryo-Carpinion characterised by communities of Downy oak and Oriental hornbeam (*Querco-Carpinetum orientalis*). Community of *Scorzonera* and golden beard grass (order *Scorzonero-Chrysopogonetalia*) are related to the sub-Mediterranean and Mediterranean-mountain belt i.e., the area occupied by Downy oak. Also, in this section community of *Seslerio-Ostryetum carpinifoliae* is significantly present.

Surveys conducted in 2020, 2021 and 2022 for the purpose of this ESIA have found similar results. It was confirmed that vegetation within the studied area is represented with a large number of plant associations that build different ecosystems including:

- Ecosystems in rock crevices: Syntaxonomy of rock-crevice-vegetation is quite complex and is represented by the class *Asplenitea trichomanis* (Br.-Bl. In Meier et Br.-Bl. 1936) Oberd 1977 which includes a large number of orders, e.g. *Pontetilletalia caulescentis* Br.-Bl. 1926, *Moltkeetalia petraeae* Lakusic 1968, *Amphoricarpetalia* Lakusic 1968 and *Potentilletalia speciosae* Quézel 1964.
- Screes: Syntaxonomically, scree-vegetation is represented by the class *Thlaspietea rotundifolii* Br.-Bl. 1948, which includes the orders: *Arabidetalia flavescentis* Lakusic 1968 and *Drypeetalia spinosae* Quézel 1964, with alliances: *Saxifragion prenjae* Lakusic 1968, *Bunion alpini* Lakusic 1968, *Peltarion alliaceae* Horvatic (1958) 1968 and *Silenion marginatae* Lakusic.
- Thermophilic meadows and dry grasslands: This habitat type is relatively rich in species and is represented by the class *Festuco Brometea* Br.-Bl. et

R.Tx. in Br.-Bl. 1943, and order *Brometalia erecti* (W. Koch 1926) Br.-Bl. 1936 and alliance *Bromion erecti* W. Koch 1926.

- Mediterranean and sub-Mediterranean dry grasslands and meadows: Associations belonging to this vegetation type are developed in the zone of thermophilic forests and shrublands of the order *Quercetalia pubescentis* and *Ostryo-Carpinetalia orientalis*. In syntaxonomy, they are very complex and are included in the class *Thero-Brachypodietea ramosi* No.-Bl. 1947 and *Scorsoneretalia villosae* Horvatić 1975, with a large number of alliances.
- Heathlands: Syntaxonomically, these ecosystems belong to the class *Loiseleurio-Vaccinietea* Eggler ex Schubert 1960 and the order *Rhododendro-Vaccinietalia* Br.-Bl. in Br.-Bl. & Jenny 1926 and alliance *Juniperion nanae* No.-Bl. et al. 1939. They are dominated by species belonging to the genus *Juniperus* L.
- Mesophilic deciduous forests and shrublands: Deciduous forests and shrubs within the study area occupy the belt up to the subalpine low beech forests (*Fagetum subalpinum*). In syntaxonomic terms they belong to the class of *Querco-Fagetea* No. et Vlieg. 1937.
- Thermophilic deciduous forests and shrublands: Syntaxonomically, these ecosystems are represented by the class *Querco-Fagetea* No.-Bl. et Vlieg. 1937 and the orders *Fraxino orni-Cotinetalia* Jakucs 1961, *Quercetalia pubescenti-petraeae* Br.-Bl. 1931 and *Ostryo-Carpinetalia orientalis* Lakusic, Palvlovic, Redzic 1972. In the layer of trees and shrubs we find the following species: *Paliurus spina-christi* Mill., *Petteria ramentacea* (Sieb.) C. Presl., *Asparagus acutifolius* L., *Cornus mas* L., *Colutea arborescens* L. etc., and in the layer of herbaceous plants: *Teucrium chamary* L., *Sedum acre* L., *Hypericum perforatum* L., *Arum italicum* Mill. and many others. Within this area, there is also an endemic species *Petteria ramentacea* (Sieber) C. Presl which builds entire subassociations.
- Relict pine forests: Ecosystems common on dolomites and dolomitic limestones, and, therefore, have the role of refugium of tertiary flora and vegetation. Syntaxonomically, these ecosystems are included in the class *Erico-Pinetea* Horvat 1959. Forests of the subendemic Bosnian pine *Pinion heldreichii* Horvat 1950 give uniqueness to this area.
- Tertiary vegetation ecosystems: They occur on arable land, abandoned habitats, along houses, roads, trampled places, etc. Syntaxonomically, these ecosystems are most often represented by the classes: *Stellarietea mediae* R. Tx., Lohmeyer & Preising in R. Tx. ex von Rochow 1951, *Plantaginetea majoris* Tüxen & Preising in Tüxen 1950, *Chenopodietea* Br.-Bl. 1951 and *Artemisietea vulgaris* Lohmeyer et al. ex von Rochow 1951.

Considering spatial distribution of vegetation and species, analysis of associations has shown that the following ones can be found in the wider area around Konjic: downy oak and white hornbeam forests (*Querco pubescentis-Carpinetum orientalis*), beech forests (*Fagetum montanum*), beech and silver fir forests (*Abieti-Fagetum*), and black pine forests (*Pinetum nigrae*). While south of Podgorani to Mostar, a thermophilic forest that belongs to the climatogenic association of the white hornbeam forest (*Carpinetum orientalis*) is present. The association *Rusco-Carpinetum orientalis* Blecic et Lakusic, 1966 is the most widespread, and in the wider area it is differentiated into: *Rusco-Carpinetum*

orientalis Blecic et Lakusic, 1966. Subas. *Typicum* Blecic et Lakusic, 1966, *Rusco-Carpinetum orientalis* Blecic et Lakusic subas. *Petterietosum* Lakusic et al., *Rusco-Carpinetum orientalis* Blecic and Lakusic, 1966. Subas. *Paliuretosum* Lakusic, 1989, *Rusco-Carpinetum orientalis* Blecic et Lakusic, 1966 subas. *Punicetosum granatii* (grez.) Muratspahic, Redzic et Lakusic and *Rusco-Carpinetum orientalis* Blecic et Lakusic, 1966. *Subas. Quercetosum pubescentis* Muratspahic, Redzic, Lakusic. The association *Rusco-Carpinetum orientalis* of Blecic et Lakusic *subas. Petterietosum* Lakusic et al. is particularly significant because it is built by endemic species *Petteria ramentacea* (Sieber) C. Presl. Which is protected by the Law on Forests of FBiH 20/02. This species occurs especially in the area of Podgorani and Podporim/Porim.

A total of 452 vascular plant species were identified by reviewing available literature data along the motorway. Out of 452 plant species, 444 were confirmed during the field surveys. A total of 21 confirmed taxa are listed on the Red List of Flora of the Federation of Bosnia and Herzegovina, of which three species are critically endangered (CR), three endangered (EN), three vulnerable (VU), seven least concern (LC) and five near threatened (NT). Fifteen plant taxa are on the Global IUCN list, of which 11 taxa with the status least concern (LC) category, and one taxon has the near threatened (NT) category. Two taxa are listed in Annex V of the Habitats Directive (*Galanthus nivalis* L. and *Ruscus aculeatus* L.). All endangered species present within the study area have a wide distribution, i.e., none of the identified species is stenoendemic, nor this is the only locality of its distribution. The results of the flora survey, with list of species registered at every observation point are given in the Annex A per sample points, along with data on conservation status on FBiH and IUCN (global) level, endemism, protection status and invasiveness.

When it comes to endemic species, the previous study lists the following species in the immediate area around the planned motorway: *Silene rezdorffiana*, *Euphorbia herzegovina*, *Alyssum moellendorfianum*, *Seseli hercegovinum*, *Thymus richardii* (*T. aeropuntactus*) and *Acinos orontius*. During the surveys, none of these species were confirmed. However, during the field survey other endemic species were found: *Arenaria gracilism*, *Astragalus monspessulanus* subsp. *illyricus, Chaerophyllum coloratum*, *Crocus dalmaticus*, *Dianthus sylvestris* subsp. *tergestinus*, *Edraianthus tenuifolius*, *Petteria ramentacea*, *Senecio thapsoides* subsp. *visianianus*, *Silene reichenbachii*, *Tanacetum cinerariifolium*. The listed species are endemic to the Balkan peninsula and have a wide range in southeastern Europe. The species that might be directly affected by the project are further elaborated in the Critical Habitat Assessment.

Based on the conducted field surveys, a total of 20 invasive species from nine families were determined within the study area (Table 6-6, Figure 6-11). The largest number of invasive species was found around roads, human settlements, and arable land.

Table 6-6: Overview of invasive plant species within the study area

No.	English name	Scientific name	Family	Origin[5]
1.	Boxelder maple	*Acer negundo* L.	Compositae	Am-C&N
2.	Tree of heaven	*Ailanthus altisima* (Mill.) Sw.	Simaroubaceae	As-E
3.	Redroot pigweed	*Amaranthus retroflexus* L.	Amaranthaceae	Am-N
4.	Annual ragweed	*Ambrosia artemisifolia* L.	Amaranthaceae	Am-N
5.	Annual saltmarsh aster	*Aster squamatus* (Spreng.) Heiron	Compositae	Am-S
6.	Greater Beggar's Ticks	*Bidens subalternans* DC.	Compositae	Am-S
7.	Paper mulberry	*Broussonetia papyrifera* L`Herit ex Vent.	Moraceae	As-E
8.	Flax-leaf fleabane	*Conyza bonariensis* (L.) Cronquist	Compositae	Am-C
9.	Horseweed	*Conyza canadensis* (L.) Cronq.	Compositae	Am-N
10.	Jimsonweed	*Datura stramonium* L.	Solanaceae	Am-N
11.	Indian goosegrass	*Eleusine indica* (L.) Gaertn.	Poaceae	As
12.	Annual fleabane	*Erigeron annuus* (L.) Pers. Subsp. *Annuus*	Compositae	Am-N
13.	Jerusalem artichoke	*Helianthus tuberosus* L.	Compositae	Am-N
14.	Alfalfa	*Medicago sativa* L.	Fabaceae	As
15.	Virginia creeper	*Parthenocissus quinquefolia* (L.) Planchon	Vitaceae	Am-N
16.	Knotgrass	*Paspalum distichum* L.	Poaceae	Am-N
17.	Black locust	*Robinia pseudoacacia* L.	Fabaceae	Am-N
18.	Persian speedwell	*Veronica persica* Poir.	Plantaginaceae	As-W
19.	Rough cocklebur	*Xanthium strumarium* L. subsp. *Italicum* (Moretti) D. Löve	Compositae	As-W
20.	Spiny cocklebur	*Xanthium spinosum* L.	Compositae	Am-S

[5] Geographical origin: Am-C – Central America; Am-N – North America; Am-S – South America; Am-C&N – Central and North America; As – Asia; As-E –East Asia; As-W – West Asia

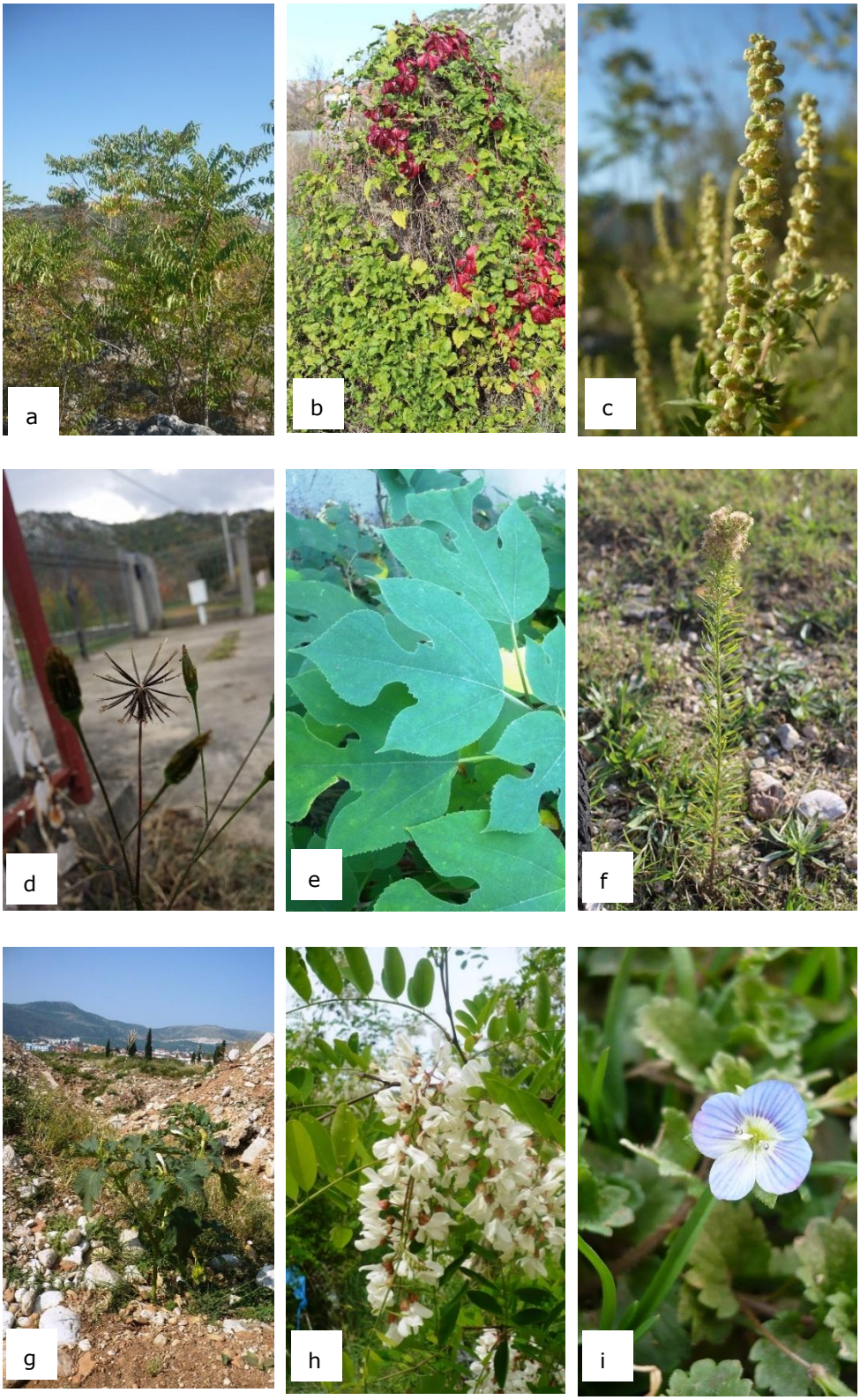

Figure 6-11: Part of invasive plant species within the study area

***a.** Ailanthus altissima (Mill.) Sw.; **b.** Parthenocissus quinquefolia (L.) Planchon; **c.** Ambrosia artemisifolia L.; **d.** Bidens subalternans DC.; **e.** Broussonotia papyrifera L`Herit*

ex Vent.; ***f.*** *Conyza canadensis (L.) Cronq.;* ***g.*** *Yestura stramonium L.;* ***h.*** *Robinia pseudoacacia L.;* ***i.*** *Veronica persica Poir.*

6.2.3.3 Fauna

6.2.3.3.1 Invertebrates

Invertebrates were not specifically analysed in the local EIA from 2016 as the study contains only a list of orders and families whose species are represented in the wider area of potential impact of the motorway construction including Diptera, Culicidae, horseflies, Lepidoptera, Noctuidae, Coleoptera, Hymenoptera, Heteroptera, and others, providing no data on methodology or geographical references. The only detailed literature data is presented in works of Apfelbeck (1894-1916) and the assessment study for potential Natura 2000 sites in BiH (Dreskovic, 2011).

Field research was conducted as a part of multiple site visits in 2020 and 2021: 24-25 October 2020, 7, 9-10, 17, 27 March 2021; 4, 15-16, 23-25 April 2021; 2, 8-9, 16-17, 20-22 May 2021. Field research took place in optimal weather conditions and during the period of activity of the researched group.

Project Area of Influence was deemed as sufficient for invertebrate surveys. However, at some locations it was enlarged to correspond to biology of potentially present species from literature. This approach was applied to forest habitats in order to ensure higher confidence in findings. Invertebrate research was done using the active terrain search methods. Field work consisted of site overview and active search for individuals, direct and indirect determination of the presence of species based on findings along transect lines within the surveyed area. Transect lines were 500-1,500 m long. Field work included day and night surveys, with a total of 21 days of invertebrate research throughout all seasons.

The research was performed on a total of seven macro localities, which included 60 micro localities (Figure 6-12).

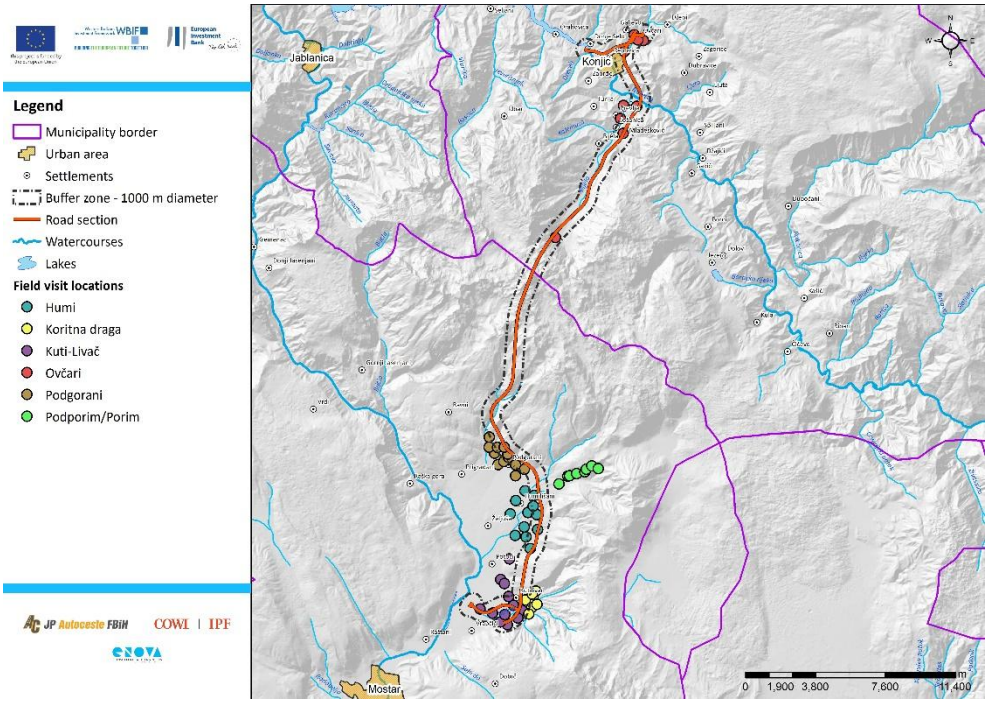

Figure 6-12: Map of sample sites for invertebrate surveys

During field survey conducted in 2020 and 2021, a total of six invertebrate species of conservation concern were confirmed. The found species are as follows: mourning cloak (*Nymphalis antiopa*; FBiH NT), southern festoon (*Zerynthia polyxena*; FBiH NT, HD IV) (Figure 6-13), Jersey tiger (*Euplagia quadripunctaria*; HD II*), long-horned beetle (*Morimus funereus*; IUCN VU, HD II), tree grayling (*Hipparchia statilinus*; IUCN NT, FBiH VU) and *Lasioglossum convexiusculum* (IUCN NT). Additionally, a presence of two more species of conservation concern was not confirmed but is likely: the European stag beetle (*Lucanus cervus*) and great beetle (*Cerambyx cerdo*). As a result, these species will be included in further assessment. Detailed findings of desk and field surveys are presented in Annex B to the ESIA Study.

*Figure 6-13: Southern festoon (*Zerynthia polyxena*) found at the locality of Podgorani*

Even though literature data suggests possible presence of a higher number of invertebrates of conservation concern, lack of suitable habitats and georeferenced data suggests these species are very likely to be limited to preserved natural ecosystems at higher altitudes or other pristine habitats of Mt. Prenj not in the vicinity of the motorway. However, the area of analysis was extended beyond AoI in case of habitats important for invertebrate species, such as *Lucanus cervus* and *Cucujus cinnaberinus*, which are associated with forest habitats. Despite this approach, the aforementioned insect species were not found during the survey.

6.2.3.3.2 Ichthyofauna

Neretva river and its tributaries are well researched when it comes to ichthyofauna. Based on the local EIA from 2016, fish fauna in the project area is represented with the following species: *Salmothymus obtustirostris oxyrhynchus*, *Salmo marmoratus*, *Salmo trutta m. fario*, *Phoxinus phoxinus*, *Cottus gobio*, *Thymallus thymallus*, *Leuciscus albus*, *Leuciscus svallize svallize*, *Cyprinus carpio*, *Carassius gibelio* and *Sander lucioperca*. Full reference list and detailed findings of fish surveys are available in Annex C-1: Ichthyofauna.
The surveying of ichthyofauna (Osteichthyes) in planned motorway section on Corridor Vc Konjic (Ovcari) – Prenj tunnel – Mostar North, has been carried out during May 2021 on two occasions: from 13 to 16 May and from 27 to 30 May. Surveys were conducted at multiple points in the project's area of impact, as well as downstream (Figure 6-14). Having in mind the motorway route crosses Neretva and Tresanica rivers with two planned bridges, project area of influence and potential impacts with regard to ichthyofauna may stretch downstream if mitigation measures are not implemented. Special attention was paid to the natural spawning grounds found in the river Neretva from the mouth of the river Krupac to the Old bridge in Konjic and from the Old Bridge to the mouth of the river Tresanica. These are salmonids spawning grounds for marble trout and

softmouth trout in the stretch of 400 m. This spawning site is located approximately 1 km downstream from the Project area.

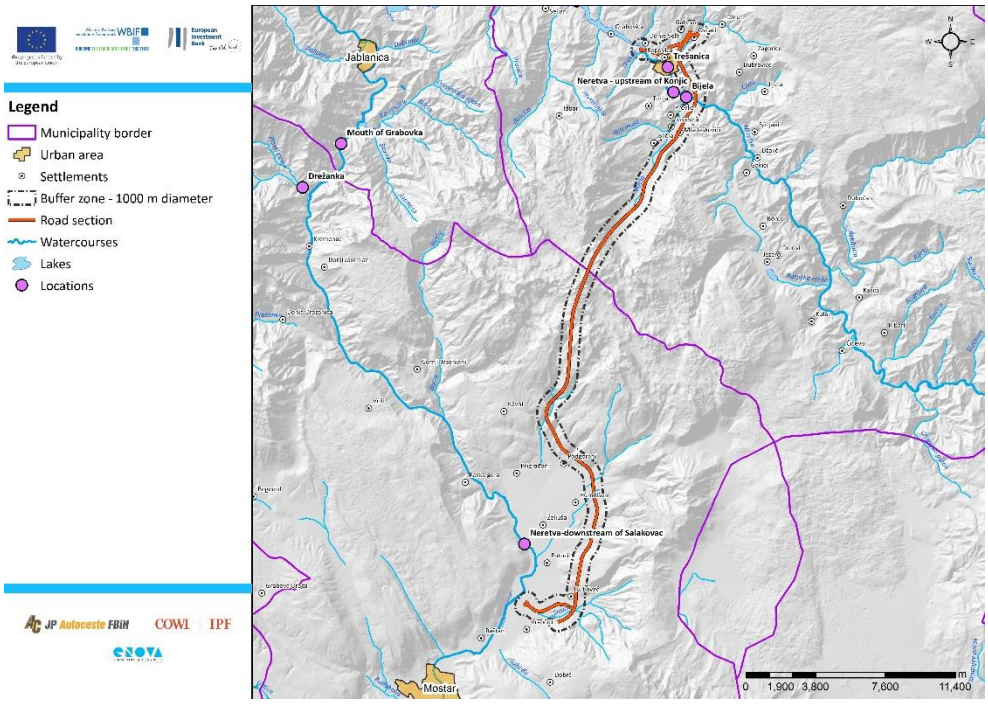

Figure 6-14: Map of sample sites for ichthyofauna surveys

The primary objective of ichthyologic research was to collect the reliable data on structure, composition and distribution of fish populations in the research area. The results of the ichthyologic analysis indicate the state of fish populations and help to determine the current status of certain populations (decreasing, increasing, in stagnation). Therefore, these surveys have important applicative significance for further assessment as part of this ESIA.

Standard scientific surveying methods that cause no long-term negative effect to the fish population were implemented. Methods of sampling, identification, and quantification of ichthyofauna used are based of European standards and normative and are in accordance with relevant EN and ISO standards:

- EN 14011:2003 (Water quality – Sampling of fish with electricity)
- EN 14962:2006 (Water quality – Guidance on the scope and selection of fish sampling methods)
- EN 14757:2005 (Water quality – Sampling of fish with multi-mesh gillnets)

The Neretva River basin is distinguished by a very large number of endemic fish species. Ichthyofauna of this river is very diverse, with large number of autochthonous and endemic species. Numerous fish species which live in this area have a very narrow and limited area of distribution, and therefore they are classified endangered on the IUCN Red List. Considering the very rich fish fauna, the Neretva River basin, together with four other areas in the Mediterranean Sea basin, represent centres of endemism in the Mediterranean and Europe.

The results of comprehensive literature review of all reliable sources from 1953 to date along with field investigations have shown that 26 fish species from eight families live in the investigated area: Cyprinidae (12), Salmonidae (8), Cobitidae (1), Balitoridae (1), Percidae (1), Cottidae (1), Anguillidae (1), and Centrarchidae (1). Thirteen species have been confirmed during field surveys.

According to IUCN's evaluation, there are two species in the category of Critically Endangered (CR) species. Endangered (EN) are two fish species while there are four fish species in the category Vulnerable (VU). The largest number of fish species is in the category Least Concern (LC). Three of the 26 (potentially) present species do not have IUCN threat status, of which two are listed on FBiH RL as LC species: *Cyprinus carpio* and *Gobio obtusirostris*, while *Salmo farioides* is not evaluated by either entity.

When it comes to FBiH RL, Critically Endangered (CR) species are: Marble trout – *Salmo marmoratus* Cuvier, 1829, Softmouth trout – *Salmothymus obtusirostris oxyrhinchus* (Heckel, 1851) and European eel – *Anguilla Anguilla* (Linnaeus, 1758). None of these species were confirmed during the surveys. Endangered (EN) species are: Dalmatian nase – *Chondrostoma knerii* Heckel, 1843 and Adriatic minnow – *Phoxinellus alepidotus* Heckel, 1843. Potentially present EN species have not been confirmed during surveys either. Vulnerable (VU) fish species are: Spirlin – *Alburnoides bipunctatus* (Bloch, 1782), Adriatic dace – *Squalius svallize* Heckel & Kner, 1858 and Neretvan spined loach – *Cobitis narentana* Karaman, 1928. When it comes to species with this conservation status, two were confirmed: *Squalius svallize* (mouth of Grabovka, river Neretva) and *Cobitis narentana* (in rivers Tresanica and Bascica).

The motorway goes through the potential Natura 2000 site Zlatar (BA8200095) and the fish species characteristic of river Neretva and its tributaries inhabit the river Ljuta that is within this Natura 2000 site of interest: *Cottus gobio* (bullhead), *Salmo marmoratus* (Marble trout), *Salmothymus obtusirostris oxyrhinchus* (Softmouth trout), and *Squalius svallize* (Adriatic dace). It is important to note that river Ljuta is approx. 2km upstream from the planned bridge over river Neretva in Bijela.

Presence of alien species has been registered in literature, as well as during field surveys (Table 6-7).

Table 6-7: Invasive fish species confirmed during fish surveys

English name	Scientific name	Origin[6]
Rainbow trout	*Oncorhynchus mykiss* (Walbaum, 1792)	Am-N
Prussian carp	*Carassius gibelio* (Bloch, 1782)	Am-N/As
Pike-perch	*Sander lucioperca* (Linnaeus, 1758)	Am-N
Pumpkinseed	*Lepomis gibbosus* (Linnaeus, 1758)	Am-N

[6] Geographical origin: Am-C – Central America; Am-N – North America; Am-S – South America; Am-C&N – Central & North America; As – Asia; As-E –East Asia; As-W – West Asia

6.2.3.3.3 Herpetofauna

Field research on amphibians and reptiles was conducted in different time periods ranging from September 2020 to June 2021. Research was conducted on multiple occasions, as follows: 28.9 – 30.9.2020, 29.10 – 01.11.2020, 28 – 31.03. 2021, 27 – 30.04.2021, 24 – 28.05.2021, 01 – 05.06.2021 and 21.06.2022. Research on amphibians and reptiles was done at 12 sampling points selected based on the road layout as well as the 500 m-wide buffer zone on each side of the planned motorway. At each sampling point, a 500-1,500 meter transect perpendicular to the corridor line was made and representatives of amphibian and reptile fauna were actively searched in transect 2.5 meters wide on each side. The coordinates, location name, general observations (e.g., habitat type or state) are listed in Table 6-8 and localities' spatial distribution is shown in Figure 6-15.

Table 6-8: Coordinates and general observations about surveyed localities

No.	Location	Latitude	Longitude	General observations regarding sampling points
1.	Ovcari	43.667564	17.973919	Thermophilic meadows and forests of oak and pine
2.	Polje Bijela	43.633227	17.976897	Residential buildings, meadows and shrubs
3.	Mladeskovici	43.615855	17.964957	Meadows and beech forest
4.	Konjicka Bijela	43.601335	17.950363	Beech forest
5.	Rakov Laz	43.581116	17.937818	Beech forest
6.	Klenova draga	43.480267	17.877882	Hornbeam bushes
7.	Podgorani	43.469522	17.887710	Garrigue
8.	Dolac	43.459714	17.903786	Garrigue
9.	Zelenika	43.456653	17.908432	Dry meadows
10.	Humilisani	43.445341	17.911096	Maquis, oak forest and dry meadows
11.	Bosnjaci	43.427028	17.910885	Maquis and dry meadows
12.	Kutilivac	43.389805	17.899043	Residential buildings of villages and urban peripheries with hedges and maquis

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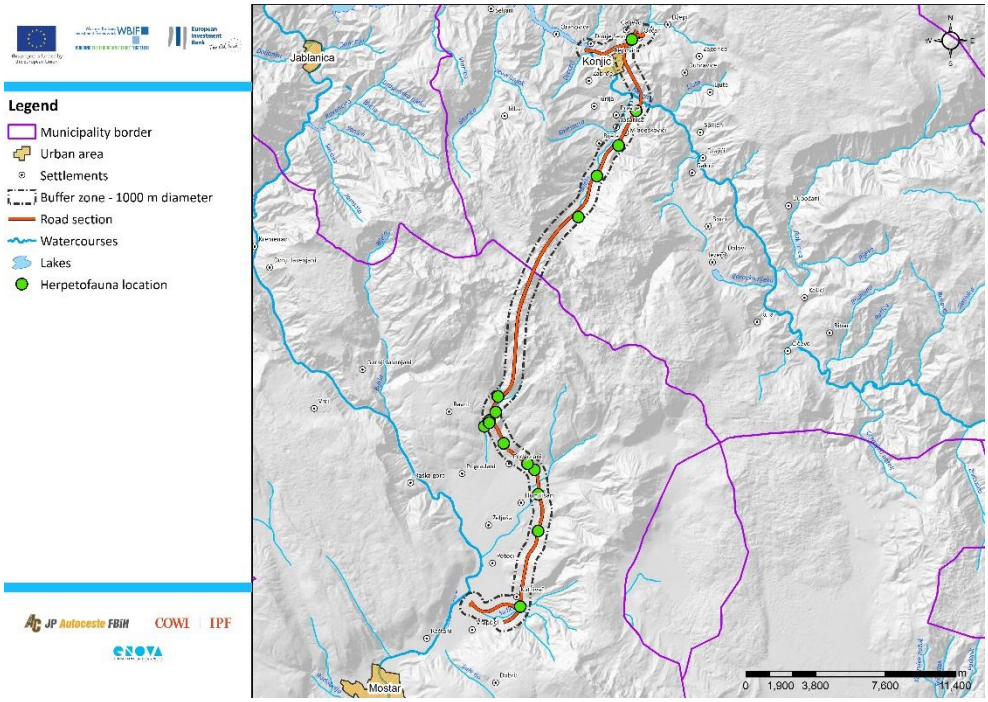

Figure 6-15: Herpetofauna survey locations in relation to the motorway route

The data on amphibians and reptiles of the area were collected in three ways: active searching of species in favourable habitats using a transect method, search for the road kills and vocal recognition. Field research was planned and conducted in a manner to provide results covering the period of the biggest activity of diverse species of amphibians and reptiles. The surveys have been carried out in optimal weather conditions with temperatures ranging from 15°C to 27°C. All caught animals were identified to the species level, and immediately released on the same location they were caught.

A total of four amphibian species were registered during 2020 and 2021 herpetofauna surveys: marsh frog (*Pelophylax ridibundus*), green toad (*Bufotes viridis*), Greek stream frog (*Rana graeca*) (Figure 6-16) and fire salamander (*Salamandra salamandra*). The presence of permanent aquatic habitats was not recorded in the Project area, except for the Neretva and Tresanica rivers, which is the reason for small number of recorded amphibian species. According to data from literature referenced in Annex C-2: Herpetofauna, in addition to the established representatives of the amphibians, presence of the following species is also stated for the study area: common toad (*Bufo bufo*), yellow-bellied toad (*Bombina bombina*) and agile frog (*Rana dalmatina*). Species Alpine salamander (*Salamandra atra*), Alpine salamander (*Salamandra atra*), Alpine newt (*Ichthyosaura alpestris*) and smooth newt (*Lissotriton vulgaris*) were listed in a previous study, but they are unlikely to be found because they do not have suitable habitats in Project's area of influence. Based on the characteristics of the habitat, the findings of the species common frog (*Rana temporaria)* and common tree frog (*Hyla arborea)* are also possible.

*Figure 6-16: Greek stream frog (*Rana graeca*) found in Mladeskovici*

During June 2025, an analysis was conducted to determine the possible presence of the olm (*Proteus* anguinus) in the groundwater habitats under the Prenj and Orlov Kuk tunnels. Three samples of groundwater were tested for environmental DNA using Real-time Polymerase Chain Reaction (qPCR) approach.

The three sampling sites were selected in geographical areas of the northern and southern portals of the Prenj and the Orlov Kuk tunnels. These sites were selected among the karst springs described in Chapter 7 Geology and Groundwater chapter and based on the latest dye tracing results described therein. The selection of sampling sites was based on several key criteria. Firstly, the construction site's zone of influence overlaps with the catchment area and coincides with the established flow direction of the karst aquifer toward the sampling location. Secondly, to ensure representative coverage, one sampling site was selected for each hydrogeological unit. Lastly, priority was given to sites that serve as sources of drinking water. An additional negative control sample using distilled water was included to verify the integrity of the filtration system.

For Prenj Tunnel, two subsamples were taken on 17 May 2025 from the Gornja Bijela spring: the main spring (used for Konjic water supply) and a smaller upstream spring. Each subsample (10 L) was combined during filtration into a single 20 L sample (Sample 1). Additionally, a 20 L sample was collected from Salakovac spring (Sample 2; unit Jablanica–Prenj), which required four filters due to sediment clogging. For Orlov Kuk Tunnel, a 20 L sample was taken from Bosnjaci spring (Sample 3) on 19 May 2025 and filtered immediately on site.

Prior to filtering the groundwater samples, a negative control sample (Sample 4) consisting of 5 L of distilled water was processed to confirm absence of contamination in the filtration system.

All samples were collected from untreated, pristine groundwater sources. Sample 3 was filtered immediately at the site, while Samples 1 and 2 were filtered within six hours in a field laboratory. Filtration was performed in two replicates per sample using sterile Mixed Cellulose Ester (MCE) membrane filters with 1.2 µm and, when feasible, 3.0 µm pore sizes. Filters were dried with silica gel, kept on ice, and stored at –80°C until DNA extraction. The filtration system was disinfected and autoclaved before use to prevent cross-contamination.

qPCR analysis was conducted at the National Institute of Biology, Department of Organisms and Ecosystems Research in Ljubljana. The procedure followed established protocols[7,8].

All four samples Gornja Bijela, Salakovac, Bosnjaci, and the negative control tested negative for the presence of *Proteus anguinus* eDNA. Samples S2 to S4 showed completely negative results across all qPCR well replicates. For sample S1 (Gornja Bijela spring), seven out of eight replicates were negative, while one well showed an inconclusive positive signal, which was deemed an artefact. To verify this, the replicate was subjected to gel electrophoresis using a positive control, which confirmed the absence of olm eDNA.

Additionally, it is important to note that the likelihood of encountering *Proteus anguinus* populations increases in the direction from Orlov Kuk toward Mostar and its known distribution limits.

Eighteen reptile species were registered in the project's area of influence. In the southern part of the route, as well as the northernmost segment near Ovcari and Zlatar, various thermophilus ecosystems are present with garrigue vegetation suitable for the reptiles. According to literature data, in addition to the confirmed reptiles, presence of the species smooth snake (*Coronella austriaca*) is also possible in the Project area. Although they have not been recorded, based on the characteristics of the habitat, the findings of the species cat snake (*Telescopus fallax*) and leopard snake (*Zamenis situla*) are also possible. Adder (*Vipera berus*) and Mosor lizard (*Dinarolacerta mosorensis*) were listed in a previous EIA, but they are unlikely to be found due to lack of suitable habitats.

Species of amphibians and reptiles mentioned in the literature and recorded during the field work are not on the European IUCN Red List of critically endangered, endangered and vulnerable species. Four species of amphibians and 15 species of reptiles listed in Annexes II and IV of the Habitats Directive as strictly protected species have been recorded trough field research and analysis of literature data.

According to the IUCN Red List, all the recorded species, except Hermann's tortoise (*Testudo hermanni*) (NT) (Figure 6-17) and Four lined snake (*Elaphe*

[7] Aljancic G., 2025. Detection of environmental DNA of proteus *(Proteus anguinus)* in groundwater samples (v. 3). Kranj: Tular Cave Laboratory, 10 p.
[8] Goricki S., Stanković D., Snoj A., Kuntner M., Jeffery W. R., Trontelj P., Pavicevic M., Grizelj Z., Năpăruș-Aljančič M., Aljancic G. (2017): Environmental DNA in subterranean biology: range extension and taxonomic implications for *Proteus*. *Scientific Reports 7*: 45054. https://doi.org/10.1038/srep45054

quatuorlineata) (NT), have the status of least concern (LC). According to the Red List FBiH, the two aforementioned species (*Testudo hermanni* and *Elaphe quatuorlineata*) have the status of vulnerable, while all the others are the least concern.

*Figure 6-17: Hermann's Tortoise (*Testudo hermanni*) found in Klenova Draga*

Adverse effects can be significantly mitigated by avoiding disturbance of breeding sites (especially for amphibians): two occasional streams in Ovcari area, Podvrabac stream in Mladeskovici village, Klenovik spring in Klenova Draga, artificial pond in Zelenika (Figure 6-18, Figure 6-19), and artificial pond in Bosnjaci (Table 6-9).

Table 6-9: Identified amphibian breeding sites

No.	Location	Latitude	Longitude	General observations
1.	Stream No. 1 Ovcari	43.668894	17.975403	Occasional stream
2.	Stream No. 2 Ovcari	43.666222	17.972408	Occasional stream
3.	Podvrabac stream, Mladeskovici	43.616256	17.965217	Constant stream
4.	Klenovik spring	43.479700	17.877453	Freshwater spring
5.	Pond Zelenika	43.455236	17.906647	Small artificial pond
6.	Pond Bosnjaci	43.426694	17.911325	Small artificial pond

Figure 6-18: Artificial pond in Zelenika, Humilisani

Figure 6-19: Juvenile Bufotes viridis around artificial pond

6.2.3.3.4 Ornithofauna

Desk study was done in addition to field surveys, and it was concluded that there are no reliable and detailed published data on birds in the project area. The local EIA from 2016 lists following bird species as present in the project area: rock partridge (*Alectoris graeca*), capercaillie (*Tetrao urogallus*), owl (*Strix* sp.), Eagle (*Aquila chrysaetos*), hawk (*Accipiter gentils*), quail (*Coturnix coturnix*), owl (*Otusscops*), cuckoo (*Cuculus canorus*), buzzard (*Buteo buteo*), nightingale (*Luscinia megarhynchos*), sparrow (*Passer domesticus*), blackbird (*Turdus merula*), great tit (*Parus major*), wild pigeon (*Columba livia*), raven (*Corvus corax*), black crows (*Corvus corone* and *C. cornix*) and other species of birds.

Additionally, published data on birds from the nearby areas was also reviewed. Information provided in such documents, scientific papers or reports was not deemed useful due to the fact that nothing can be concluded about ornithofauna in the Project area, because parallel between the habitats can't be drawn. Therefore, the bird data collected during the survey related to this Project is the first and only bird data of the given area.

Field research of ornithofauna was carried out in the period from September 2020 to June 2021 and again in June 2022. A total of seven field trips of 4-5 days each were realised. Field trips were planned to cover the most important ornithological phenophases: nesting, as well as spring and autumn migration (Table 6-10). Bird research transects were defined in different parts of the route in order to cover all types of bird habitats, so that their combination provides a representative sample presenting the preliminary data on ornithofauna of the given area, spatial distribution of species, and the number and endangerment of birds along the route. In addition to transect method, counting birds on the surface from the census point was done as well.

Table 6-10: Review of field trips by seasons (phenophases) and months

No.	Ornithological aspect	Date
1.	Autumn migration	29 September – 2 October 2020
2.	Autumn migration	29 October – 1 November 2020
3.	Spring migration and breeding	23 – 27 March 2021
4.	Spring migration and breeding	11 – 14 April 2021
5.	Breeding	13 – 16 May 2021
6.	Breeding	06 – 10 June 2021
7.	Breeding	21 June 2022

For a more precise determination of the spatial distribution of registered species, the area was divided into 14 sections where bird research transects were defined (Table 6-11, Figure 6-20). Detailed habitat descriptions are given in Annex C-3: Ornithofauna.

Table 6-11: Review of research localities by sections

No.	Locality	Reference point	
		Latitude	Longitude
1.	Ovcari	43°39’55.24” N	17°58’14.56” E
2.	Neretva Konjic	43°38’13.31” N	17°58’46.53” E
3.	Polje Bijela	43°37’48.62” N	17°58’23.76” E
		43°37’29.83” N	17°58’13.56” E
4.	Mladeskovici	43°36’57.45” N	17°57’53.34” E
5.	Konjic Bijela	43°36’36.33” N	17°57’20.24” E
		43°36’4.57” N	17°56’59.94” E
6.	Rakov Laz	43°35’30.82” N	17°56’46.07” E
		43°34’43.15” N	17°56’1.62” E
7.	Klenova Draga	43°28’46.50” N	17°52’38.04” E
8.	Seliste	43°28’26.78” N	17°53’5.79” E
		43°27’59.18” N	17°53’27.44” E
9.	Dolac	43°27’49.44” N	17°53’44.99” E
10.	Zelenika	43°27’25.49” N	17°54’28.11” E
11.	Humi	43°26’43.27” N	17°54’40.61” E
12.	Humilisani	43°26’11.96” N	17°54’49.24” E
13.	Lisani	43°25’37.06” N	17°54’38.78” E
14.	Bosnjaci	43°25’11.23” N	17°54’31.07” E

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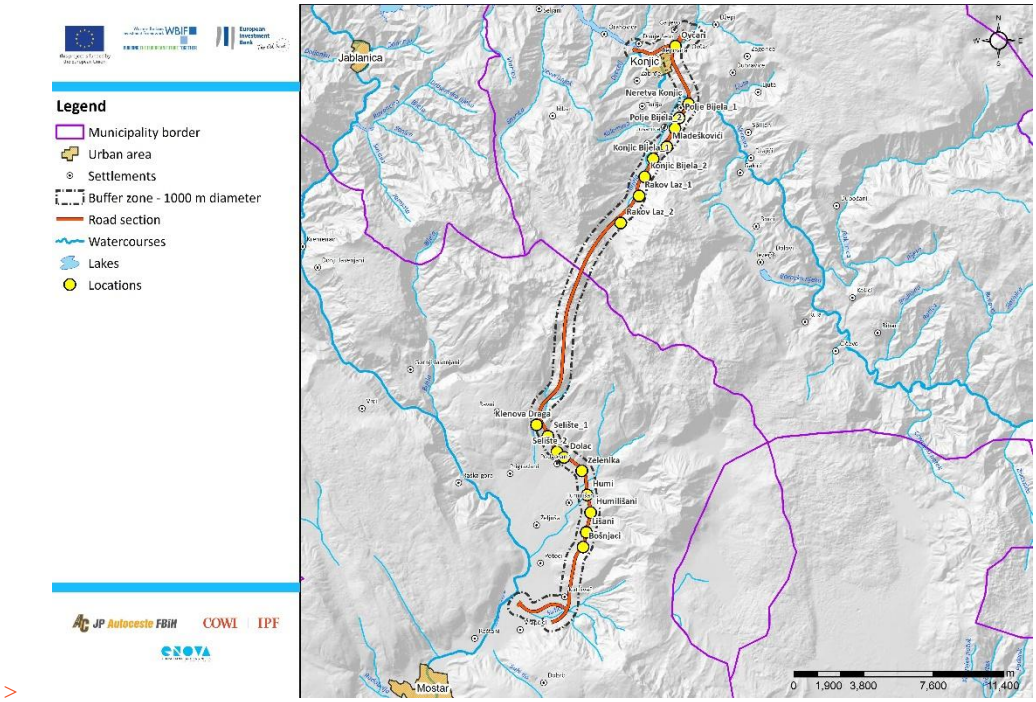

Figure 6-20: Map of ornithofauna survey localities in relation to the motorway route

A total of 2,285 data entries on the ornithofauna in the referenced area were collected, with 6,031 recorded specimens belonging to 98 bird species. Of this number, 76 species are marked as nesting birds, 18 species are registered in migration, while six species are in dispersion (they nest outside, but occasionally feed within the surveyed area).

From the aspect of species and categories of endangerment according to the IUCN Red List, Red List of Endangered Species of Fauna of the Federation of Bosnia and Herzegovina and Annex I of the Birds Directive, 14 bird species were identified as sensitive species. All of them are briefly discussed below.

The Great Cormorant (*Phalacrocorax carbo*; FBiH VU) and Common Kingfisher (*Alcedo atthis*; BD I), which are registered at the Neretva Konjic site, are present only during migration. Gray Herons (*Ardea cinerea*; FBiH VU), Marsh Harriers (*Circus aeruginosus*; FBiH VU, BD I), Syrian Woodpeckers (*Dendrocopos syriacus*; BD I), and Gray-headed Woodpeckers (*Picus canus*; BD I) do not nest in the motorway impact zone, but occasionally appear in dispersion, wandering, or flying over. The Pallid Swift (*Apus pallidus*; FBiH EN) nests in urban areas on tall buildings and feeds high in the sky, outside the motorway impact zone. A pair of Hobby falcons (*Falco subbuteo*; FBIH VU) was observed in mating ritual on May 13 at the Lisani site, on one of the transmission line poles, approx. 350 m away from the route. This species feeds in flight, most often catching large insects or birds in the sky. Since there are no suitable tall trees with crow nests along the direct impact zone, which is often inhabited by the Hobby, the motorway impact on this species can be considered minor. The Red-rumped swallow (*Cecropis daurica*; FBiH VU) is associated with settlements where it often nests in buildings. It is a widespread species in Herzegovina. The population size is estimated at 1,000-2,000 pairs with a trend of growth and

expansion of the range to the north. In the impact zone, a negligibly small number of pairs nest.

The Middle Spotted Woodpecker (*Dendrocopos medius*; BD I) was registered at five localities in the study area, of which nesting was confirmed at the localities of Neretva Konjic, Polje Bijela and Mladeskovici, while in the area of Zelenika and Hum, nesting territories of this species are on the edge of the impact zone. This species is a common and widespread species throughout Bosnia and Herzegovina, with a population size of 3,000-5,000 pairs. In the interior and in the north of the country, it is incomparably more numerous than in the area of Herzegovina.

The Black Woodpecker (*Dryocopus martius*; BD I) is an indicator species of preserved forest habitats. Nesting of this species in the impact zone was confirmed only at the locality of Rakov Laz, while at other localities it was recorded while flying over. The size of the nesting population in Bosnia and Herzegovina is estimated at 1,500-2,500 pairs and it is a common species throughout the country, especially in old and preserved forests with many rotten trees on the ground.

The White-backed Woodpecker (*Dendrocopos leucotos*; FBiH VU, BD I), with a population of 300-500 pairs, is one of the rarest and most endangered bird species in Bosnia and Herzegovina. It is an indicator of preserved beech forests, with a lot of rotten trees on the ground. Due to intensive forestry and sanitary felling, its population trend is declining. One specimen was observed during the nesting season approx. 170 m west of the motorway (Figure 6-21), while three more territorial males were registered on the slopes of Prenj, outside of the impact zone.

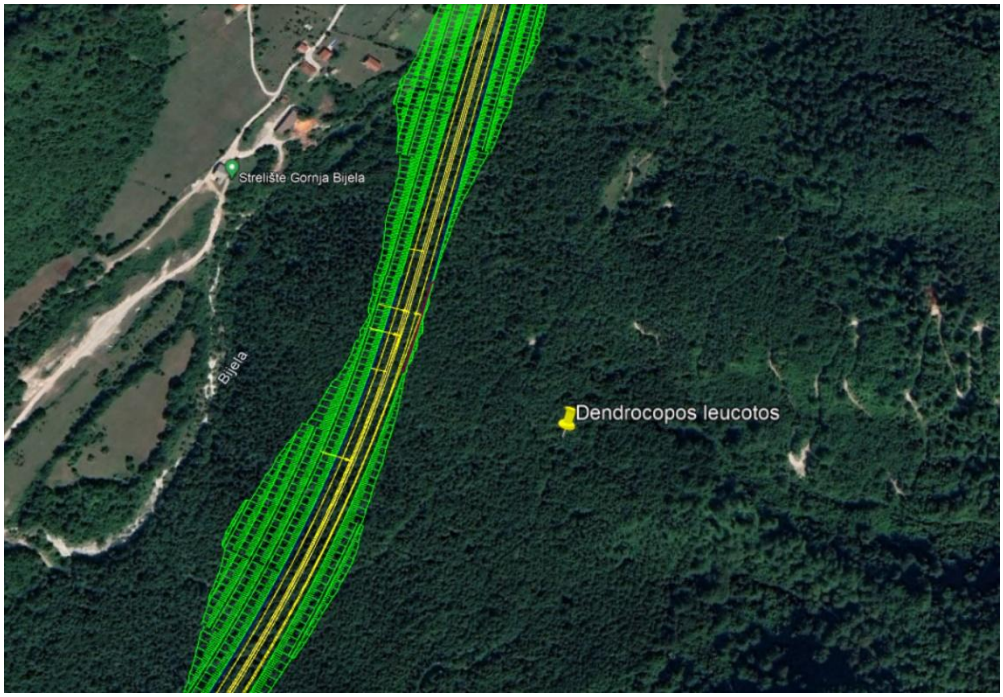

*Figure 6-21: Territory of white-backed woodpecker (*Dendroocopos leucotos*) in relation to the planned motorway route*

The size of the Golden Eagle (*Aquila chrysaetos*; FBiH EN, BD I) population in Bosnia and Herzegovina is estimated at 50-80 pairs and according to the Red List of Endangered Species of the Federation of Bosnia and Herzegovina it has the EN status. One inactive nest was found on the cliffs of Klenova Draga above the planned tunnel T3A during the month of June of 2021 and monitored in June 2022 (Figure 6-22). There are three possible reasons why the nest is inactive. The Golden Eagle sometimes has several nests in its immediate vicinity that change over the years. Considering the sensitivity of the species there is also a real possibility that the litter perished in the early stages of nesting or one of the individuals died, which was the initial assumption; however, an individual Golden Eagle was spotted flying above Klenova Draga in 2022. The flying individual and the empty nest found at a given locality are a definite confirmation of the presence of a nesting pair. Golden eagles in the region usually have 2-3 nests they maintain; however, this species is known to maintain over 10 nests at the same time. Come nesting season, they select one for that year. It cannot be known whether this nest will ever be inhabited again. The species is extremely sensitive to disturbance.

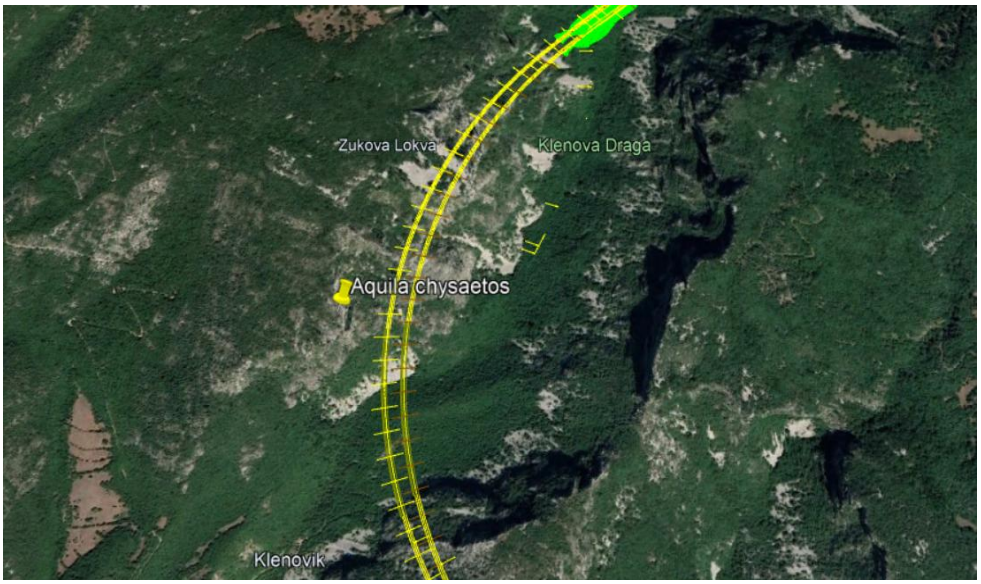

*Figure 6-22: Location of the inactive nest of golden eagle (*Aquila chrysaetos*) in relation to the planned motorway route*

According to the IUCN Red List, the European Turtle Dove (*Streptopelia turtur*; IUCN VU) falls within the highest endangerment category of all registered species. In Bosnia and Herzegovina, it is a relatively common and widespread species up to 1200 m above sea level. It is especially numerous in karst fields and on the edges of forests with clearings in Herzegovina, while avoiding large complexes of dense shrubs. Along the route of the future motorway, one territorial male was registered in the direct impact zone (Figure 6-23), while other territories of this species were positioned in the border area designated as the impact area.

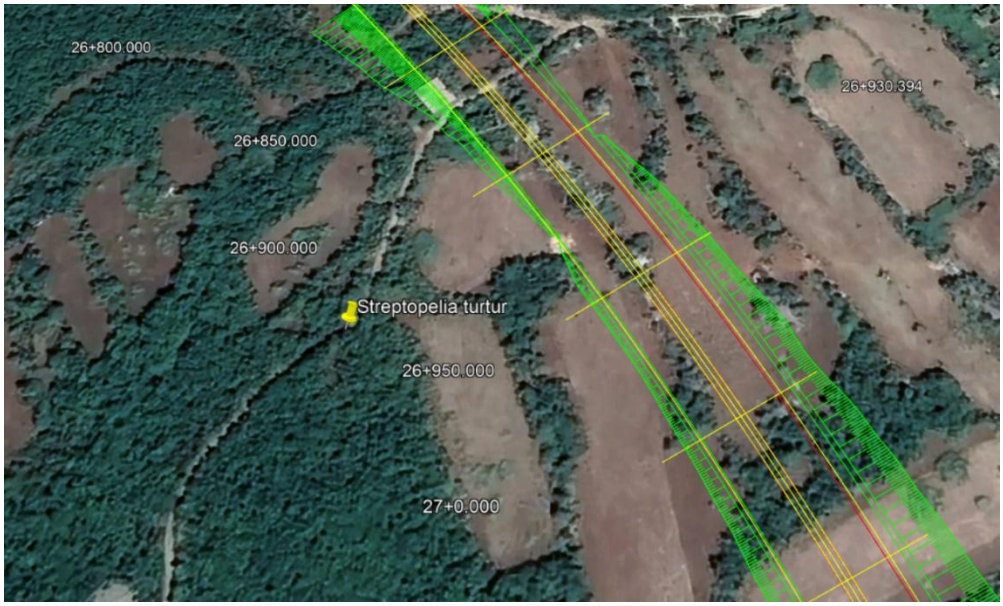

Figure 6-23: Territory of male turtle dove (Streptopelia turtur) in relation to the planned motorway route

Based on habitat types, number of species, presence of rare and endangered species, size of their populations, it is concluded that the most part of the motorway route are characterised by secondary habitats, formed under anthropogenic influence, or due to the succession of open meadows and pastures into dense shrubs and bushes and, as such, these parts of the route have extremely little protective value for bird conservation. There are no large open water areas in these localities where birds could concentrate for migration or nesting, no large nesting colonies have been discovered, as well as no nesting sites of rare and endangered species of European or national importance, and no bottlenecks through which birds migrate. Therefore, it can be assumed with great certainty that the construction of the motorway along this route will not have a great negative impact on birds.

On the other hand, due to the presence of rare and endangered species, the most important are forest habitats on the left side of the route at Rakov Laz where the white-backed woodpecker is registered, rocks and cliffs in Klenova Draga where the Golden Eagle nest was found, as well as fragments of grassland habitats in the locality of Zelenika where the turtle dove nests. In order to protect these species, it is necessary to apply special mitigation measures presented in ESMP and BMP.

6.2.3.3.5 Mammals (bats)

Field surveys were conducted in 2020 and 2021. They were carried out in two phases: a literature review for the study area and field trips for the purpose of species confirmation. The field surveys were conducted: from 28 to 30 September 2020, from 16 to 18 April 2021 and from 7 to 9 May 2021.

The research was conducted on 7 macro localities encompassing 60 micro localities along the future motorway route (Table 6-12). Prior to the field trips the literature review was done on recorded bat species in the respective area.

The available information was then verified through field surveys. Important observation is that estimated conservation status of BiH bat population is questionable due to very low local knowledge of bat population, distribution and trends. Data on local migration routes are almost completely absent.

Table 6-12: Coordinates of localities where field survey was conducted

Wider locality	Narrow locality	Coordinates
Kuti-Livac	Dubrava	43°23'12.23" N 17°53'7.00" E
	Dubrava_2	43°23'19.66" N 17°52'37.04" E
	Komic	43°22'51.79" N 17°53'43.17" E
	Buđevci	43°22'56.75" N 17°53'26.37" E
	Susica	43°23'9.90" N 17°53'36.95" E
	Kuti	43°23'17.51" N 17°54'18.64" E
	Kuti_1	43°23'26.17" N 17°53'57.87" E
	Kuti_3	43°23'3.77" N 17°54'8.72" E
	Kutilivac	43°23'41.53" N 17°53'45.98" E
	Livac	43°24'11.60" N 17°53'26.72" E
	Orlov kuk	43°24'4.56" N 17°53'35.69" E
	Orlov kuk_2	43°24'47.91" N 17°53'48.07" E
Koritna draga	Koritna draga	43°23'22.56" N 17°54'42.32" E
	Orlinka	43°23'10.89" N 17°54'34.94" E
	Dobrusa	43°23'39.39" N 17°54'44.95" E
	Dobrusa_2	43°23'51.11" N 17°54'51.32" E
	Kuti_2	43°23'35.71" N 17°54'26.74" E
	Dobrusa_3	43°23'28.11" N 17°54'54.83" E
	Dobrusa_4	43°23'46.15" N 17°54'42.90" E
Humi	Lisani	43°25'29.40" N 17°54'1.86" E
	Lisani_2	43°25'6.15" N 17°54'38.46" E
	Lisani_3	43°25'26.69" N 17°54'27.95" E
	Lisani_4	43°25'39.85" N 17°54'56.20" E
	Lisani_5	43°25'43.99" N 17°54'23.48" E
	Humi	43°26'7.13" N 17°53'49.68" E
	Humi_2	43°26'30.84" N 17°54'2.85" E
	Humi_3	43°26'9.90" N 17°54'32.64" E
	Humi_4	43°26'6.12" N 17°54'54.02" E
	Humi_5	43°26'21.12" N 17°54'45.37" E
	Humi_6	43°26'39.65" N 17°54'47.16" E
	Humi_7	43°26'47.87" N 17°54'25.54" E
Podgorani	Dolac	43°27'26.05" N 17°54'23.79" E
	Dolac_2	43°27'14.55" N 17°54'2.50" E

Wider locality	Narrow locality	Coordinates
	Dolac_3	43°27’33.70” N 17°54’2.55” E
	Podgorani	43°27’34.23” N 17°53’20.29” E
	Podgorani_2	43°27’39.50” N 17°53’34.03” E
	Podgorani_3	43°27’46.95” N 17°53’45.20” E
	Podgorani_4	43°27’52.48” N 17°53’43.47” E
	Podgorani_5	43°27’54.06” N 17°53’11.79” E
	Podgorani_6	43°28’4.82” N 17°52’58.37” E
	Podgorani_7	43°28’22.39” N 17°52’59.06” E
	Podgorani_8	43°28’4.42” N 17°53’18.78” E
	Podgorani_9	43°28’4.99” N 17°53’34.78” E
Podporim/Porim	Podporim/Porim	43°27’0.04” N 17°55’47.49” E
	Podporim/Porim_2	43°27’13.77” N 17°56’9.18” E
	Podporim/Porim_3	43°27’14.43” N 17°56’13.07” E
	Podporim/Porim_4	43°27’18.37” N 17°56’30.51” E
	Podporim/Porim_5	43°27’21.78” N 17°56’49.98” E
	Podporim/Porim_6	43°27’26.20” N 17°56’53.87” E
	Podporim/Porim_7	43°27’31.90” N 17°57’7.01” E
	Podporim/Porim_8	43°27’27.17” N 17°57’22.76” E
Ovcari	Ovcari_1	43°40’1.35” N 17°59’11.77” E
	Ovcari_2	43°40’11.43” N 17°58’49.51” E
	Ovcari_3	43°40’2.52” N 17°58’58.34” E
	Ovcari_4	43°39’42.07” N 17°58’26.06” E
Polje Bijela	Polje_Bijela_1	43°38’5.64” N 17°58’55.69” E
	Polje_Bijela_2	43°38’7.04” N 17°58’23.60” E
	Polje_Bijela_3	43°37’43.89” N 17°58’16.12” E
	Polje_Bijela_4	43°37’17.71” N 17°58’22.78” E
	Rakov_laz	43°34’14.25” N 17°55’38.71” E

The species were identified based on analysis of sound recorded on a heterodyne recorder Pettersson D1000X Ultrasound Detector (Bat detector) and by USB microphone u256 USB Ultrasound Microphone. The sound was then analysed in the software BatSound 5 (Windows software) and in application BatSound (Android phone application). The literature used for analysis of the recordings was: *Die Fledermause Europas* (2014) and *Bats of Britain and Europe* (2018). All species were identified exclusively based on the *time expansion* analysis, i.e., the analysis of frequency and length of call for the species where possible.

Literature listed in Annex C-4: Mammals (bats) suggests possible presence of 22 species for the wide surrounding area of the section of the Corridor Vc Konjic (Ovcari) – Prenj Tunnel – Mostar North (including Mts. Prenj, Zlatar, Velez). However, not all of them could be confirmed during surveys. Presence of a total

of 11 bat species was confirmed through surveys in 2020 and 2021. During the field surveys in 2020 the presence of eight species was confirmed: *Myotis oxygnathus* (Lesser mouse-eared bat), *Myotis mystacinus* (Whiskered bat), *Pipistrellus kuhlii* (Kuhl's pipistrelle), *Pipistrellus nathusii* (Nathusius's pipistrelle), *Eptesicus serotinus* (Serotine bat), *Nyctalus approx.* (Common noctule), *Nyctalus leisleri* (Lesser noctule), *Tardarida teniotis* (European free-talied bat). The 2021 field surveys revealed presence of four bat species. The species identified based on heterodyntal sound recording and analysis in Batsound software can be divided into two groups based on the appearance of the calls they emit:

- Group 1: The species identified are Greater horseshoe bat (*Rhinolophus ferrrumequinum*) and Lesser horseshoe bat (*Rhinolophus hipposideros*). By heterodyntal sound recording, these two species may be classified in the group of Rhinolophida based on the sound they emit and appearance of the call during the analysis in the Batsound software (FM/CF/FM call form).
- Group 2: Genus *Pipistrellus* (calls are of the FM/Qcf form) with two identified species: Common pipistrelle (*Pipistrellus pipistrellus*) and Khuli's pipistrelle (*P. kuhlii*).

All bat species are of conservation concern for the EU due to the fact that all species are listen in Annex IV of Habitat Directive. Additionally, a total of 10 bat species recorded during field surveys have the status of EN or VU according to the Red List of the Federation of Bosnia and Herzegovina. No critically endangered bat species have been registered.

Locality of Konjicka Bijela stands out with its diversity since all of the 11 species were registered there. Five species were found in the locations of Ovcari and Humilisani. Spatial distribution of registered bat species is shown in Figure 6-24 below.

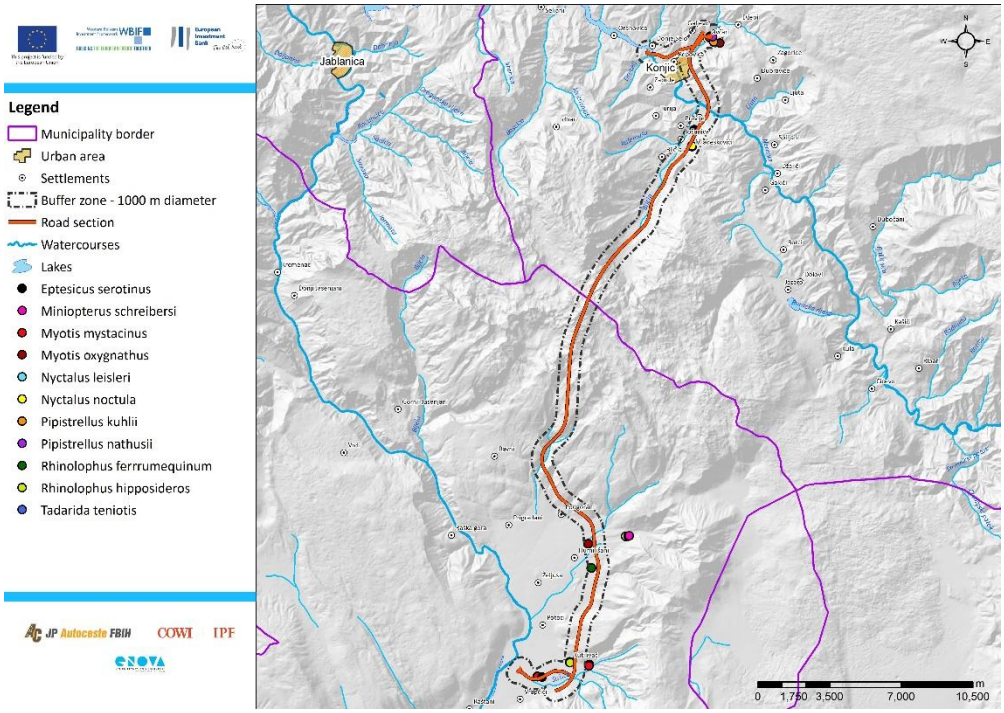

Figure 6-24: Spatial distribution of registered bat species in relation to the motorway route

During the topographic mapping of speleological sites in the area of influence, the presence of a number of speleological objects on the northern side of Prenj tunnel (Figure 6-25) and two caves north of the settlement of Podgorani was recorded (Figure 6-26). Based on stakeholder consultations, potential presence of approx. 10 speleological objects on the Prenj Mt. plateau is also anticipated; however, precise locations are not known.

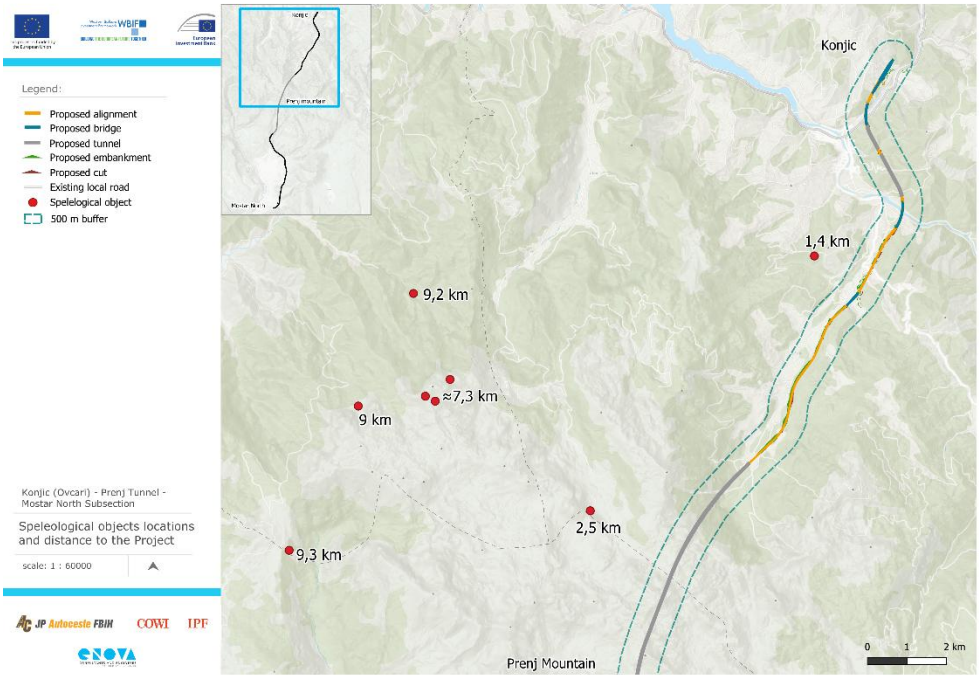

Figure 6-25: Mapped speleological objects on the Corridor Vc subsection Konjic (Ovcari) – Prenj Tunnel with indicated distances

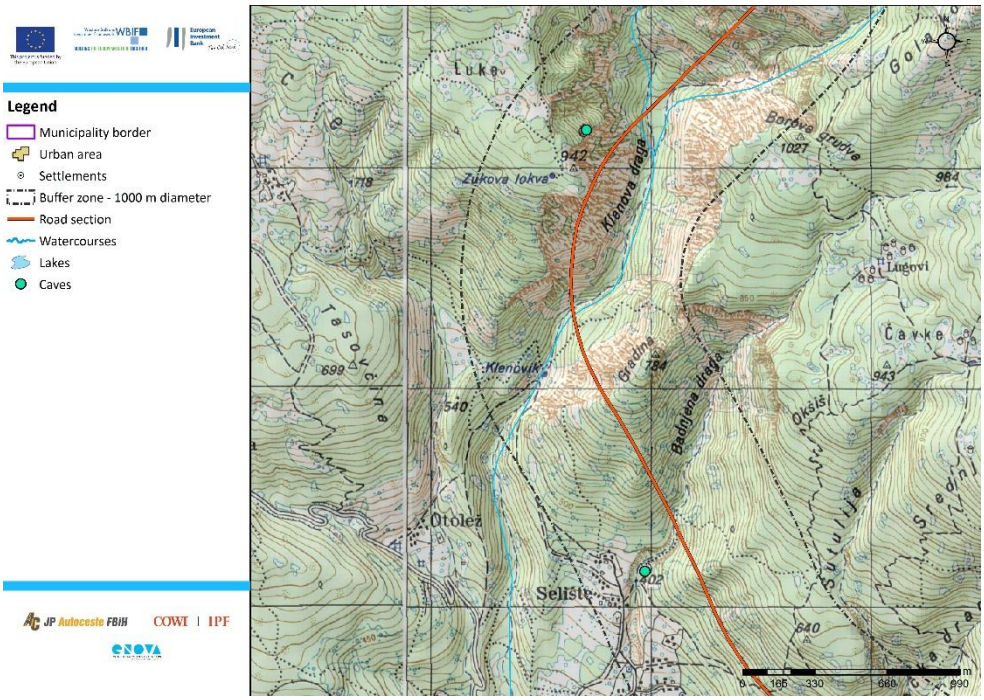

Figure 6-26: Mapped speleological objects on the Corridor Vc subsection Prenj Tunnel – Mostar North

6.2.3.3.6 Mammals (large mammals)

Field surveys were conducted on multiple occasions in 2020 and 2021: 24-25 October 2020, 7, 9-10, 17, 27 March 2021; 4, 15-16, 23-24 April 2021; 2, 8-9,

16-17, 21-22 May 2021. The surveys have been carried out in optimal weather and during activities of the targeted fauna.

Mammal field research was conducted by methods of active field search and observations. Field work consists of site inspection and active search for individuals, direct and indirect determination of species presence based on traces in snow, mud, hair remains, traces of antlers cleaning, faeces, and other traces. In addition to the above, a survey was conducted with the local population and local hunting associations in order to determine the presence of certain species in the route area. Also, mammal species were monitored by waiting at sites within the area of influence. The research was conducted on 7 macro sites that included 60 micro sites (Table 6-2Table). Systematic field research was preceded by the collection of all available literature data.

According to the results of the previous study and other literature the presence of at least 15 species of mammals was suggested in the wider area of the motorway among which we highlight: *Canis lupus* (wolf), *Ursus arctos* (brown bear), *Lutra lutra* (otter), *Lynx lynx* (Eurasian lynx), and rodent *Dinaromys bogdanovi* (Balkan snow vole). The listed species are among the most sensitive species identified as part of the desk study, since the species are classified as vulnerable or endangered on the Red List of FBiH. Eurasian otter is also classified as near-threatened on the IUCN Red List, while Balkan snow vole is endemic to the Balkan peninsula and is classified as VU by the IUCN. Other species of large mammals identified in the literature review as part of this report are not on the IUCN Red List of critically endangered, endangered, and vulnerable species. Considering the importance of these species, research on habitat characteristics were performed during field surveys. Large mammals usually have wide areal which may stretch to e.g. 50 km or larger for some species, but having in mind the present conditions of the habitats in the project area and existing fragmentation of habitats due to the local roads, settlements and other infrastructure, it is considered that the project area has no potential to sustain large mammals as most natural habitats are already degraded and due to traffic noise of urban and semi-urban areas. Habitats on this route do not support the needs of animal species for breeding and feeding (Figure 6-27). However, plateau of the Mt. Prenj outside of Project’s area of influence is possibly used by all species other than otter as a habitat or transit area.

Figure 6-27: Example of habitats present in the surveyed area in the locality of Humilisani south of Prenj tunnel

In the Project's area of influence, field survey (directly and indirectly based on traces and biological traces of mammals) determined the permanent presence of six species from the group of mammals (European mole, northern white-breasted hedgehog, European hare, roe deer, wild boar, European polecat, beech marten and red fox). The most numerous are the findings of the European hare (20 findings at nine site locations); while the species of northern white-breasted hedgehog and polecat were found on two site locations with one individual each.

Figure 6-28: Traces of digging characteristic for wild boar (left) and peeled tree bark from deer cleaning their antlers (right)

No mammal species with the IUCN status VU, EN, CR on the global, European, and (F)BiH level nor species of importance for the European Union were found in the 500 m-buffer zone of the motorway section.

It must also be noted that the representatives of Bankwatch recorded otter scat during their visit to Project area in 2022[9]. This suggests that even though the habitat was not evaluated as suitable for its permanent presence, otter is at least occasionally present in Bijela River. Additionally, during stakeholder consultations, it was mentioned that otter is occasionally seen in the very centre of City of Konjic. Based on the Bankwatch findings and stakeholder consultations, it is believed that at least one territorial male moves through its territory that includes Bijela, Tresanica and Neretva Rivers. Otter habitat preferences and migration tendencies depend on the availability of resources and environmental conditions; therefore, the otter(s) may migrate locally in pursuit of food. Bijela River in its upper part does not represent an abundant food source but is more rich in fish in its lower part.

The impact on wildlife and hunting needs to be considered through several factors that are crucial for its assessment, the most important being: habitat fragmentation (it affects migration and basic needs of fauna), inorganic waste (poses a potential risk to game due to injury) and organic waste (predators gather due to easily accessible food and thereby lose their innate fear of humans, which represents danger to the possible occurrence of disease). An increase in casualties of people and animals (traffic accidents) can also be expected it is therefore necessary to apply measures acceptable in terms of game and hunting.

6.2.4 Flora and Fauna of Konjic Bypass

6.2.4.1 Habitats

The methodology for habitat surveys for the Konjic bypass area was the same as for the motorway layout; therefore, it will not be further elaborated in this chapter. A total of eight EUNIS habitat types were registered along the Konjic bypass. Surveyed area included bypass footprint and 1 km-wide buffer zone around it. The registered habitat types are shown in Table 6-13 below.

Table 6-13: EUNIS habitat types registered along the Konjic bypass

EUNIS code	Habitat name	HD/BC
C1	Surface standing waters	No
C2.2	Permanent non-tidal, fast, turbulent watercourses	No*
G1.6	Beech (*Fagus*) woodland	No*
G2.1	Mediterranean evergreen *Quercus* woodland	No*
G5.2	Small broad-leaved deciduous anthropogenic forests	No
I1.3	Arable land with unmixed crops growing under low-intensity agricultural methods	No
I2.1	Large-scale ornamental garden areas	No

[9] Photo provided on pg. 52: https://bankwatch.org/wp-content/uploads/2024/07/Comments-on-ESIA-package-Prenj-for-written-submission-to-the-EBRD-and-EIB-30-June-2024.pdf [24.12.2024]

EUNIS code	Habitat name	HD/BC
J1.2	Residential buildings of villages and urban peripheries	No

*the habitat types themselves have analogues in other classifications i.e. Habitats Directive and Bern Convention; however, the habitats present in the surveyed area do not meet the criteria as they are degraded and under significant anthropogenic pressure

C1 Surface standing waters are non-coastal above-ground open water bodies of fresh and brackish stagnant water, including dune pools, with natural or semi-natural benthic, submerged, floating and planktonic communities. These habitats can also be seasonally dry (temporary or occasional ponds and lakes), with the dry period lasting less than six months.

C2.2 Permanent non-tidal, fast, turbulent watercourses develop at the bottom of fast moving streams in clear oligotrophic water. Due to the speed of the water, there are no conditions for the lush development of a large number of plant species. In addition to a small number of representatives of different groups of algae: Chlorophyta, Cyanophyta, Rhodopyta, the main representatives of these habitats are invertebrates from the groups: Ephemeroptera, Plecoptera, Trichptera, Amiphipoda, etc. Creeping mosses are often represented, e.g. *Fontinalis antipyretica, Calliergon cordifolius, Scapania undulata* etc.

G1.6 *Fagus* woodland are tall forests dominated by different species of beech. Beech forests can vary in their floristic composition and structure. Beech forests occupy terrains with different slopes and all exposures. Depending on the type of the substrate, these forests develop on different types of automorphic soils. Depending on the slope of the terrain, the age of the stands and anthropogenic influences, the soils under mountain beech forests can be very deep (60-90, but up to 120 cm). The most common companions of beech in these forests among woody species are: *Acer campestre* L., *Acer obtusatum* Willd., *Carpinus orientalis* Mill., *Cornus mas* L., *Corylus colurna* L., *Cotinus coggygria* Scop., *Crataegus monogyna* Jacq., *Fraxinus ornus* L., *Juglans regia* L., *Prunus avium* (L.) L., *Rubus idaeus* L., *Sambucus nigra* L., *Ruscus aculeatus* L., *Arum maculatum* L., *Anemone nemorosa* L., *Asarum europaeum* L. etc.
G2.1 Mediterranean evergreen *Quercus* woodland is dominated by deciduous trees (pubescent oak, black hornbeam, black ash, white hornbeam). The tree canopy in this type of habitat can be up to 15m, although it is often lower. The most commonly found species are: *Quercus pubescens* Willd, Cornus mas L., *Crataegus monogyna* Jacq., *Fraxinus ornus* L., *Fraxinus excelsior* L., *Ostrya carpinifolia* Scop., *Prunus avium* (L.) L., *Rubus idaeus* L., *Ruscus aculeatus* L., *Teucrium chamaedrys* L. etc.

G5.2 Small broad-leaved deciduous anthropogenic forests are natural or artificial habitats with an area usually less than 0.5 ha, with crown coverage usually higher than 10% and tree height usually higher than 5 m, under strong human influence through maintenance and damage (small, intensively managed forests and small forests strongly influenced by anthropogenic activities, plantations of young trees with a potential canopy cover greater than 10%, groves; rows of mature trees, such as avenues and windbreaks).

I1.3 Arable land with unmixed crops growing under low-intensity agricultural methods encompasses land used for commercial agriculture or horticulture, usually of large area (often more than 25 ha, rarely around 1 ha) with few or no buildings. These habitat types are dominated by weedy and segetal plant species such as: *Amaranthus retroflexus* L. *Linaria genistifolia* (L.) Mill., *Veronica agrestis* L. etc.

I2.1 Large-scale ornamental garden areas include cultivated areas dominated by ornamental plants, and invasive alien species occupy a significant place among them.

J1.2 Residential buildings of villages and urban peripheries include primarily human settlements, more or less densely distributed buildings with accompanying infrastructure, on smaller or larger areas, and with a smaller or very large number of inhabitants.

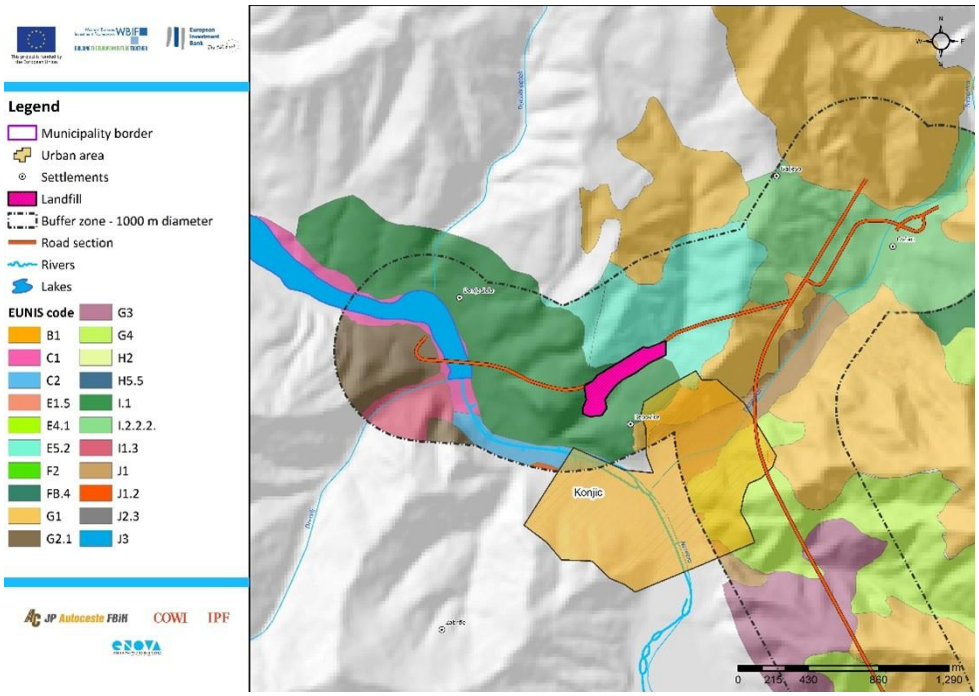

Figure 6-29: EUNIS habitat types in relation to the buffer zone of the surveyed area around Konjic bypass

6.2.4.2 Flora

The plant species were determined directly in the field, while only a small part of the plant material was collected and photographed for subsequent determination and verification. For species determination, standard keys and iconographies were used. The nomenclature is mostly harmonised with the data of Flora Europaea, i.e. its revision, which is carried out with the publication of the Atlas of the Flora of Europe (Jalas et al, 1972-2013) and Euro+MedPlantBase (2006-2022) and the Flora of Croatia (Nikolic, 2022). As for habitats, the methodology used in flora survey for Konjic bypass area is identical as the methodology used for motorway surveys.

Based on field research, the presence of a total of 178 vascular plant taxa was established. Detailed alphabetical list of species and subspecies with associated data (endangered status based on the Red List of Flora of the Federation of Bosnia and Herzegovina, endemism status, protection status at the level of the Federation of Bosnia and Herzegovina and invasiveness code in the Federation of Bosnia and Herzegovina) is provided in Annex A to the ESIA.

The Konjic bypass area is characterised by low diversity of flora, dominated by species common and widespread in BiH, region and Europe. A very small number of species of low conservation concern were recorded: the pyramidal orchid *Anacamptis pyramidalis* (FBiH NT), European cyclamen *Cyclamen purpurascens* (strictly protected in FBiH), *Edraianthus tenuifolius* (endemic), *Genista sylvestris* subsp. *dalmatica* (endemic), Butcher's broom *Ruscus aculeatus* (VU in FBiH). A total of eight invasive species were recorded, which is expected for areas under anthropogenic pressure.

6.2.4.3 Fauna

Fauna of area surrounding Konjic bypass was performed with focus on herpetofauna and ornithofauna. As the bypass passes through areas with human presence and pressure (Figure 6-30), amphibians, reptiles and birds were groups identified as possibly most present and with species potentially differing from the species found along the motorway alignment.

Figure 6-30: Photograph from the surveys of Konjic bypass

Additional field research on amphibians and reptiles was conducted from the 20th to the 21st June 2022. Field research was planned and conducted in a manner to provide results covering the period of the biggest activity of diverse species of amphibians and reptiles. The used materials and methods are the same as the ones described in Chapter 6.2.3.3.3 and Annex C-2 to the ESIA.

Four species of amphibians were registered in the study area: marsh frog (*Pelophylax ridibundus*), common toad (*Bufo bufo*), yellow-bellied toad

(*Bombina variegata*), and fire salamander (*Salamandra salamandra*). Recorded permanent aquatic habitats in the area of Konjic bypass road are the Neretva River, Tresanica River, and an unnamed stream that flows between Repovica and Gredina (Figure 6-31). The presence of the yellow-bellied toad (*Bombina variegata*) has been recorded in the unnamed stream. It is very important to preserve this water body in as original form as possible, considering that this species is listed on the Red List of the FBiH, Annexes II and IV to the Habitats Directive, and Appendix II to the Bern Convention.

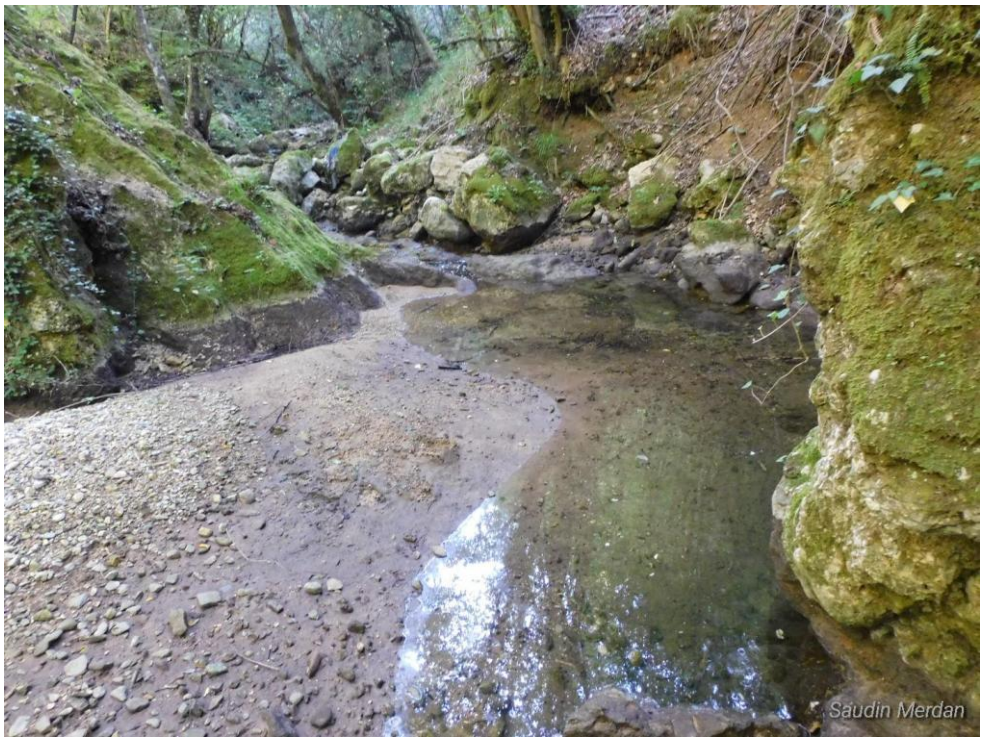

Figure 6-31: The unnamed stream that flows from Repovica

During the field research on the Konjic bypass, four species of reptiles were registered: Dalmatian Wall Lizard (*Podarcis melisellensis*), Common Wall Lizard (*Podarcis muralis*), Eastern Green Lizard (*Lacerta viridis*), and Grass Snake (*Natrix natrix*). The found species are very numerous and common in the area of Konjic, the entire BiH and wider.

The field survey of ornithofauna was performed on the same dates as herpetofauna, 20-21 June 2022. Used methodology is the same as the methodology used for motorway ornithofauna surveys provided in 6.2.3.3.4 and, in more detail, Annex C-3 to the ESIA.

In order to provide a more accurate overview of the spatial distribution of registered species, the area of the Konjic bypass was divided into six smaller sections, defined according to habitat types. The researched sections were chosen with the aim of covering all present habitat types, which would result in the most representative sample (Figure 6-32).

Figure 6-32: Sections (polygons) included in ornithofauna surveys

A total of 30 bird species were registered. Considering the research period, which includes the late nesting aspect, this number does not reflect the real state of the ornithofauna on the given section, but it gives a good insight into the state of the habitat and the degree of influence of the construction of the bypass on bird populations and their habitats. According to the IUCN Red List, all species along this section have the lowest level of threat (LC). According to the EU Birds Directive, one species, the red-backed shrike (*Lanius collurio*) is on Annex I. Only two territories of this species were found in fragments of the typical habitat for this species, in the settlement of Donje Selo, along the right bank of the Neretva. Red-backed shrike inhabits open grassy habitats, with scattered bushes. It is a numerous and widely distributed species throughout Bosnia and Herzegovina. Therefore, the construction of the bypass, along which there are individual pairs of the species, will not have a negative impact on the national and European population of this species. Regarding FBiH Red List, red-rumped swallow (*Cecropis daurica*) and the gray heron (*Ardea cinerea*) have the status of vulnerable species (VU). Both species have a trend of population growth and area expansion at the level of Bosnia and Herzegovina. The gray heron does not nest along the route of the bypass but can be seen in the given area in search of food and in flight. On the other hand, the red-rumped swallow nests on buildings in the Donje Selo settlement. The construction of the bypass will not contribute to the disturbance of the national populations of the given species.

6.2.5 Flora and Fauna of Disposal Sites

The disposal of inert waste that will be created by preparing the site for construction works and tunnelling will take place at three planned locations. All planned locations are within a zone of 500 m on both sides of the planned motorway and Konjic bypass and were considered from the aspect of biodiversity in the context of the baseline conditions and potential impacts of the Project.

The inert waste that will primarily be generated by the construction of the Prenj tunnel will mainly consist of rocks. The disposal of this material is planned on the route itself, in the form of an embankment for material that is appropriate

for this purpose. This area was considered as part of the biodiversity analysis on the northern side of the Prenj mountain. The route in this part is located near the area where human activity is present and is not characterised by high value biodiversity. The area under direct influence is included in the previously described analysis of habitat areas under direct influence. The dominant type of habitat that will be affected by the deposition of stone material at this location and the creation of an embankment for the planned motorway is I1 - Arable land and market gardens. The location of the embankment is within a potential Natura 2000 site and a candidate Emerald site. However, the impact of this disposal site as such cannot be observed independently of the impact of the motorway itself, considering the future role of the disposal site as an embankment, and is addressed in Chapter 6.3.

Excess excavated material unsuitable for embankment preparation and unsuitable organic material will be used for landscaping on three sections of the Konjic (Ovcari) – Tunnel Prenj subsection. The main reason for landscaping of these areas is that in the zone where the longitudinal slope is at 6.0%, breaking ramps are planned in case of brake failure, and an indirect outcome will be a better visual experience because the height of the embankment will not be as prominent in the general surroundings. Once the landscaping is completed up to the final elevation, the areas will be greened to blend with the surrounding environment. Greening must be done with autochthonous plants that are characteristic and appropriate for the biotic and abiotic conditions in the intervention area, and in accordance with the future Land and Habitat Restoration Plan. The habitat type that is present next to the landscaping zones is G1 – Broadleaved deciduous forests in which you can find various types of oak, hawthorn, and other common deciduous species, but also invasive plant species that will have to be controlled in accordance with the future Invasive Species Management Plan.

The site planned for the disposal of waste resulting from the construction of part of the Prenj tunnel, the entire subsection of the Prenj Tunnel - Mostar North and the access roads to the Prenj tunnel from the south is located in Humilisani. This disposal site will be arranged by applying a surface layer of land, and special studies will be prepared to ensure integration into the environment. As with other landfills, greening must be done with autochthonous plants that are characteristic and suitable for the biotic and abiotic conditions in the intervention area, and in accordance with the future Land and Habitat Restoration Plan. This is the only planned landfill located in a natural environment, which will not be under the direct impact of the motorway itself. It is not located in protected areas, potential Natura 2000 or candidate Emerald sites. The dominant type of habitat at the planned location of the waste disposal site is E5.2 – Thermophile woodland fringes. The locality is going through an intensive process of succession, i.e. progressive change in the dominant vegetation. As a result of this natural process, plant and animal species accustomed to open meadows with little or no vegetation, e.g. turtle dove present in such habitats in the general area, lose their habitat. There are no core habitats of endangered,

protected or endemic species present on the location, and there are no critical habitats in the area.

The disposal site for inert waste generated by the construction of the Konjic bypass is planned at the currently active Konjic Municipal Solid Waste disposal site, which will have a positive impact from an environmental point of view. The location of the Konjic Municipal Solid Waste disposal site has no biodiversity values.

6.2.6 Protected Areas

According to the Law on Nature Protection of Federation of Bosnia and Herzegovina[10] the system of protection of natural areas foresees the establishment of protected areas of different categories in line with IUCN categorisation. National Biodiversity Strategy and Action Plan of BiH 2015-2020 (NBSAP BiH)[11] aimed to map and protect BiH's specific biodiversity by 2020 in accordance with the current spatial documentation (legislation on nature protection determines that protected areas are established on the basis of spatial plans). According to the Sixth national report to UNCBD and based on the analysis of available spatial plans it can be concluded that BiH strives to protect 17% of its territory. The current percentage of territory under protection in Bosnia and Herzegovina is significantly smaller than planned and currently sits at 2.73%[12].

There are no officially designated protected areas (PAs) in the Project area according to the Federal Ministry of Environment and Tourism[13], as shown in Figure 6-33 below. The nearest officially established PA to the project site is Blidinje Nature Park, which is located 13 km of air distance west of the motorway route.

[10] Official Gazette of FBiH, No. 66/13
[11] Council of Ministers, Strategy and Action Plan for the Protection of Biological Diversity of Bosnia and Herzegovina for the period 2015-2020, 2017 (available at: http://www.vijeceministara.gov.ba/akti/prijedlozi_zakona/default.aspx?id=25304&langTag=hr-HR)
[12] As of February 2023, calculations based on the newest data available
[13] Available at: http://e-prirodafbih.ba/en/protectedsites/

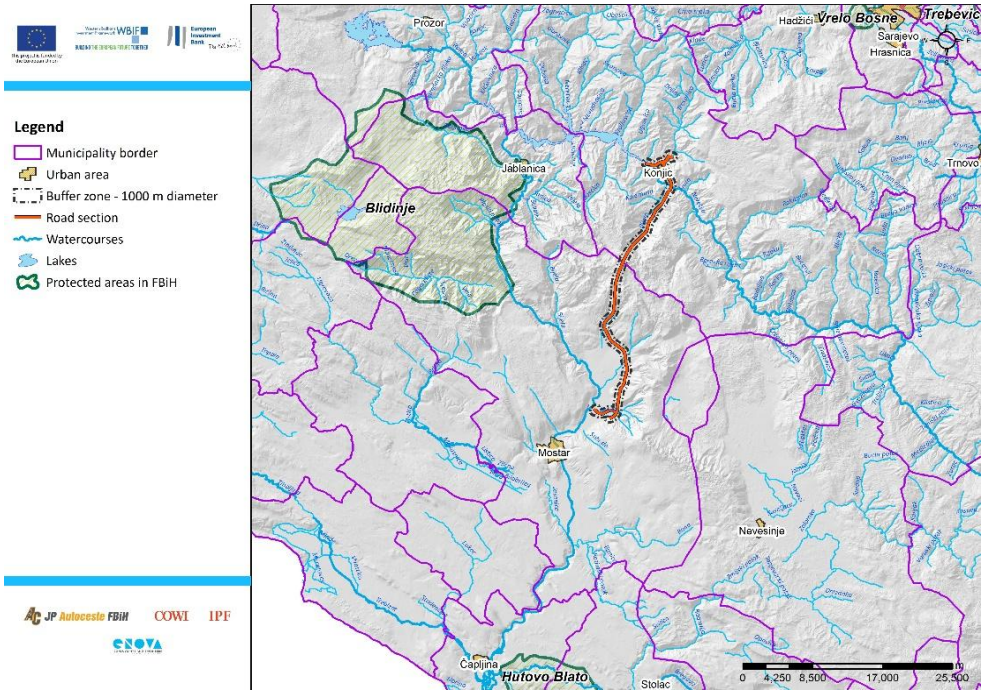

Figure 6-33: Spatial distribution of existing protected areas in relation to the motorway route

Protected area of Vrtaljica dolomites (Zlatar-Vrtaljica Hill) near Konjic, through which a tunnel is planned, was designated to protect a number of rare plant species in 1956[14] but it is no longer under formal protection *in praxis*. Size of this PA is approx. 56 ha and was protected as a botanical reserve in Socialist Republic of BiH (SRBiH). This category would correspond to the current IUCN category I, however, previous categorisation of PAs in former Yugoslavia (SFRJ) was not in line with IUCN. The *Law on Nature Protection of FBiH* states that all natural features protected until said law was enacted stay protected but must go through the process of revision. Laws on designation of protected areas adopted in SFRJ are not in force in Bosnia and Herzegovina nowadays, therefore this PA cannot be considered protected *in praxis* since no legal steps have been taken to re-establish the PA in independent Bosnia and Herzegovina, there is no monitoring, management body nor management plan. Nonetheless, as the area is considered protected *de iure*, the ESIA considers it as such. Spatial plan of SRBiH (1981-2000) also listed planned protected areas among which National parks Prenj and Cvrsnica-Cabulja were the closest to the motorway route[15]. However, as previously highlighted, these formerly planned PAs have no legal status in independent Bosnia and Herzegovina.

[14] Official Gazette of SRBiH, No. 4/56
[15] Spatial plan of Konjic Municipality 2013-2033

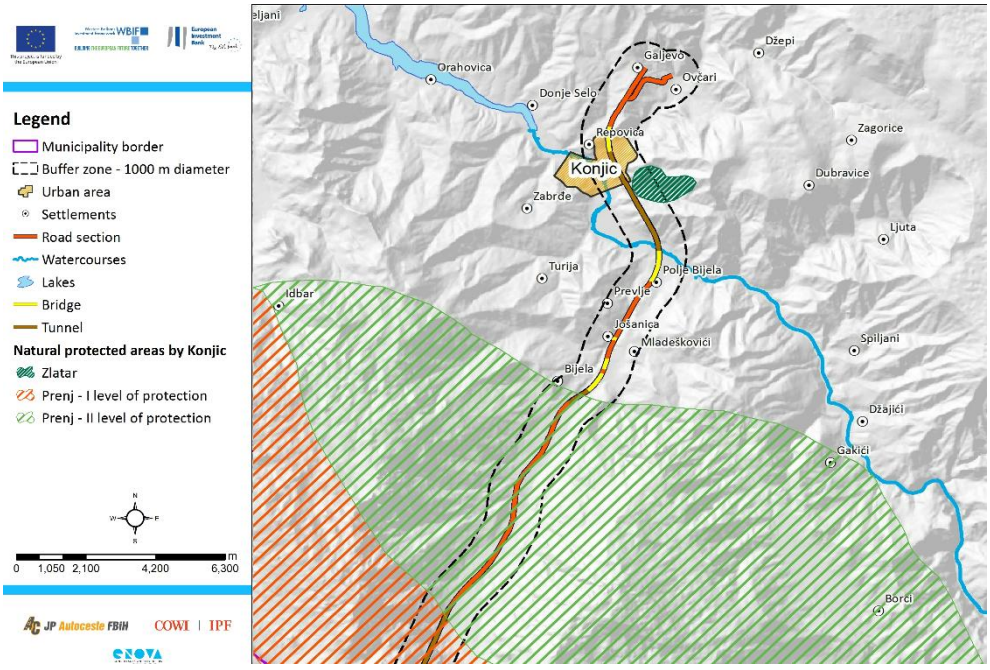

Figure 6-34: Position of the motorway in relation to PA Zlatar and Prenj

A total of 86,659.66 ha is protected in Federation BiH, which covers 3.32% of its territory[16]. Proposal of the Spatial Plan of the FBiH (2008-2028), which is never officially adopted, envisages the establishment of 14 new protected areas with a total spatial coverage of 18.5% of the area of the Federation of Bosnia and Herzegovina. Table 6-14 shows planned PAs in FBiH, out of which Prenj – Cabulja – Cvrsnica – Vran can be highlighted as PA that would be affected by this project if established.

Table 6-14: Planned protected areas in FBiH[17]

No.	Name of protected area	Surface (ha)
1.	Igman – Bjelasnica – Treskavica – Visocica – Rakitnica River Canyon	**95,032.4**
2.	Prenj – Cabulja – Cvrsnica – Vran	**101,744.3**
3.	Mt. Vranica	**25,078.1**
4.	Mt. Grmec	**78,939.8**
5.	Radusa – Stozer – Crni Vrh	**42,415.5**
6.	Mt. Sator	**29,736.3**
7.	Dinara	**26,314.9**
8.	Mt. Pljesevica	**5,094.7**
9.	Livanjsko Field	**19,833.8**
10.	Mt. Vlasic	**12,382.9**
11.	Popovo Field – Vjetrenica	**3,572.5**
12.	Canyons of Neretva, Doljanka, Ribnica and Drezanka	**7,357.3**
13.	Pliva Lakes	**633.9**
14.	Una River Basin	**34,685.8**

[16] Calculation based on official sizes of protected areas compared to total FBiH area
[17] Proposal of the Spatial Plan of the FBiH (2008-2028)

Throughout history, there were multiple initiatives for establishment of a protected area on Mt. Prenj (and various other nearby mountains). During 1996, an initiative for establishing Prenj-Cabulja-Cvrsnica-Vran National Park was launched. Institute for Protection of Cultural and Natural Heritage of FBiH first made a *Draft Proposal for Establishment of Nature Park Prenj-Cvrsnica-Cabulja* in 1996 and the same initiative was resubmitted in 2003 by non-governmental organisations in the framework of the project *Possibilities and perspective of National Park Prenj-Cvrsnica-Cabulja* supported by the World Wildlife Fund (WWF). Official proposal was presented to the Federal Ministry of Spatial Planning and Environment in 2005, which led to the *Decision on Establishing Prenj-Cvrsnica-Cabulja as Area of Interest to FBiH* by the Federal Parliament in 2006. This has increased interest and biodiversity research as well as disagreements on the size, borders and category of the PA which make the establishment of this national park within its planned boundaries highly unlikely in the near future. The *Feasibility Study for Protection of Cvrsnica, Cabulja, Vran, Prenj Area with Nature Park Blidinje* was commissioned by the Federal Ministry of Environment and Tourism in 2011. After a long period of no progress on the protection, it was announced in late 2024 that the United Nations Development Programme in BiH plans to support the expert studies that will aid protection of the parts of Mt. Prenj within City of Konjic[18].

A small portion of section Konjic (Ovcari) – Prenj tunnel – Mostar North is designed through the mentioned planned protected area via tunnel passing through Mt. Prenj, thus avoiding direct adverse impacts. Tunnel will also enter the mountain at a lower altitude, avoiding sensitive and valuable habitats and species mainly limited to higher altitudes. No other potential PAs will be under the impact of this project.

In addition to the Proposal of the Spatial Plan of the FBiH, Global Environment Facility (GEF) is funding the ongoing project *Achieving Biodiversity Conservation through Creation and Effective Management of Protected Areas and Capacity Building for Protection of Nature in BiH*, implemented by United Nations Environment Programme in BiH[19] with the aim to officially protect five areas in FBiH:

- Botanical and floral reserve Mediteranetum in Municipality of Neum (Herzegovina-Neretva Canton),
- Cave system Vjetrenica (Herzegovina-Neretva Canton),
- Livanjsko Field (Canton 10),
- Bjelasnica – Visocica – Treskavica – Rakitnica River Canyon (Herzegovina-Neretva Canton and Sarajevo Canton),
- Mt. Zvijezda (Zenica-Doboj Canton).

All five ongoing initiatives regarding designation of mentioned protected areas are located outside of area where project impacts are expected. The three closest natural areas to the motorway route are: Bjelasnica – Visocica –

[18] Available at: https://www.undp.org/bosnia-herzegovina/news/initial-meeting-declaration-prenj-mountain-protected-area
[19] Available at: https://www.thegef.org/project/achieving-biodiversity-conservation-through-creation-effective-management-and-spatial

Treskavica – Rakitnica River Canyon at 7 km east, Mt. Zvijezda at 63 km north-north east and Livanjsko Field at 65 km west of air distance away from the project area, therefore not under expected project impact (Figure 6-35).

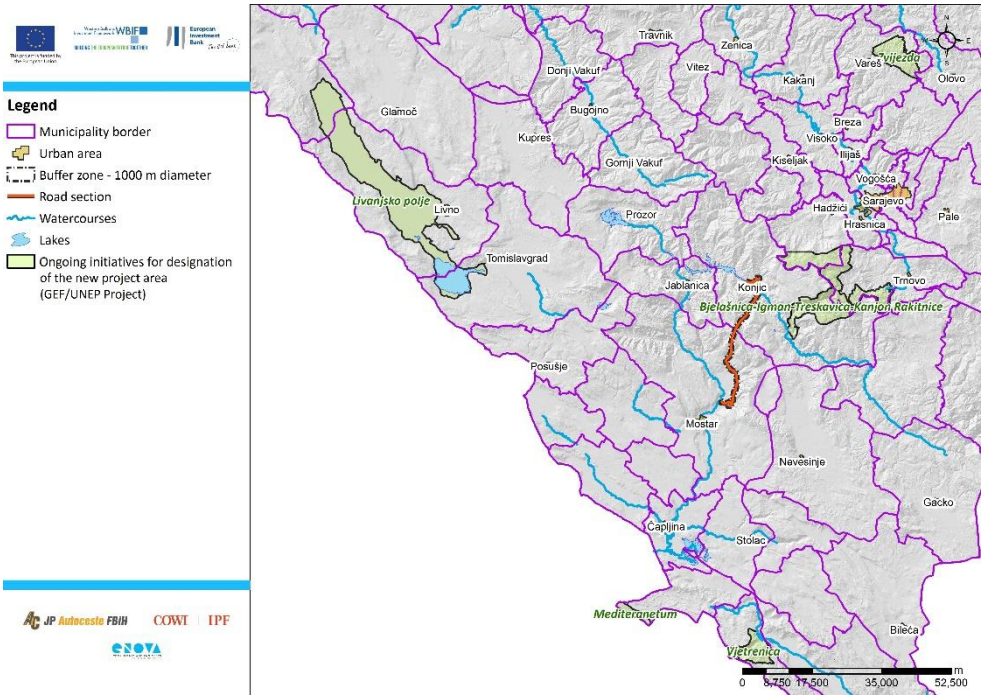

Figure 6-35: Spatial distribution of future protected areas that are part of the UNEP/GEF project in relation to motorway route

Ramsar sites[20] are not found in vicinity of this motorway section either, with Hutovo blato being the closest one approx. 45 km south of project area. Considering IBAs[21], there are no existing sites nearby; however, according to the Ornithological Society "Nase ptice", Prenj – Cvrsnica – Cabulja area falls under sites of potential conservation interest regarding ornithofauna.[22]

6.2.7 Potential Natura 2000 Sites

The Government of Federation of Bosnia and Herzegovina adopted the *Decree on the Natura 2000 Program – Protected Areas in Europe*[23] in 2011, in order to establish the ecological network of protected natural habitat types and species in the Federation of Bosnia and Herzegovina and to include certain sites into international network of protected natural habitats and species. This *Decree* includes objectives for preservation of Natura 2000 sites and necessary measures for preservation or for favourable state of population of wild plants and animal species in the nature, their respective habitats and habitat types.

[20] Wetlands protected by national governments to fulfil their obligations under the Convention on Wetlands of International Importance (the Ramsar Convention)
[21] IBA is an area identified using an internationally agreed set of criteria as being globally important for the conservation of bird populations
[22] Kotrosan, D, Drocic, N, Trbojevic, S, Simic, E, & Dervovic, I, Program IBA. Medunarodno znacajna podrucja za ptice u Bosni i Hercegovini, 2012.
[23] Official Gazette of FBiH, No. 41/11

The *Decree* passes a part of EU Habitat directive[24] with its Annexes and a part of the Birds Directive[25] on the conservation of wild birds with its Annexes.

Bosnia and Herzegovina is not a member of the European Union and does not have the obligation to formally proclaim Natura 2000 areas before accession to the EU. However, BiH is a signatory of the Bern Convention and ratified it in 2008. Therefore, it has an obligation to designate Emerald sites which are complementing each other as the EU contributes to the Emerald network through its Natura 2000 sites. The *Support to implementation of the Birds and Habitats directives in Bosnia and Herzegovina* project aimed to identify potential Natura 2000 sites in BiH with appropriate site codes, areas, present species and habitats. First preliminary Natura 2000 sites for Bosnia and Herzegovina have been proposed based on the value of species and habitats but they have not been officially recognised nor do they have protection and management plans.

There are two potential Natura 2000 sites within the scoped area: Prenj – Cvrsnica – Cabulja (site code BA8300064) and Zlatar (site code BA8300064) shown in Figure 6-36. In addition, the closest Natura 2000 site that is outside of the project area is Velez (FBiH) at 1 km east from the southernmost point of the route. The sites are not officially recognised, management plans have not been adopted for either of these sites, there are no management bodies. Additional information about two potential Natura 2000 areas under potential impact by the project is shown in Table 6-15 and Table 6-16 respectively[26].

[24] Council Directive 92/43/EEC of 21 May 1992 on the conservation of natural habitats and of wild fauna and flora
[25] Directive 2009/147/EC of the European Parliament and of the Council of 30 November 2009
[26] Support to implementation of the Birds and Habitats Directives in BiH

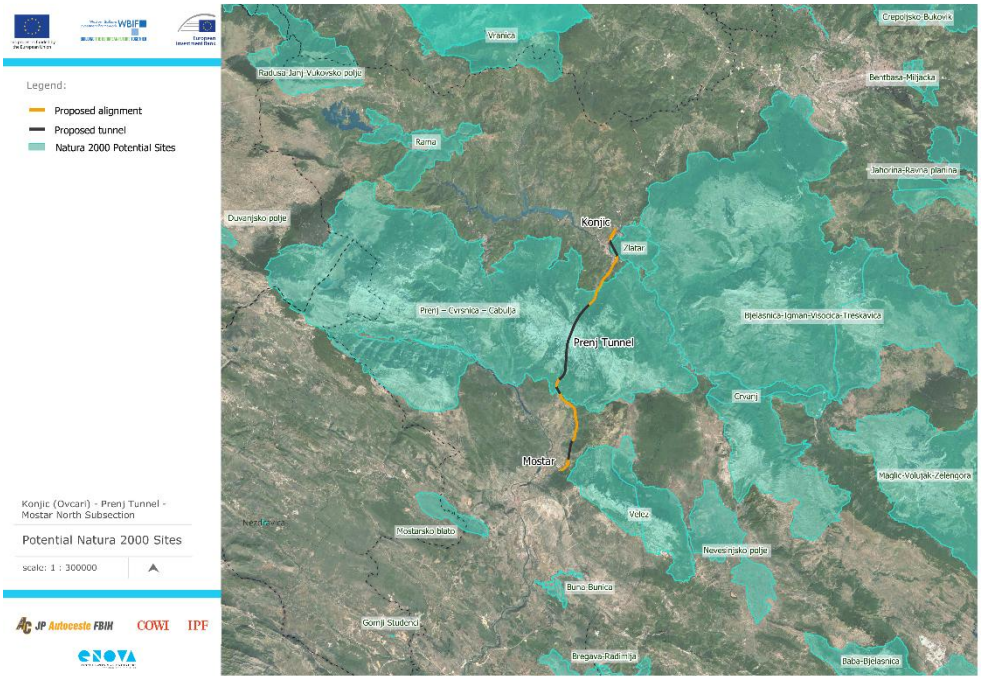

Figure 6-36: Potential Natura 2000 sites in relation to the motorway route

The size of the project area that will be under direct impact to the Natura 2000 is approx. 3,335 ha. The area under direct permanent impact of the project in the Natura 2000 site Zlatar is 4.41 ha (1.54 ha short road segment between Tunnel T1 and Tunnel T2, 2.87 ha Ovcari disposal site) and in the site Prenj-Cvrsnica-Cabulja 31.55 ha (road layout including embankments; access roads; disposal will be created on the motorway footprint and the inert waste generated by construction of access roads to Prenj Tunnel and Prenj Tunnel itself will be used by Contractor for embankments, avoiding the need for additional disposal sites). The rest of the motorway will pass through these areas in the form of tunnels, avoiding biological values.

Considering the fact Bosnia and Herzegovina is not part of the EU, potential Natura 2000 sites as such are still not mandatory for protection, unlike the Emerald sites designated under the Bern Convention. Additionally, the Prenj-Cvrsnica-Cabulja site was not nominated as an Emerald site in its entirety, while Zlatar is also a candidate Emerald site, albeit with different borders. Different borders of potential Natura 2000 sites in comparison with the candidate Emerald sites can be explained by the project proposing Natura 2000 areas being implemented over five years after the candidacy of Emerald sites. It can be assumed the more recent project had up-to-date data and is more reliable as some discrepancies were noticed between the listed species and present suitable habitats for Emerald sites. However, since they have been proposed through the aforementioned project, they must be treated as if they are formally designated. Due to this, appropriate assessment will be done for proposed Natura 2000 sites potentially impacted by the motorway. In line with the Article 58 of the Law on Nature Protection, the Government of Federation of Bosnia and Herzegovina will establish a separate European ecological network of protected areas, however currently no areas have been officially proclaimed in the FBiH. No subsidiary legislation on Natura 2000 has been adopted in FBiH either.

Table 6-15: Supplementary information on potential Natura 2000 site Prenj-Cvrsnica-Cabulja

Code	**Area Name**					**Type**	**Area (km²)**
BA8300064	**Prenj-Cvrsnica-Cabulja**					**C**	**970.98**
Species BD	**Species HD**						
Birds	**Habitats**	**Plants**	**Invertebrates**	**Fish**	**Amphibians**	**Reptiles**	**Mammals**
Aegolius funereus (Boreal owl)	3240 Alpine rivers and their ligneous vegetation with *Salix eleagnos*	**Campanula serrata*	**Euplagia quadripunctaria* (Jersey tiger)	*Salmo marmoratus* (Marble trout)	*Bombina bombina* (Yellow-bellied toad)	*Testudo hermanni* (Hermann's tortoise)	*Dinaromys bogdanovi* (Balkan snow vole)
Alectoris graeca (Rock partridge)	*4070 Bushes with *Pinus mugo* and *Rhododendron hirsutum* (Mugo-Rhododendretum)	*Aquilegia kitaibelii*	**Rosalia alpina* (Alpine longhorn beetle)	*Cottus gobio* (European bullhead)		*Vipera ursinii* (Orsini's viper)	**Canis lupus* (Wolf)
Anthus campestris (Tawny pipit)	*9180 Tilio-Acerion forests of slopes, screes and ravines	*Arabis scopoliana*	*Cerambyx cerdo*	*Pomatoschistus canestrinii* (Canestrini's goby)			**Ursus arctos* (Brown bear)
Aquila chrysaetos (Golden eagle)	*91E0 Alluvial forests with *Alnus glutinosa* and *Fraxinus excelsior* (Alno-Padion, Alnion incanae, Salicion albae)	*Botrychium simplex* (Least moonwort)	*Euphydryas aurinia* (Marsh fritillary)	*Salmothymus obtusirostris* (Adriatic trout)			*Lutra lutra* (Eurasian otter)
Bonasa bonasia (hazel grouse)	*9530 (Sub-)Mediterranean pine forests with endemic black pines	*Cerastium dinaricum*	*Lucanus cervus* (Stag beetle)	*Squalius svallize*			*Lynx lynx* (Lynx)
Bubo bubo (Eurasian eagle-owl)	4060 Alpine and boreal heaths	*Cypripedium calceolus* (Lady's slipper)	*Morimus funereus*				*Miniopterus schreibersi* (Common bent-wing bat)

Code	Area Name					Type	Area (km²)
BA8300064	**Prenj-Cvrsnica-Cabulja**					**C**	**970.98**
Species BD	**Species HD**						
Birds	**Habitats**	**Plants**	**Invertebrates**	**Fish**	**Amphibians**	**Reptiles**	**Mammals**
Caprimulgus europaeus (European nightjar)	4080 Sub-Arctic *Salix* spp. Scrub	*Eryngium alpinum* (Alpine Sea Holly)					*Myotis blythii* (Lesser mouse-eared bat)
Circaetus gallicus (short-toed snake eagle)	5130 *Juniperus communis* formations on heaths or calcareous grasslands	*Pulsatilla vulgaris ssp. grandis* (Pasqueflower)					*Myotis myotis* (Greater mouse-eared bat)
Circus pygargus (Montagu's harrier)	6170 Alpine and subalpine calcareous grasslands	*Scilla litardierei* (amethyst meadow squill, Dalmatian scilla)					*Rhinolophus euryale* (Mediterranean horseshoe bat)
Emberiza hortulana (Ortolan bunting)	62A0 Eastern sub-Mediterranean dry grasslands (Scorzoneratalia villosae)						*Rhinolophus ferrumequinum* (Greater horseshoe bat)
Falco biarmicus (Lanner falcon)	6430 Hydrophilous tall herb fringe communities of plains and of the montane to alpine levels						*Rhinolophus hipposideros* (Lesser horseshoe bat)
Falco peregrinus (Peregrine falcon)	8120 Calcareous and calcshist screes of the montane to alpine levels						*Rupicapra rupicapra balkanica* (Balkan chamois)

Code	Area Name					Type	Area (km²)
BA8300064	**Prenj-Cvrsnica-Cabulja**					**C**	**970.98**
Species BD	**Species HD**						
Birds	**Habitats**	**Plants**	**Invertebrates**	**Fish**	**Amphibians**	**Reptiles**	**Mammals**
Gypaetus barbatus (Bearded vulture)	8140 Eastern Mediterranean screes						
Gyps fulvus (Griffon vulture)	8210 Calcareous rocky slopes with chasmophytic vegetation						
Hieraaetus pennatus (Booted eagle)	8310 Caves not open to public						
Lanius collurio (Red-backed shrike)	9140 Medio-European subalpine beech woods with *Acer* and *Rumex arifolius*						
Lanius minor (Lesser grey shrike)	91K0 Illyrian *Fagus sylvatica* forests (Aremonio-Fagion)						
Lullula arborea (Woodlark)	91R0 Dinaric dolomite Scots pine forests (Genisto januensis-Pinetum)						
Neophron percnopterus (Egyptian vulture)	9250 *Quercus trojana* woods						

Code	Area Name					Type	Area (km²)
BA8300064	Prenj-Cvrsnica-Cabulja					C	970.98
Species BD	Species HD						
Birds	Habitats	Plants	Invertebrates	Fish	Amphibians	Reptiles	Mammals
Picoides tridactylus (Three-toed woodpecker)	95A0 High oro-Mediterranean pine forests						
Platalea leucorodia (Eurasian spoonbill)							
Tetrao urogallus (Western capercaillie)							
Tringa glareola (Wood sandpiper)							

Table 6-16: Supplementary information on potential Natura 2000 site Zlatar

Code	Area Name					Type	Area (km²)
BA8200095	Zlatar					B	26.23
Species BD	Species HD						
Birds	Habitats	Plants	Invertebrates	Fish	Amphibians	Reptiles	Mammals
-	*6110 Rupicolous calcareous or basophilic grasslands of the Alysso-Sedion	*Aquilegia kitaibelii*	**Euplagia qudripunctaria* (Jersey tiger)	*Cottus gobio* (European bullhead)	-	-	*Rhinolophus euryale* (Mediterranean horseshoe bat)

Code	Area Name					Type	Area (km²)
BA8200095	Zlatar					B	26.23
Species BD	Species HD						
Birds	Habitats	Plants	Invertebrates	Fish	Amphibians	Reptiles	Mammals
	*6220 Pseudo-steppewith grasses and annuals of the Thero-Brachypodietea	*Cypripedium calceolus* (Lady's slipper)	*Austropotamobius pallipes* (freshwater white-clawed crayfish)	*Salmo marmoratus* (Marble trout)			
	*91E0 Alluvial forests with *Alnus glutinosa* and *Fraxinus excelsior* (Alno-Padion, Alnion incanae, Salicion albae)		*Euphydryas aurinia* (Marsh fritillary)	*Salmothymus obtusirostris* (Adriatic trout)			
	*9530 (Sub-)Mediterranean pine forests with endemic black pines		*Lucanus cervus* (Stag beetle)	*Squalius svallize*			
	4030 European dry heaths						
	6210 Semi-natural dry grasslands and scrubland facies oncalcareous substrates (Festuco-Brometalia) (*important orchid sites)						
	62A0 Easternsub-Mediterranean dry grasslands (Scorzoneratalia villosae)						

Code	Area Name					Type	Area (km²)
BA8200095	Zlatar					B	26.23
Species BD	Species HD						
Birds	Habitats	Plants	Invertebrates	Fish	Amphibians	Reptiles	Mammals
	8210 Calcareous rocky slopes with chasmophytic vegetation						
	91K0 Illyrian *Fagus sylvatica* forests (Aremonio-Fagion)						

6.2.8 Emerald sites

The Bern Convention was ratified by Bosnia and Herzegovina in 2008. According to the *Updated List of Officially Nominated Candidate Emerald Sites*[27], the country has officially nominated 29 sites as candidate Emerald sites in a process that begun in the period 2004-2006 within Western Balkans CARDS/Emerald programme. Two of the candidate Emerald sites are brought forward for further consideration as part of this ESIA Study: Zlatar (site code BA0000004) and Canyon of river Konjicka Bijela (site code BA0000006) (Figure 6-37).

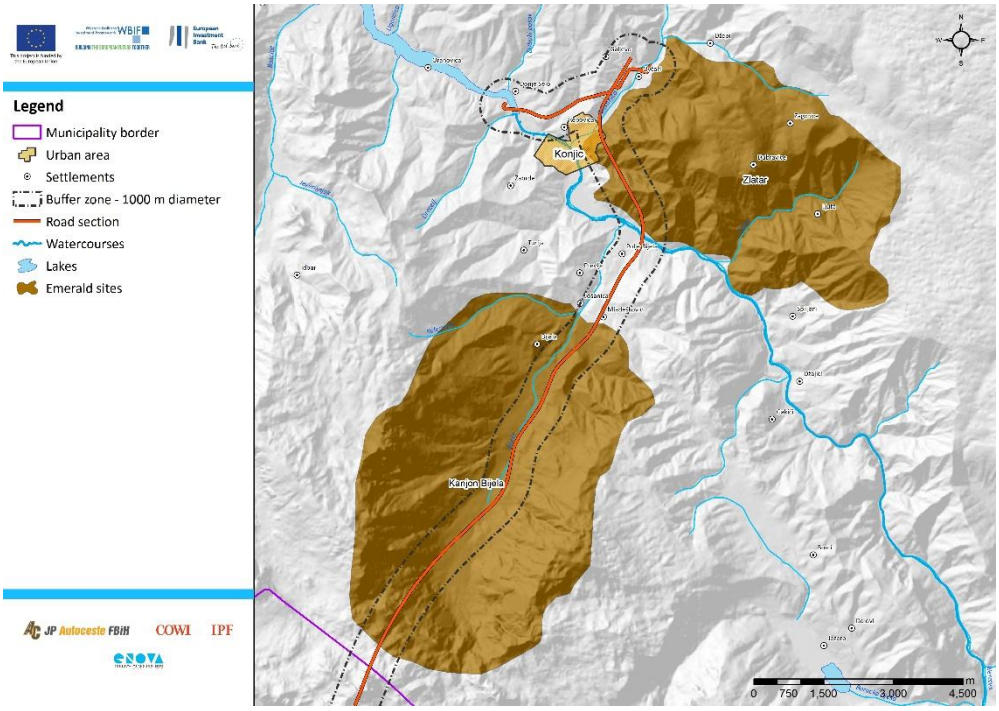

Figure 6-37: Two candidate Emerald sites, Zlatar and Konjicka Bijela in relation to the planned motorway route

Zlatar has the surface of 2,368.00 ha and the road is planned to cross the south-western corner in the form of a tunnel through the mountain thus avoiding direct negative impact. Approx. 1.8 km of the route passes through the Zlatar site in the form of tunnels T1 and T2. Area of the Emerald site Zlatar to be under direct impact is approx. 14.74 ha (1.54 ha – short road segment between Tunnels T1 and T2, 1 ha - after southern portal of the Tunnel T2, and 12.2 ha – disposal site Ovcari). Canyon of river Konjicka Bijela (total area of 3,300.00 ha) will be used as natural access to Mt. Prenj and approach to northern tunnel entry point. Approx. 5.6 km of the route is located within the Konjicka Bijela site covering approx. 36 ha that will be under direct impact (31.3 ha by the construction of the road, approx. 4.7 ha by widening of existing roads for the purpose of using them as access roads).

Even though Emerald sites have not been officially proclaimed and have no legal protection in BiH, they will be considered in proposing mitigation measures as a

[27] Council of Europe, Updated List Of Officially Nominated Candidate Emerald Sites, December 2021

part of ESMP and BMP. They will also be a part of the process used for the determination of "acceptability" of projects in the context of Natura 2000 sites in the EU. Due to the fact Emerald sites are to non-EU countries what Natura 2000 sites is to EU members and they represent an important step towards establishment of the ecological network, they will be a subject of Appropriate Assessment as stipulated by the Habitats Directive.

6.2.9 Critical Habitat Assessment

A Critical Habitat Assessment (CHA) was undertaken as part of this assignment and is available as Annex D: Critical Habitat Assessment. Based on the presented field survey findings and the desk search studies, a total of six habitats and 63 species of flora and fauna have been brought forward for further assessment. The main conclusions of the CHA are included below.

The project is considered to trigger the criteria regarding priority ecosystems for habitats listed in Annex I of the Habitats directive as follows:

- EAAA is habitat type listed in Annex I of EU Habitats directive (HD) – A total of four registered habitats habitats meet this criteria: 3240 Alpine rivers and their ligneous vegetation (*Salix eleagnos*), 6210 Semi-natural dry grasslands and scrubland facies on calcareous substrates, 62A0 Eastern sub-Mediterranean dry grasslands and 95A0 High oro-Mediterranean pine forests. The listed EAAAs are priority biodiversity features (PBFs).
- EAAA is habitat type listed in Annex I of EU Habitats Directive marked as „priority habitat type" - Two habitats confirmed during field surveys are (*) priority habitat types: *6220 Pseudo-steppe with grasses and annuals of the Thero-Brachypodietea and 62A0 Eastern sub-Mediterranean dry grasslands. Due to being of large importance for the EU and preserving efforts, EAAA of said habitats are critical habitats (CH).

Regarding the criteria for priority species and their habitat, the project triggers criteria set out by the EBRD and EIB.

The first analysed criterium is Species and their habitats listed in EU Habitat Directive and Birds Directive/Bern Convention – a number of fauna species meet this criteria, for both PBF and CH:

- EAAA for species and their habitats listed in Annex II of the Habitats Directive, Annex I of the Birds Directive, Resolution 6 of Bern convention - four invertebrate, one fish, three amphibians, two reptiles, eight bird and thirteen mammal species meet this criteria and therefore qualify as PBFs. However some of the assessed species are listed both in Annex II and Annex IV and therefore are assessed as CH as seen bellow.
- EAAA for species and their habitats listed in Annex IV of the Habitats Directive - two invertebrate, four amphibian, 13 reptile and 21 mammal species and their habitats meet the criteria for critical habitat.

Second and third criteria for threatened species are based on conservation status according to IUCN (VU, EN, CR) and FBiH RL (EN, CR). Endangered and

critically endangered (IUCN) species were not found during surveys, although several confirmed species are vulnerable. No species and their habitats meet the benchmark for critical habitat; however, seven species are PBFs on the following basis:

- EAAA supports IUCN VU species: one invertebrate, two amphibian, two fish one bird and two mammal species are vulnerable based on IUCN's assessment and therefore their EAAAs are classified as PBFs.
- The criterion for nationally or regionally listed EN or CR species is met by a total of 15 species, three of which were listed as critically endangered (plants) and 12 were listed as endangered (three plants, one amphibian, one bird and seven mammals). These species and their habitats are thus PBFs.
- There are no range-restricted species confirmed in the surveyed area, all species have extent of occurrence (EOO) larger than 50.000 km^2. In addition to this, no IBA or Ramsar sites are located within the project area or the area of 10 km radius.
- A total of 40 species meet the criteria for critical habitat, while 23 meet the criteria for PBF. Species satisfying multiple criteria for both CH and PBF are regarded as CH. The following species and their habitats are CH: southern festoon (*Zerynthia polyxena*), cerambyx longicorn (*Cerambyx cerdo*), yellow bellied toad (*Bombina bombina*), green toad (*Bufotes viridis*), Greek stream frog (*Rana graeca*), olm (*Proteus anguinus*), Hermann's tortoise (*Testudo hermanni*), glass lizard (*Pseudopus apodus*), Dalmatian wall lizard (*Podarcis melisellensis*), common wall lizard (*Podarcis muralis*), sand lizard (*Lacerta agilis*), blue-throated keeled lizard (*Algyroides nigropunctatus*), eastern green lizard (*Lacerta viridis*), Balkan green lizard (*Lacerta trilineata*), nose-horned viper (*Vipera ammodytes*), Dahl's whip snake (*Platyceps najadum*), dice snake (*Natrix tessellate*), four-lined snake (*Elaphe quatuorlineata*), Aesculapian snake (*Zamenis longissimus*), wolf (*Canis lupus*), brown bear (*Ursus arctos*), Eurasian lynx (*Lynx lynx*), European wildcat (*Felis silvestris*), Eurasian otter (*Lutra lutra*), Balkan snow vole (*Dinaromys bogdanovi*), Balkan chamois (*Rupicapra rupicapra balcanica*), Geoffry's bat (*Myotis emarginatus*), Schreiber's bent-winged bat (*Miniopterus schreibersii*), lesser mouse-eared bat (*Myotis oxygnathus*), whiskered bat (*Myotis mystacinus*), common pipistrelle (*Pipistrellus pipistrellus*), Kuhl's pipistrelle (*Pipistrellus kuhlii*), Nathusius' pipistrelle (*Pipistrellus nathusii*), Serotine bat (*Eptesicus serotinus*), common noctule (*Nyctalus noctula*), Leisler's bat (*Nyctalus leisleri*), free-tailed bat (*Tadarida teniotis*), Greater horseshoe bat (*Rhinolophus ferrrumequinum*), lesser horseshoe bat (*Rhinolophus hipposideros*) and Mediterranean horseshoe bat (*Rhinolophus euryale*).
- Species and their habitats that are PBFs are: *Anthyllis vulneraria subsp. praepropera, Asphodelus fistulosus, Crocus dalmaticus, Cyclamen hederifolium, Opopanax chironium, Spiranthes spiralis*, jersey tiger (*Euplagia quadripunctaria*), long-horned beetle (*Morimus funereus*), European stag beetle (*Lucanus cervus*), bullhead (*Cottus gobio*), Adriatic dace (*Squalius svallize*), Neretvan spined loach (*Cobitis narentana*), Fire Salamander (*Salamandra salamandra*) European turtle-dove (*Streptopelia turtur*), pallid swift (*Apus pallidus*), golden eagle (*Aquila chrysaetos*), western marsh harrier (*Circus aeruginosus*), middle spotted woodpecker (*Dendrocopos medius*), white-backed woodpecker (*Dendrocopos leucotos*), Syrian

woodpecker (*Dendrocopos syriacus*), grey-headed woodpecker (*Picus canus*), black woodpecker (*Dryocopus martius*) and red-backed shrike (*Lanius collurio*).

- An important thing to note is that several species were not confirmed during field suveys. Despite that they are included in critical habitat assessment due to conservation statuses that concerns both the EU and BiH. Following species meet that criteria: wolf (*Canis lupus*), brown bear (*Ursus arctos*), Eurasian lynx (*Lynx lynx*), European wildcat (*Felis silvestris*), Olm (*Proteus anguinus*), Eurasian otter (*Lutra lutra*), Balkan snow vole (*Dinaromys bogdanovi*), Balkan chamois (*Rupicapra rupicapra balcanica*), Geoffry's bat (*Myotis emarginatus*), Schreiber's bent-winged bat (*Miniopterus schreibersii*), Mediterranean horseshoe bat (*Rhinolophus euryale*), European stag beetle (*Lucanus cervus*), Cerambyx longicorn (*Cerambyx cerdo*). Presence of these species was not confirmed and the habitats within the Project's area of influence are not thought to be able to persistently support life habits of these species. Concerning large carnivores, despite not having suitable habitat for breeding and feeding, the species have a very large range and Project area might be used as a corridor. Therefore, mitigation measures relating to wolf, bear and lynx are proposed as a part of this assessment as well as in BMP.

In addition to adhering to EBRD criteria, the criteria set forth by the EIB were also followed. Habitats and species proclaimed as critical habitat assess following criteria:

- Criterion 1: Highly Threatened or unique ecosystems - Priority Habitats listed in Annex I of the Habitats Directive and habitats considered to be their equivalent in countries outside the EU;
- Criterion 2: Population of critically endangered, endangered or vulnerable species, as defined by the IUCN Red List of threatened species and in relevant legislation - A population of species listed in Annex II and IV of the Habitats Directive.

Based on the following criteria two habitats and 19 species are identified as critical habitat. Such habitats are: *6220 Pseudo-steppe with grasses and annuals of the *Thero-Brachypodietea* and 95A0 High oro-Mediterranean pine forests. Species that meet the criteria are: cerambyx longicorn (*Cerambyx cerdo*), yellow bellied toad (*Bombina bombina*), olm (*Proteus anguinus*), Hermann's tortoise (*Testudo hermanni*), four-lined snake (*Elaphe quatuorlineata*), wolf (*Canis lupus*), brown bear (*Ursus arctos*), Eurasian lynx (*Lynx lynx*), Eurasian otter (*Lutra lutra*), Balkan snow vole (*Dinaromys bogdanovi*), Balkan chamois (*Rupicapra rupicapra balcanica*), lesser mouse-eared bat (*Myotis oxygnathus*), Geoffry's bat (*Myotis emarginatus*), Schreiber's bent-winged bat (*Miniopterus schreibersii*), Greater horseshoe bat (*Rhinolophus ferrrumequinum*),lesser horseshoe bat (*Rhinolophus hipposideros*) and Mediterranean horseshoe bat (*Rhinolophus euryale*). It is important to mention, that not all species were found during the field survey, however due to their conservation status and importance both in EU and BiH, they were listed in critical habitat assessment.

Based on the requirement of the PR 6 paragraph 13 and 15, critical habitat must not be further fragmented, converted or degraded to the extent that its ecological integrity or biodiversity importance is compromised. No net loss of habitats and species that triggered PBF is allowed, and project must be designed to deliver net gains for features that triggered CH. EBRD's requirements can only be achieved through specific and targeted mitigation in line with mitigation hierarchy of avoiding the negative impact to these habitats and species. The EIB's Standard 4 also states that there are strict conditions under which works are allowed in critical habitat. If the project is taking place in an area of critical habitat, a Net Positive Impact on biodiversity and ecosystem services must be achieved.

Mitigation measures for all species of conservation concern have been given in BMP and this ESIA and must be implemented effectively, adequately and timely. Negative (in)direct impacts can occur and such will be addressed in accordance with EBRD and EIB requirements. Following the EBRD PR 6 (namely paragraphs 13 and 15)[28] implementation of the Project if it compromises biodiversity can be done if, among others, no other viable alternatives within the region exist for development of the project in habitats of lesser biodiversity value which applies to this Project. Comparable is stipulated by EIB Standard 4 which states that no project activities should implement in areas of critical habitat unless no other viable alternatives for the project exists either in terms of location or design, and there is rigorous justification of overriding public interest based on human health, public safety considerations and/or beneficial consequences of primary importance for the environment. Furthermore it also states that project activities in areas of critical habitat can be considered if the project does not lead to measurable adverse impacts that will result in any detrimental effect on the ecological and conservation status of the critical habitat, and impacts are avoided and minimized to the extent possible.[29]

Considering geographical and biodiversity features of the country of implementation, this Project considered best option with lowest possible net loss than other alternatives. Any other alternative would have comparable or bigger impacts on biodiversity as recorded critical habitats are present throughout the region.

As a last resort and in response to residual impacts, compensation measures are given in the BMP to reach a minimum of no loss of biodiversity overall.

6.2.10 Ecosystem Services

Both Lenders, EBRD and EIB emphasise the importance of ecosystem services and their assessment as a part of the ESIA.

[28] Environmental and Social Policy 2029
[29] Environmental and Social Sustainability Framework Standard 4 – Biodiversity and Ecosystems

According to the information presented in LARF[30] approx. 350 land plots will be affected by the project. The exact scope of land acquisition and location of affected land plots will be defined in LARPs, which will be developed for:

- Konjic (Ovcari) to Prenj Tunnel,
- Prenj Tunnel itself,
- Exit of Prenj Tunnel to Mostar North,
- Konjic Bypass

The changes described in the physical and biotic environment will have profound consequences for the Project area and potentially in the project area of influence, including the 10 cadaster municipalities Galjevo, Dzepi, Konjic I, Dubravice, Bijela, Podgorani II, Podgorani I, Humilisani I, Potoci and Kutilivac I that are in the Project area. The identified ecosystem services related to project footprint and the buffer zone are listed in Table 6-17. At this stage of the project, not much information is available regarding land plots and land use. Therefore, the assessment is based on generalised data without precise numbers.

Table 6-17: Ecosystem services identified in the project area

Ecosystem services	Identified ecosystem services	
	Project footprint	**Buffer zone**
Provisioning services **Food resources, freshwater, raw materials, water, medicinal and vitamin plants**	A total of 80.7% of surveyed households (HH) are engaged in fruit production, mainly for personal use – only 2.63% sells fruit along with personal use. On many private land plots there are orchards, it can be expected that a smaller number of land plots are used as farmland and as farmland and orchards combined. The vast majority (90.35%) of surveyed HH grow vegetables, mainly for personal use, whereas only 2.63% sell vegetables along with personal use. Most common cultivated crops in the general Project area are potatoes, cabbage, onions, carrots, lettuce, peppers, beans, tomatoes, and other agricultural crops. Most common crops in orchards in the general Project area are apple trees, cherry trees, hazelnut trees, pear and plum trees, walnut trees, fig trees and vineyards. Meadows and pastures are mostly used for mowing therefore hay is used for feeding livestock.	All benefits from food provisioning ecosystem service will remain the same as there will be no significant impact on this ecosystem service in the buffer zone except for potential impact caused by activities in the project footprint area. Freshwater springs Gornja Bijela, Crno Vrelo, Bascica, Buk, Draganica Vrelo, Milakovac, Sanica, Salakovac, Bosnjaci and Livicina located in and around project area of influence might be under adverse impact. In order to mitigate any potential negative consequences to water supply and freshwater as an ecosystem service, adequate mitigation measures are proposed.

[30] Land Acquisition and Resettlement Framework (LARF), March 2023

Ecosystem services	Identified ecosystem services	
	Project footprint	**Buffer zone**
	Forest fruits and wild plants are common in this Project area. Some of them are raspberry, blackberry and fig tree and shrubs. Medicinal plants are also common in the Project area, such as wild thyme and dog rose. Many invasive species have been observed during the site visits, such as: tree of heaven, annual fleabane and annual ragweed. Ruderal species have also been found since the land near the main road is degraded. In the Project footprint a smaller number of greenhouses used for cultivation and nutrition can be expected. In settlements Konjic I and Bijela private land plot owners breed animals (cows, chicken, sheep and goats) for own needs (eggs and meat). In addition to the regulating services pollinators provide mentioned below, beehives are confirmed in the project area. Bee-keeping activities are not common in the project area and up to 50 beehives can be expected in the Project area.	
Regulating services **Climate regulation, carbon storage, prevention and mitigation of natural disasters, soil erosion control, wastewater treatment, pest and disease regulation**	Maintaining the quality of air and soil, providing flood and disease control, or pollinating crops are some of the regulating services provided by ecosystems**.** Agroecosystems produce a variety of ecosystem services, such as regulation of soil and water quality, carbon sequestration, support for biodiversity and cultural services. The majority (86.92%) of surveyed HH own agricultural land, but only less than 1% is registered for agricultural production. Forests play a major role in carbon storage and climate regulations. As the area of Herzegovina represents the Mediterranean region of B&H, a high diversity of forests and meadows is present. Dark coniferous spruce and fir forests (*Vaccinio - Piceion*) and low juniper pine shrubs (*Pinion mugi*	The maintenance of natural carbon capture and storage processes is important for the beneficiaries, since, given their proximity to emission sources such as vehicles there is a greater risk of developing health effects for settlements in the buffer zone. Vegetation, various marine organisms and riverbanks play a role in the interception, filtration, decomposition, and detoxification of pollutants and wastes but they are not within the scope of the Project area.

Ecosystem services	Identified ecosystem services	
	Project footprint	**Buffer zone**
	„illyricum") play a major role in carbon storage and are present in the project area. The province of relict pine forests includes parts of the subendemic pine and black pine areas. Of particular interest are the forests of the *Pinion heldreichii munica*, which are differentiated into a large number of endemic communities which create specific climate conditions in their habitats. Pollinators provide a crucial regulating ecosystem service by improving or stabilising yields of approximately 75% of crop-plant species globally. As the area of Herzegovina is represented by the Mediterranean climate, a high diversity of wild pollinators (wild bees and bumblebees), diurnal and nocturnal butterflies and Hoverflies/ family Syrphidae have been recorded. The trend of presence of the mentioned groups can be found at all localities within the project area. There is no evidence that suggests that the ecosystems or any particular species within the vicinity of the Project Area plays a significant role in pest control.	
Cultural services **Tourism, recreation, mental and psychical health, spiritual enrichment, aesthetic value landscape diversity, cultural diversity, art and design**	There is a rafting club and touristic agency in Bijela which will be affected by land acquisition. There are no large-scale touristic or recreational enjoyments in the Project footprint except for properties on private land plots. Proposal of the Spatial Plan of the FBiH (2008-2028), which is still in the process of adoption, envisages the establishment of Prenj-Cabulja-Cvrsnica-Vran National Park, and a significant portion of this motorway sub-section is designed through the mentioned planned protected area via tunnel passing through Mt. Prenj. There are two potential Natura 2000 sites within the Project area: Prenj – Cvrsnica – Cabulja and Zlatar, thus impacts on the area that will be under direct permanent impact will be minimised. The motorway will pass through these areas in the	The nearest officially established protected area to the Project area is Blidinje Nature Park, which is located 13 km of air distance west of the motorway route. Also, Nature Park Hutovo blato is located approx. 45 km south of Project area. The closest potential Natura 2000 site outside of the Project area is Velez (FBiH) at 1 km east from the southernmost point of the motorway route. According to the list provided by the Institute for Protection of Cultural, Historical and Natural Heritage of BiH, most of the monuments listed as present belong to III and IV categories and are of a low or medium value. A total of 14 cultural and historical assets have been recorded in the area of approx. 500-1,000 m distance from the route. meaning that the project activities may have

Ecosystem services	Identified ecosystem services	
	Project footprint	**Buffer zone**
	form of tunnels, avoiding impact on biological values. There are two officially nominated Emerald sites in the Project area: Zlatar and Canyon of river Konjicka Bijela. The impacts will be avoided by the planned construction of a tunnel through the mountain.	on these assets is insignificant. Two registered assets are in operation (mosque in Podgorani and mosque in Potoci) – the first one is approx. 200-300 m away from the route.
Supporting services	One of the most important supporting services is biodiversity itself, along with soil quality, primary production, and nutrient cycling. During the research of the area, a high number of species was recorded, it can be confirmed that the area is characterised by high genetic diversity. Supporting services include, among others, natural or semi-natural spaces that maintain species populations and protect the capacity of ecological communities to recover from disturbances. Forests are among the most resilient and important repositories of terrestrial biological diversity, and they offer very diverse habitats for plants, animals and micro-organisms. Areas around settlements, recorded ecosystems, vegetation and habitats are suitable hiding places and living places for various plant and animal species. The presence of 452 plant species was confirmed in the surveyed area and wild pollinators and butterflies are mostly in charge of their maintenance and reproduction. Plant species that serve as habitats and feeding plants for butterflies and bees have been recorded. Such example is the recorded butterfly species *Phengaris arion* and its host plant, plants from the genus *Thymus.* Semi natural grasslands can be among the habitats with highest biodiversity levels. They host a unique pool of species, specifically adapted to these open habitats. Extensive livestock management is often the only way to maintain these habitats.	Increase in concentration of contaminants could exceed the capacity of soils to regulate quality through accidental leaks and spills and deposition of dust and atmospheric pollutants generated during construction activities.

Ecosystem services	Identified ecosystem services	
	Project footprint	Buffer zone
	Soil quality is important for human health, landowners, flora, and fauna. Healthy soil also plays an important role in flood regulation through the capacity for water absorption. As stated in previous ecosystem services construction activities will cause modifications, soil conversion and erosion.	

6.3 Assessment of Impacts

6.3.1 Habitats, Flora, and Fauna

6.3.1.1 Introduction

The Project is expected to have impacts on biodiversity in general, with varying scopes in the different phases of construction works and during the operation phase. The key baseline facts that guide the assessment of impacts on biodiversity are the following:

- six habitats listed in the Annex I of the Habitats Directive, two of which are priority habitats, have been recorded in the Project's EAAA
- during field research and literature review (IUCN and Red List of Flora of FBiH), species with conservation status of CR, EN and VU were recorded, as well as species listed in Annexes II and IV of the Habitats Directive and Annex I of the Birds Directive
- a number of biodiversity receptors meet the criteria for critical habitat and priority biodiversity feature.

Biodiversity impacts associated with pre-construction phase refer to inadequate and untimely planning of mitigation measures. The root cause of such impact stems from pre-construction phase, but the effects arising from problems with implementation of measures appears during construction and operation phases.

Impacts on biodiversity features during the construction and operation phase are in principle assessed as adverse and can directly affect terrestrial habitats and species and aquatic habitats and species. The following key impacts to the habitats and species are considered likely because of the Project implementation:

- permanent habitat loss,
- habitat fragmentation,
- project related disturbance of species during construction and operation phase e.g. noise or light pollution,
- fatalities or injuries of species during construction,
- impacts such as disturbance of fauna and potential road mortality (roadkill).

An overview of the impacts and significance of effects are elaborated below separately for pre–construction, construction and operation phase.

The Project applied the mitigation hierarchy and therefore plans for the project were developed based on avoiding the most significant impacts, and then managing and mitigating the remaining impacts.

In order to demonstrate net gain/no net loss of biodiversity, the mitigation hierarchy is applied to Project's potential biodiversity impacts. The first aim of any project is to avoid impacts, but where impacts cannot be avoided, they should be minimised. If an impact cannot be minimised to the extent that it becomes non-significant in nature, then further mitigation and compensation may be required. Finally, if an impact cannot be mitigated for within the project footprint, then offsetting can be considered; though this should be carried out as a last resort, if possible. From inception to completion, the aim of a project should be to achieve no net loss of biodiversity, and, where possible, to achieve net gain. With the mitigation hierarchy in mind, this section contains three tables, each relating to the timing or phase of mitigation: preconstruction, construction and operation.

6.3.1.2 Habitats

The **pre-construction** phase can cause adverse impacts due to inadequate work planning or lack of up-to-date information on existing species. Proposed mitigation measures listed in BMP elaborate on habitats that must be avoided during construction works. The BMP must be consulted during the planning stage so that mitigation measures can be timely and successfully implemented. Due to six habitats registered in the project zone being listed in the Annex I of Habitats Directive, sensitivity of these biodiversity features is high. The strength of the impact is moderate and significant.

During the **construction phase**, there will be direct physical loss of vegetation and thus smaller parts of the habitat in the project area as part of the works on site preparation. During the field research conducted as part of this task, based on the overall analysis of available literature data and field research, the presence of six Habitat Directive Annex I habitat types in the study area was determined: 3240 Alpine rivers and their ligneous vegetation (*Salix eleagnos*), *6220 Pseudo-steppe with grasses and annuals of the *Thero-Brachypodietea*, 6210 Semi-natural dry grasslands and scrubland facies on calcareous substrates, 62A0 Eastern sub-Mediterranean dry grasslands, 95A0 High oro-Mediterranean pine forests and *9530 (Sub-)Mediterranean pine forests with endemic black pines. The recorded habitats are of European importance and are registered within the 1,000 m buffer zone around the planned route of the motorway Konjic (Ovcari) - Prenj Tunnel - Mostar North. All Annex I habitats are priority biodiversity features, and no net loss must be ensured. Additionally, priority habitats are critical habitats. EBRD PR 6, paragraph 15 states that the project must deliver net gains for critical habitats impacted by the project; therefore, net gain of priority habitat types is required. EIB's Standard 4, paragraph 19 states the same: If the project is taking place in an area of critical habitat, a Net Positive Impact on biodiversity and ecosystem services must be

achieved. In view of this fact, any deviation from avoidance and mitigation measures cannot be accepted. Mitigation measures given by the BMP are designed to avoid any impact to the habitats not under direct pressures, to minimise the impact on the habitats that will be affected directly and ensure residual impacts are acceptable through compensation.

Out of the 178.94 ha, which is the land permanently taken by the project construction (project footprint), 58.14 ha is under EUNIS habitat type G1 (Broadleaved deciduous woodland), 36.04 ha is EUNIS habitat type E5.2 (Thermophile woodland fringes), and 17.28 ha is EUNIS habitat type I1 (Arable land and market gardens). The construction of the motorway will also directly affect approx. 1.58 ha of Coniferous woodland (G3) and 5.03 ha of Mixed deciduous and coniferous woodland (G4), which are, along with E5.2, the most valuable and best-preserved vegetation types in the area. The full list is given in Table 6-4. Invasive species must be monitored and controlled with the implementation of mitigation measures as outlined by the BMP. A number of tunnels planned along the motorway section are the optimal solution regarding biodiversity as the construction impacts such as habitat loss and fragmentation can be avoided. Nonetheless, tunnelling can cause adverse impacts on habitats through release of untreated groundwater drainage generated in the process of tunnel drilling and sediment release. The impact has the potential to especially negatively affect aquatic habitats. The magnitude for the potential additional disturbance of habitats (habitat loss, pollution) is expected to be potentially with major magnitude, whereas the sensitivity of these areas is considered to be high.

Despite the fact that majority of habitats along the future motorway were already formed under influence of anthropogenic factors, six habitats listed in Annex I of Habitats Directive, out of which two are (*) priority habitats, makes them sensitive biodiversity receptors. Any net loss of Annex I habitats is unacceptable, while net gain is obligatory for priority habitats. Mitigation measures have been proposed in the BMP to reflect these requirements.

Predicted habitat removal is an adverse impact. Habitat types will be directly and indirectly affected in the planned motorway and project performance area, as explained in the previous sections. There will be additional general loss and fragmentation of habitats due to construction works with increased marginal effect. The construction of the project will also result in the possible loss and fragmentation of the surrounding habitats. This can happen due to the construction of auxiliary access roads for tunnels and bridges as well as water drainage pipes.

No additional habitat loss is expected during the **operation phase** as land loss will only occur during construction. However, vegetation clearance during the construction phase and physical impact of the motorway will result in permanent habitat fragmentation. Position of the planned motorway route in relation to generally large present habitats will not cause habitats to be fragmented into small fragments which could be extremely susceptible to changing environmental conditions and edge effect. Priority and Annex I habitats present in the sites of interest (potential Natura 2000 sites and candidate Emerald sites)

will be avoided by the project on grounds of their general size, distance from the motorway and proposed mitigation measures that will prevent their physical loss. Motorway will have a minor impact on the habitats of Zlatar and Prenj potential Natura 2000 sites, while candidate Emerald site Konjicka Bijela - that is largely already under significant anthropogenic impact - will be physically split in two fragments of comparable size and habitats. Majority of habitats of the Project area overall are degraded or otherwise affected by human activity. Nevertheless, due to habitats of the Project area being occupied by a number of Annex II and IV species, as well as species with some level of endangerment, sensitivity is moderate. In view of the size of the project, magnitude is moderate.

During the operation phase, chemical pollution is likely to occur due to exhaust gases from vehicles that can settle in the surrounding areas, especially along habitats near the motorway route. The impact is caused by traffic on the motorway and can result in an increase in the concentration of heavy metals in the soil. It is considered to be an unfavourable impact, causing changes in habitat quality but of a low strength.

Table 6-18: Summary of impact assessment on habitats and assessment of their significance

Phase	Type of impact	Adverse/ Beneficial	Magnitude	Sensitivity	Impact evaluation	Significance (before mitigation)
Pre-construction	Adverse impacts due to inadequate planning of works	Adverse	Moderate	High	Major	Significant
Pre-construction	Lack of up-to-date baseline conditions	Adverse	Moderate	High	Major	Significant
Construction	Loss of habitats due to preparation of the construction site and performing construction works	Adverse	Moderate	High	Major	Significant
Construction	Potential additional and unplanned disturbance of habitats (habitat loss, pollution)	Adverse	Moderate	Medium	Moderate	Significant
Construction	Spread of invasive species	Adverse	Moderate	Medium	Moderate	Significant
Operation	Habitat fragmentation	Adverse	Moderate	Medium	Moderate	Significant
Operation	Chemical pollution of	Adverse	Minor	Medium	Minor	Not significant

Phase	Type of impact	Adverse/ Beneficial	Magnitude	Sensitivity	Impact evaluation	Significance (before mitigation)
	habitats adjacent to the motorway					

6.3.1.3 Vegetation and Flora

The main impact on vegetation and flora in the **pre-construction phase** will be the result of inadequate planning of work and lack of new data. A total of 452 vascular plant species were identified by reviewing available literature data and field research, while 444 were confirmed. Based on the given analysis, a total of 14 confirmed and four taxa from literature with some level of endangerment were determined. Analysing the confirmed species, five are NT, three are VU, three are endangered and three are critically endangered. Additionally, 13 taxa are listed in the global IUCN list of which 12 have LC status and one (*Galanthus nivalis*) has NT status. None of these species meet the criteria for critical habitat, but there are six plant species that are priority biodiversity features. No net loss of PBFs is EBRD's requirement; therefore, adequate planning of works in accordance with BMP in order to ensure this standard is followed is of highest priority.

Poor planning of works and inadequate management can lead to fires that can cause unforeseeable consequences for flora, vegetation, and habitats. Associations of black and Bosnian pine are described as sensitive in this regard. There is also a possibility of increasing the number of alien and invasive species or the introduction of new alien and invasive species that did not exist in the area before. This can be mitigated by the development and implementation of Invasive Species Management Plan. Sensitivity of flora elements in this aspect is medium, due to presence of sensitive species, and magnitude is moderate.

Plant species identified in the project area will have direct (damages, losses) and indirect (emissions) impacts during the **construction phase**. The construction phase includes the removal of vegetation and the removal of plant species as part of the site preparation work. Physical removal of vegetation is considered an adverse impact and will be permanent for the project implementation area, therefore remaining as a residual impact that must be compensated. Construction work can temporarily affect plant species in the area, and the operation of heavy machinery during the construction phase can lead to the plants being covered in dust. This can lead to clogging and damage to the stoma, shading and abrasion of the leaf surface to the cuticle. Impact on forest complexes with emissions of harmful substances (exhaust gases, oil, fuel, dust, etc.) generated during the construction is also expected. The impacts during the construction phase are therefore unfavourable.

Based on the assessment of the magnitude of the impact, the following consequences were interpreted: high impact without mitigation measures was recorded in the pre-construction phase with unfavourable land management in the construction phase. These impacts would have significant consequences on

flora and vegetation if mitigation measures were not applied. A detailed description of mitigation measures is given in the BMP.

Direct impacts on flora during the operation phase are expected to a lesser extent and can occur as chemical pollution caused by motorway traffic, which can result in increased concentrations of heavy metals in the soil which can have a negative impact on vegetation and flora of nearby habitats. The impact is considered to be unfavourable, causing lasting changes, but to a small extent, so the strength of the impact is expected to be low. Most species of flora along the future motorway during this phase are weeds that are resistant to higher concentrations of heavy metals, and the sensitivity to this impact is low. The impact is considered negligible and insignificant.

The Table 6-19 below summarises the impacts and assesses their significance. Adequate mitigation measures are proposed in the ESMP and BMP.

Table 6-19: Summary of impact assessment on vegetation and flora and assessment of their significance

Phase	Type of impact	Adverse/ Beneficial	Magnitude	Sensitivity	Impact evaluation	Significance (before mitigation)
Pre-construction	Adverse impacts due to inadequate planning of works and Main Design requirements	Adverse	Moderate	Medium	Moderate	Significant
Pre-construction	Lack of up-to-date baseline conditions	Adverse	Moderate	Medium	Moderate	Significant
Construction	Removal of vegetation and clearance of flora due to preparation of the construction site and during construction works	Adverse	Moderate	Medium	Moderate	Significant
Construction	Dusting of nearby flora due to performance of construction works	Adverse	Minor	Medium	Minor	Not significant

Phase	Type of impact	Adverse/ Beneficial	Magnitude	Sensitivity	Impact evaluation	Significance (before mitigation)
Operation	Chemical pollution	Adverse	Minor	Medium	Minor	Not significant

6.3.1.4 Fauna

Potentially significant impact on fauna in the **pre-construction phase** can result from inadequate planning of works and lack of up-to-date baseline data. The potential impact that may arise the noise and vibrations from machines and construction in general. The impact is labelled as unfavourable, as noise leads to scaring the wildlife and results in avoidance behaviour. The sensitivity of fauna receptors to this impact is medium. Noise represents a current occurrence (happening only while the project is ongoing), with the cessation of works there will be an immediate cessation of the impact. However, temporal limitations to construction works must be imposed as a part of avoidance measures. The impact of noise will be evident during construction but adequate planning in earlier phases can prevent it.

Due to a number of species, and therefore their habitats, meeting the criteria for CH and PBF, no net loss and net gain (obligatory for CH) is the main requirement to be met. Mitigation measures proposed in the BMP are designed to prevent any impact to the habitats not under direct pressures, as well as minimise the impact on the habitats that will be affected directly.

Disturbance during **the construction phase** has the potential to affect animal species - mammals, reptiles, and birds in particular. Impacts will be temporary, reversible and will include loss of habitats, modification of habitats, noise, and light disturbance from construction activities. Loss and disturbance of the habitat environment caused by removal of natural vegetation and excavation of the route, cuts and tunnels, and disposal of excess excavated material in the area of the planned motorway route will have adverse impacts on the fauna of the area. Mitigation for said impact is necessary and entails limitations regarding daily and seasonal timing of works, limitations in machinery movement, speed etc.

Also, the increase in vehicle movement from construction activities could lead to possible injuries and mortality of fauna species due to vegetation removal and preparation of construction site. This impact is adverse, and it can result with negative effects especially for sensitive terrestrial fauna species that have seasonally variable vulnerability due to breeding, critical feeding times or seasonal migrations. In absence of avoidance and mitigation, the magnitude is considered to be moderate; however, the sensitivity is medium due to the presence of sensitive fauna species of conservation concern. Therefore, the impact is moderate and significant.

During operation phase, disturbance of species is possible as a result of traffic and noise. Edge effect for fauna species is likely to be expected and it is considered as an adverse impact, with potential positive impacts on invertebrate

species if the vegetation surrounding the motorway is maintained as given in the BMP. Sensitivity of the impact is expected to be medium due to the presence of species of conservation concern. Due to the expected minor magnitude (as these impacts will be mitigated from the design phase), the general impact is considered minor and not significant.

As noted before, habitat clearance during the project's pre-construction and construction phases will result in habitat fragmentation. Indirect habitat loss and degradation from habitat clearance and the encroachment of settlements adjacent to the proposed road alignment poses a significant threat, further contributing to direct project-related impact of habitat loss and fragmentation. This may deter some fauna species from crossing the cleared area, particularly in combination with disturbance arising from vehicle activity. Hence, habitat fragmentation may serve as a barrier to the movement of fauna with home ranges that overlap the project footprint. Fragmentation of habitats and subsequently populations generally might result in isolated populations and disturbed gene flow. However, it is not expected that fragmentation caused by this project will result in any kind of isolation or local extinction. Species present in the area are common and widespread species that will not be significantly affected by the motorway. Planned structures such as tunnels and viaducts minimise this adverse impact on the majority of the route. For the parts of the route most affected by the impact, mitigation measures will be proposed. Large mammals which have large ranges will not be affected by this impact. By preserving the entire plateau of the Mt. Prenj, the habitats of large carnivores have been preserved in the context of structural integrity. Not all fauna will be impacted equally, though; therefore the sensitivity can be evaluated as medium. Impacts to medium-sensitive fauna arising from habitat fragmentation and barriers to movement are expected to be of moderate significance prior to mitigation.

Also, during the operation, potential collision of fauna species due to high speed of vehicles (e.g., birds, bat species, other small mammals and reptiles) is possible. Mitigation measures such as protective bird panels will reduce possibility of collisions, as well as adequate fencing of the motorway will be implemented as a technical standard of the motorway. It is necessary to install protective panels on the bridges over the Tresanica River in Ovcari, over the Neretva River and in the area of Mladeskovici on Interchange Konjic South. At these localities, a high frequency of birds feeding high in the sky is noticeable, which is why it is possible for them to get hurt due to collisions with moving cars. The general impact is considered moderate.

Increased traffic may lead to negative impacts from increased level of light and noise that can affect sensitive fauna species such as bats. The magnitude is expected to be minor while the sensitivity is medium due to the conservation requirements of these species. The impact is considered minor and not significant.

A summary of the estimation of impacts is shown Table 6-20. Adequate mitigation measures have been proposed in Chapter below, the ESMP and the

BMP. The residual impacts have been assessed in Chapter 19 and are considered to be insignificant if all requirements of ESAP and BMP are timely implemented.

Table 6-20: Summary of impact assessment on fauna and assessment of their significance

Phase	Type of impact	Adverse/ Beneficial	Magnitude	Sensivity	Impact evaluation	Significance (before mitigation)
Pre-construction	Adverse impacts due to inadequate planning of works	Adverse	Moderate	High	Major	Significant
Pre-construction	Lack of up-to-date baseline conditions	Adverse	Moderate	Medium	Moderate	Significant
Construction	Disturbance of fauna species due to increased level of noise, vibration and light in the zone of construction activities	Adverse	Moderate	Medium	Moderate	Significant
Construction	Potential disturbance of nests/roosts of species that have a seasonally variable vulnerability due to breeding, feeding times or seasonal migrations	Adverse	Moderate	Medium	Moderate	Significant
Construction	Potential fatalities or injuries of fauna species due to vegetation removal and movement of heavy machinery	Adverse	Moderate	Medium	Moderate	Significant
Operation	Habitat fragmentation	Adverse	Moderate	Medium	Moderate	Significant
Operation	Chemical pollution	Adverse	Minor	Moderate	Minor	Not significant
Operation	Collision of fauna due to high speed of	Adverse	Minor	Medium	Minor	Not significant

Phase	Type of impact	Adverse/ Beneficial	Magnitude	Sensivity	Impact evaluation	Significance (before mitigation)
	vehicles (birds, bats, small mammals, herpetofauna)					
Operation	Edge effect of fauna species	Adverse	Minor	Low	Negligible	Not significant
Operation	Negative impacts of pollution, increased light and noise levels on sensitive fauna species such as bats	Adverse	Minor	Low	Negligible	Not significant

6.3.2 Protected Areas

6.3.2.1 Protected Areas in the Project Area of Influence

There are no officially designated protected areas (PAs) in the Project area and in the Project area of influence, therefore they could not be considered for assessment of impacts. No impacts on any officially proclaimed and managed protected areas are expected during the pre-construction, construction and operation phase, hence no requirement for mitigation measures. However, the project will pass through a protected area established prior to B&H independence. As such, it should go through a process of revision. It remains protected *de iure*, but in praxis it is not managed. The motorway will pass through this area in the form of tunnels (T1 and T2), avoiding direct impacts.

6.3.2.2 Appropriate Assessment Information

In BiH, the Habitats Directive does not apply and therefore there are no officially proclaimed Natura 2000 sites. Consequently, there are no formal *Qualifying Interests* or *Conservation Objectives* for the sites of European nature conservation interest. This means that directly applying the AA process is very difficult. However, there are lists of species that are of concern registered within those potential Natura 2000 sites identified by the aforementioned project. Confirmed species from said lists and other registered species were used on evaluating impacts.

Up-to-date desk survey found that the planned motorway crosses two potential Natura 2000 sites (Zlatar and Prenj-Cvrsnica-Cabulja) and two candidate Emerald sites (Zlatar and Konjicka Bijela) which triggered the need for appropriate assessment in line with Article 6(3) of the Habitats Directive and

Article 25 of *Law on Nature Protection in FBiH* in order to enable the project to meet the requirements of the EBRD's PR6 as well as EIB Standard 4. The purpose of the appropriate assessment is to provide all relevant information that can help in the process of assessing the Project's potential adverse impacts to the identified potential Natura 2000 sites and, if identified, how they can be mitigated. Appropriate assessment constitutes the Annex E: Appropriate Assessment on potential Natura 2000 areas of the Volume 2: Book of Technical Annexes to the ESIA.

It is important to note that Bosnia and Herzegovina is not a member of the European Union and does not have the obligation to formally proclaim Natura 2000 areas. Bosnia and Herzegovina received the status of a candidate for EU membership in December 2022[31]. Bosnia and Herzegovina have opted for EU integration and, accordingly, strives to fully transpose EU legislation into national legislation. Also, international financial institutions that are considering financing the construction of the motorway section in question require compliance with the relevant EU directives and the same was applied in the preparation of this study. Also, BiH is a signatory of the Bern Convention and does have the obligation to protect Emerald sites. The *Support to implementation of the Birds and Habitats directives in Bosnia and Herzegovina* project aimed to identify potential Natura 2000 sites in BiH with appropriate site codes, areas, present species, and habitats. Natura 2000 sites for Bosnia and Herzegovina have been proposed based on the valorisation of species and habitats but they have not been officially proclaimed nor do they have protection or management plans. The results of aforementioned project have been used to establish whether the planned motorway encroaches any potential Natura 2000 areas.

Desk survey has shown that the planned motorway route passes directly through two potential Natura 2000 areas: Prenj-Cvrsnica-Cabulja (site code BA8300064), Zlatar (site code BA8300064); hence the potential Natura 2000 sites considered for the appropriate assessment are Prenj-Cvrsnica-Cabulja and Zlatar as they are in the direct impact zone of the motorway as well as the 500 m buffer zone. Since these sites are not officially protected, management plans have not been developed for either of them. The planned project also passes through two officially nominated Emerald sites – Konjicka bijela (Site code BA0000006) and Zlatar (Site code BA0000004), which are territorially located in the previously mentioned potential Natura 2000 areas. Therefore, the two potential Emerlald sites areas are treated with the same measures as potential Natura 2000 sites.

Screening report (Stage 1) has found that potential negative impacts to the sites are possible. Due to precautionary principle and despite the impact being minimised by marginal encroachment, Stage 2 assessment was done as well. It was followed by Alternative Solutions (Stage 3) and Assessment Where No Alternative Solutions Exist and Where Adverse Impacts Remain (Stage 4).

[31] European Council 34/22, European Council meeting (15 December 2022) – Conclusions. Brussels, 15 December 2022

In the absence of management plans that define qualifying interests and conservation objectives of areas, an alternative strategy was used. An equivalent to these features was found based on species listed in Standard Data Forms (SDF) submitted with the nomination of Emerald and Natura 2000 sites. Some discrepancies were noted between SDFs for Emerald sites and habitats present on the site. Namely, a number of wetland species (dominantly birds) are listed for the sites, but they do not have suitable habitat within the sites borders. It is possible they were registered in dispersion and/or flyover to nearby Jablanicko Lake where there is a possibility they rest on migration. It is possible that information were extrapolated from other sites nearby due to lack of time and/or funds to do adequate research. On the other hand, SDF for Natura 2000 sites are more recent and reliable. A small number of species was confirmed during surveys which can be attributed to biodiversity features of highest value being predominantly present at high altitudes of the Prenj Mountain and which must be preserved. As such, the motorway might cause minor direct impact on the Qualifying interests. Such species include, among others, three species of invertebrates, white-backed woodpecker, bats. A full list of species with residual impacts is given in the CHA and BMP with proposed compensational measures. With the implementation of mitigation measures provided in the ESMP and measures provided in the BMP of 2025 ESIA Disclosure package, impacts on these species will be avoided, mitigated or compensated through habitat connectivity by bat hop-overs, passages for fish, amphibians, designation of core habitats that are a no-go zone and protection of these areas, biodiversity and therefore conservation objectives will be preserved and improved despite the inevitable adverse impact motorway construction represents.

As for flora and fauna, inadequate planning of works in the preconstruction phase could have negative impacts on the mentioned sites. The area of potential Natura 2000 sites affected by the project is predominantly already degraded due to settlements and intensive human activity; however, due to them being within the sites of interest, sensitivity is high. Planned motorway passes though Mt. Zlatar and affects only the northern-most part of Prenj-Crvsnica-Cabulja, therefore the magnitude of impact can be considered as moderate.

As the main direct impact on habitats and species in the phases of pre-construction and construction, deforestation of the section Konjic (Ovcari) – Prenj tunnel – Mostar North will be done for the construction of auxiliary roads and the main part of the project - construction of tunnels through Prenj and Zlatar. Significant portion of sub-section Ovcari-Prenj and Zlatar is designed through the mentioned planned protected area via tunnel passing through Mt. Prenj, thus avoiding and minimising adverse impacts. Tunnel will also enter the mountain at a lower altitude of approx. 620 m, avoiding sensitive and valuable habitats and species mainly found at the higher altitudes. The consequences are the physical loss of following plant communities: White hornbeam forests (*Carpinetum orientalis*), Pubescent Oak-hornbeam forests (*Querco-Ostryetum carpinifolia* and *Orno-Osryetum*), Beech Forest (*Fagetum montanum*), Thermophilic beech forests (*Seslerio-Fagetum, Ostryo-Fagetum* and *Aceriobtusati-Fagetum*), Black hornbeam forests (*Pinetum-nigrae*) as well as increased loss of geological base - dolomite and its erosion, especially in the

localities Zlatar and mountain Prenj. Deforestation indirectly can cause the spread of invasive species.

During the construction, there will be a direct physical loss of habitat due to work on the preparation of the construction site. Primarily habitat fragmentation will happen through the motorway fencing and due to road construction.

Habitat fragmentation will occur partly due to tunnel construction; however, compared to the total habitat area estimated for potential Natura 2000 sites the impact is negligible. The indirect effect of fragmentation is to prevent the movement of species due to burial in the ground and the emergence of burials into which important species (reptiles and amphibians recorded in the habitat) can fall. Significant impacts on fauna can be avoided by construction of tunnels, however, the tunnels themselves pose a risk for sensitive fauna species as tunnelling works produce a lot of noise and vibrations that may cause fauna to disperse and avoid the area.

The identified impacts are summarised in the Table 6-21 below, however, the impacts are comparable to the impacts identified for habitats, flora and fauna in general, therefore the same mitigation must be applied.

Table 6-21: Summary of impact assessment on potential Natura 2000 sites and candidate Emerald sites and assessment of their significance

Phase	Type of impact	Adverse / Beneficial	Magnitude	Sensitivity	Impact evaluation	Significance (before mitigation)
Zlatar						
Pre-construction	Adverse impacts due to inadequate planning of works	Adverse	Moderate	High	Major	Significant
Construction	Disturbance of fauna species due to increased level of noise, vibration, and light in the zone of construction activities	Adverse	Moderate	Medium	Moderate	Significant
Construction	Habitat loss	Adverse	Moderate	Medium	Moderate	Significant
Construction	Habitat fragmentation	Adverse	Moderate	Medium	Moderate	Significant
Construction	Pollution	Adverse	Minor	Medium	Minor	Significant
Operation	Collision of fauna due to	Adverse	Minor	Low	Negligible	Not significant

Phase	Type of impact	Adverse / Beneficial	Magnitude	Sensitivity	Impact evaluation	Significance (before mitigation)
	high speed of vehicles					
Operation	Impact of increased levels of noise and light on sensitive fauna species such as bats	Adverse	Minor	Low	Negligible	Not significant
Prenj – Cvrsnica - Cabulja						
Pre-construction	Adverse impacts due to inadequate planning of works	Adverse	Moderate	High	Major	Significant
Construction	Disturbance of fauna species due to increased level of noise, vibration, and light in the zone of construction activities	Adverse	Moderate	Medium	Moderate	Significant
Construction	Habitat loss	Adverse	Moderate	Medium	Moderate	Significant
Construction	Habitat fragmentation	Adverse	Moderate	Medium	Moderate	Significant
Construction	Pollution	Adverse	Minor	Medium	Minor	Significant
Operation	Collision of fauna due to high speed of vehicles	Adverse	Minor	Low	Negligible	Not significant
Operation	Impact of increased levels of noise and light on sensitive fauna species such as bats	Adverse	Minor	Low	Negligible	Not significant
Konjicka Bijela						
Pre-construction	Adverse impacts due to inadequate planning of works	Adverse	Moderate	High	Major	Significant
Construction	Disturbance of fauna species due to	Adverse	Moderate	Medium	Moderate	Significant

Phase	Type of impact	Adverse / Beneficial	Magnitude	Sensitivity	Impact evaluation	Significance (before mitigation)
	increased level of noise, vibration, and light in the zone of construction activities					
Construction	Habitat loss	Adverse	Moderate	High	Major	Significant
Construction	Habitat fragmentation	Adverse	Moderate	High	Major	Significant
Construction	Pollution	Adverse	Minor	Medium	Minor	Significant
Operation	Collision of fauna due to high speed of vehicles	Adverse	Moderate	Medium	Moderate	Significant
Operation	Impact of increased levels of noise and light on sensitive fauna species such as bats	Adverse	Minor	Low	Negligible	Not significant

6.4 Mitigation and Enhancement Measures

Please refer to Chapter 18 ESMP for the full list of measures and additional details.

6.5 Habitats

6.5.1 Pre-construction

Adverse impacts due to inadequate planning of works and Main Design requirements

- During the development of the Main Design for the motorway, include the recommendations given in BMP regarding viaducts over River Neretva. No construction should be allowed in the riparian area due to its sensitivity.
- Prior to commencement of construction, select inert waste disposal sites and borrow pits and access roads for them, machinery parking spaces, other access roads, service plateaus, fuel containers, construction worker camps and other (temporary) infrastructure. Selection of these localities must be based on minimal impact on environmental and social receptors, including natural habitats. Infrastructural elements must not be established in critical habitats (CH) or within priority biodiversity features (PBF), candidate Emerald sites or potential Natura 2000 sites unless there is no other viable option based on analysis of environmental, social and financial criteria,

which must be agreed upon by the Lenders and accompanied by mitigation and compensation (if necessary). Additionally, implement measures protecting the aquatic habitats as given under ESMP measures 19.10.3 and 19.10.4.

- Permanent structures with potential negative impact on biodiversity such as gas stations and billboards with bright lights must not be planned within PBFs, CHs, candidate Emerald sites or potential Natura 2000 sites.
- Design viaducts as passable structures in the Main Design so to keep habitat connectivity.
- Include the requirement for reinstatement of habitats along the inert waste disposal sites, access roads and motorway layout, after the construction is finalised with planting autochthonous plant species characteristic for the area (e.g., Dalmatian laburnum, Bosnian pine, oak etc.) and prevent growing and spread of invasive species in the Main Design. The requirements regarding restoration must be outlined within Land and Habitat Restoration Plan (LHRP), whole issues regarding invasive species shall be further elaborated in Invasive Species Management Plan (ISMP).

Lack of up-to-date baseline conditions

- If the construction phase begins more than five years after the completion of the detailed surveys performed for the ESIA Study (finalised in 2022), additional baseline surveys need to be conducted before commencement of works.

6.5.2 Construction

Habitat loss due to preparation of construction site and during the performance of construction works, fragmentation of habitats and Potential additional and unplanned disturbance of habitats

- Develop Land and Habitat Restoration Plan (LHRP) and Invasive Species Management Plan (ISMP) as a part of CESMP. Guidelines and recommendations for LRHP and ISMP development are included in the BMP.
- Implementation of mitigation measures during the construction stage will be the responsibility of the Contractor in accordance with the contract specifications and loan requirements. As the project is located in ecologically sensitive area, adequate and timely implementation will be ensured by employment of a suitably qualified Biodiversity Expert (BE) specifically to coordinate the implementation and monitoring of the ESMP and BMP.
- During the vegetation clearance and earthworks, the disposal of the material is to be well managed in line with Construction Environmental and Social Management Plan, in order to prevent the degradation of natural vegetation and invasion of non-native species into the natural habitats. Removed topsoil rich on organic matter must be deposited in controlled way and later used for arrangement of embankments and cuts.
- Motorway route only needs to be used for construction activities and organisation of construction site. Should any need for additional areas to be used occur, e.g., access roads to the motorway route, natural areas such as woodland, meadows and grassland shall be avoided and only already

modified areas may be used (e.g., existing roads or degraded non-natural habitats).

- Implement pollution prevention measures at construction site, e.g. spill containment bunds to prevent any leakage from the oil tanks. Construction site is to be well organised (e.g. inorganic waste that could trigger possible injuries) and organic waste (because of accessible food source, this represents a threat of possible diseases) need to be adequately managed, as given in Waste Management Plan and Construction Waste Management Plan.
- Construction materials must be stored and maintained away from watercourses. Chemicals and fuels should be stored in secure containers located away from watercourses or water bodies. Refuelling of plant of machinery must not take place near the watercourse and must only be carried out in designated areas.
- Surface water runoff from the construction sites into the watercourses must be avoided and a system of cut-off ditches, silt fencing and/or bunds should be installed if required.
- Prevent erosion and minimise washing and leaking of solids from surrounding area (by grass plantation, interception and drainage, application of mulch coverage, use of lattice plots, concrete prefabricated panes or gypsum).
- Prevent the negative impacts on habitats, especially on aquatic habitats, caused by tunnelling works by implementing measures given under 19.2.2 and 19.3.5 of the ESMP.
- Employed BE must monitor all works with potential to harm wildlife and act accordingly if any sensitive biodiversity features have to be removed in line with the BMP requirements.
- Employed BE must inform the Contractor about the vulnerability of karst areas, protected cave fauna and the importance of protective measures to preserve drinking water sources.
- Appropriate brief training targeted at the needs of different construction personnel can help raise awareness of the vulnerability and ecological importance of karst areas (e.g. short karst conservation workshops, leaflets).

Spread of invasive species

- Actively manage and maintain vegetation of areas marginal to the construction site to prevent drastic edge effect and spread of invasive species.
- Continuously implement measures given in the BMP provided as a part of 2025 ESIA package and detailed in Invasive Species Management Plan that is to be developed.
- A site wide ban on workers bringing vegetation or soil from outside the site area must be imposed to prevent dispersion of non-native invasive species.

6.5.3 Operation

Habitat fragmentation

- Develop and implement Biodiversity Offsetting Plan (BOP). The guidelines and recommendations for development of BOP are given in the BMP.
- Implementation of habitat clearance that aims to minimise habitat loss to the extent practicable. Clearance must be performed only in areas necessary for adequate workflow and functioning of the construction site – along access roads, road alignment, service plateaus and accompanying objects. Sensitive areas must be avoided as given in maps in Annex D to the ESIA.

Chemical pollution of habitats adjacent to the motorway

- Use of herbicides as a tool for vegetation clearance is not allowed.
- Avoid the use of other hazardous substances and materials, as to protect the environment from their potentially harmful impacts.
- Undertake regular maintenance and cleaning of the drainage structures and oil separators

6.6 Vegetation and Flora

6.6.1 Pre-construction

Adverse impacts due to inadequate planning of works and Main Design requirements

- Prepare Invasive Species Management Plan with measures regarding how to control the spreading of invasive species with focus on species with the A2 and A3 invasive codes as given in the Annex A to the ESIA. Guidelines for development of the plan are provided in the BMP. JPAC is obliged to include the Plan in tender documentation.

Up-to-date baseline conditions

- If the construction of the motorway begins more than five years after the completion of the detailed surveys performed for the ESIA Study (finalised in June 2021), additional baseline surveys need to be conducted before commencement of works in order to account for any occurred changes in the environment. Measure applies to the construction of Konjic bypass as well. As the surveys in the area of Konjic bypass were completed in 2022, if construction works start later than June 2027, additional surveys are needed.

6.6.2 Construction

Vegetation removal and clearance of flora species in the phase of preparation of construction site and during the performance of construction works

- Develop Land and Habitat Restoration Plan (LHRP) and Invasive Species Management Plan (ISMP) as part of CESMP. Guidelines and recommendations for LRHP and ISMP development are included in the BMP.
- Implementation of mitigation measures during the construction stage will be the responsibility of the Contractor in accordance with the contract specifications and loan requirements. As the project is located in ecologically sensitive area, adequate and timely implementation will be ensured by

employment of a suitably qualified Biodiversity Expert (BE) specifically to coordinate the implementation and monitoring of the ESMP and BMP.

- BE employed by the Contractor to clearly mark areas for vegetation clearance, with biodegradable paint of high visibility, undertake temporary fencing to prevent unnecessary loss of vegetation in the Project area.
- There must be no loss of plant species of conservation importance. If they are found, they must be replanted to a suitable undisturbed habitat nearby that is not exposed to risk, e.g. away from roads, construction works and settlements. The relocation must be carried out by an expert, under the supervision of a federal inspector for nature protection and a professional expert for a given species, as prescribed by the *Rulebook on protection measures for strictly protected species and subspecies and protected species and subspecies* (Official Gazette of FBiH, No. 21/20).
- Contractor to recultivate the inert waste disposal sites by using autochthonous species in order to preserve the domestic gene pool.
- The excess inert construction waste must be re-used to level the road route and the remaining material shall be disposed only at designated disposal sites, in order to prevent degradation of other natural vegetation and no temporary landfills are to be formed elsewhere, as these act as focal points for dispersion of invasive species.
- A total of 65.65 ha (58.14 ha of G1 Broadleaved deciduous woodland, 0.9 of G2.1 Mediterranean evergreen *Quercus* forest, 1.58 ha of G3 Coniferous woodland and 5.03 ha of G4 Mixed deciduous and coniferous woodland) will be directly affected by the project. The same or bigger area needs to be afforested/revegetated within one month upon completion of works and the requirements for the process of afforestation will be included in the Biodiversity Offsetting Plan (BOP). Revegetation must be done with species characteristic for said habitats, species that are common and suitable for the area such as, but not limited to, Dalmatian Laburnum, Bosnian pine, black pine, oaks etc. The guidelines for development of the BOP, the recommended location and structure is provided in the BMP.
- It is necessary to establish forest order immediately after cutting the trees along the alignment, i.e., remove the stumps, create, and export all the felled timber (where not required to leave them for saproxylic beetles). At the same time, cut down and repair all damaged trees, so that they do not become a source of disease. This especially applies to black pine cultures in Konjic bypass area, which are particularly sensitive to damage. The establishment of forest order will allow the remaining trees, especially those on the new forest edges, to build a new protective edge more quickly, which will be able to protect the stand from direct and indirect harmful effects.
- Install drainage infrastructure to prevent erosion.
- Minimise possibility of fire occurrence to preserve vegetation by implementing measures e.g., careful handling of flammable materials and open flame. Follow guidelines regarding protecting forests from forest fires and measures outlined under 19.4.1 and 19.4.2 of the ESMP.
- Continuously implement the mitigation measured as given in Invasive Species Management Plan.

6.6.3 Operation

Chemical pollution

- Adequate storage location of chemicals used in motorway maintenance must be carefully selected to prevent impact on biodiversity. Selected location must not be in or near near sensitive receptors (as given in BMP and CHA), including water bodies, candidate Emerald sites, potential Natura 2000 sites, PBFs and CHs.
- Avoid the use of herbicides and hazardous substances and materials, as to protect the environment from their potentially harmful impacts.
- Undertake regular maintenance and cleaning of the drainage structures and oil separators.
- Regular maintenance must include all surfaces adjacent to the motorway and must include elimination and control of weeds and invasive species.

6.7 Fauna

Adverse impacts due to inadequate planning of works and Main Design requirements

- In order to protect fish species and their habitats, including species at risk, from development activities it would be necessary to reduce or eliminate constriction of flow through structure design. No river training of Neretva and its shoreline is allowed, and no interference of the natural flow rates is allowed.
- Design and install culverts near streams to prevent creation of barriers to fish movement.
- The viaducts along the motorway route should be constructed as open passages for wildlife.
- The aforementioned design requirements are to be included in Main Design by the Designer and JPAC is in charge to ensure the measures are implemented.

Lack of up-to-date baseline information

- Conduct additional research for birds. An inactive nest of a Golden Eagle (*Aquila chrysaetos*) was found in the area of Klenova Draga and one individual was registered in flight at the same location. Before construction, it is necessary to conduct additional research in order to determine whether there is another location in the immediate environment where this species nests. Depending on survey results, updating of BMP and ESMP might be required. If inhabited nest(s) of the golden eagle is (are) registered, risk assessment must be performed to identify potential adverse impacts the project might have. If adverse impacts are likely to occur, mitigation measures must be provided and implemented. Measures may include restriction of works, establishing a feeding site in order to attract the eagle to an area away from the project etc. Monitoring of such nests most be performed throughout the construction phase.
- Additional baseline surveys with the aim to confirm findings from 2021 (for motorway) and 2022 (for Konjic bypass) should be planned for all fauna if

the pre-construction phase begins more than five years after the completion of surveys.

- Should any other threatened species or species of conservation concern be identified in pre-construction phase, BMP update process must include additional mitigation measures to avoid any impacts and further assessment of possible residual impacts. If residual impacts are expected, no net loss accounting should be updated. BMP needs to be updated prior to finalisation of the Main Design to enable potential additional mitigation measures to be included in the Main Design.

6.7.1 Construction

Disturbance of fauna

- Mitigation measures in the construction period regarding fauna are reduced to avoiding works in the area of forest ecosystems within the zone of indirect physical impact, and it should be especially emphasised that it is necessary to plan works in a manner to avoid additional deforestation and ecosystem damage. The planning of works and marking sensitive areas to be avoided must be done by the Biodiversity Expert employed by the Contractor.
- Restrict the movement of construction machinery, mechanisation and means of transport exclusively in the designated roads and construction area for the purpose of maximal habitat protection without any additional disturbance of habitats.
- Motorway route only needs to be used for construction activities and organisation of construction site. Should any need for additional areas to be used occur, e.g., access roads to the motorway route, natural areas such as woodland and dry grassland need to be avoided and only already modified areas may be used (e.g. existing roads or degraded non-natural habitats). Sensitive areas, i.e. CHs, PBFs, candidate Emerald sites and potential Natura 2000 sites are mapped in the CHA and Biodiversity Expert is responsible for marking of such areas.
- Special attention must be given to blasting techniques in line with the Blasting Management Plan.
- Temporarily cover karstic features to prevent dust ingress, backfilling from construction site or runoff from concrete works.
- During the construction period, underground cave systems and caverns with cave organisms may be encountered. In case of encountering underground structures, it is obligatory to suspend the works immediately, as soon as it is safe to do so. All cases of such systems opening must be reported to the Lenders.
- If caverns open biospeleologists must be informed by the Contractor's Geologist upon which biospeleologist will visit the site or inform further activities. Any findings should be included in further planning and, if data on species of conservation importance is gathered, included in BMP and CHA upon EBRD's and EIB's approval.
- Sealing must be done following good practice guidelines. Improper closure of such systems by backfilling may cause an unacceptable pressure on valuable and unique underground habitats and animals.

- Implement monitoring of physico-chemical parameters (conductivity, pH, oxygen, nitrates, oil residues) of groundwater quality, preferably in cooperation with local water supply companies in the springs covered by the *Proteus anguinus* eDNA analysis – Gornja Bijela, Salakovac, Bosnjaci, as it could detect any negative impacts on the drinking water quality and subterranean ecosystems. This is to be included in the Groundwater Monitoring Plan.
- Prohibit or limit access to banks or areas adjacent to waterbodies, to the extent required to protect the structural integrity of riverbanks.
- Restrict riparian vegetation removals only to the area necessary for performing construction works and machinery access.
- Project construction will not be undertaken at dusk, dawn and at night to avoid disturbance to nocturnal and crepuscular fauna (i.e., bats) from increased noise and vibration.
- Where lighting is required, it will be directional, non-UV and used only when necessary.
- Hunting and collection of medicinal plants by workers is strictly prohibited for their safety and prevention of negative impact any exploitation may have.

Potential disturbance of nests/roosts of species that have a seasonally variable vulnerability due to breeding, feeding times or seasonal migrations

- Develop Land and Habitat Restoration Plan (LHRP) as a part of CESMP. Guidelines and recommendations for LRHP development are included in the BMP.
- Regarding mammals, measures during the construction period refer to avoiding tunnelling and extensive excavation works in the period from March to May, when the largest number of species give birth to offspring. This ensures peace in the hunting area and a period of wildlife getting used to the new conditions in the habitat.
- It is necessary to plan the clearance works on all parts of the Corridor Vc subsection Konjic (Ovcari) - Prenj Tunnel - Mostar North, to begin in the period July - March, i.e., outside the bird breeding period. No large-scale works are allowed in June and July.
- Prohibit work near water bodies during the spawning period and migrations of fish (February to April).
- A safety fence shall be placed along construction site near watercourses.
- Prohibit works near ponds, streams and canals (reproductive centers) during the reproductive period of amphibians (March and April).
- It is necessary to install protective panels on the bridges over the Tresanica River in Ovcari, over the Neretva River and in the area of Mladeskovici on Interchange Konjic South. At these localities, a high frequency of birds feeding high in the sky is noticeable, which is why it is possible for them to get hurt due to collisions with moving cars. Protective panels must be placed on both sides of the road at a height of 3 m. In order to reduce the collision of birds with protective panels, it is necessary to stick black and white foil over the transparent plexiglass, which increases the visibility of the panels

for birds, or silhouettes of birds of prey, which would scare the birds and move them away from the route.

- On the part of the route between 9 + 820 km and the Prenj tunnel in the zone of direct impact, one territory of the white-backed woodpecker and two territories of the black woodpecker have been registered. Both species are indicators of preserved forests with a lot of rotten trees on the ground. In order to protect these species, it is necessary to reduce removal of the forest cover to the required minimum for machinery movement. Designation of the required minimum is to be marked by the employed Biodiversity Expert.
- In the area of Klenova Draga, an abandoned nest of a Golden Eagle has been registered. If it is established that in the following seasons the couple is active at the given locality, it is necessary to apply a number of protective measures:
    - Continuously monitor the nest through the construction phase.
    - It is necessary to break through the access roads and work on the Tunnel Klenova Draga (T3A) in the off-breeding period from July to February, i.e., to suspend the works from the beginning of incubation to the take-off of the fledglings (beginning of March-end of June).
    - Remove trees from access roads only to the width of the road. The existence of a living barrier made of trees will significantly absorb noise, and tree canopies will reduce the visibility of machines, which could reduce the negative impact of disturbance.
- Potential roost sites are one of the most important features for the bat species conservation, therefore shall be preserved and not to be disturbed. Pre-clearance checks will be undertaken of trees to support roosting bats by an experienced bat ecologist prior to the commencement of works to avoid causing disturbance or injury to roosting bats. The surveyor will initially walk the alignment and mark trees with features that may potentially support roosting bats (i.e.i.e., holes and crevices). The detected bats will be translocated to a receptor roost by an experienced bat ecologist following a method statement prepared by the BE.
- If not in use during construction activities, and if adequate alternative natural roost sites are available in the wider area then no further action will be required. If not in use during construction activities, and if no other roost sites are available, then it will be necessary to provide artificial roost sites. The artificial roost should be suitable for they species/number of bats that use the roost that will be lost; expert input should be provided to inform this. If the roost is in use during construction works, and if these works cannot be delayed long-term until the bats have vacated the roost, then a suitably experienced bat worker should be consulted to attend site and remove the bats prior to work. In advance of this an alternative roost site should be identified (whether natural or artificial). The bats should be oved to a suitable new roost site. It is important than an experienced bat worker is engaged to do this work.
- Should any roosts be accidentally disturbed by negligence of the Contractor or as the result of an accidental situation, habitat restoration shall be done

after the construction phase is finished. Alternative roost sites in the vicinity shall be built in case of any being destroyed by the construction works.

- Employed BE must monitor all works with potential to harm wildlife and act accordingly if any sensitive biodiversity features have to be removed in line with the BMP requirements.
- Appropriate education targeted at the needs of different construction personnel can help to achieve minimal impact on species occupying areas of construction, as well as to ensure safety of the construction personnel in case of encounter with reptiles.

Potential fatalities or injuries to fauna species due to vegetation removal and movement of heavy machinery

- On-site speed limits must be enforced to avoid direct mortality of animals.
- Habitat clearance will be undertaken by the contractors in a progressive and sensitive manner to enable fauna to move away from the area of works, disperse into surrounding habitats and to avoid fauna from being isolated in fragmented areas of habitat.
- In the time frame from 48h to 24h before commencing vegetation clearing, BE shall do a walkover of the site.
- Machinery operation should be restricted to daylight hours to minimise the risk of vehicle collisions with nocturnal and crepuscular wildlife.
- Avoid unnecessary cutting of older trees and removal of dead wood in the zone of project area of influence, particularly oak, from habitats as they are important for saproxylic species.
- Fragmented and small habitats suitable for amphibians found in the area of Ovcari, Mladeskovici, Klenova draga, Zelenika and Bosnjaci must not be disturbed by heavy machinery during construction.
- It is necessary to perform daily checks for the presence and removal of individuals of the species fire salamander (*Salamandra salamandra*) and Hermann's tortoise (*Testudo hermanni*) within the motorway subsection under construction, and, if species are found, the comissioned BE must safely remove them from the area to the adjacent habitat of the same type away from machines, local roads and other dangers. If tortoise nests with eggs are found during construction, it is necessary to ensure they are not disturbed or destroyed and BE must safely remove them from the location.
- In order to prevent fauna from entering, all construction sites within candidate Emerald sites and potential Natura 2000 sites must be fenced with a wire fence at least 1,5 m tall, the bottom 30 cm of the fence must be made of preformed metal sheets, recycled plastic lumber or (perforated) scored plastic and will prevent smaller fauna from entering the site.
- During the construction period sites will be managed so that they do not provide suitable habitat for reptiles (shelter and hibernation). Measures would involve not stockpiling rubble and only undertaking works to move rubble when temperatures are above 7 degrees Celsius, i.e., when reptiles are not in hibernation.
- During the construction phase, significant construction work such as excavation and trenching works will be carried out in the area of physical and direct area of influence of the motorway. It is expected that in the

conditions of disturbed habitat structure and fauna movement, there will be fauna mortality. It is recommended that the contractor fences all parts of the area where significant earthworks and excavations will be carried out, with focus on forested areas and area near watercourses.

- All surplus material that will not be used in construction works must be stored on previously planned disposal sites and construction waste must be systematically transported to disposal sites to prevent fatalities of fauna due to inadequate material management.
- The fence along the motorway should be constructed properly (1m-high wire fence which in the lower parts (at least 50 cm from the ground) has a diameter of 2cm or less), to ensure there would be no collision of these species during operation phase. The use of a dense net in the lower part of the fence will prevent the passage of small fauna to the motorway route. This measure is to be constructed during construction phase, however, will act as a mitigation measure during operation phase.
- During the construction period, whenever possible, and after completion of the construction of the Prenj tunnel, it is necessary to recultivate the excavated material disposal sites, which will compensate for the loss of habitats that will be buried in landfills. Recultivation should be done with indigenous species, including Dalmatian laburnum (*Petteria ramentacea*), hornbeam (*Carpinus orientalis*) and oak (different species of the genus *Quercus* found in the Project area).

6.7.2 Operation

Habitat fragmentation

- Revegetation must be done as stated in the mitigation measures regarding habitats.
- The viaducts along the motorway route, which are constructed as open passages for wildlife, should be kept passable during operation phase.
- In locations Streams no. 1 and 2 in Ovcari, artificial pond in Zelenika and artificial pond in Bosnjaci, due to identification of a large number of amphibians and potential habitat fragmentation, tunnels should be set up to allow the unimpeded passage of animals. To encourage use by amphibians and reptiles, all terrestrial crossings should have a natural substrate on the tunnel floor that consists of soil, sand, branches and other natural materials. The precise design, dimensions, and factors that may affect tunnel placement are listed in the *Guidelines for Amphibian and Reptile Conservation During Road Building and Management Activities in British Columbia* and should be taken into consideration when designing and planning.
- Plant high trees on chainage 10+580.00 in the form of hop-overs for bats. The aim with hop-overs is to reduce the mortality risk by guiding the bats across the roads above the traffic. The chosen locality is placed in forested area where bats are present, and where embankments narrow down and the road cuts into the slope. This will be utilised as a natural guidance for bats along with trees.

Potential collision of fauna species due to high speed of vehicles

- Possible negative pressure on the invertebrate species caused by the construction of the Prenj tunnel comes down to the aggregation of insects in the lighting and the death of insects when in contact with cars moving at high speed. The ecotone along the motorway can play a significant role in the expansion of the habitats of butterflies and other insect species that inhabit marginal habitats. The importance of the ecotone along the motorway will be reflected through the increase of the habitat area of indigenous species of open habitats, such as the species Euplagia quadripunctaria. However, the effects of ecotones and habitat fragmentation are much more significant for forest species (such as Lucanus cervus) that fly from forest to open habitats, thus increasing the likelihood of individuals being killed by cars. Possible mitigation measures are the use of red lighting that is less attractive to insects and, if necessary, the installation of high barriers (mesh materials) in the parts where the high frequency of dead individuals is determined after monitoring.
- Undertake regular maintenance of protective bird panels.
- The motorway needs to be fenced and the fence maintained properly throughout the operation phase. The fence must be fixed to the ground. The fence must be fixed to the ground. All damage to the fence is to be promptly repaired, therefore regular inspections are required.
- Should any fatalities of birds be observed during regular maintenance of the road in operation phase, protective barriers should be placed at such locations in consultation with the local ornithological society.
- The motorway maintenance service is obliged to record mammal's injury cases in order to respond timely with additional protection measures, during first three years as given in the BMP.
- The fence along the motorway should be constructed properly (1m-high wire fence which in the lower parts (at least 50 cm from the ground) has a diameter of 2 cm or less), to ensure there would be no collision of these species during operation phase. The use of a dense net in the lower part of the fence will prevent the passage of reptiles to the motorway route. This measure is to be constructed during construction phase, howeverhowever, will act as a mitigation measure during operation phase.

Negative impacts of pollution, increased light and noise levels on sensitive fauna species such as bats

- Adequate maintenance of drainage structures and oil separators (EN 858-1 and 858-2) to ensure their efficiency regarding the pollution prevention by engaging an authorised third party to ensure their efficiency regarding the pollution control.
- Avoid the use of dissolving salts and other chemicals and their discharge into the natural habitats as much as possible.
- All species of bats are nocturnal animals. The light near the colony will affect their behaviorbehaviour and reduce the amount of outings intended for hunting. Strong light will reduce social flight and cause the species to move to another darker location. Illumination of the bat litter leads to disturbances that cause the bats to leave the litter. Also, light causes insects to accumulate allowing bats to aggregate in those places. As mitigation

measures replacement bulbs may be used such as low-pressure sodium lights, high-pressure sodium bulbs or mercury bulbs as elaborates in the BMP.

- Avoid placing the artificial street lightsstreetlights and unnecessary lightened traffic signs, auxiliary facilities, such as gas stations, resting places, billboards etc. Preferably use only red lights for signalization which will not attract insects.
- Motor vehicle noise is a constant but not limiting factor. Adapting to noise and conditioning to emerging conditions is a phase in adaptation for local populations of mammal species. It is not necessary to implement mitigation measures.