ЈП ЖРСМ Инфраструктура
NP HRMV Infrastruktura

Construction of new railway section from Kriva Palanka to the border with Republic of Bulgaria, as part of Corridor VIII

Supplementary Biodiversity Assessment

Public Enterprise for Railway Infrastructure Railways of Republic of North Macedonia – Skopje

June, 2023

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Explanation note:

The project is expected to be financed in part by an approved Instrument for Pre Accession II (IPA II) grant. This grant shall be deployed through the IPA Operating Structure. See for further details: IPA 2014-2020 (IPA II) - CFCD (finance.gov.mk). In that context, the Environmental and Social instruments, including this document, shall be implemented by the Public Enterprise for Railway Infrastructure Railways of Republic of North Macedonia – Skopje in collaboration with the Contracting Authority, the Central Financing and Contracting Department within the Ministry of Finance, and the Ministry of Transport and Communication.

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List of Abbreviations

Abbreviation	Meaning
AEWA	African-Eurasian Migratory Waterbirds
AOI	Area of Interest
ASCI	Areas of Special Conservation Interest
BD	Bird Directive
BMP	Biodiversity Management Plan
SBA	Supplementary Biodiversity Survay
CBD	Convention on Biological Diversity
CITES	Species of Wild Fauna and Flora
CH	Critical Habitat
CR	Critically endangered
EAAA	Ecologically Appropriate Areas of Analysis
EAAA	Ecologically Appropriate Areas of Assessment
EBRD	European Bank for Reconstruction and Development
EIA	Environmental Impact Assessment
EIB	European Investment Bank
EN	Endangered
EOO	Estimated Extent of Occurrence
ESIA	Environmental and social impact assessment
EU	European Union
EUNIS	European nature information system
GPS	Global Positioning System
HD	Habitat Directive
IBA	Important Bird Area
IPA	Important Plant Area
IUCN	International Union for Conservation of Nature
kHz	Kilohertz
LC	Least Concern
MTC	Ministry of Transport and Communications
PBA	Prime Butterfly Areas
PBF	Priority Biodiversity Feature
PCC HYDRO	Private company managing small hydro power plant
PE ZRSMI	Public Enterprise Railways of the Republic of North Macedonia, Infrastructure
PR	Performance Requirements
SHPP	Small Hydro Power Plant
UNESCO	United Nations Educational, Scientific and Cultural Organization
VU	Vulnerable
HNVF	High nature value forests
HPP	Hydro-power plant
ES	Ecosystem services
CLC	Corine Land Cover
Mts.	Mountain
NNL/NG	Nonet loss/ Net gain
MAFWE	Ministry of Agriculture, Forestry and Water Economy
MoEPP	Ministry of Environment and Physical Planning

Abbreviation	Meaning
UNEP	United Nations Environmental Programme
CITES	Convention on International Trade in Endangered Species of Wild Fauna and Flora
ha	hectar
NGO	Non-Goermental Organisation
SDC	Swiss Agency for Development and Cooperation

EXECUTIVE SUMMARY

The railway line from Kumanovo to Deve Bair (Bulgarian border) is an integral part of the identified Corridor VIII and includes 3 sections: section 1: Kumanovo-Beljakovce, then section 2: Beljakovce to Kriva Palanka (T'lminci) and section 3: Kriva Palanka (T'lminci) to Deve Bair (Bulgarian border). The original ESIA Study prepared in 2011-2012 considers three strategic alternatives for the Railway Corridor VIII – Eastern Section: 'Do nothing' alternative, Reference alignment and Alternative alignment (see Addendum, Project description).

With consideration to all criteria applied, Alternative A (Reference alignment) was selected as the preferred option for all three sections of the railway alignment, and put forward for further elaboration through preparation of a technical Detailed Design and the present environmental and social appraisal.

This Supplementary Biodiversity Assessment is focused on Section 3 - Kriva Palanka (T'lminci) to Deve Bair (Bulgarian border). Following a review of the two ESIA documents written in 2012 and 2017, the first covering the whole railway corridor from Kumanovo to Deve Bair, and the latter focusing on Section 3 of the corridor i.e. Kriva Palanka (T'lminci-Deve Bair), a number of gaps were noted in the biodiversity baseline studies. Noted gaps were primarily outlined with reference to non-compliance to the updated EBRD and EIB requirements for a project of this scale, lack of up-to-date information on protected species and limited mitigation with regards to some protected species likely to be present. The Supplementary Biodiversity Survey was carried primarily to cover data gaps in line with the updated EBRD requirements, and hence was focused on species of conservation concern listed in the EU Directives and/or national/regional legal conservation documents that in accordance with the updated EBRD PR6 requirements qualify as PBF and/or CH. To cover the identified gaps, supplementary biodiversity surveys were commissioned from April to June. However, with due consideration of the project timeline and the prolonged winter conditions in early spring of 2022, the field surveys were intesified throughout May and the first week of June 2022. The SBA also took into consideration (i) all relevant available documents on supplemental assessment of impacts on and monitoring of biodiversity from project activities in the area of the Osogovo-German bio corridor during construction of Expressway A2; (ii) Supplemental Biodiversity Assessment Report and assessment and monitoring reports for project for reconstruction and rehabilitation of the state road, section Kriva Palanka – Deve Bair; (iii) Assessment, valorization and monitoring reports carried in the frame of conservation project activitiesand (iv) expert's personal field data i.e. available field data records on species and habitats collected as part of other survey activities in the area of interest. The data was then used to inform an updated Biodiversity Impact Assessment, Critical Habitats Assessment and to target additional mitigation where required. In addition to this an Outline Biodiversity Management Plan (BMP) has been completed based on the information presented in this report, as a standalone document. Before disclosure, a consultation with critical stakeholders (biodiversity specialists, protected areas, MoEPP) was carried in order to identify any potential gaps with reference to species and habitat findings, identified impact and correspomnding mitigation and management actions elaborated in the SBA and BMP[1].

The additional baseline surveys were undertaken for: reptiles, birds and mammals, insects and habitats. The supplementary assessment was undertaken in order to establish presence or likely absence of species/habitat of conservation concern within the survey area. The habitat map was revised based on the EUNIS, 2012 (parent) habitat types, to establish if any EU Habitats Directive Annex I Habitats are present. Aquatic fauna and fish were not considered as part of the Supplementary Biodiversity assessment as none of the identified species recorded in the biodiversity assessment studies carried as part of the ESIA 2012 and 2017 were considered to be of conservation concern, so would not trigger the need for a PBF or CH assessment.

[1] No potential gaps were identified with reference to both species and habitat findings, as well as identified impacts and corresponding mitigation and management actions elaborated in SBA and BMP. Few minor suggestions were given that were accounted for in this report

The critical habitat assessment took into consideration all species listed in the ESIA, 2017, as well and habitat and species findings from the supplementary fieldwork carried for the purpose of the Supplementary Biodiversity Assessment (SBA). From total of ~40 habitats and ~415 species, only 10 habitat types and 68 species qualify for PBF/CH based on the Lenders' requirements. Of these, 8 habitat types were assessed as PBF and 2 were assessed as CH. A total of 21 species were assessed as PBF i.e. 19 birds, 1 amphibian and 1 reptile; and 39 were assessed as CH i.e. 16 mammals of which 13 bats; 13 reptiles; 5 amphibians and 5 insects.

Forest habitats were noted to be largely degraded/not representative mostly due to the long-term extensive use of this natural resource (firewood/construction material) by the resident population of Kriva Palanka and the nearby rural settlements. Grasslands were found to occupy small areas and due to the ongoing process of abandonment of stockbreeding practices, large portion of areas under grassland is under succession i.e. overgrown with small trees from the subordinate layers of forests. The community structure of riparian woodlands was noted to be altered due to notable presence of anthropogenic trees and invasive species. It is noteworthy that large portion of conservationally important natural habitats, particularly thermophillous forests and riparian woodlands and belts was noted to be severely degraded in the process of ongoing construction of other infrastructural projects implemented in the area (access roads, landfills and borrow pits, construction sites). The degradation of the river Kriva Reka valley, largely occurring due to the ongoing construction of the SHPP "Kriva Reka", PCC HYDRO is particularly notable from Kriva Palanka to Zhidilovo (see Figure 6). The degradation from the ongoing construction of the Expressway A2, LOT 2: Sub-section Kriva Palanka – Dlabocica is most notable from T'lminci to Stambolica and disturbance from works related to Kriva Palanka Road Rehabilitation Project are noted at Kiselichka Reka valley. Ongoing construction activities were also noted to have potentially negative effect on species presence.

Nonetheless, presence of patches of representative habitats of conservational importance were also noted as present, largely in the area between Drenje and Uzem. The faunal surveys also recorded a range of species of conservation concern. It is also noteworthy that the mammal, reptile and bird surveys recorded the presence of few other species that were not noted in the previous ESIAs: Soprano pipistrelle (*Pipistrellus pygmaeus)* and Schreiber's Bent-winged Bat (*Miniopterus schreibersii*), the Black stork (*Ciconia nigra*) and the Dahl's whip snake (*Platyceps najadum*).

All species are considered to be relatively widespread and common in the region; however to reduce any likely negative effect that project implementation will have on species, appropriate mitigation measures and management actions have been detailed in the Outline Biodiversity Management Plan (to be completed and updated prior to construction commencing by the qualified Biodiversity Supervisor appointed as part of PE ZRSMI PIU). The BMP also includes adequate offset management actions and mitigation measures to acheave no net loss/net gain and to reduce possible negative impacts that project implementation will have on habitats. In this regard it is noteworthy that approximately 2/3 of the the alignment is routed through tunnels and bridges and hence negative impacts on sensitive habitats are largely avoided (particularly during operation).

Should mitigation measures and management actions detailed in the BMP be implemented accordingly, it is assessed that the project would have a non-significant impact on the biodiversity features in the project area.

1 Introduction

1.1 Project Background

The railway line from Kumanovo to Deve Bair (Bulgarian border) is an integral part of the identified Corridor VIII which would connect Macedonia to Varna (Bulgaria) and to the Black Sea. The railway link between Kumanovo and the Bulgarian Border includes 3 sections: section 1: Kumanovo-Beljakovce, then section 2: Beljakovce to Kriva Palanka (T'lminci) and section 3: Kriva Palanka (T'lminci) to Deve Bair (Bulgarian border). The original ESIA Study prepared in 2011-2012 covered all three sections of the Kumanovo-Deve Bair railway line. Due to the expired relevance of the consent issued by the Ministry of environment and physical planning issued as well as significant changes in the technical documentation, with regards to number of bridges and tunnels, a completely new ESIA Study for the third section of the railway (Kriva Palanka-Deve Bair) was prepared in 2017 (Figure 1).

This document represents a Supplementary Biodiversity Assessment represented by this document, which covers Section 3 of the railway line, Kriva Palanka (T'lminci) to Deve Bair (Bulgarian border). This Supplementary Biodiversity Assessment, has been written in order to take in to account the requirements of international lenders, such as the European Bank of Reconstruction and Development (EBRD).

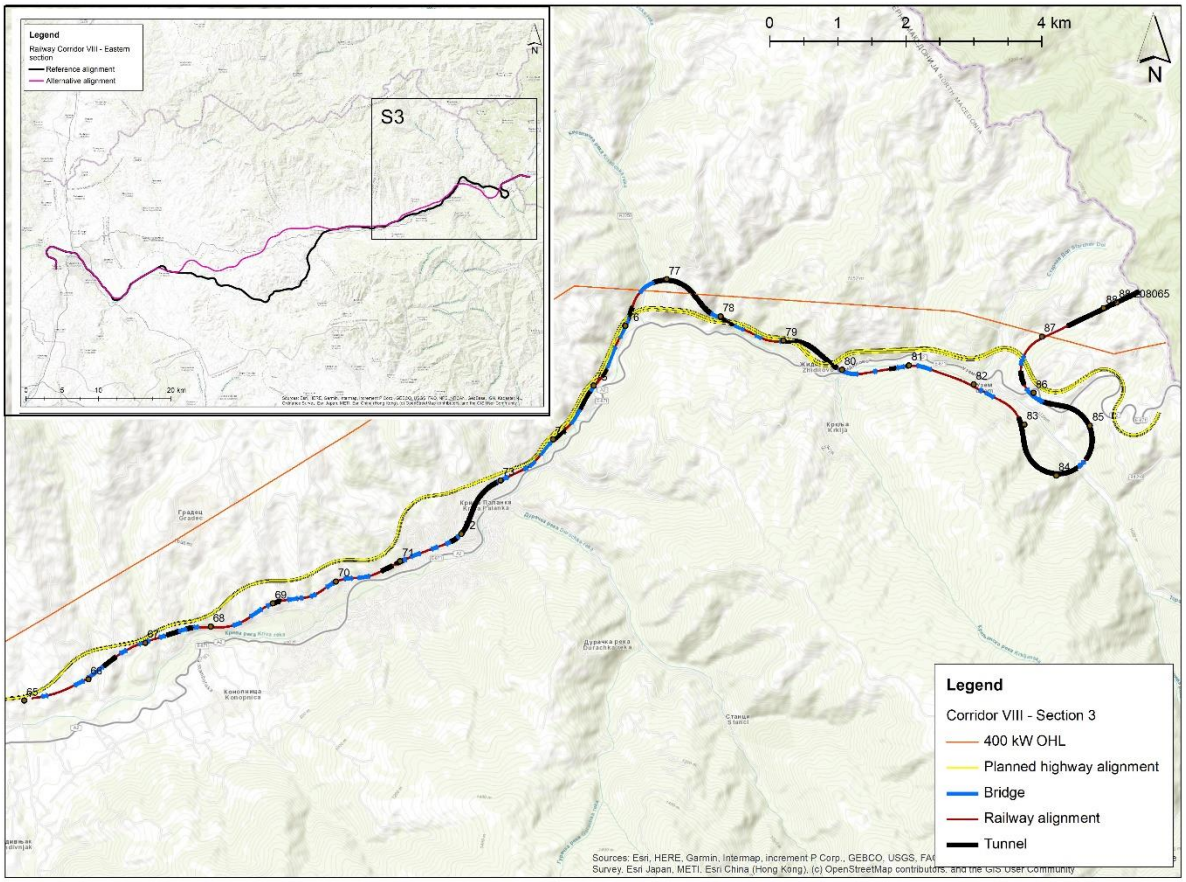


Figure 1 Overview of the railway alignment

1.2 Summary of Gap Analysis

The biodiversity gap analysis, submitted in April, 2022, identified a number of issues that needed to be addressed to meet the EBRD requirements, namely:

- The study area and scope to be revised to provide more detailed information on the effect of project implementation, with particular reference to species and habitats, and to account for the effects on the natural environment, including ecosystem service provision.
- Previously the study area was defined with consideration only of the physical footprint of the project and its direct and indirect impacts, all encompassed within an artificially delineated buffer along the project corridor. This requires amending to include consideration of rational ecological/natural boundaries.
- No Ecologically Appropriate Areas of Analysis (EAAA) were previously defined, so these will need defining.
- No reference on field survey findings, such as GPS references for species sightings, or specific locations of botanical inventories for each habitat type surveyed. Updated surveys undertaken in 2022 will provide this additional data.
- Previously the description of the assessed biodiversity features (fauna, flora and habitats) has been made based on literature data, personal experience of the experts and their Project field research. This data will be augmented with field survey data from 2022.
- No Critical Habitat (CH) or Priority Biodiversity Feature (PBF) assessment had previously been undertaken, so this will be added in the Supplementary Biodiversity Assessment.
- Ecosystem services were not assessed and considered within 2012 and 2017 ESIA, an assessment will be included in the Supplementary Biodiversity Assessment.

The GAP analysis also included an extensive review of all species and habitats noted within the ESIA 2012 and ESIA 2017 (both literature and field data) to provide initial screening for PBA/CH features to ensure full compliance with EBRD PR6 requirements, while also providing specific reference to other potential gaps within the baseline information. The GAP analysis found that:

- From total of 22 habitat types noted in previous ESIA studies as present in the area, 8 habitat types qualify as threatened ecosystems: Priority Biodiversity Features (PBF) or Critical Habitat (CH).
- From a total of 33 mammal species noted in available reviewed ESIA studies, 15 species qualify as PBF/CH, amongst which , the otter *Lutra lutra* and the wild cat *Felis sylvestris*, the wolf *Canis lupus* and the brown bear *Ursus arctos;* including 11 species of bats amongst which: *Rhinolophus ferrumequinum, Rhinolophus hipposideros, Pipistrellus kuhlii, Pipistrellus nathusii, Pipistrellus pipistrellus, Nyctalus noctula, Hypsugo savii, Eptesicus serotinus, Myotis mystacinus, Myotis myotis, Myotis blythii.* All are considered as a priority species on a European level listed in Annex II, IV and V of the Habitats Directive so would trigger CH if present. However, the brown bear was not recorded in the area (in the last 20 plus years)[2].

[2] Kryštufek, B. & Petkovski, S. (2003). Annotated Checklist of the Mammals of the Republic of Macedonia. Bonner zoologische Beiträge, 51, 229-254.
Stojanov, A., Melovski, D. and Ivanov, Gj. (2009). Mammals of Osogovo Mts. Final Report. Macedonian Ecological Society, Skopje: 27 pp. Project: Osogovo Mts. in the Balkan Green Belt. Macedonian Ecological Society.
Stojanov A., Ivanov Gj., Melovski D., Hristovski S., Velevski M. (2010) Population Status of the Brown bear (*Ursus arctos*) in the Republic of Macedonia - *Project : Development of the National Ecological Network in R. Macedonia (MAK-NEN) (Project report).* MES, Skopje, Republic of Macedonia.
Stojanov, A., Sarov, A., Zlatanova, D., Paraskova, M. 2016. Expert analysis of the existing information for large carnivores (*Brown bear*, *Wolf* and *Lynx*) and recommendations for relevant monitoring methods on Osogovo Mt. Expert report. Project: Supporting a Sustainable Future for People and Nature in the Osogovo Mountain.

Zlatanova, D., Popova, E. and Stojanov, A. (2018). Large carnivore monitoring on Osogovo mountain with active participation of local partners – results and analysis (2016-2018). Technical report. February 2018, 24 pp.

- From a total of 9 Amphibian and 13 Reptile species noted in previous ESIA studies, 5 amphibians (*Bombina variegate, Rana graeca, Rana dalamatina, Bufo bufo, Bufotes viridis* and *Hyla arborea)* and 11 Reptiles (*Podarcis muralis, Podarcis erhardii, Podarcis taurica, Lacerta viridis, Lacerta trilineata, Zamenis longissimus, Coronella austriaca, Dolichophis caspius, Natrix tessellata, Vipera ammodytes*) are listed in the Annex IV of the HD so would trigger PBF/CH if present.
- From total of ~160 bird species noted in previous ESIA studies, 19 are listed on the Annex I of the Bird Directive so would trigger PBF/CH if present *(Ciconia ciconia, Caprimulgus europaeus, Alcedo atthis, Picus canus, Dryocopus martius, Dendrocopos syriacus, Dendrocopos medius, Melanocorypha calandra, Calandrella brachydactyla, Lullula arborea, Anthus campestris, Ficedula albicollis, Lanius collurio, Lanius minor, Accipiter nisus, Curruca (Sylvia) nisoria, Ficedula semitorquata, Lullula arborea, Pernis apivorus).* Furthermore, reviewed ESIA studies note that attention should be paid to possible presence of Peregrine falcon *Falco peregrinus.*
- From total of ~200 reviewed insect species noted in previous ESIA studies, 6 would trigger PBF/CH if present: 4 butterflies (*Parnassius mnemosyne, Zeerynthia polyxena, Lycaena dispar, Euphydryas aurinia*) and also *Morimus funereus* and the great Capricorn beetle *Cerambix cerdo* both are assessed as VU according to the IUCN red list.

Within the previous Project documentation (ESIA 2017), the Project environmental impact assessment and mitigation measures for affected habitats and species groups were provided in detail. However, the GAP analysis concluded that the impacts and mitigation measures for species needed to be revised, to provide a reference to an assessment of Critical Habitat (CH) and/or Priority Biodiversity Features (PBF) and to further determine the need for and level of mitigation/compensation required.

The 2017 ESIA provided a clear reference to all alignment crossings with internationally or nationally proposed or protected areas. Impacts on Protected Areas including sites proposed as Emerald sites were considered and a detailed description of the landscape character provided with reference to broader surroundings of the area where the railway alignment is projected to be, is provided.

1.3 Legal and policy framework

Although North Macedonia is not an EU member state, the EIB and EBRD-financed projects are expected to meet good international practice related to sustainable development. For this purpose, the Bank has defined specific Performance Requirements (PR) that its Clients must apply to manage its environmental and social risks and impacts. For this Biodiversity Assessment, these requirements are specifically addressed in **PR 6: Biodiversity Conservation and Sustainable Management of Living Natural Resources.**

In the context of PR6, the following key directives must be considered:

- **EU Habitats Directive (Annex I, II and IV)**
  with added consideration to *Key Biodiversity Area*s (including Important Bird Areas and Ramsar sites), *UNESCO* Natural World Heritage Sites and *International Union for the Conservation of Nature* (IUCN) *Red Lists of ecosystems and species, Bern Convention;*
- **Birds Directive**
- **EIA Directive (85/337/EEC)**

In line with the EBRD requirement, following the EU guidance, an Appropriate Assessment has been undertaken and included as Appendix 1 at this document.

The legal basis for nature protection **in the Republic of North Macedonia** is contained within the Constitution, the Law on Nature Protection, the Law on Environment, the National Red List(s) of Amphibians, Reptiles, Mammals and Plants based on the principles and methodologies of the global

IUCN Red List of Threatened Species and in line with the international agreements signed or ratified by the Country and other laws regulating the use of certain natural resources, listed below:

- Convention on Biological Diversity (CBD)
- Berne convention on the Conservation of European Wildlife and natural Habitat
- Bonn Convention: Conservation of Migratory Species of Wild Animals
- Convention on Wetlands of International Importance;
- Convention on the International Trade in Endangered Species of Wild Flora and Fauna (CITES);

1.4 Scope of work (aims and objectives)

Seeking to meet the EBRD and EIB expectations for managing project impacts on biodiversity, ecosystem services and living natural resources this Supplementary Biodiversity Assessment aims to reassess the risks and impacts on biodiversity and natural resources along Section 3 of the railway line in accordance with Performance Requirement (PR) 6.

Following the due diligence assessment of the existing documentation for the development of the Project (GAP analysis), the Supplementary biodiversity assessment and management plan aims to:

- Provide habitat mapping in accordance with EUNIS classification of habitats, to enable the identification of sensitive habitats and/or habitats of conservation concern;
- Undertake a supplementary biodiversity assessment to gather additional baseline data and compensate noted data gaps in biodiversity baseline needed to conclude critical habitats assessment
- Undertake a Critical Habitats Assessment and provide a critical review of previously identified habitats/species to appropriately account for the potential effects that the project implementation will have on priority biodiversity features or critical habitats.
- Determine if any international or national (candidate) protected areas are likely to be affected by the Project and conduct an Appropriate Assessment;
- Assess effects on ecosystem services delivery
- Provide information on proposed mitigation and monitoring, to inform the Biodiversity Management Plan.

It is noteworthy that during the preparation of both the SBA and the BMP the project underwent design changes with reference to four access roads, three of which fall within the urban environment of Kriva Palanka. Project design changes with reference to the one access road projected to provide access at km 77.67 to facilitate tunnel exit and bridge construction are already accounted for as part of the SBA, as the projected road cuts through G3.F12 : Native pine plantations that does not qualify as PBF/CH and falls within the buffer of assessed impacts related to habitat loss. Hence, project design changes with reference to access roads do not trigger any changes in the documents with reference to PR6 requirements.

1.5 Document structure

1. Introduction
   provides project background and summary of the GAP analysis. It also provides a general overview of the national and international legal and policy framework considered in the preparation of this document and outlines the scope of work i.e. aims and objectives of the Supplementary Biodiversity Assessment
2. Methodology
   Provides details on the study site; gives details on the overview of the survey background whilst providing a reference to documents considered for the desk study and provides information on

the selection of Ecologically Appropriate Areas of Assessment (EAAA). This section further provides information on area covered during the 2022 fieldwork surveys and gives a brief summary of the methodology used for surveying each species group.

3. Results
   Gives details on the findings from the supplementary biodiversity assessment while also providing data on the perceived ecosystem services by the relevant stakeholders.
4. Critical habitat and priority biodiversity feature assessment
   Identifies the features that qualify for CH/PBF
5. Supplementary biodiversity assessment
   Provides a more detailed description of the habitats/species that qualify as CH/PBF with specifics of fieldwork findings and observations relevant for the assessment and gives a reference to the potential impacts. This section also provides an overview of international or national (candidate) protected areas that are likely to be affected by the Project.
6. *Mitigation and monitoring*
   This section outlines the mitigation and monitoring actions needed to avoid/minimise impacts from the project implementation, provides a reference to the Biodiversity Management Plan prepared as a standalone document and summarises the residual effects from the Project.

2 METHODOLOGY

2.1 Study Area

Railway Corridor VIII - Eastern Section Project comprises a corridor with a total length of 88.1 km running across the North-Eastern region of North Macedonia, affecting five municipalities: Kumanovo, Staro Nagoricane, Kratovo, Rankovce and Kriva Palanka.

The project area (Section 3) is located on the territory of the municipality of Kriva Palanka, which belongs to the Northeast Region of the Republic of Macedonia. Section 3 starts before the town of Kriva Palanka (at km 64 + 942) and goes to the border with the Republic of Bulgaria (at km 88 + 365). Along the alignment there are 22 tunnels with a total length of about 10 km and 52 bridges with a total length of about 5 km (see Figure 1).

For the purpose of the Supplementary biodiversity assessment, the Area of Interest (AOI) or study area, has been delineated with consideration of the physical footprint of the project and its direct and indirect impacts, while taking into account sensible ecological/natural boundaries of distribution of species and habitats under consideration (Figure 2).

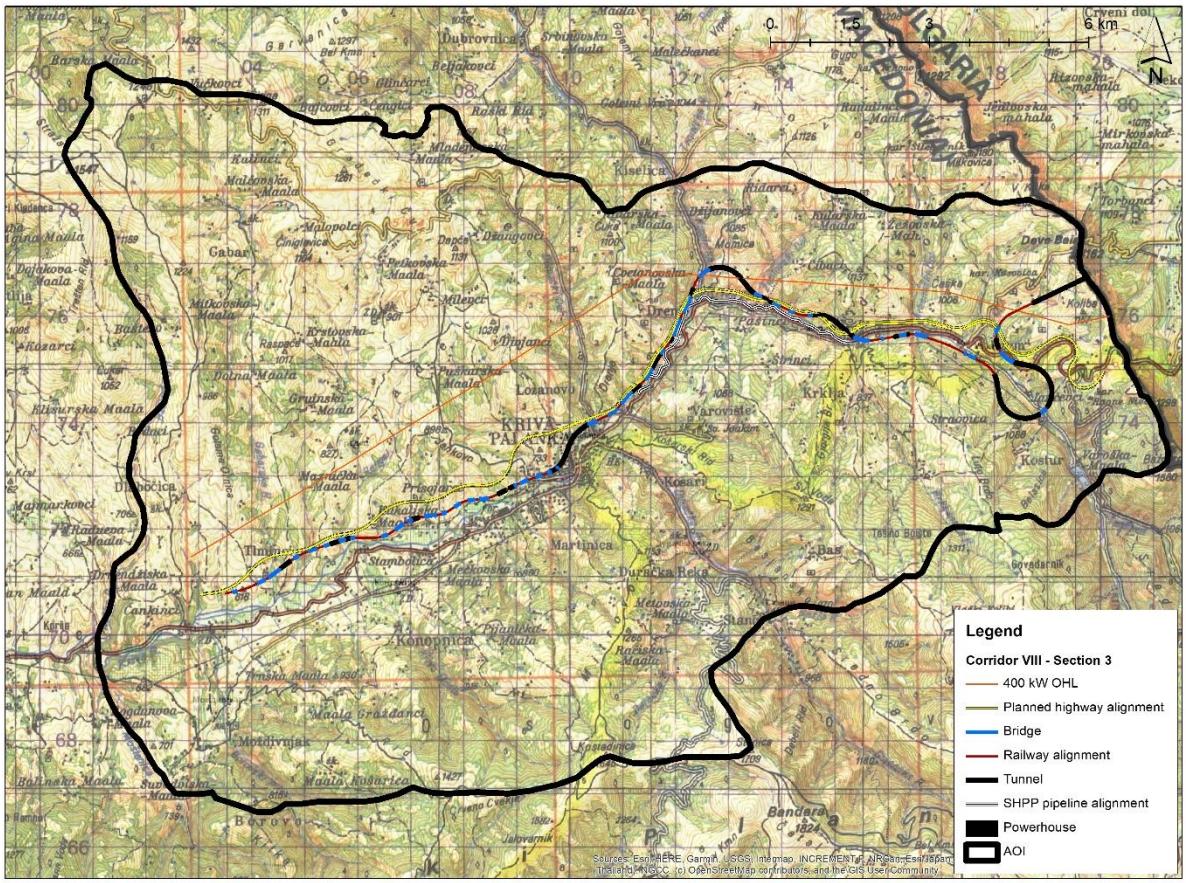


Figure 2 Area of Interest (AOI) as defined for the Supplementary biodiversity assessment

Figure 2 shows the area that has been delineated to represent the maximum extent of the AOI. The land cover in the AOI is largely covered with broadleaved forests and transitional woodland-scrubland, with some sizable areas principally occupied by agriculture. This habitat mosaic does contain significant areas of natural vegetation, generally occurring along the Kriva Reka river valley. Excluding the lowland

rolling rural setting along Kriva Reka river, this section of the railway line, stretches almost entirely through an area with characteristics of a mountainous rural landscape.

Land cover specifics of the AOI are provided on Figure 3[3], Table 1.

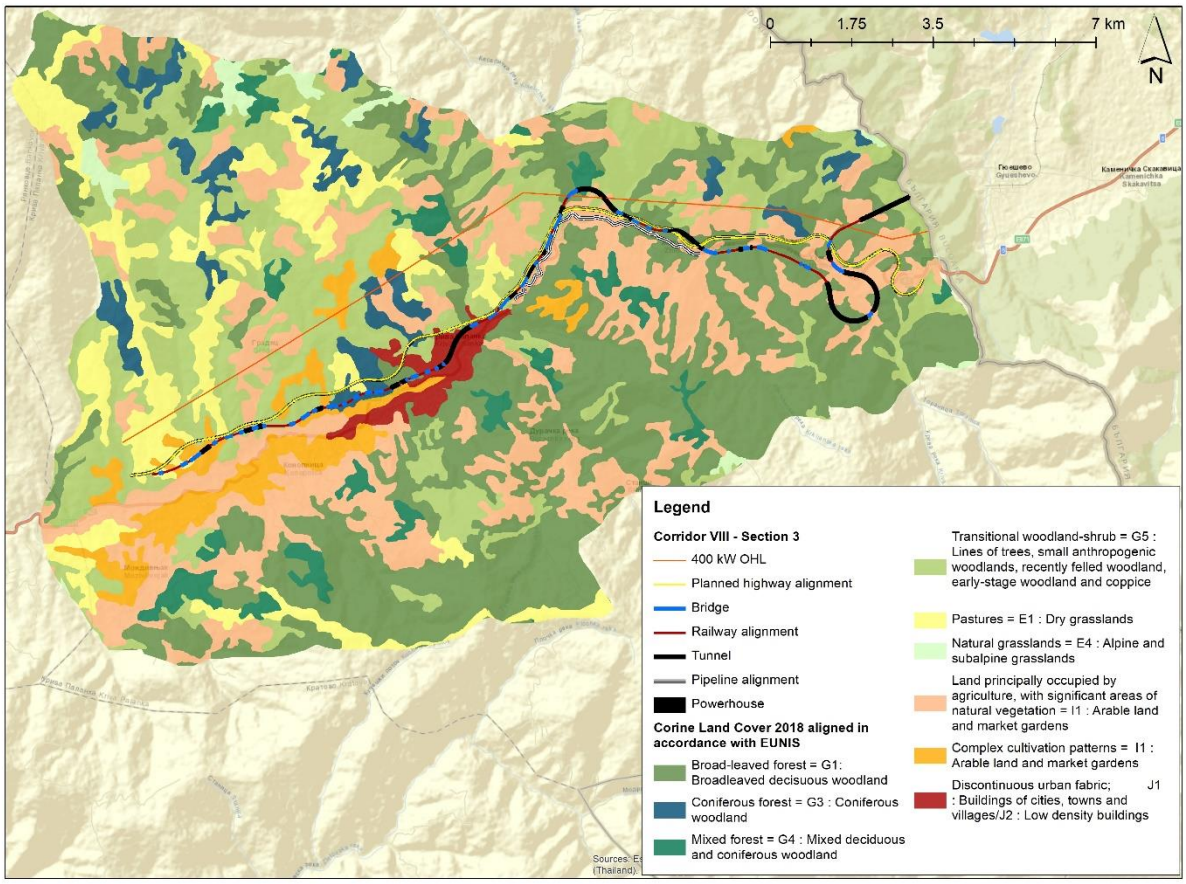


Figure 3 Land cover specifics of AOI according to Corine Land Cover data, 2018 aligned with EUNIS

Table 1 Coverage of Corine Land Cover types within the AOI, data from Corine Land Cover, 2018 aligned with EUNIS

Corine Land Cover type	EUNIS reference	Area (ha)	Area (%)
Pastures	E1 : Dry grasslands	1774.282	9
Natural grasslands	E4 : Alpine and subalpine grasslands	220.6109	1
Broad-leaved forest	G1: Broadleaved deciduous woodland	6268.106	33
Coniferous forest	G3 : Coniferous woodland	702.5604	4
Mixed forest	G4 : Mixed deciduous and coniferous woodland	712.926	4
Transitional woodland-shrub	G5 : Lines of trees, small anthropogenic woodlands, recently felled woodland, early-stage woodland and coppice	4226.017	22
Complex cultivation patterns	I1 : Arable land and market gardens	835.4492	4
Land principally occupied by agriculture, with significant areas of natural vegetation	I1 : Arable land and market gardens	4122.186	22

[3] Note that all large format of all habitat and species related maps are available in Appendix 3

Corine Land Cover type	EUNIS reference	Area (ha)	Area (%)
Discontinuous urban fabric	J1 : Buildings of cities, towns and villages; J2 : Low density buildings	275.8559	1
Total		**19138**	**100**

2.1.1 Protected areas

This section of the railway alignment passes through 3 areas that are proposed for protection or identified as important for conservation, in accordance with international conventions and initiatives:

- Proposed area for protection, Nature Park "Gorge of Kiselichka Reka" [4]
- proposed Emerald site Pchinja-German – MK0000029[5]
- proposed Emerald site Osogovo Mountains – MK0000023

This section of the railway alignment also passes through areas identified as important corridors for large mammals in Macedonian Ecological Network[6]. These corridors are:

- Osogovo-Bilina Planina (Deve Bair) linear bio-corridor;
- Osogovo-German landscape bio-corridor

Two other bio-corridors fall within the AOI:

- Kozjak-German-Bilina restoration area, not directly affected by the construction of the railway
- Osogovo Mt. core area, part of which was reassessed and since 2020 established as IUCN Category V - Protected landscape “Osogovo Mts.” The railway line does not pass nearby the designated protected landscape “Osogovo”.

This section of the railway alignment passes on the periphery of all important conservation areas.

The alignment does not cross any IPA, IBA or PBA boundaries.

A detailed overview of any potential negative impacts of project implementation on conservationally important areas and/or proposed for protection on a national level and an overview of feasible impacts on proposed Emerald sites is provided as part of the Supplementary Biodiversity Impact Assessment (section 5.5). Impacts on proposed Emerald sites are further elaborated in detail in Appendix 1 - Appropriate Assessment.

2.2 Survey background

Following the gap analysis recommendations, supplementary biodiversity surveys were carried to complement the existing baseline studies, cover the information gaps identified in the relevant gap analysis and to provide the additional information on species occurrence and effects on ecosystem service delivery.

[4] MES (2011). Strengthening the Ecological, Institutional and Financial Sustainability of Macedonia's National Protected Areas System (Project 00058373 - PIMS 3728.). Development of Representative National System of Protected Areas (Project activity Ref. RFP 79/2009). UNDP, Ministry of Environment and Physical Planning of the Republic of Macedonia, Macedonian Ecological Society.
[5] MoEPP (2008). Development of National EMERALD Network in Macedonia, Report. Ministry of Environment and Physical Planning, Skopje.
[6] Brajanoska, R., Melovski, L., Hristovski, S., Sarov, A., Avukatov, V. (2011). Brown Bear Corridor Management Plan. Report under the Project: “Development of the National Ecological Network in the Republic of Macedonia (MAK-NEN). Macedonian Ecological Society, Skopje, 114 p.

2.3 Desk study

The desk study took into consideration all relevant information on biodiversity, including information on habitats and vegetation, insects, reptiles, mammals and avifauna. Reviewed ESIA studies take into consideration recent relevant surveys and available secondary data and provide a solid reference to the aquatic fauna along the railway alignment, including fish species[7].

The literature review considered all relevant available documents developed in line with the EBRD PR 6 (except the Report on Materials, Borrow Pits and Landfills):

- 2017 ESIA Study for the construction of new railway track at the section Kriva Palanka-Republic of Bulgaria (Section 3), part of Corridor VIII 2017,
- 2012 ESIA Study Corridor VIII-Eastern section, and

With added consideration of the following documents:

- Report on Materials, Borrow Pits and Landfills,
- Supplemental Biodiversity Assessment Report, EBRD Kriva Palanka Road Rehabilitation Project, Macedonia, 2018, Maneko Solutions,
- Reports on supplemental assessment of impacts on and monitoring of biodiversity from project activities in the area of the Osogovo-German bio corridor during construction of Expressway A2, LOT 2: Sub-section Kriva Palanka – Dlabocica, 2020-2021, Geonatura Zagreb
    - Survey of the large mammal fauna during construction of Expressway A2, LOT 2: Sub-section Kriva Palanka – Dlabocica, Field report VI, October - December 2020
    - Field report VII, January - February 2021
    - Field report VIII, March - May 2021
    - Final assessment of impacts on biodiversity from project activities in the area of the Osogovo-German bio corridor during construction of Expressway A2, LOT 2: Sub-section Kriva Palanka – Dlabocica, Biodiversity Management Plan
- Assessment and monitoring reports for project for reconstruction and rehabilitation of the state road A2, section Kriva Palanka – Deve Bair (border with the Republic of Bulgaria)
    - Elaborate for Environmental Protections for project for reconstruction and rehabilitation of the A2 state road, section Kriva Palanka – Deve Bair (border with the Republic of Bulgaria), GEING 2016
    - Biodiversity Management and Monitoring Plan, Macedonian Biological Society, July 2020
    - Monthly biodiversity monitoring reports, Macedonian Biological Society, October-December 2020, July-December 2021.
- Assessment, valorization and monitoring reports carried in the frame of conservation project activities
    - Nature Conservation Programme in Macedonia, exit phase - project of the Swiss Agency for Development and Cooperation (SDC), 2021–2024 – available data;
    - Nature Conservation Programme in Macedonia, phase 2 - project of the Swiss Agency for Development and Cooperation (SDC), 2017–2020;
    - Nature Conservation Programme in Macedonia, phase 1 - project of the Swiss Agency for Development and Cooperation (SDC), 2012–2016.
    - Valorization study for establishing a protected area on Osogovo Mts., Category V Protected Landscape, Macedonian (2019), Macedonian Ecological Society

[7] Nine fish species have been reported in the ESIA, 2017: Leuciscus cephalus, Chondrostoma nasus, Gobio gobio, Barbus barbus, Barbus meridionalis petenyi, Abramis vimba melanops, Alburnus albidus, Cobitis taenia, Salmo truta phario (only in the upper flow of Kriva Reka).

- Added consideration of expert's personal field data i.e. available field data records on species and habitats collected as part of other survey activities in the area of interest.

2.4 Ecologically Appropriate Areas of Assessment

The Ecologically Appropriate Areas of Assessment (EAAA) were defined to follow natural distributions of species and habitats, combined within ecologically sensible boundaries within the AOI. The IUCN Red List was consulted and the Estimated Extent of Occurrence (EOO) was taken in to account for each species. The Desk study (including camera trap monitoring data from other infrastructure projects also being implemented within the AOI effective from November 2019 to December 2020) were considered to provided sufficient information to identify the EAAA for the target species groups and habitats. With added consideration of habitat distribution and species habitat requirements, a total of 15 EAAA for 11 species were identified (Figure 4 and 5).

Seven of the EAAAs were focused on target mammal species, however field surveys were not restricted solely to the delineated EAAAs. Instead, where feasible, field surveys were done with consideration to the wider area of interest to account for other species that are common in the Country but listed in the Annex II/IV of the Habitat Directive, and Annex I of the Birds Directive. Due to natural boundaries within the AOI, for some species more than one EAAA was delineated. For example, two separate EAAAs were created for the wolf and the European wild cat, and one EAAA for the otter and one for the target bat species. The brown bear was also considered, since this species was noted within the species list of the ESIA 2017, although its presence has not been recorded within the wider area in northeast North Macedonia for more than 20 years. The EAAA delineated for the brown bear *Ursus arctos* overlaps with the AOI.

It should be noted that the EAAAs for some of the mammal species overlap, like that of the wolf and the wild cat and/or the EAAAs for the wild cat and the otter. Total of 2 EAAAs were determined for the peregrine falcon and 4 EAAAs were determined for the target insects. The EAAAs for the two tortoise species were delineated to overlap with their distribution in accordance with the most recent species distribution data published as part of the recently available National Red List for reptiles.

EAAA for habitats that qualify as PBF/CH were selected using the information provided in the habitat map made available as part of the ESIA 2017. More than 200 habitat polygons were selected for review, the largest number of which were located from Drenje (after the city of Kriva Palanka) to Uzem (Bulgarian border).

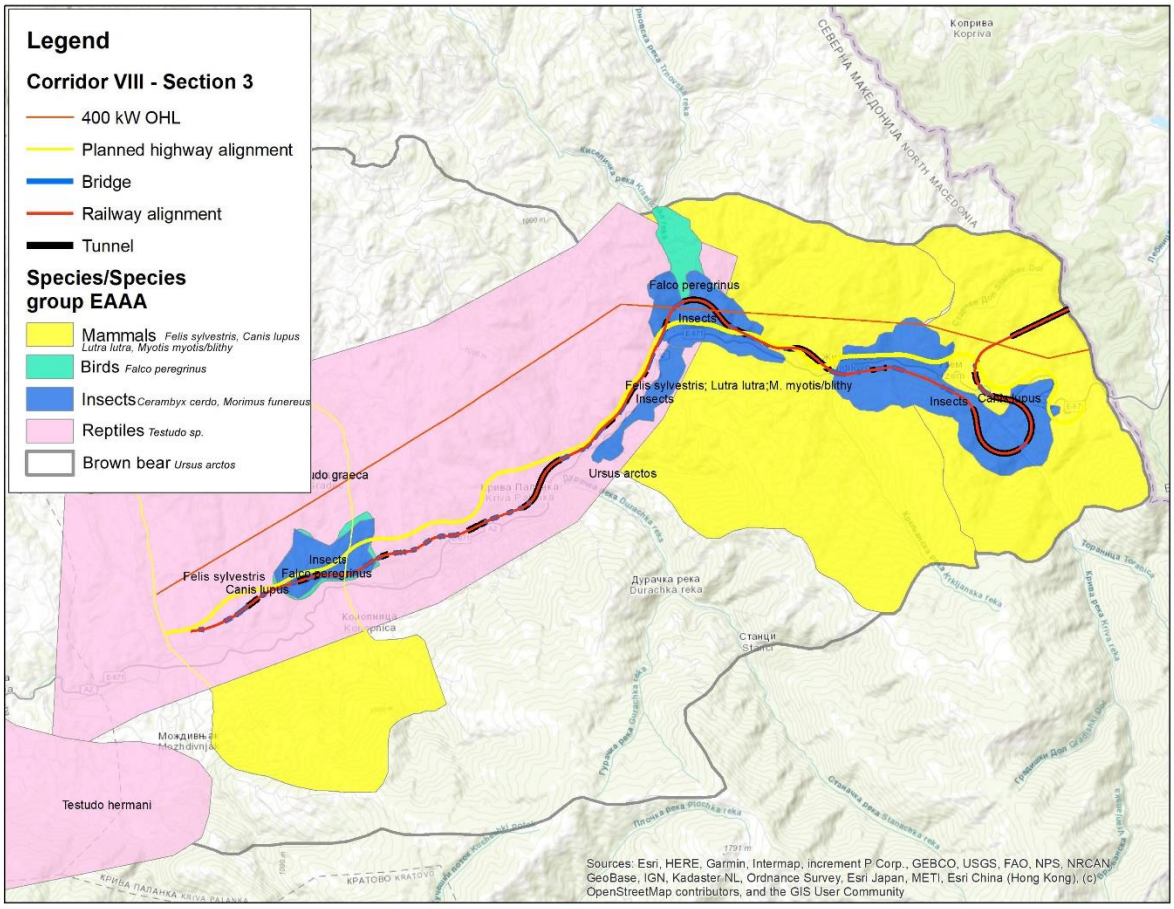
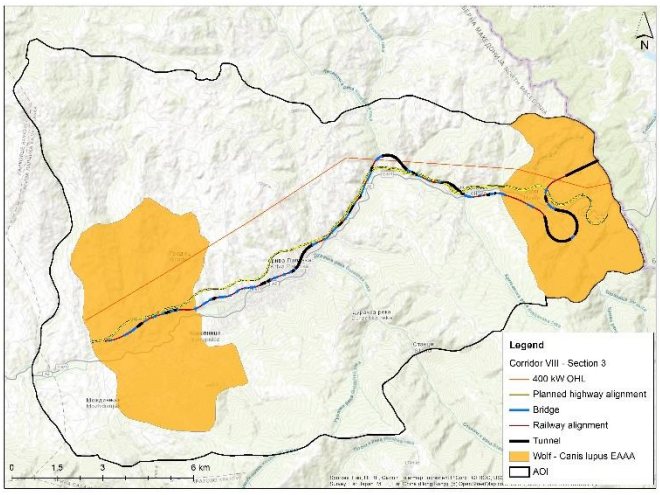
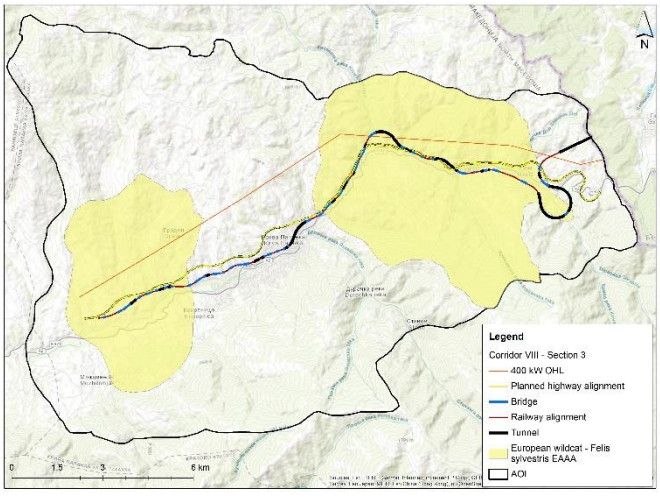


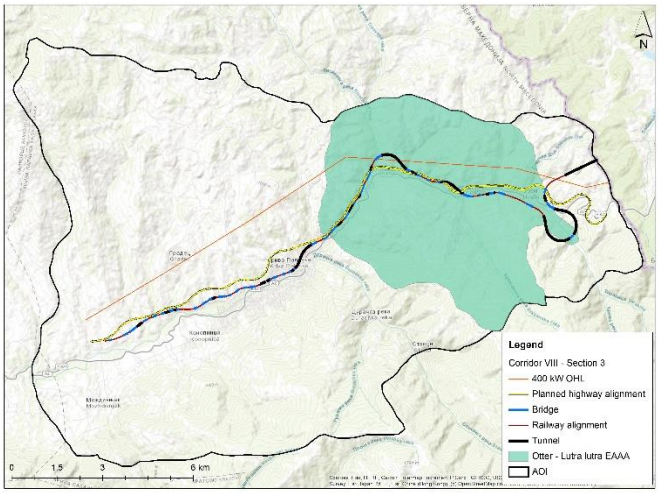
Figure 4 Joint presentation of delineated EAAA for target species/species groups in the AOI. Please note that EAAAs for some species overlap. The Brown bear EAAA is shown separately from other mammal species EAAAs as it delineates the AOI



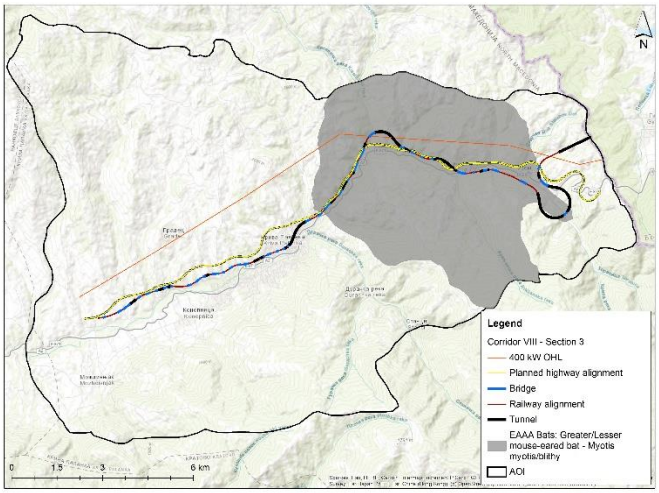
EAAA for the Wolf *Canis lupus*



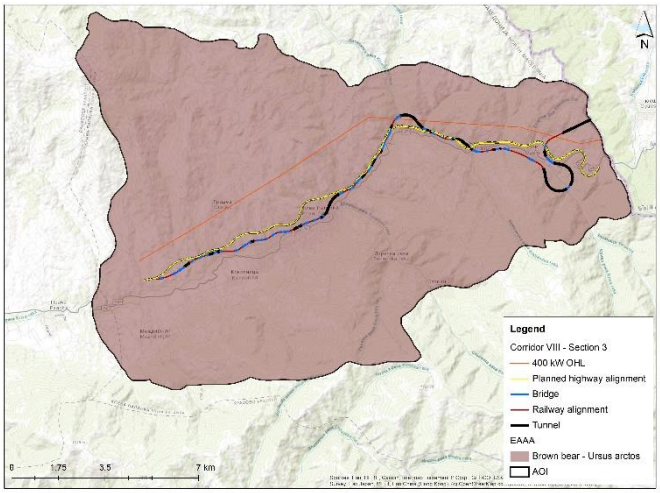
EAAA for the European wildcat *Felis Sylvestris*



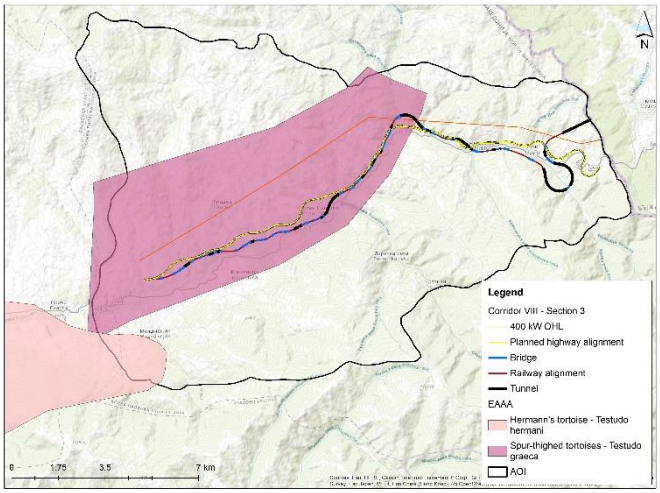
EAAA for the Otter *Lutra lutra*



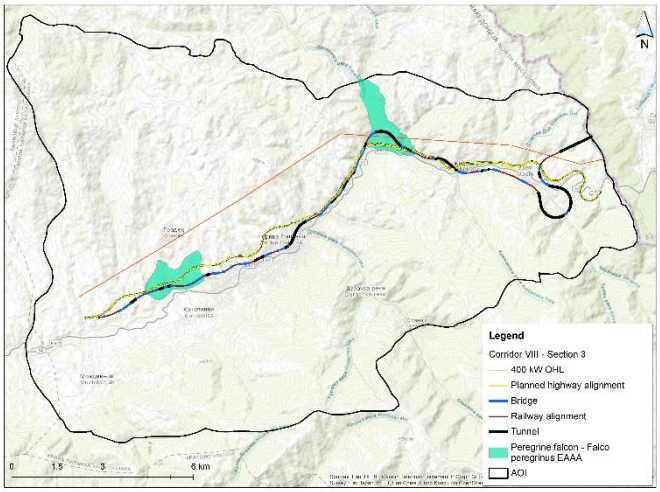
EAAA for the Greater mouse-eared bat - *Myotis myotis* and the Lesser mouse-eared bat - *Myotis blythii*



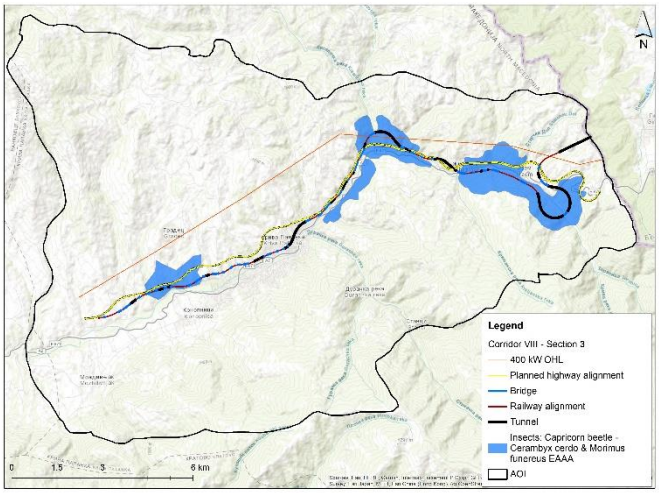
EAAA for the Brown bear *Ursus arctos*



EAAA for the Spur-Thighed Tortoise *Testudo graeca* (dark pink) and the Hermann's tortoise *Testudo hermanii (*light pink)



EAAA for the Peregrine falcon *Falcus peregrinus*



EAAA for Insects: the Great capricorn beetle *Cerambix cerdo* and *Morimus funereus*

Figure 5 Individual EAAA for target species/species groups in the AOI.

2.5 Fieldwork

With due consideration of the project timeline the field surveys were commissioned from April to June 2022. However, due to the prolonged winter conditions in early spring of 2022, only mammal field surveys were carried in April. Field survays for all other target species groupswere carried throughout May and beginning of June. To compensate, the feld work in May was intensive and fieldtrips were consequential, carried at a weekly basis to increase probability of finding species. While this fieldwork timeframe might be perceived as limited for conducting biodiversity related surveys, it was not considered to have affected data gathering since in late spring species have increased activity in search for food and/or mating. Spring and late spring are also favorable time for habitat assessment as tree canopy is fully developed and both early-blooming and late-blooming vegetation is noted.

To further compensate for the limited survey time, the SBA took into consideration (i) all relevant available documents on supplemental assessment of impacts on and monitoring of biodiversity from project activities in the area of the Osogovo-German bio corridor during construction of Expressway A2; (ii) Supplemental Biodiversity Assessment Report and assessment and monitoring reports for project for reconstruction and rehabilitation of the state road, section Kriva Palanka – Deve Bair; (iii) Assessment, valorization and monitoring reports carried in the frame of conservation project activitiesand (iv) available field data records on species and habitats collected by engaged experts as part of other survey activities done in the frame of conservation project activities.

For the purpose of conducting the fieldwork and bearing in mind the target species groups and habitats, relevant experts on mammals, reptiles, avifauna, insects and habitats were engaged.

Bearing in mind the relevance of the supplementary biodiversity surveys and to preserve consistency, the biodiversity survey reports have been integrated within this assessment, rather than being attached in Appendices.

Visual representation of the fieldwork survey routes is provided on Figure 6.

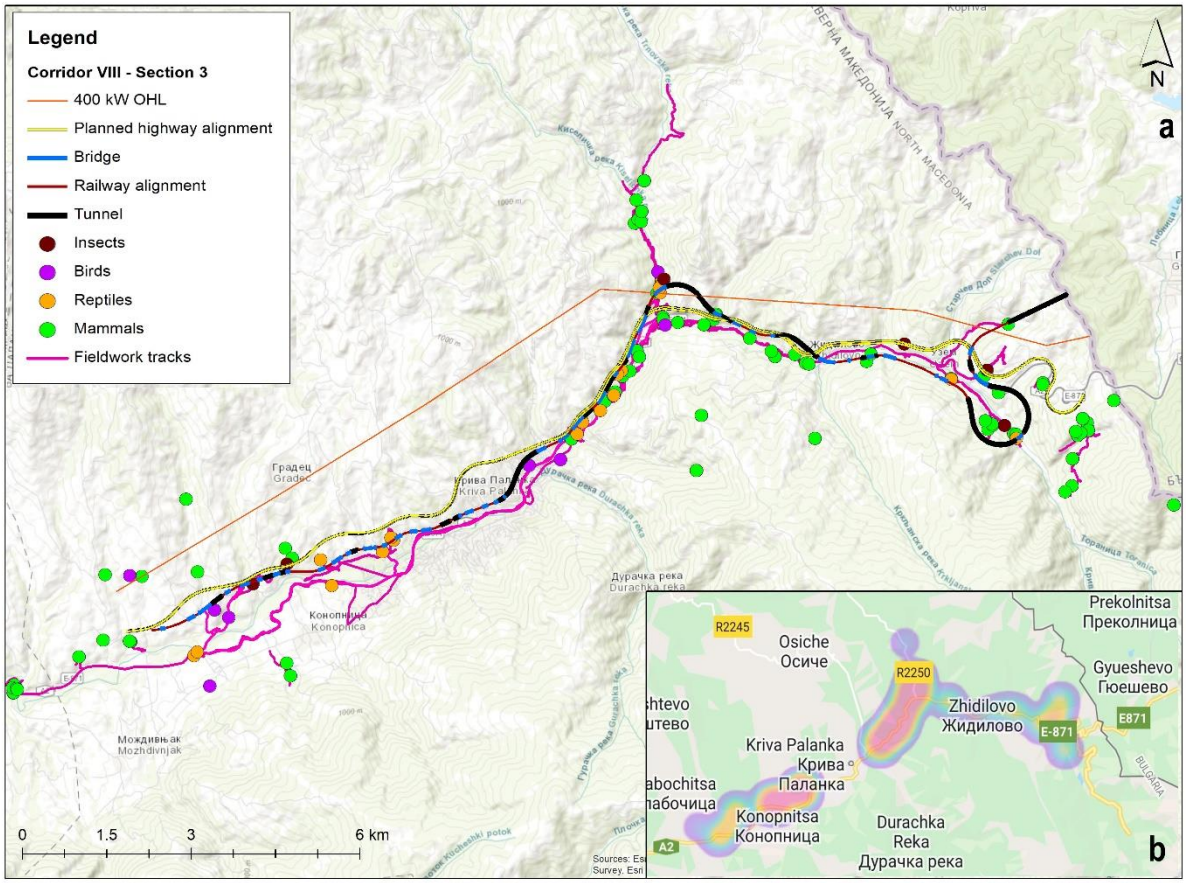


Figure 6 Cumulative representation of fieldwork survey routes and species findings along the railway alignment (a) and overview of area covered during fieldwork research indicating frequency of visit from red (most frequent) to blue (less frequent) (b)

2.6 Methodology

2.6.1 Biodiversity surveys

2.6.1.1 Habitats, vegetation and invasive species

The vegetation surveys were undertaken by walking and driving along selected routes and stopping in close proximity to areas noted to support the habitats selected for review. At sample points, notes were taken on plant species present, the type of vegetation assemblage and habitat representativeness. Notes on visible degradation were also recorded to determine habitat condition. Where seen, invasive species were also recorded. At all points, either a GPS coordinate or GPS tagged photographs were taken. Species were generally identified in the field and where required, literature and publications were used to enhance species identification. Surveys were carried with consideration of the requirements set by the Mynistry of Environment and Physical Planning (MoEPP) for conducting field observation, inventory and monitoring of biodiversity and habitats on the territory of the Republic of North Macedonia.

Habitat description and mapping was carried with reference to EUNIS, 2012.

2.6.1.2 Mammals

The assessment of the mammalian fauna included desktop analysis and review of the existing literature data and field research in the area of interest, with due consideration of related conservation

work done by local and national environmental NGOs and regional hunting societies. Conversations with the locals were also carried and accounted for. The field visits were carried out on selected locations within EAAAs considering the habitat preferences of the target species and the accessibility of the terrain. The following methods were applied:

- Sign surveys - one of the most used methods for determination of the presence of large mammal species. Transects are followed while searching for footprints, scats, hairs and other signs of passing large mammal species. Transects are usually set in specific habitats were the possibility of encountering certain species is higher. When found, all signs were photographed and data on identified species, date, location, habitat and type of data were recorded.
- Roost inspection – one of the basic and simplest methods to search for bat presence and most suited to species that form large colonies in visually easily accessible places. The inspection was undertaken in natural and artificial underground sites within the AOI and included observation, counting and identification of species.
- Ultrasound audio-detection – commonly used non-invasive method for studying bat distribution and ecology. This method requires use of a special device – ultrasound bat detector which detects and records (in internal memory or external audio device) ultrasounds emitted by bats (frequencies from 12 to 120 kHz). Recorded sounds are analysed afterwards using specialized software. During the field visits, bat calls were recorded using Pettersson D240X ultrasound detector and Edirol R-09 stereo sound recorder both along transect and on stationary census spots. The analysis of the calls was done by the software BatSound v.4.01.

2.6.1.3 Reptiles

The reptile survey was undertaken by on-site screening the appointed EAAAs for suitable habitat for targeted species. The survey was undertaken by conducting transect surveys directly at sites selected as suitable for target species. This entailed a slow walk through areas of hill pastures/hill pastures with shrubs for while screening for the Spur-thighed tortoise and Thermophillous forests and forest edges for *Hermann's tortoise*. Road killed individuals were also observed, recorded and species determined and logged. All findings of amphibian and reptile species were noted.

2.6.1.4 Avifauna

Field surveys were focused in the appointed EAAAs, primarily by using point counting method, but also transect method, and in some places the "free method" was used to generally record presence of bird species present in the area. For visual observation, binoculars with magnification and telescope were used. Terrain tracking and coordinates were recorded with the GPS device.

2.6.1.5 Insects

Field surveys were focused in the appointed EAAAs. Additionally, during the habitat survey, the scope of screening for the target insects (saproxylic beetles, *Morimus funereus* and potentially *Rosalia alpina, Lucanus cervus, Osmoderma eremita, Cucujus cinnaberinus*) was widened to well preserved forest patches or well-structured woodlands with dead wood, determined as suitable habitat for one or more of the target species. The survey was focused in six line transects: 2 in the area of T'lminci covering termophilous oak forest and riparian woodlands; Kiselichka Reka gorge in termophilous oak forest, then riparian woodland along Kriva Reka-Zidilovo; Italian and Turkey oak forests at village Uzem and beech forests at village Kostur. Insect survey was done using active collecting, such as searching the ground and peeling tree bark.

Other sensitive insect species, noted in the ESIA, 2017 that were considered in the supplementary biodiversity assessment are: *Paracaloptenus caloptenoides, Cordulegaster bidentata, Cerambyx cerdo, Morimus funereus, Lycaena dispar, Parnassius mnemosyne* and *Zerynthia polyxena*.

Species surveys also took into consideration the requirements set by the MoEPP for conducting field observation, inventory and monitoring of biodiversity and habitats on the territory of the Republic of North Macedonia.

2.6.2 Ecosystem services

Ecosystem services assessment took into consideration the national assessment of ecosystem condition in North Macedonia and the assessment and maping of ecosystem capacity to suply ecosystem services[8]. Here, the ecosystem service assessment made further efforts to collect qualitative data on the perceived effect the project implementation would have on ecosystem service supply by conducting face-to-face/phone interviews with relevant stakeholders (beneficiaries of the ecosystem services generated in the area e.g. gatherers of plants, mashrooms and fruits, fisherman, tourist facilities holders etc.) and a few representatives from the general local population. Ecosystem service assessment was done in coordination to the the social baseline analysis which at this stage focused primarily on the perceived loss of ecosystem services by people affected by resettlement

The methodological approach for the ecosystem services assessment involved selection of 12 classes of ecosystem services in line with the wide used CICES classification[9]. The selection was done based on two criteria: 1. correlation with the national capacity matrix and 2. importance/relevance of the ecosystem service to the land use types present in the study area.

As a second step, a short questionnaire that involved three sections constructed (Figure 7).

[8] Macedonian Ecological Society (2020). Selection of ecosystem services, assessment and maping of ecosystem capacity to suply ecosystem services. Programme for Nature Protection of North Macedonia - phase 2. Ministry of Environment and Physical Planning, Swiss Agency for Development and Cooperation, Skopje, North Macedonia.

Macedonian Ecological Society (2020). Mapping and assessment of ecosystem condition in North Macedonia. Programme for Nature Protection of North Macedonia - phase 2. Ministry of Environment and Physical Planning, Swiss Agency for Development and Cooperation, Skopje, North Macedonia.

[9] Potschin, M. and Haines-Young, R., 2016. Defining and measuring ecosystem services. Routledge handbook of ecosystem services, pp.25-44.

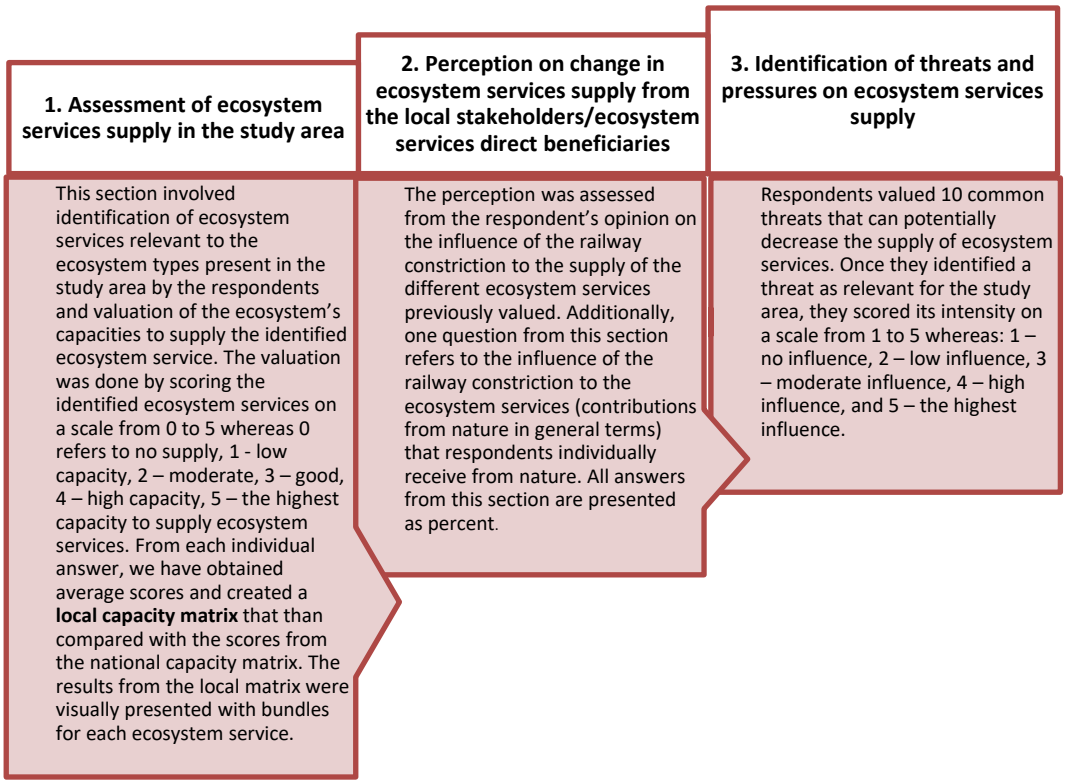


Figure 7 Outline of the three sections of the questionnaire

2.7 General assumptions and limitations

This Report has been prepared with all reasonable skill, care and diligence within the ToR for this Assignment approved by EIB and EBRD and taking account of the staffing and resources assigned to it in agreement with EBRD. The Report is based on the individual surveys and the desk research using the available documentation, which are assumed to be accurate at the time of drafting this Report.

To assure that the surveys would cover the optimum time for fieldwork the EBRD team recommended that the survey period to be extended from April, throughout May to June when species are most active. However, with due consideration of the project timeline and the prolonged winter conditions in early spring of 2022, the field surveys for all target species groups, excluding mammals, were initially commissioned from April to June 2022 were carried throughout May and finalised in the beginning of June 2022, that is the optimal season for all target species. Mammals' survey was carried from April to June. For all other targer species groups, the feld work in May was intensive and fieldtrips were consequential, carried at a weekly basis.

With due consideration of the available time for field surveys, the vegetation survey did not involve detailed quadrat sampling. However, bearing in mind the comprehensive description of the plant communities (including the dominant and most common plant species) made available as part of the

previous ESIA studies in the area of interest[10], it is not considered that this has presented a significant constraint to the habitat surveys that were primarily focused on confirming habitat presence/absence and habitat representativeness.

Amphibians and Reptiles - based on a habitat assessment it is considered that sufficient data was gathered to inform the supplementary ecological assessment.

Birds - although a greater length of survey period may be beneficial, the ornithologist considered that the 2022 survey data, combined with the desk study data and with consideration of information made available by the local and national environmental NGOs, would be sufficient to inform this Supplementary Biodiversity Assessment.

Mammals - although a greater length of survey period may be beneficial, the mammal survey results are considered sufficient to inform the supplementary ecological assessment. There were no significant issues during implementation of the assignment; however, access to some sites was limited due to steep terrain. It should also be noted that ongoing construction linked to other projects that area currently being implemented in the area (Kriva Palanka Road Rehabilitation Project; Expressway A2, LOT 2: Sub-section Kriva Palanka – Dlabocica and SHPP “Kriva Reka”, PCC HYDRO) also limited the experts’ access to some of the sites. Habitat degradation, noise and disturbance during active construction might have also contributed to species disturbance and hence, affected species presence.

Bearing in mind the comprehensive lists of species made available as part of the previous ESIA studies in the AOI (both literature and field data considered), the experts involved considered that there was sufficient baseline data to inform this Supplementary Biodiversity Assessment. Furthermore, considering that this is a supplementary biodiversity survay aimed primarily to compensate data gaps on selected biodiversity features that qualify as PBF/CH in accordance with the updated EBRD PR6 requirements and bearing in mind relevance and volume of available (i) baseline survey data already available from previous ESIAs; (ii) supplemental assessment of impacts and monitoring of biodiversity from other infrastructural project activities in the area; (iii) assessment, valorization and monitoring reports carried in the frame of conservation project activitiesand (iv) expert’s personal field data i.e. available field data records on species and habitats collected as part of other survey activities in the area of interest; and (v) the update baseline surveys undertaken in 2022 the survey data is sufficient and it is not likely that any additional surveys are needed in order to prove presence/absence to inform mitigation.

Overall, the limitations described above are not considered to have significantly affected the outcome of the assessment.

[10] None of the Plant specs listed in annexes (both literature data and field data) are listed in any international biodiversity conservation documents and none found on the National Red List of species (published 2021). None of the plant species identified along within the project area qualify for priority biodiversity feature/critical habitat.

3 RESULTS

A summary of results from both the biodiversity (desk study and field surveys) and ecosystem services surveys are presented below. Focus has been given to those species which are of notable interest or of conservation concern and are considered to be (or likely to be) in the survey area.

3.1 Desk study

Baseline biodiversity studies provided in the ESIA 2012/2017 provide reference to ecosystems/habitats/species and their conservation value with respect to EU Habitats Directive, Birds Directive, Bern Convention, Key Biodiversity Areas (including IPA, IBA, PBA and Ramsar sites) and UNESCO.

Available biodiversity studies and monitoring reports provide comprehensive lists of faunal species by habitats: Vertebrates (Amphibians, Reptiles, Birds, Mammals, including Bats); Invertebrates (Ground beetles, Dragonflies, Daily butterflies) in the appendices, assessed in accordance with conservation documents and Conventions. Recorded species (from literature and field data) were assessed in accordance with conservation documents and Conventions: the Bern Convention, Habitats Directive and Bird directive, Bonn Convention (relevant for bats) and IUCN Red List.

National Red lists of Amphibian, Reptiles, Fungi and Mammals were not available at the time of preparation of the study 2012/2017 and were hence not considered. The National red list of species was subsequently published in 2021.

None of the Plant species listed in annexes (both literature data and field data) are listed in any international biodiversity conservation documents and none are found on the National Red List of species. **None of the plant species identified within the project area qualify for priority biodiversity feature/critical habitat.**

Generally, within North Macedonia the endemic and endangered species are found higher in mountain areas and outside of the project's area of influence, or associated with limestone complexes.

Table 2 below shows which species, considered to be of conservation concern (International Union for Conservation of Nature (IUCN); North Macedonia Red List – Critical - CR, Endangered – EN and Vulnerable - VU); listed on the European Habitats Directive (HD) as well as Birds Directive (BD) and are likely to occur in the project area.

Baseline biodiversity studies provided in the ESIA 2012/2017 with due consideration of other relevant available reports give reference to total of 29 habitat types, of which 19 could be referred to as anthropogenic. A review of natural habitats identified to be important for conservation is provided on Table 3.

Table 2 List of species that qualify as PBF/CH, target species for the Supplementary Biodiversity Assessment are marked in bold

Species group/Species	Bern/Bonn Convention appendices	Habitat Directive Annexes/ Bird Directive	The IUCN Red List	National Red List	Law on Nature Protection (67/2004)
MAMMALS **(total of 33 reviewed)**					
Ursus arctos	II	II/IV	LC	VU (listed with reference to literature data, not	Strictly protected under the national legislation

Species group/Species	Bern/Bonn Convention appendices	Habitat Directive Annexes/ Bird Directive	The IUCN Red List	National Red List	Law on Nature Protection (67/2004)
				present in the project area)	
Canis lupus	II	II/IV	LC	NT	N/A
Lutra lutra	II	II/IV	NT	VU	Strictly protected under the national legislation
Felis sylvestris	II	IV	LC	N/A	Strictly protected under the national legislation
Myotis myotis [11]	II	II/IV	LC	N/A	N/A
Myotis blythii[12]	II	II/IV	LC	N/A	N/A
Rhinolophus ferrumequinum	II	II/IV	LC	N/A	N/A
Rhinolophus hipposideros	II	II/IV	LC	N/A	N/A
Pipistrellus kuhlii	II	IV	LC	N/A	N/A
Pipistrellus nathusii	II	IV	LC	N/A	N/A
Pipistrellus pipistrellus	II	IV	LC	N/A	N/A
Nyctalus noctula	II	IV	LC	N/A	N/A
Hypsugo savii	II	IV	LC	N/A	N/A
Eptesicus serotinus	II	IV	LC	N/A	N/A
Myotis mystacinus	II	IV	LC	N/A	N/A
AVIFAUNA **(total of ~150 reviewed)**					
Falco peregrinus	II	I	LC	N/A	Strictly protected under the national legislation
Ciconia ciconia	II	I	LC	N/A	N/A
Caprimulgus europaeus	II	I	LC	N/A	N/A
Alcedo atthis	II	I	LC	N/A	N/A
Picus canus	II	I	LC	N/A	N/A
Dryocopus martius	II	I	LC	N/A	N/A
Dendrocopos syriacus	II	I	LC	N/A	N/A
Dendrocopos medius	II	I	LC	N/A	N/A
Melanocorypha calandra	II	I	LC	N/A	N/A
Calandrella brachydactyla	II	I	LC	N/A	N/A
Lullula arborea	III	I	LC	N/A	N/A
Anthus campestris	II	I	LC	N/A	N/A

[11] Field record during Rapid Biodiversity Assessment Report EBRD Kriva Palanka Road Rehabilitation Project, Macedonia in 2018

ss[12] Field record during Rapid Biodiversity Assessment Report EBRD Kriva Palanka Road Rehabilitation Project, Macedonia in 2018

Species group/Species	Bern/Bonn Convention appendices	Habitat Directive Annexes/ Bird Directive	The IUCN Red List	National Red List	Law on Nature Protection (67/2004)
Ficedula albicollis	II	I	LC	N/A	N/A
Lanius collurio	II	I	LC	N/A	N/A
Lanius minor	II	I	LC	N/A	N/A
Curruca (Sylvia) nisoria	II	I	LC	N/A	N/A
Ficedula semitorquata	II	I	LC	N/A	N/A
Lanius collurio	II	I	LC	N/A	N/A
Lullula arborea	III	I	LC	N/A	N/A
Pernis apivorus	III	I	LC	N/A	N/A
AMPHIBIANS AND REPTILES **(total of 33 reviewed)**					
Reptiles					
Testudo hermanni	II	II/IV	NT	VU	Strictly protected under the national legislation
Testudo graeca	II	II/IV	VU	VU	Strictly protected under the national legislation
Podarcis muralis	II	IV	LC	LC	Strictly protected under the national legislation
Podarcis erhardii	III	IV	LC	LC	N/A
Podarcis taurica	II	IV	LC	NT	N/A
Lacerta viridis	II	IV	LC	LC	Strictly protected under the national legislation
Lacerta trilineata	II	IV	LC	LC	N/A
Zamenis longissimus	II	IV	LC	LC	Strictly protected under the national legislation
Coronella austriaca	III	IV	LC	LC	N/A
Dolichophis caspius	II	IV	LC	LC	N/A
Natrix tessellata	II	IV	LC	NT	N/A
Vypera ammodites	II	IV	LC	LC	N/A
Amphibians					
Bombina variegata	II	II/IV	LC	LC	N/A
Rana graeca	III	IV	LC	NT	N/A
Rana dalmatina	II	IV	LC	NT	N/A
Bufotes viridis	II	II/IV	LC	LC	N/A
Hyla arborea	II	IV	LC	NT	N/A
INSECTS **(total of ~200 reviewed)**					
Cerambyx cerdo	N/A	II	VU	N/A	N/A
Morimus funereus	II		VU	N/A	N/A
Parnassius mnemosyne	II	II	NT	N/A	N/A
Zerynthia polyxena	II	II	LC	N/A	N/A

Species group/Species	Bern/Bonn Convention appendices	Habitat Directive Annexes/ Bird Directive	The IUCN Red List	National Red List	Law on Nature Protection (67/2004)
Maculinea (Phenagris) arion	II	II	EN	N/A	N/A
Lycaena dispar	I/II	II/IV	LC	N/A	N/A

Table 3 Review of habitats listed under the Habitat Directive qualifying as PBF/CH

Association	EUNIS reference	Habitat Directive reference	Bern Convention
ass. *Quercetum frainetto-cerris macedonicum* Oberd. 1948 Em. Ht.1959 – Hungarian oak and Turkey oak forests	G1.76 *Balkano-Anatolian thermophilous [Quercus]* forests - G1.762 *Helleno-Moesian [Quercus frainetto]* forests	9280 *Quercus frainetto* woods	Included in a Resolution 4 habitat type at a higher level (G1.7) G1.8 Acidophilous [*Quercus*]-dominated woodland
ass. *Orno-Quercetum petreae* Em 1968 - Mesophilous Oak Forests - Flowering Ash and Sessile Oak Forest	G1.7641 Helleno-Moesian *Quercus petraea* forests G1.761 : Helleno-Moesian *Quercus cerris* forests	91M0 Pannonian-Balkanic turkey oak-sessile oak forest	Included in a Resolution 4 habitat type at a higher level (G1.7) G1.8 Acidophilous [*Quercus*]-dominated woodland
ass. *Festuco heterophyllae Fagetum* Em 1965 - submontane beech forest **ass. *Calimintho grandiflorae-Fagetum* Em 1965 - montane beech forest**	G1.691 Southwestern Moesian Beech Forests	91W0 Moesian Beech Forests	Included in a Resolution 4 habitat type at a higher level (G1.6) G1.6 [*Fagus*] woodland
***Salicetum albae-fragilis* Soo (1930, 1934) 1958- community of riverine willow and poplar**	G1.11 Riverine [*Salix]* woodland - G1.112 Mediterranean tall [*Salix*] galleries (G1.1121 Mediterranean white willow galleries)	92A0* *Salix alba* and *Populus alba* galleries (Annex I priority habitat)	Resolution 4 habitat type at a higher level (G1.11) G1.11 Riverine [*Salix*] woodland
***Tamarici-Salicetum amplexicaulis* (Kárpáti 1962) Em 1967** **Riparian Shrub Communities - Shrublands of Tamarisk and Salix amplexicaulis**	F9.12 Lowland and collinar riverine [*Salix*] scrub - F9.123 Balkan riverine willow scrub F9.3133 East Mediterranean tamarisk thickets	3230 Alpine rivers and their ligneous vegetation with *Myricaria germanica* and 3240 Alpine rivers and their ligneous vegetation with *Salix elaeagnos*	Included in a Resolution 4 habitat type at a higher level (F9.1) F9.3 Southern riparian galleries and thickets
Grasslands			
Hill Pastures	E1.33 East Mediterranean xeric grassland (E1.332 Heleno-Balkanic short	6220* Pseudo-steppe with grasses and annuals of the *Thero-*	Resolution 4 habitat type at a higher level (E1.3)

Association	EUNIS reference	Habitat Directive reference	Bern Convention
	grass and therophyte communities)	*Brachypodietea* (Annex I priority habitat)	E1.3 Mediterranean xeric grassland
Meadows	E2.238 Southwestern Moesian submontane hay meadows	6510 Lowland hay meadows (*Alopecurus pratensis*, *Sanguisorba officinalis*)	Included in a Resolution 4 habitat type at a higher level (E2.2) E2.2 Low and medium altitude hay meadows
Wetlands/ water habitats			
Epipotamal streams – rivers **Hiporhithral Streams - Rivers (approximately narrower than 5 m)**	C2.31 Epipotamal streams C2.22 Hiporhithral streams	3260 Water courses of plain to montane levels with the *Ranunculion fluitantis* and *Callitricho-Batrachion* vegetation	
Intermittent streams	C2.5 Temporary running waters	3290 Intermittently flowing Mediterranean rivers of the *Paspalo-Agrostidion*	
Gravelly and Sandy Riverbanks	C3.62 Unvegetated river gravel banks C3.61 Unvegetated river sand banks	3270 Rivers with muddy banks with *Chenopodion rubri* p.p. and *Bidention* p.p. vegetation	Resolution 4 habitat type C3.55 Sparsely vegetated river gravel banks
Fraxino-Alnetum glutinosae Micevski 1978	G1.131 : Southern *Alnus glutinosa* galleries	91E0 * Alluvial forests with Alnus glutinosa and Fraxinus excelsior (Annex I priority habitat)	Resolution 4 habitat type at a higher level (G1.13)
Fraxino-Alnetum glutinosae Micevski 1978	G1.131 : Southern *Alnus glutinosa* galleries	40A0* Subcontinental peri-Pannonic scrub (Annex I priority habitat)	Resolution 4 habitat type

Ecosystem services delivery was not assessed in any of the available reviewed studies and monitoring reports.

In consideration of the data provided in the ESIA and all other available assessment and monitoring reports for projects implemented in the area (see section 2.3), supplementary biodiversity surveys and an ecosystem service assessment were carried to compensate for data gaps, to provide sufficient baseline data to undertake a critical habitats assessment for those species and habitats noted to be of conservation concern.

3.2 Supplementary biodiversity field assessment

3.2.1 Baseline condition of the study area

The railway line under assessment - Section 3 (Kriva Palanka –T'lminci to Deve Bair) goes along the foothills of Bilina Planinan mountain, on the right bank of the valley of river Kriva Reka up to Zhidilovo where it crosses on to its left bank through a bridge up until its entrance in the tunnel at Uzem. As projected, the railway largely passes through anthropogenic or modified/altered natural habitats along this stretch.

Affected forest habitats were noted to be largely degraded and not representative of their natural habitat type, mostly due to the long-term extensive use of this natural resource (firewood/construction material) by the resident population of Kriva Palanka and the nearby rural settlements.

Grasslands occupy small areas along the route, but due to the ongoing process of abandonment of stockbreeding practices, a large portion of the grassland areas are under succession i.e. overgrown with small trees from the subordinate layers of forests (*Carpinus orientalis, Cornus mas, Crataegus monogyna, Pyrus pyraster, Pyrus amygdaliformis, Ulmus sp.*) or true shrub species (*Prunus spinosa, Paliurus spina shristi, Rosa spp., Colutea arborescens, Coronilla emeroides, Evonymus europaeus*) etc. At some places (often close to settlements and particularly notable on the grasslands pass the city of Kriva Palanka) grasslands were noted to be overgrown with the tree of heaven *Ailanthus altissima* which is an invasive species, native to north east and central China and Taiwan.

The community structure of riparian woodlands was noted to be altered due to notable presence of anthropogenic trees (*Juglands regia, Robinia pseudoaccacia, Ulmus sp., Rubus sp*.). The invasive species false indigo bush *Amorpha fruticosa,* a species native to North America, was often recorded to spread in the riparian zone of Kriva Reka river[13].

Notable portion of the natural habitats, particularly thermophillous forests and riparian woodlands and belts were noted to be degraded, in the process of ongoing construction of other infrastructural projects implemented in the area (access roads, landfills and borrow pits, construction sites), none of which are related to the construction of the railway section Kriva Palanka-Deve Bair. Ongoing construction activities were also noted to have potentially negative effect on species presence.

Expressway A2, LOT 2: Sub-section Kriva Palanka

Expressway A2, LOT 2: Sub-section Kriva Palanka

Expressway A2, LOT 2: Sub-section Kriva Palanka

SHPP “Kriva Reka” PCC Hydro

[13] List of Invasive Alien Species of Union concern RegulationEU 1143/2014

Kriva Palanka Road Rehabilitation Project

Construction work in the gorge of Kiselichka Reka

Kriva Palanka Road Rehabilitation Project & HPP Kriva Reka PCC Hydro

Kriva Palanka Road Rehabilitation Project & HPP Kriva Reka PCC Hydro

Figure 8 Habitat degradation resulting from ongoing construction work related to other infrastructure projects in the area of interest

Presence of patches of representative habitats of conservation importance were also noted as present, but mainly restricted to the area of Uzem-village Kostur.

3.2.2 Habitats

Habitat field surveys were focused on natural habitat types listed in Annex I of the Habitat Directive. The field survey did not result in any additional habitat findings than those identified in the available reviewed studies (see section 2.3). Summary findings of vegetation surveys for habitats of interest are provided in Table 4. Habitat distribution along the railway line is presented in the updated habitat map and takes into consideration all habitat types along the railway line. The map has been updated with the noted changes in habitat distribution and habitat degradation on site that were visible on satellite imagery (see Figures 9 to 11). A description of the habitat type coverage in a corridor of 500 m, is provided in Table 5. No high nature value forests were identified in the area of interest [14].

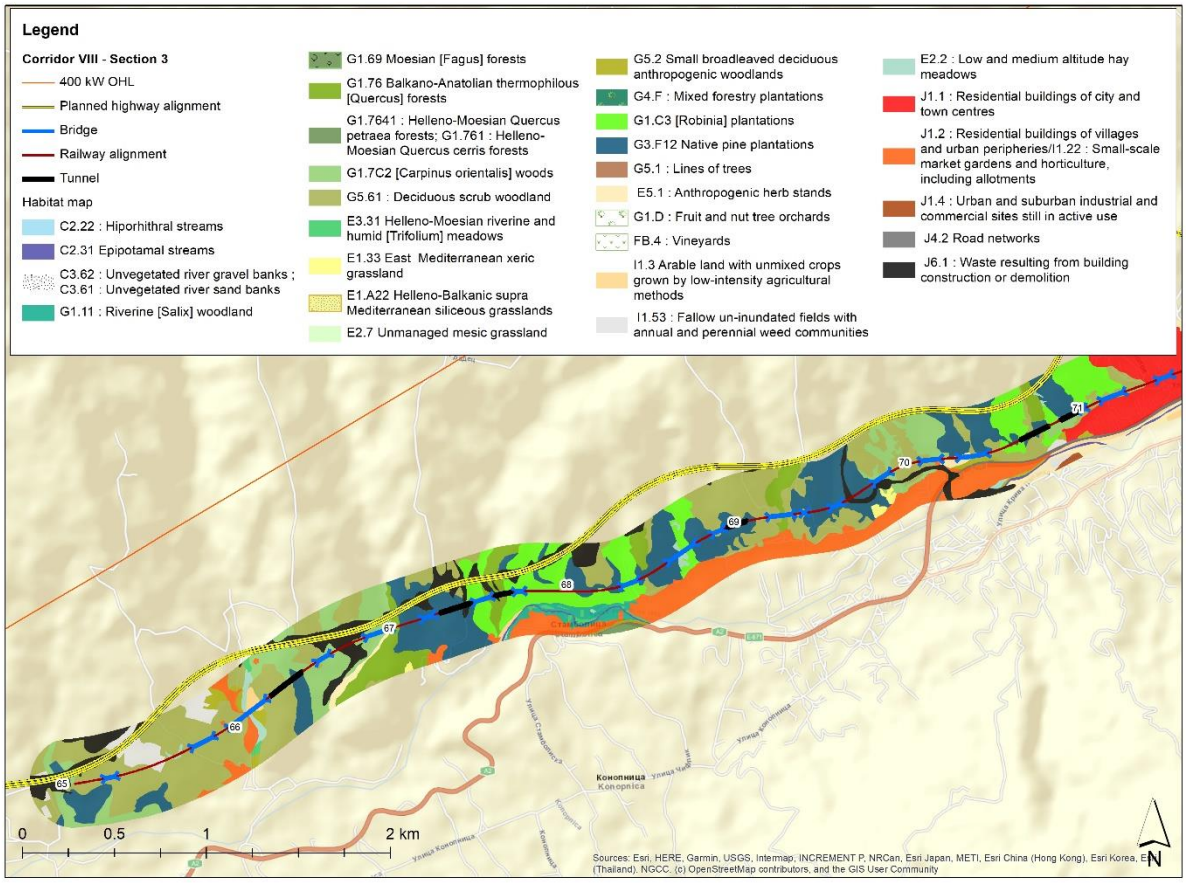
[14] Macedonian Ecological Society (2022) Identification of high nature value forests at the national level and development of guidelines for the management of two selected pilot HNVFs sites (Bukovic and Belasica). STAR 5 – Achieving biodiversity conservation through the creation and effective management of Protected Areas and mainstreaming biodiversity into land use planning. UNEP, MoEPP.

Table 4 Habitat field survey results

EUNIS reference	Habitat Directive reference
G1.76 Balkano-Anatolian thermophilous [*Quercus*] forests - G1.762 Helleno-Moesian [*Quercus frainetto*] forests	**9280 *Quercus frainetto* woods**
Habitat description: The key species of the plant community are Italian oak (*Quercus frainetto*) and Turkey oak (*Quercus cerris*). In the area of interest, this habitat type is also presented by second-growth forest that are dominated by *Carpinus orientalis*. In this case, presence of pubescent oak (*Quercus pubescence*) (mostly hybrids of pubescent oak and Turkey oak) is also noted at southern slopes and at forest edges where *Carpinus orientalis* is dominant. Beside these tree species, *Cornus mas, Carpinus orientalis, Crataegus monogyna, Rosa galica, Rosa arvensis* etc. represent the subdominant tree layer and shrub layer. This habitat type is primarily found on the southern slopes of the right bank of Kriva Reka river and are largely represented with stands at various stages of degradation that are not representative. Representative forest stands are found in the area between Drenje and Uzem.	
G1.7641 Helleno-Moesian *Quercus petraea* forests **G1.761 : Helleno-Moesian Quercus cerris forests**	**91M0 Pannonian-Balkanic turkey oak-sessile oak forest**
Habitat description: The key species of the plant community are *Quercus petraea*, *Quercus cerris*, *Fraxinus ornus* with *Carpinus betulus* and *Acer campestre*. Beside these tree species, *Corylus avellana*, *Cornus mas*, *Ligustrum vulgare*, *Crataegus monogyna, Euonymus verrucosa*, *Mallus sylvestris* represent the subdominant tree layer and shrub layer. Patches of this habitat type are largely representative, except at forest edges and nearby settlements where human impact is visible. This habitat type is primarily found on the northern slopes of the left bank of Kriva Reka river, between Kriva Palanka and Uzem. Particularly well preserved patch of this habitat was noted in the area of Vitanovci (Uzem) and the upper slopes of Kiselichka Reka gorge. Representative forest stands are also found in the area of the v. Kostur - Janchevci.	
G1.691 Southwestern Moesian Beech Forests	**91W0 Moesian Beech Forests**
Habitat description: In the area of interest this habitat is represented by the ass. Festuco heterophyllae-Fagetum. The key species is *Fagus sylvatica*, and there are individual growths of *Quercus petraea, Sorbus torminalis, Ostrya carpinifolia* etc. *Corylus avellana* dominates the tree layer and shrub layer. The beech forests occupy the highest elevations of the corridor, and the northern and north-eastern expositions on the left side of the Kriva Reka river. They develop only in the area between the villages of Uzem and Kostur. The ass. Calimintho grandiflorae-Fagetum Em 1965 - montane beech forest is absent in the broader project area.	
G1.11 Riverine [*Salix*] woodland - **G1.112 Mediterranean tall [*Salix*] galleries (G1.1121 Mediterranean white willow galleries)**	**92A0* *Salix alba* and *Populus alba* galleries**
Habitat description: This woodland type belongs to the *Salicetum albae-fragilis* Issler 1926 association. The most typical tree species are *Salix alba*, or mixed *Salix alba* and *Salix fragilis*. *Salix purpurea, Salix triandra*, *Sambucus nigra*, *Petesites alba, Viburnum opulus, Cornus sanguinea, Rhamnus frangula*, alien and invasive *Amorpha fruticosa* etc. occur in small groups or individually. These forests and shrublands develop along the riverbanks and streams. Well-preserved forests of this type are very rare, because people have largely altered this habitat types for the purpose of utilizing the fertile alluvial soil for agriculture. Well-preserved riparian willow-poplar woodlands have very limited distribution along the railway corridor of interest for this study. It occurs on a number of localities along the Kriva Reka river, most representative habitat patch was recorded between Zhidilovo and Uzem. However, even here, degradation is notable as the site is being affected by the Kriva Palanka Road Rehabilitation Project construction activities that are ongoing. A notable portion of this habitat has been degraded due to ongoing construction activities, particularly for the construction of the SHPP Kriva Reka PCC Hydro.	

EUNIS reference	Habitat Directive reference
F9.12 Lowland and collinear riverine [*Salix*] scrub - F9.123 Balkan riverine willow scrub **F9.3133 East Mediterranean tamarisk thickets**	**3230 Alpine rivers and their ligneous vegetation with *Myricaria germanica* and 3240 Alpine rivers and their ligneous vegetation with *Salix elaeagnos***
Habitat description: This habitat is represented as a very narrow belt along the streams and rivers with willow domination (*Salix alba* and *Salix purpurea*) and rare occurrence of poplars (*Populus alba*). In the area of village Kostur, in the range of willow communities, on sandy and gravely river drifts, the presence of Tamarici-Salicetum amplexicaulis is noted. Well-developed riparian willow-poplar belts are a rare find along the Kriva Reka river as most stands were noted to be at various stages of degradation and not representative. As a result, riparian-willow poplar belts in the area of interest often have mixed ingrowth of *Rubus* sp. and the invasive *Amorpha fruticosa.* This habitat type is also strongly affected by the ongoing construction activities.	
E1.33 East Mediterranean xeric grassland (E1.332 Heleno-Balkanic shrot grass and therophyte communities) **E1.A22 Helleno-Balkanic supra Mediterranean siliceous grasslands**	**6220* Pseudo-steppe with grasses and annuals of the *Thero-Brachypodietea***
Habitat description: Hill pastures in the area of interest are a secondary formation that long replaced the Thermophilous oak forests occurring as a result of extensive long-term stockbreeding practices. As today the intensity of grazing is lower as a result of the ongoing abandonment of stockbreeding practices, hill pastures are being overgrown with shrubs (elements of the adjacent Thermophilous oak forests). In the vicinity of Kriva Palanka hill pastures were noted to be overgrowing with *Ailanthus altissima,* an invasive species. The dominant community in the area is *Helianthemo-Euphobietum thessalae* from the *Astragalo-Potentilletalia* Micev. 1970 order. Recorded plant species were *Astragalus onobychis*, *Bromus* sp., *Senecio rupestre*, *Achilea coarctata*, *Verbascum* sp., *Euphorbia cyparisias*, *Silene* sp., *Anthemis* sp., *Geranium* sp., *Festuca callieri* etc. Close to the settlements, the species composition changes slightly because of the invasion of ruderal plants, as well as weed plants from the neighboring fields. The best-developed communities were noted around Drenje, near Kriva Palanka. This habitat also occurs on stony or sandy open ground. Species composition of the biocenosis is very similar to that of the neighboring hill pasture community. However, numerous species characteristic for the rocky areas can be found as well. Hill pastures on stony ground cover a very small areas in the area of interest, mainly in the surroundings of Krklja, Zhidilovo and Uzem.	
E2.238 Southwestern Moesian submontane hay meadows	**6510 Lowland hay meadows (*Alopecurus pratensis, Sanguisorba officinalis*)**
Habitat description: The plant community characteristic for this habitat type belongs to the same alliance as in the case with the wet meadows community – *Trifolion resupinati* Micev. 1964. Clover species (*Trifolim resupinatum, T. balansae, T. filiforme* and others) have higher abundance and coverage. Grass species (*Alopecurus utriculatus, Agrostis alba, Poa sylvicola*) are rare. Meadows found in the area of interest are not representative of this habitat type, as the plant composition is dominated by several *Trifolium* species. Ruderal plants (*Euphorbia cyparissias, Taraxacum officinale, Plantago lanceolate, Urtica dioica* etc.) are also common. In the area of interest, meadows are managed and/or semi intensively managed, and a small number of them are extensively managed or have been abandoned a number of years before. Dependent on the intensity of mowing, meadows can have a specific structure of plant and animal species, or species from the neighboring grassland and forest habitats may prevail in the floristic structure. Most of the meadows are located along the Kriva Reka river. There are larger areas next to the river in the vicinity of the v. Zhidilovo, and there are smaller areas near the village of Krklja, and also on the stretch between the villages Uzem and Kostur.	
C2.31 Epipotamal streams **C2.22 Hyporhithral streams**	**3260 Water courses of plain to montane levels with the *Ranunculion fluitantis* and *Callitricho-Batrachion* vegetation**

EUNIS reference	Habitat Directive reference
Epipotamal streams description: Water courses that can fulfil the aforementioned criteria for "river" in the area of the railway corridor is only the river Kriva Reka. The lowermost flow of Kiselichka Reka (just befor its inflow into Kriva Reka) can also be considered as an epipotamal stream. A large portion of Kriva Reka riverbed is heavily altered due to ongoing construction activities of other infrastructure projects in the area of interest (SHPP "Kriva Reka", PCC HYDRO; Kriva Palanka Road Rehabilitation Project; Expressway A2, LOT 2: Sub-section Kriva Palanka). Effects from the "Toranica" mine are also notable, particularly in its upper flow, up to the confluence of Kiselichka Reka. **Hyporhithral streams description:** In the area of interest, there are several rivers that enter this category of habitats: Gaberska Reka, Gradecka Reka, Kiselechka Reka and Kriva Reka in the upper course (in front of Uzem village). This habitat also includes Kriva Reka in its upper course (in the area of the village of Kostur). The rivers Gaberska and Gradechka in the region of the alignment are with similar hydrological and biological characteristics and represent small watercourses with relatively fast flow. Water is transparent without visible clouding and presence of organic matter. Macrophytic vegetation in the water is poorly developed and is mainly represented by small populations of *Ranunculus trichophyllus* and the presence of *Petesites alba* is often noted along the riverbanks. Kiselechka Reka is the largest tributary of Kriva Reka in the investigated area. The river is with a rapid flow and the presence of large stones at the bottom. The water is poorly clouded, probably due to excavations carried out near the river. Kriva Reka, in the upper course of the village of Uzem, represents a small river with a rapid flow and presence of large and medium stones on the bottom. The water is strongly clouded by the visible presence of inorganic particles, but also by a noticeable weak odor possibly resulting from the pollution from the "Toranica" mine, located upstream. Riparian vegetation is poorly developed because the river is located near the village of Uzem.	
C2.5 Temporary running waters	**3290 Intermittently flowing Mediterranean rivers of the *Paspalo-Agrostidion***
Habitat description: These streams are characterised numerous ravines in the railway corridor region on the left and right slopes of river Kriva Reka valley. The water flow exists only during the humid period of the year and during late spring and summer these streams are characterised by a dry bed. Hence, these streams do not have great importance as water ecosystems. However, the ravines through which they flow are regularly covered by denser or sparser woody or herb vegetation.	
C3.62 Unvegetated river gravel banks **C3.61 Unvegetated river sand banks**	**3270 Rivers with muddy banks with *Chenopodion rubri* p.p. and *Bidention* p.p. vegetation**
Habitat description: This habitat type is represented by gravel or sandy river bank and river islands with sparse vegetation, mainly *Gramineae*, then many pioneer plant species adapted to sandy ground from *Polygonaceae*, *Chenopodiaceae* and other families. This habitat type is found to be not representative as it has been severely altered due to ongoing construction activities of other infrastructural projects in the area of interest (SHPP "Kriva Reka", PCC HYDRO; Kriva Palanka Road Rehabilitation Project; Expressway A2, LOT 2: Sub-section Kriva Palanka).	
G1.131 : Southern *Alnus glutinosa* galleries	**91E0 * Alluvial forests with *Alnus glutinosa* and *Fraxinus excelsior***
Habitat description: Listed in forest communities for wide the region of Kriva Palanka, but absent in the broader project area.	
G1.131 : Southern Alnus glutinosa galleries	**40A0* Subcontinental peri-Pannonic scrub**
Habitat description: Absent in the broader project area.	


Legend
Corridor VIII - Section 3
400 kW OHL
Planned highway alignment
Bridge
Railway alignment
Tunnel
Habitat map
C2.22 : Hiporhithral streams
C2.31 Epipotamal streams
C3.62 : Unvegetated river gravel banks ; C3.61 : Unvegetated river sand banks
G1.11 : Riverine [Salix] woodland
G1.69 Moesian [Fagus] forests
G1.76 Balkano-Anatolian thermophilous [Quercus] forests
G1.7641 : Helleno-Moesian Quercus petraea forests; G1.761 : Helleno-Moesian Quercus cerris forests
G1.7C2 [Carpinus orientalis] woods
G5.61 : Deciduous scrub woodland
E3.31 Helleno-Moesian riverine and humid [Trifolium] meadows
E1.33 East Mediterranean xeric grassland
E1.A22 Helleno-Balkanic supra Mediterranean siliceous grasslands
E2.7 Unmanaged mesic grassland
G5.2 Small broadleaved deciduous anthropogenic woodlands
G4.F : Mixed forestry plantations
G1.C3 [Robinia] plantations
G3.F12 Native pine plantations
G5.1 : Lines of trees
E5.1 : Anthropogenic herb stands
G1.D : Fruit and nut tree orchards
FB.4 : Vineyards
I1.3 Arable land with unmixed crops grown by low-intensity agricultural methods
I1.53 : Fallow un-inundated fields with annual and perennial weed communities
E2.2 : Low and medium altitude hay meadows
J1.1 : Residential buildings of city and town centres
J1.2 : Residential buildings of villages and urban peripheries/I1.22 : Small-scale market gardens and horticulture, including allotments
J1.4 : Urban and suburban industrial and commercial sites still in active use
J4.2 Road networks
J6.1 : Waste resulting from building construction or demolition
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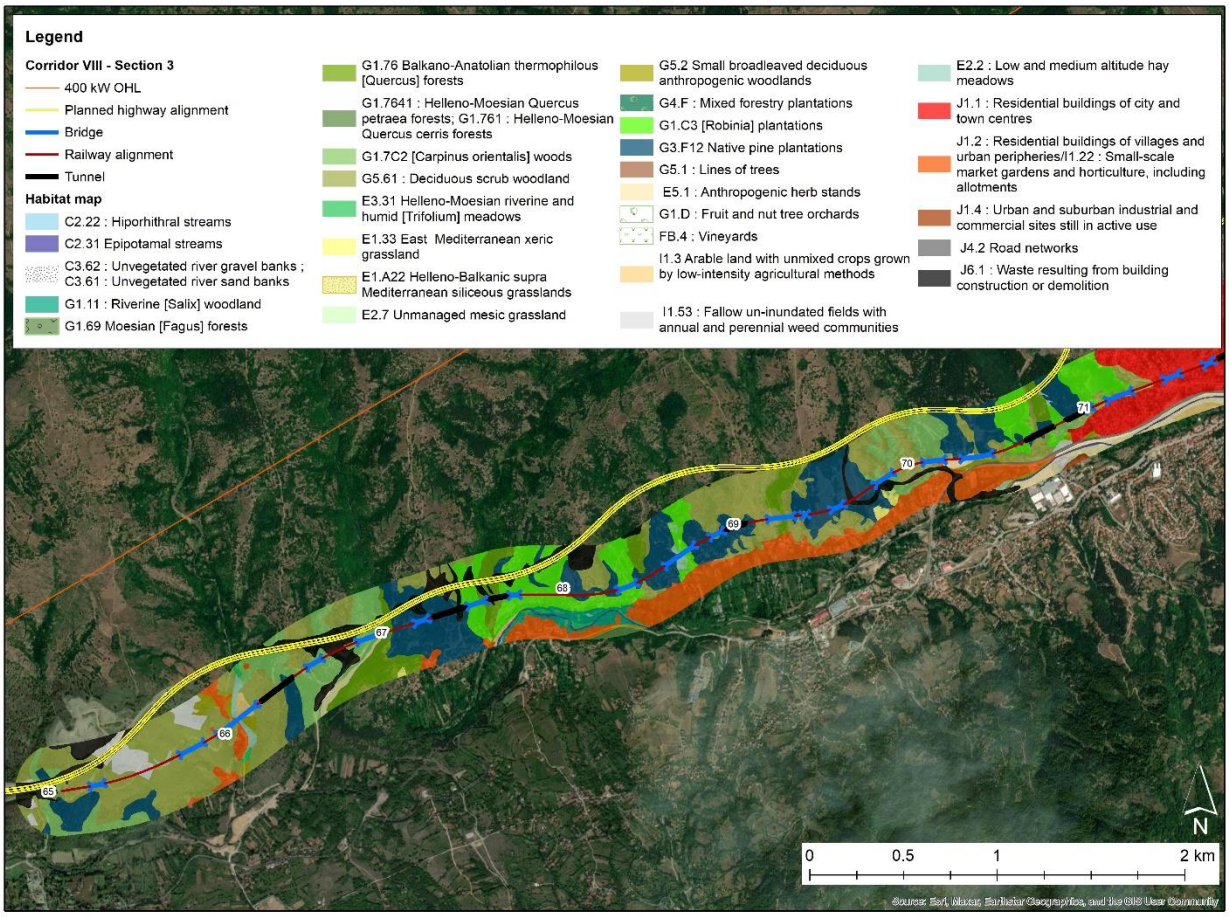
Sources: Esri, HERE, Garmin, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI, Esri China (Hong Kong), Esri Korea, Esri (Thailand), NGCC, (c) OpenStreetMap contributors, and the GIS User Community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J4.2 Road networks
J6.1 : Waste resulting from building construction or demolition
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Source: Esri, Maxar, Earthstar Geographics, and the GIS User Community

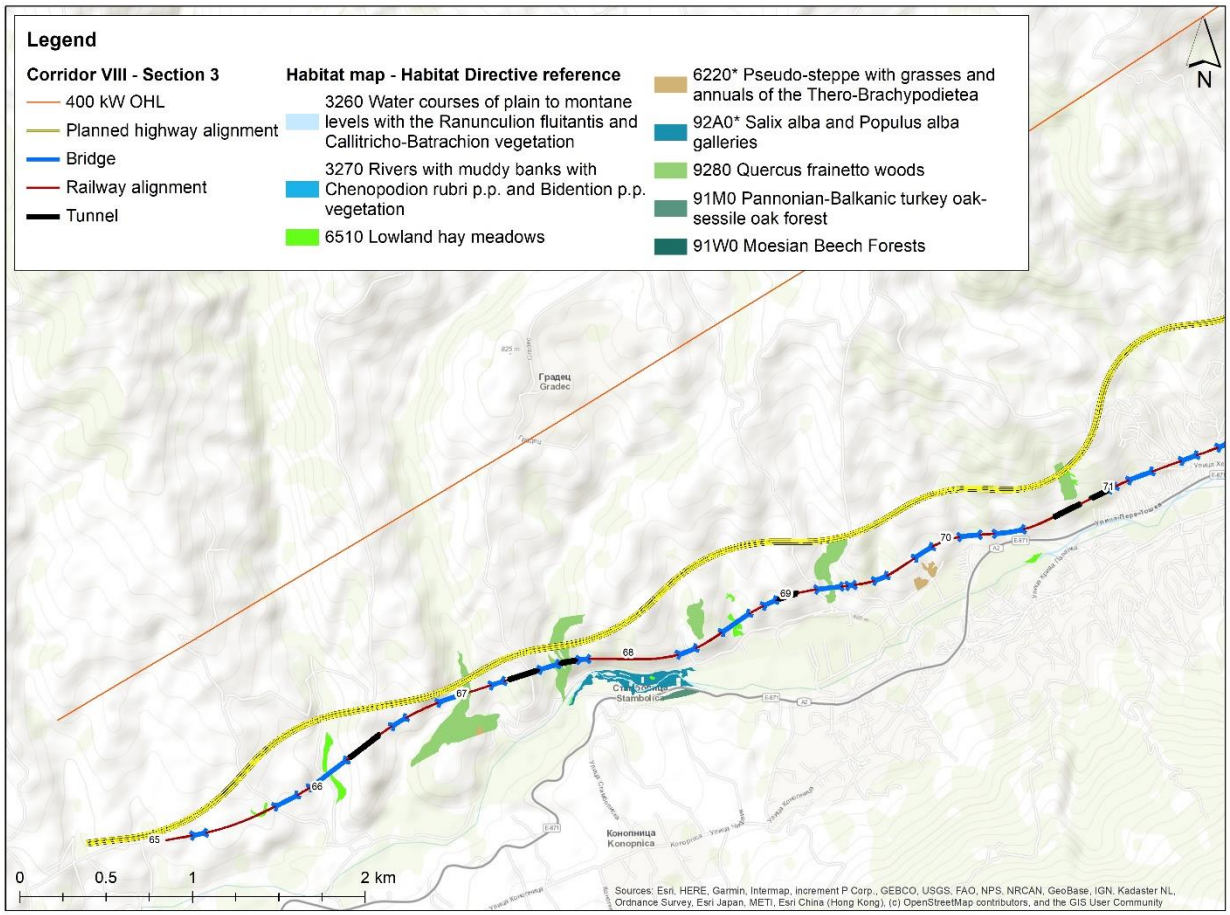
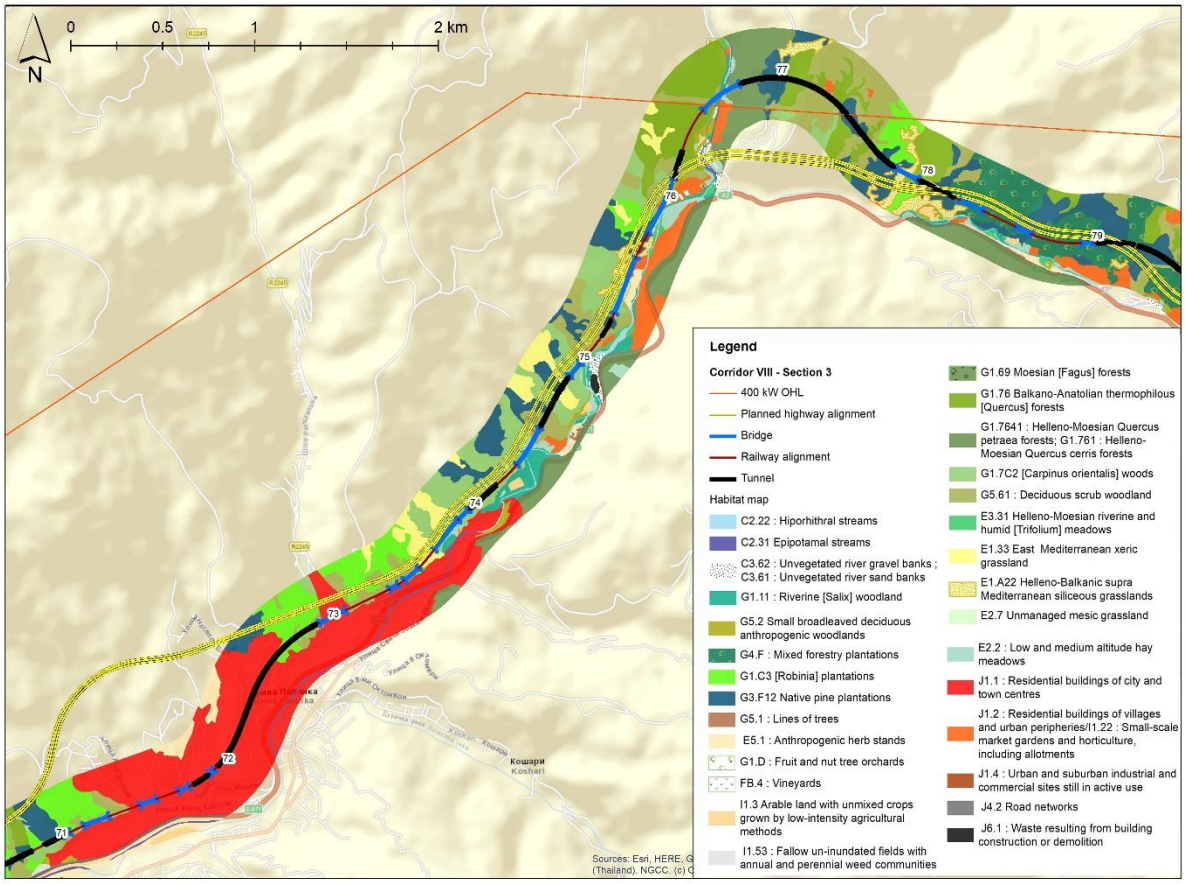


Figure 9 Habitat types along Kumanovo-Deve Bair railway line, Section 3 – Kriva Palanka (T'lminci) to Deve Bair: part 1 – T'lminci to Kriva Palanka. Reference to EUNIS and Habitat Directive provided on separate maps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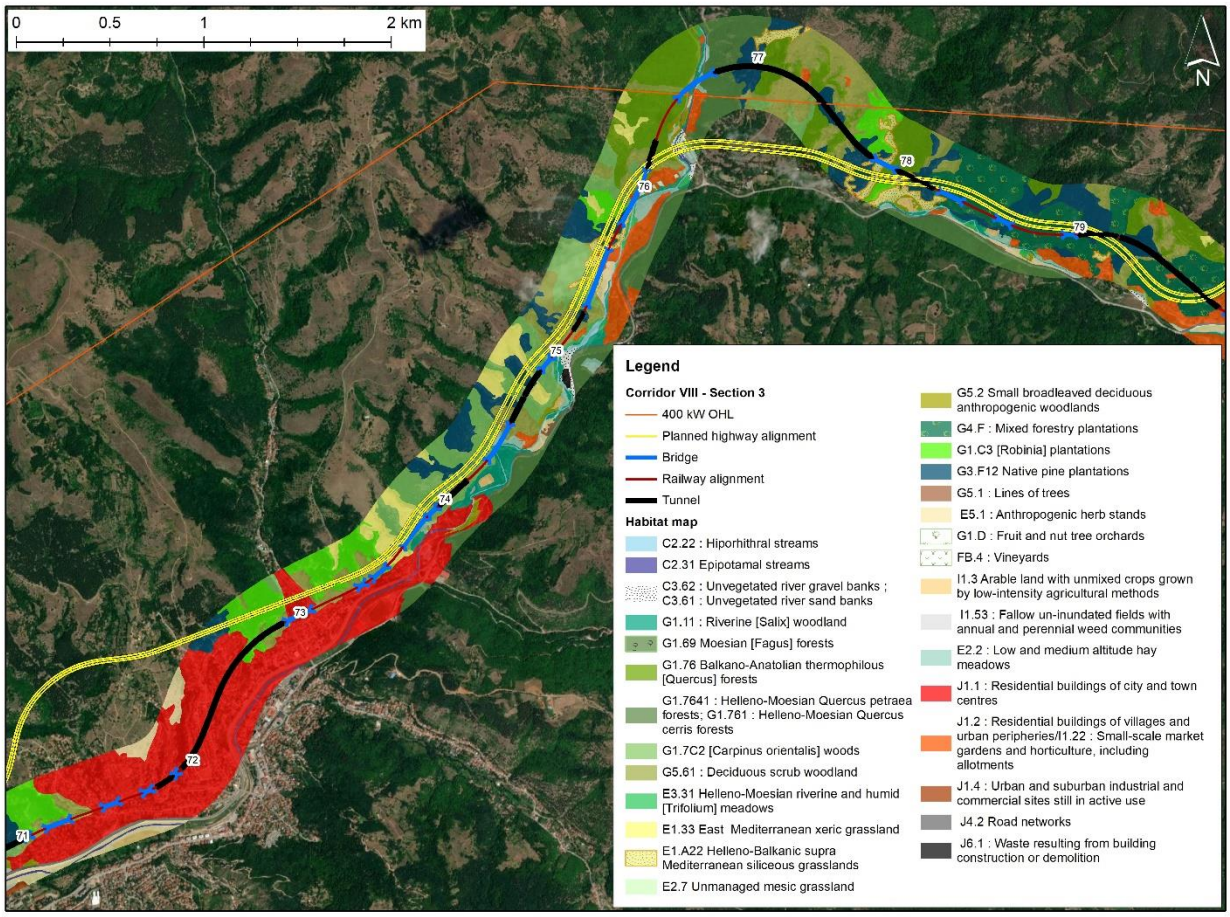
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C2.31 Epipotamal streams
C3.62 : Unvegetated river gravel banks ; C3.61 : Unvegetated river sand banks
G1.11 : Riverine [Salix] woodland
G1.69 Moesian [Fagus] forests
G1.76 Balkano-Anatolian thermophilous [Quercus] forests
G1.7641 : Helleno-Moesian Quercus petraea forests; G1.761 : Helleno-Moesian Quercus cerris forests
G1.7C2 [Carpinus orientalis] woods
G5.61 : Deciduous scrub woodland
E3.31 Helleno-Moesian riverine and humid [Trifolium] meadows
E1.33 East Mediterranean xeric grassland
E1.A22 Helleno-Balkanic supra Mediterranean siliceous grasslands
E2.7 Unmanaged mesic grassland
G5.2 Small broadleaved deciduous anthropogenic woodlands
G4.F : Mixed forestry plantations
G1.C3 [Robinia] plantations
G3.F12 Native pine plantations
G5.1 : Lines of trees
E5.1 : Anthropogenic herb stands
G1.D : Fruit and nut tree orchards
FB.4 : Vineyards
I1.3 Arable land with unmixed crops grown by low-intensity agricultural methods
I1.53 : Fallow un-inundated fields with annual and perennial weed communities
E2.2 : Low and medium altitude hay meadows
J1.1 : Residential buildings of city and town centres
J1.2 : Residential buildings of villages and urban peripheries/I1.22 : Small-scale market gardens and horticulture, including allotments
J1.4 : Urban and suburban industrial and commercial sites still in active use
J4.2 Road networks
J6.1 : Waste resulting from building construction or demolition

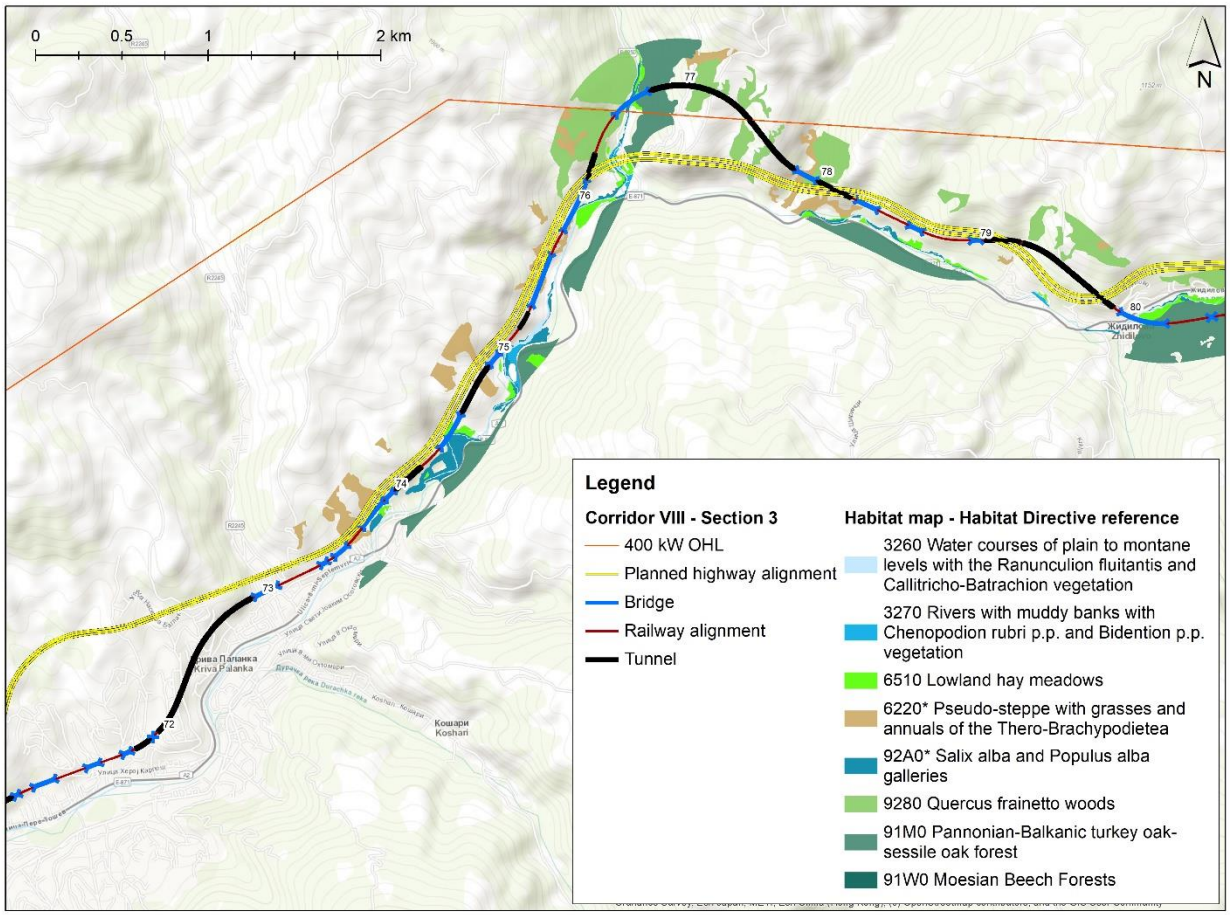
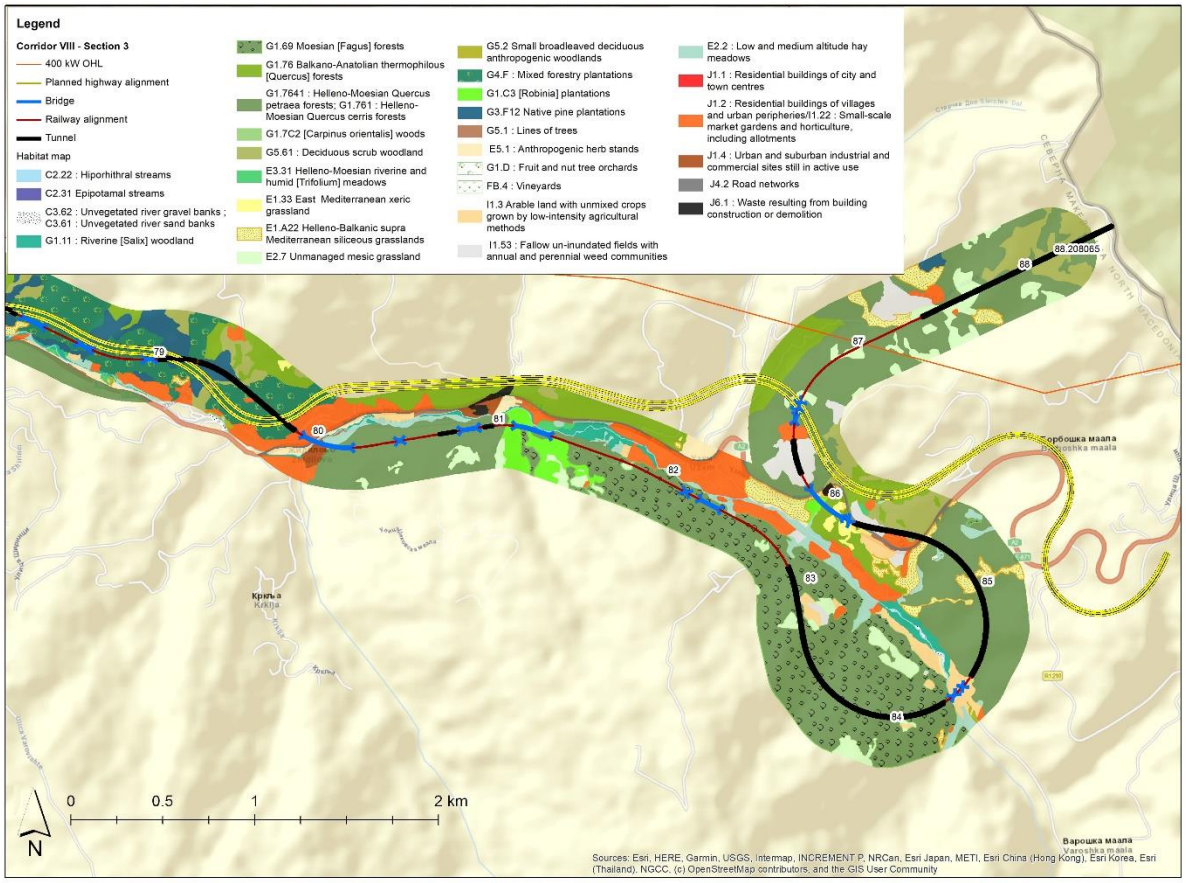


Figure 10 Habitat types along Kumanovo-Deve Bair railway line, Section 3 – Kriva Palanka (T'lminci) to Deve Bair: part 2 – Kriva Palanka to Zhidilovo. Reference to EUNIS and Habitat Directive provided on separate maps


Legend
Corridor VIII - Section 3
400 kW OHL
Planned highway alignment
Bridge
Railway alignment
Tunnel
Habitat map
C2.22 : Hiporhithral streams
C2.31 Epipotamal streams
C3.62 : Unvegetated river gravel banks ; C3.61 : Unvegetated river sand banks
G1.11 : Riverine [Salix] woodland
G1.69 Moesian [Fagus] forests
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J1.4 : Urban and suburban industrial and commercial sites still in active use
J4.2 Road networks
J6.1 : Waste resulting from building construction or demolition
79
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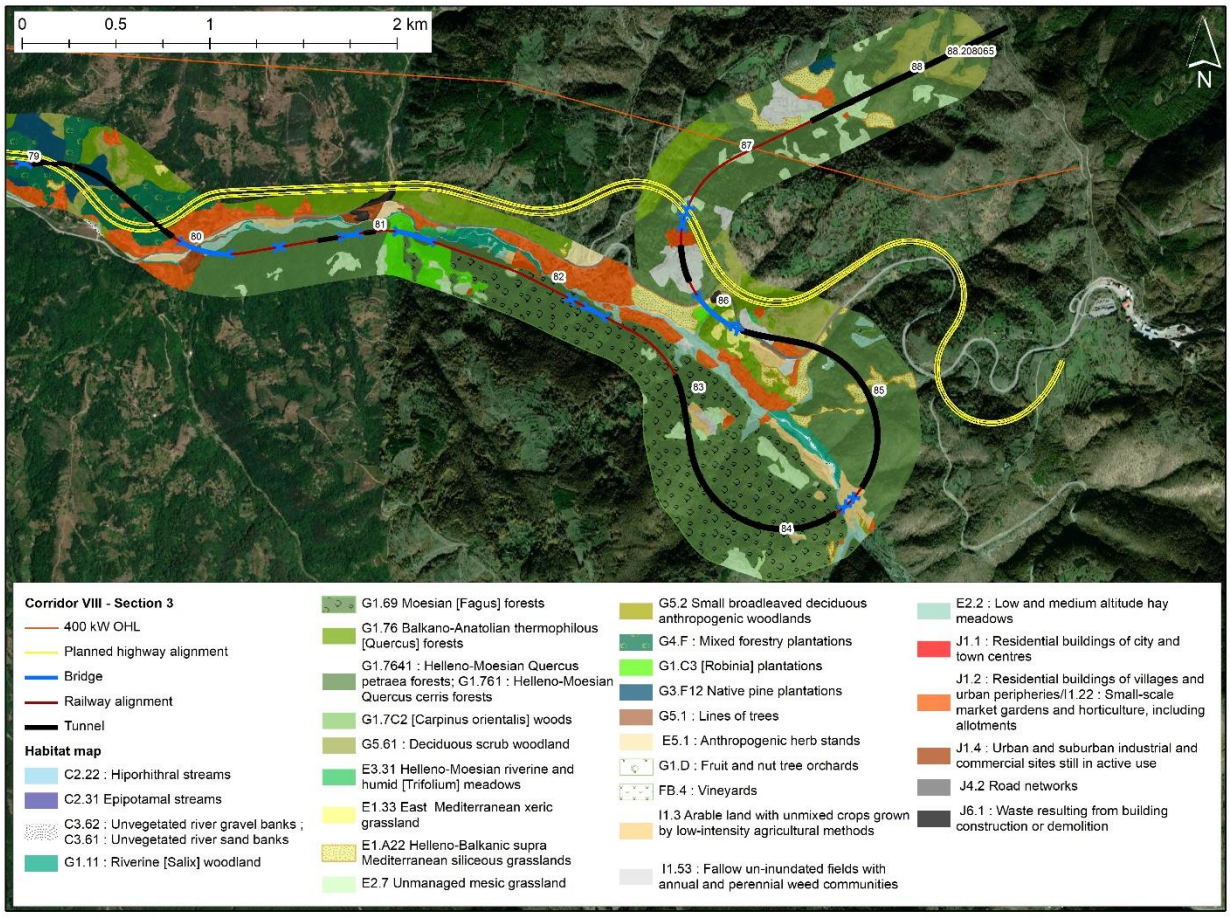
Sources: Esri, HERE, Garmin, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI, Esri China (Hong Kong), Esri Korea, Esri (Thailand), NGCC, (c) OpenStreetMap contributors, and the GIS User Community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Corridor VIII - Section 3
400 kW OHL
Planned highway alignment
Bridge
Railway alignment
Tunnel
Habitat map
C2.22 : Hiporhithral streams
C2.31 Epipotamal streams
C3.62 : Unvegetated river gravel banks ; C3.61 : Unvegetated river sand banks
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G1.7641 : Helleno-Moesian Quercus petraea forests; G1.761 : Helleno-Moesian Quercus cerris forests
G1.7C2 [Carpinus orientalis] woods
G5.61 : Deciduous scrub woodland
E3.31 Helleno-Moesian riverine and humid [Trifolium] meadows
E1.33 East Mediterranean xeric grassland
E1.A22 Helleno-Balkanic supra Mediterranean siliceous grasslands
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J1.2 : Residential buildings of villages and urban peripheries/I1.22 : Small-scale market gardens and horticulture, including allotments
J1.4 : Urban and suburban industrial and commercial sites still in active use
J4.2 Road networks
J6.1 : Waste resulting from building construction or demolition

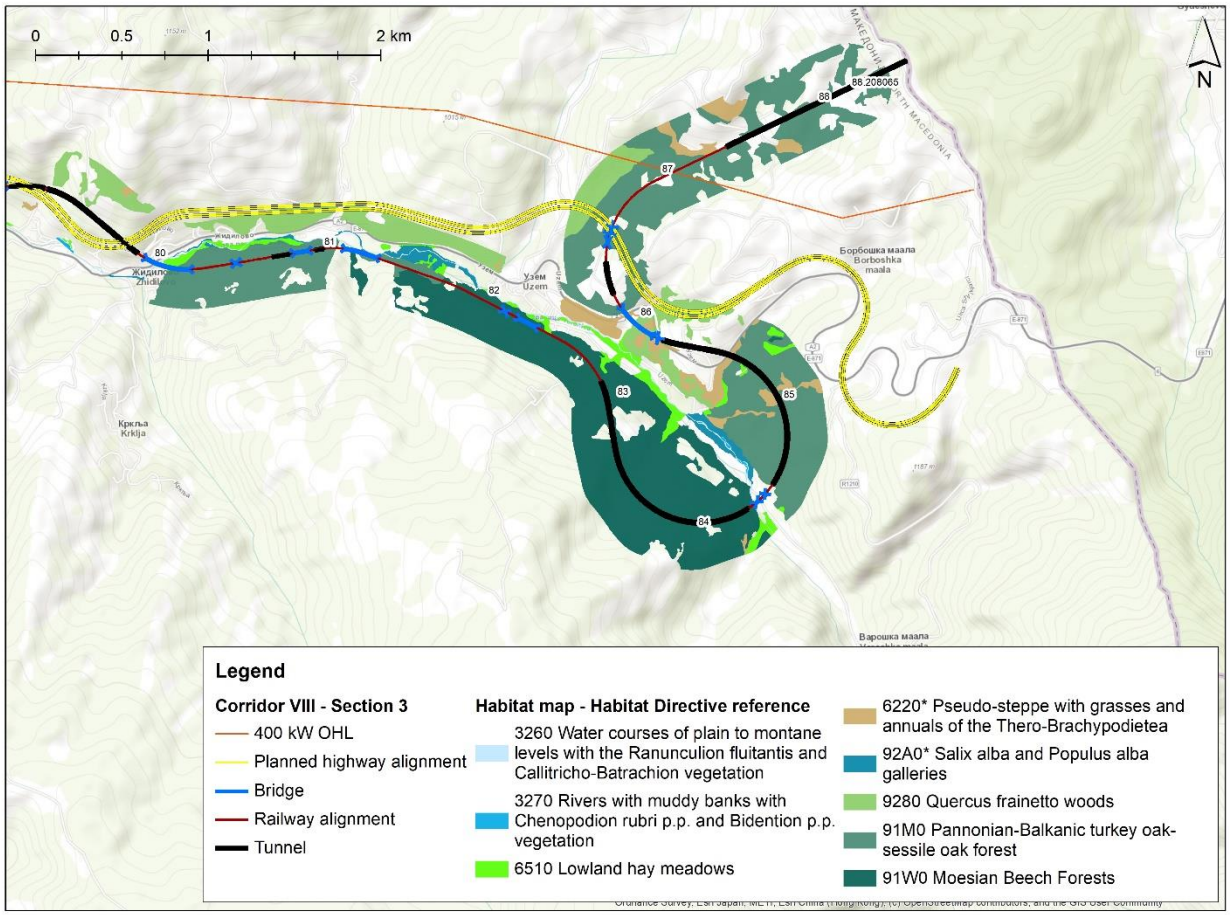


Figure 11 Habitat types along Kumanovo-Deve Bair railway line, Section 3 – Kriva Palanka (T'lminci) to Deve Bair: part 3 – Zhidilovo to Deve Bair. Reference to EUNIS and Habitat Directive provided on separate maps

Table 5 Habitat types in a 500 m corridor along the railway line Section 3 – Kriva Palanka (T'lminci) to Deve Bair. Habitats of conservation importance with reference to Habitat Directive Annex I are coloured in light blue

EUNIS habitat types	**Reference to Habitat Directive** Annex I	**Area (ha)**	**Area (%)**	**Area (ha)**	**Area (%)**	**Area (ha)**	**Area (%)**
		500 m buffer		**100 m buffer (feasible indirect impact)**		**20 m buffer (direct impact/permanent habitat loss)**	
C2.22 : Hyporhithral streams	3260 Water courses of plain to montane levels with the *Ranunculion fluitantis* and *Callitricho-Batrachion* vegetation	5	<1	0.7	0.5	0.04	0.1
C2.31 : Epipotamal streams		3	<1	0.0	0.0	0.01	0.0
C3.62 : Unvegetated river gravel banks ; C3.61 : Unvegetated river sand banks	3270 Rivers with muddy banks with *Chenopodion rubri* p.p. and *Bidention* p.p. vegetation	2	<1	0.1	0.1	0	0
E1.33 : East Mediterranean xeric grassland	6220* Pseudo-steppe with grasses and	17	1	5.6	3.5	1.3	4.2

EUNIS habitat types	**Reference to Habitat Directive** Annex I	**Area (ha)**	**Area (%)**	**Area (ha)**	**Area (%)**	**Area (ha)**	**Area (%)**
		500 m buffer		**100 m buffer (feasible indirect impact)**		**20 m buffer (direct impact/permanent habitat loss)**	
E1.A22 : Helleno-Balkanic supra Mediterranean siliceous grasslands	annuals of the *Thero-Brachypodietea*	25	2	3.7	2.4	0.5	1.7
E2.2 : Low and medium altitude hay meadows	6510 Lowland hay meadows (*Alopecurus pratensis*, *Sanguisorba officinalis*)	20	2	2.8	1.8	0.8	2.7
E2.7 : Unmanaged mesic grassland	N/A	21	2	0.9	0.6	0	0
E3.31 : Helleno-Moesian riverine and humid [Trifolium] meadows	N/A	4	<1	0.1	0.1	0.3	0.9
E5.1 : Anthropogenic herb stands	N/A	18	2	1.5	1.0	0.2	0.6
FB.4 : Vineyards	N/A	<1	<1	0	0	0	0
G1.11 : Riverine [Salix] woodland G1.112 Mediterranean tall [Salix] galleries (G1.1121 Mediterranean white willow galleries)	92A0* *Salix alba* and *Populus alba* galleries	19	2	2.2	1.4	1.3	4.0
G1.69 : Moesian [Fagus] forests	91W0 Moesian Beech Forests	102	9	10.7	6.9	2.5	7.8
G1.76 Balkano-Anatolian thermophilous [Quercus] forests - G1.762 Helleno-Moesian [Quercus frainetto] forests	9280 *Quercus frainetto* woods	157	13	20.5	13.1	4.3	13.9
G1.7641 : Helleno-Moesian Quercus petraea forests; G1.761 : Helleno-Moesian Quercus cerris forests	91M0 Pannonian-Balkanic turkey oak-sessile oak forest	110	9	12.1	7.7	2.8	9.1
G1.7C2 : [Carpinus orientalis] woods	N/A	64	5	12.0	7.7	2.1	6.6
G1.C3 : [Robinia] plantations	N/A	66	6	0.1	0.1	0.0	0.0
G1.D : Fruit and nut tree orchards	N/A	1	<1	19.1	12.2	4.0	12.8
G3.F12 : Native pine plantations	N/A	104	9	8.8	5.6	1.8	5.8
G4.F : Mixed forestry plantations	N/A	39	3	0.2	0.1	0.1	0.2

EUNIS habitat types	**Reference to Habitat Directive** Annex I	**Area (ha)**	**Area (%)**	**Area (ha)**	**Area (%)**	**Area (ha)**	**Area (%)**
		500 m buffer		**100 m buffer (feasible indirect impact)**		**20 m buffer (direct impact/permanent habitat loss)**	
G5.1 : Lines of trees	N/A	1	<1	1.3	0.8	0.3	0.8
G5.2 : Small broadleaved deciduous anthropogenic woodlands	N/A	8	1	10.7	6.9	5.5	17.6
G5.61 : Deciduous scrub woodland	N/A	151	13	24.7	15.8	0.4	1.4
I1.3 : Arable land with unmixed crops grown by low-intensity agricultural methods	N/A	13	1	2.1	1.4	0.4	1.2
I1.53 : Fallow un-inundated fields with annual and perennial weed communities	N/A	19	2	2.6	1.7	1.3	4.3
J1.1 : Residential buildings of city and town centres	N/A	93	8	9.3	5.9	0.8	2.6
J1.2 : Residential buildings of villages and urban peripheries/I1.22 : Small-scale market gardens and horticulture, including allotments	N/A	86	7	5.3	3.4	0.1	0.3
J1.4 : Urban and suburban industrial and commercial sites still in active use	N/A	3	<1	0.3	0.2	0.1	0.3
J4.2 : Road networks	N/A	9	1	0.5	0.3	0.3	1.0
J6.1 : Waste resulting from building construction or demolition	N/A	27	2	3.1	2.0	0.04	0.1
Total		**1185**	**100**	**156.5**	**100.0**	**31.3**	**100**

3.2.3 Species supplementary field assessment

The Supplementary biodiversity field assessment was focused on mammal, reptile, bird and insect species found to be important for conservation.

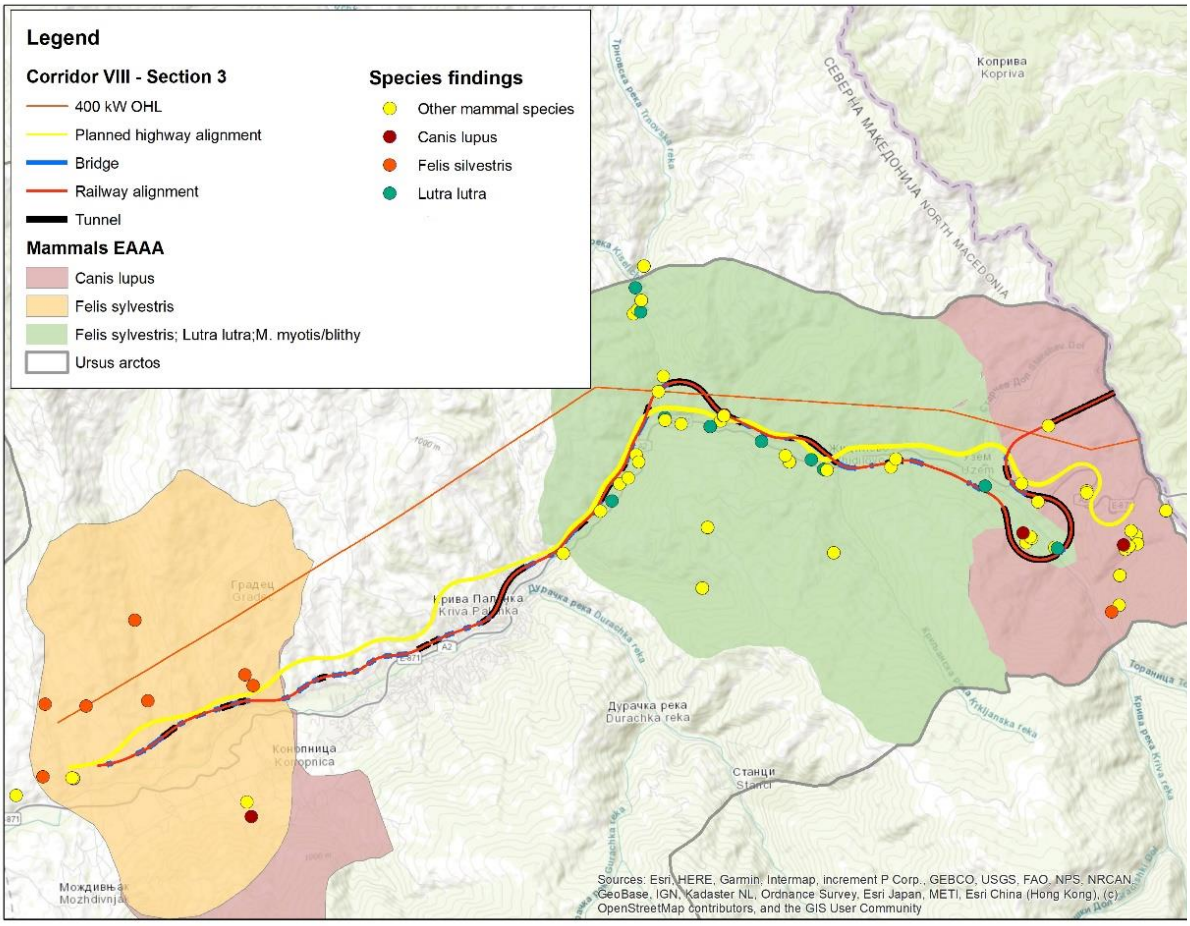
3.2.4 Mammals

Within the assigned area of interest, a total of 16 species of mammals have been recorded. Two bat species were recorded for the first time in the area (Soprano pipistrelle *Pipistrellus pygmaeus* and

Schreiber's Bent-winged Bat *Miniopterus schreibersii*), while the other 14 mammal species were noted in previous ESIA studies[15].

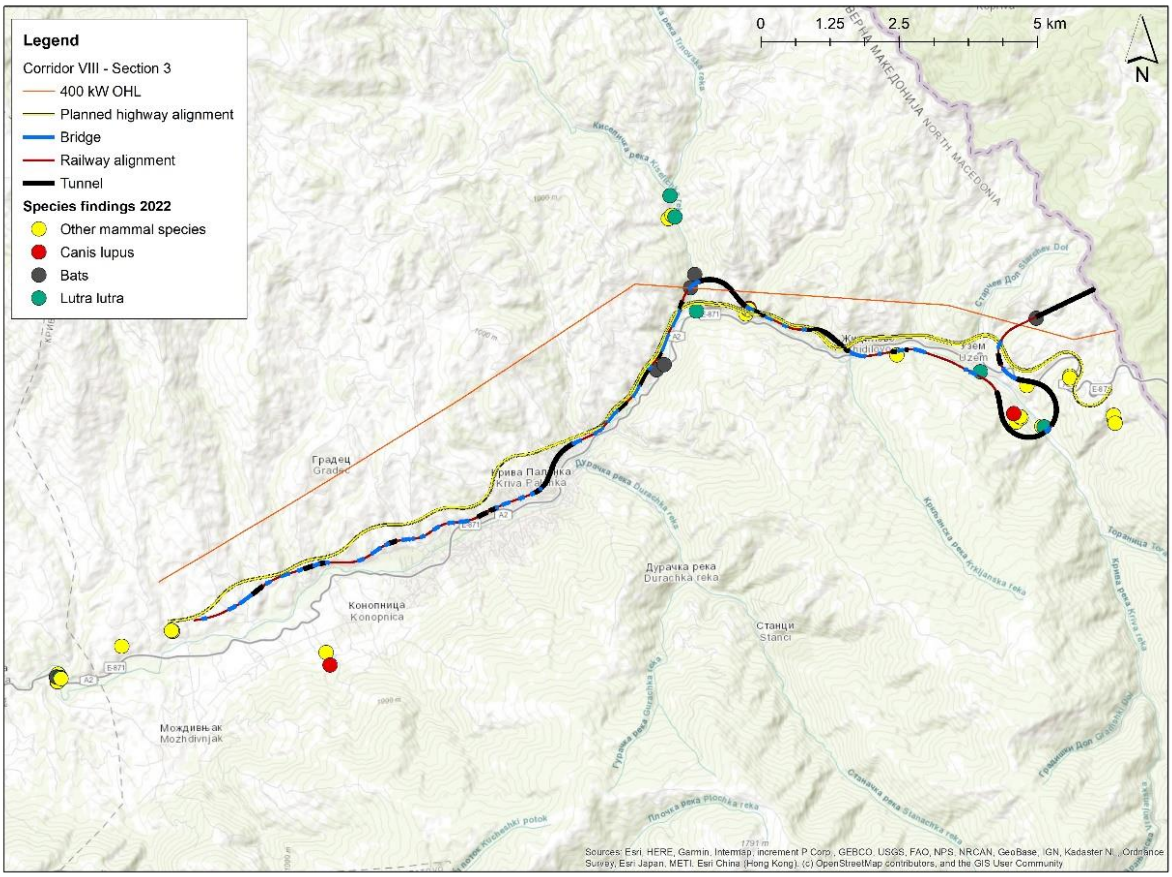
3.2.4.1 Targeted species

During the field surveys, presence of wolf was registered at four locations (Dlabovhica, Pashinci, Konopnica and Uzem), whereas otter presence was confirmed at 4 locations along Kriva Reka and 2 locations along Kiselichka Reka (see Figure 12). No signs of wild cat were recorded, likely due to bad tracking conditions, although it is regarded as a common species in the area, which has been registered on many locations during the period 2014-2022[16]. Greater mouse-eared bat and lesser mouse-eared bat were also not recorded in 2022, but had been recorded previously. Although there are suitable habitats, brown bear is considered unlikely to be present in the area of interest, as it has not been sighted for at least two decades.



a) Mammal species in the area of interest, including expert's personal field data from previous research

[15] Unpublished reports or studies from several conservation projects (Balkan Lynx Recovery Programme, MAK-NEN Project and Supporting a Sustainable Future for People and Nature in the Osogovo Mountain 2016-2018) which provided an overview of the status of large carnivores (brown bear, wolf and lynx) and their prey species for entire Osogovo Mts. Were also considered.
[16] For details on reviewed reports see section 2.3



b) Mammal species recorded during the supplementary field survey in 2022 (May-June)

Figure 12 Locations of species findings - mammals

In addition to the targeted species listed above, the survey team also registered the presence of three other important bat species: greater horseshoe bat *Rhinolophus ferrumequinum* and Schreiber's bent-winged bat *Miniopterus schreibersii*) and lesser horseshoe bat *Rhinolophus hipposideros*.

The Greater Horseshoe Bat (*Rhinolophus ferrumequinum*) is considered to be common species in N. Macedonia. It forages over pastures, deciduous woodland and shrubland. One individual of this species was sighted in an unused artificial tunnel close to the riverbed of Kriva Reka, in the vicinity of v. Psacha.

The Lesser Horseshoe Bat (*Rhinolophus hipposideros*) is common species found throughout the country. It forages along the edges of broadleaf deciduous woodland, riparian vegetation and shrubland. The presence of the species was recorded in a tunnel near Deve Bair.

There are no data about exact distribution and population size of the Schreiber's Bent-winged bat (*Miniopterus schreibersii*) in N. Macedonia, but it is considered to be widespread. This species favors hardwood forest-rich habitats and mainly roosts in colonies in karst caves, mines and cellars with other cave-dwelling species. One individual of this species was sighted in an unused artificial tunnel close to the riverbed of Kriva Reka, in the vicinity of v. Psacha.

There are not many data on the distribution of Soprano pipistrelle (*Pipistrellus pygmaeus*) in N. Macedonia. It forages mainly close to riparian forests and waterbodies, as well as in villages and city parks. Within the area of interest, the species has been recorded along the gorge of Kiselichka River.

The suitable habitats for the target mammal species are already affected by the ongoing construction activities of the express road Rankovce – Kriva Palanka and the rehabilitation of the existing road Kriva Palanka – border pass Deve Bair. However, the small hydropower plant project (HPP) constructed on Kriva Reka near v.Zhidilovo has the highest negative impact on the otter habitats, as the HPP has been canalising the river with artificial channels and river banks, along with the removal of the existing riparian habitats.

3.2.5 Avifauna

The cliffs in the gorge of Kiselichka Reka, were found to be the most suitable habitat for the Peregrine falcon to nest; however, the Peregrine falcon was not recorded in the area of interest during the supplementary field assessment done as part of none of the surveys related to this project. However, as in the reviewed ESIA documentation it is noted that "attention should be paid to possible presence of Peregrine falcon", it was selected as a target species for the SBA in order to explore any possibility of species presence/nesting in the area of interest. In the areas of suitable habitat for the Peregrine falcon ongoing construction activities from other infrastructural projects implemented in the area were noted.

Within the area of interest during the survey season a total of 57 species were observed, all noted in the previous ESIA studies. The most abundant species that occupies the similar habitat as the Peregrine Falcon is the Common Raven (*Corvus corax*) with an estimate of 3-4 breeding pairs. The record of the Black Stork *Ciconia nigra* (T'lminci area) is an important observation as this species was not recorded in the previous ESIA studies. The Black stork breeds in the IBA River Pcinja-river Petrohsnica-river Kriva Reka[17] (located at about 10 km west from the area of interest), but uses the upper streams of Kriva Reka to forage and to feed. The Black Stork is a specialist species confined to a mosaic habitat of forests (riparian mostly) and rivers.

3.2.5.1 Targeted species

The Peregrine falcon was not recorded in the area of interest during the supplementary field assessment done as part of none of the surveys related to this or any other infrastructural projects implemented in the area. Nonetheless, the Peregrine falcon is active throughout the year and in North Macedonia this bird is most active in spring (March to May). The literature review and the review of the datasets from the surveys conducted for the purposes of the Second European Breeding Bird Atlas (in the period 2014-2018) also did not uncover any sightings or confirmed breeding of the Peregrine Falcons in the project area. However, there is a positive record of Peregrine falcon flyover observation just before the starting point of Section 3 of the railway, in close surrounding of Chankinci, just before T'lminci (Nakev, S. 2020) indicating that it occasionally might use the area to forage and feed. The closest confirmed breeding and sighting of Peregrine Falcon is in the IBA River Pcinja-river Petrohsnica-river Kriva Reka (located at about 10 km air distance west from the area of interest). While in the area of interest there is no observation of breeding sites of Peregrine falcon, it may occasionally visit the area for feeding and foraging as its home range approximates 20-30 km^2.

[17] Velevski, M. Hallmann B. Grubač B. Lisičanec T. Stoynov E. Lisičanec E. Avukatov V. Božič L. & Stumberger B. 2010. Important Bird Areas in Macedonia: Sites of Global and European Importance. Acrocephalus 31, no. 147:181-282.
Velevski, M. Grubač B. & Hallmann B. 2008. 2008. Distribution and estimation of the population size of the Black Stork Ciconia nigra in Macedonia. Ciconia 17:14-19.

3.2.6 Amphibians and Reptiles

Currently, the most updated maps from the National Red List of Threatened Species[18] inform on a relatively widespread continuous presence of the Spur-thighed tortoise in the area of interest, from T'lminci to Kiselica, and surprisingly, almost complete absence of the Hermann's tortoise (only marginally touching the surveyed area south of T'lminci). Taking into account that the Spur-thighed tortoise is absent from the wider neighbouring region of Bulgaria (only present down the Strumica and Struma rivers valley bordering southwestern North Macedonia) and having their respective ecological preferences in mind, this is likely owed to coincidental field observations and lack thereof, and misidentifications with the similar Hermann's tortoise.

As the precise distribution of both tortoise species present in North Macedonia is still not considered entirely resolved, particularly in the east, the study area was subjected to as detailed a survey as possible during the field work period.

Within the area of interest total of 7 reptile (1 tortoise, 3 snakes, 3 lizards) and 2 amphibian (1 toad and 1 frog) species were observed. All species, except the Common toad *Bufo bufo*, the Slow worm *Anguis fragilis* and the Dahl's whip snake had been recorded in the previous ESIAs.

3.2.6.1 Targeted species

Only one of the targeted species was observed in the area of interest, Hermann's tortoise which was observed on two occasions in the project area: at Uzem, near the Macedonian-Bulgarian border and in the vicinity of Kriva Palanka. The Spur-thighed tortoise was not observed. This is most likely due to absence of suitable habitats for the Spur-thighted tortoise and the fact that the area of interest is at the edge of the global distribution range of this species. The closest recent observation of this tortoise comes from the valley of Pcinja river (at ~30km distance). The distribution range of the Spur-thighed tortoise continues north along Pcinja river to Serbia, touching the extreme south of the country and only barely entering Serbia. Whether its range also stretches along Pcinja's tributary - Kriva Reka through to Kriva Palanka and then close to the border (up to ~1000m asl) remains an open question as the species is absent from this neighbouring part of Bulgaria, hence colonization events from the east are unlikely. Even if the Spur-thighed tortoise is extant in the region, marginal populations such as this one tend to be sparse as they often face suboptimal environmental conditions and are therefore more difficult to record.

3.2.7 Insects

The field surveys conducted in the spring of 2022 resulted in 12 species of saproxylic beetles and 30 species of ground beetles being recorded. Larvae of different undetermined saproxylic beetles were noted along all of the transects. All of the recorded species were listed in the previous ESIA studies. They are common species, characteristic for the habitats in the area. The greatest diversity of ground beetles was recorded in the riparian woodland along Kriva Reka - Zhidilovo, however the all of the recorded species are common for moist habitats.

3.2.7.1 Targeted species

None of the target species was recorded: *Morimus funereus, Cerambyx cerdo, Rosalia alpina, Lucanus cervus, Osmoderma eremita, Cucujus cinnaberinus*.

The longhorn beetle *Morimus funereus* was mentioned in the previous ESIA studies as part of the mesophilous oak forests (Flowering Ash and Sessile Oak Forest) and submontane beech forests.

[18] Arsovski, D., & Sterijovski, B. (2020). Hermann's Tortoise. National Red List of North Macedonia. http://redlist.moepp.gov.mk/hermanns-tortoise/
Arsovski, D., & Sterijovski, B. (2020). Spur-thighed Tortoise. National Red List of North Macedonia. http://redlist.moepp.gov.mk/hermanns-tortoise/

However, its presence was not confirmed by the research conducted in the spring of 2022, eventhough the survey was undertaken during the optimal time for this species as adults are active from spring till the end of summer, the peak of activity being mid May to mid June. *Morimus funereus* is distributed throughout the country but no population estimation has been attempted for this species. The research in the Bregalnica watershed (2015-2021) provided significant number of new records of this species[19]. According to the map of national distribution of *Morimus funereus* produced in 2016[20], there are no confirmed records of *Morimus funereus* in the EAAA.

Only one target insect species was recorded during the field surveys conducted in spring 2022, this was the clouded apollo butterfly *Parnassius mnemosyne*.

3.2.8 Ecosystem services

In total, 11 interviews were conducted with local stakeholders from Kriva Palanka, Trnovo, T'lminci and Stambolica. Three of these interviews were conducted with local collectors/sellers of non-timber forest products.

3.2.8.1 Assessment of ecosystem services supply in the study area

The most dominant ecosystem types within the study area are forests, riparian forests, woodlands and scrublands and grasslands. Sparsely vegetated areas only comprise a very small area. The ecosystem services supply is dependent upon, and connected to, the ecosystem condition of each ecosystem type.

Table 6 shows the results from the local matrix with average scores obtained from local stakeholders. It can be observed that the average scores for almost all ecosystem services are high. Additionally, the cultural ecosystem services also have highest scores, than the regulating and provisioning respectively.

Table 6 Local capacity matrix with scores for 12 ecosystem services relevant to the study area (score ranges from 1 (minimum) to 5 (maximum)

Capacity matrix on local level	**Provisioning**				**Regulating**				**Cultural**			
	Wild plants (terrestrial and aquatic, including fungi, algae) used for nutrition	Surface water used as a material (non-drinking purposes)	Mineral substances used for material purposes	Surface water for drinking	Polli-nation	Regulation of temperature and humidity, including ventilation and transpiration	Fire protection	Regulation of baseline flows and extreme events	Characteristics of living systems that are resonant in terms of culture or heritage	Natural, abiotic characteristics of nature that enable active or passive physical and experiential interactions	Characteristics of living systems that enable education and training	Characteristics or features of living systems that have an option or bequest value
	1	2	3	4	**1**	**2**	3	4	1	2	3	4
Ecosystem types in the study area	**3.9**	**3.7**	**3.9**	**4.1**	**3.9**	**4.2**	**3.2**	**4.1**	**4.1**	**4.4**	**3.9**	**4.1**

[19] Hristovski, S. and Cvetkovska-Gjorgievska, A. (2021). Status and distribution of beetles of importantce for the European Union and establishment of Natura 2000 sites. Macedonian Ecological Society. Nature Conservation Programme in North Macedonia.

[20] Hristovski, S. and Cvetkovska-Gjorgievska, A. (2016). Final Report on Working Group Land Invertebrates. Strengthening the capacities for implementation of Natura 2000 Project Reference Number: EuropeAid/136609/IH/SER/MK

Additional visual representation of the average scores in the local capacity matrix is given in Figure 13 through bundles analysis. The length of each bundle in the graph presents the supply of each ecosystem service from the ecosystems present in the study area. It can be observed that most of the selected ecosystem services from all three groups (provisioning, regulating and cultural) have high supply in the study area, according to the local capacity matrix.

Wild plants (terrestrial and aquatic, including fungi, algae) used for nutrition
Surface water used as a material (non-drinking purposes)
Mineral substances used for material purposes
Surface water for drinking
Pollination
Regulation of temperature and humidity, including ventilation and transpiration
Fire protection
Regulation of baseline flows and extreme events
Characteristics of living systems that are resonant in terms of culture or heritage
Natural, abiotic characteristics of nature that enable active or passive physical and experiential interactions
Characteristics of living systems that enable education and training
Characteristics or features of living systems that have an option or bequest value

Figure 13 Bundles analysis for 12 ecosystem services supplied in all ecosystem types within the study area. Each petal in the bundles is associated with to a specific ES. The length of each petal is proportional to the relative abundances of the other ES within each bundle (petals are comparable within bundles).

4 CRITICAL HABITAT AND PRIORITY BIODIVERSITY FEATURE ASSESSMENT

4.1 Introduction

Critical Habitat Assessment (CH) is performed in line with relevant guidance (EIB[21] and EBRD 2020[22]), to identify areas of highest biodiversity value that might be impacted by the project.

Priority biodiversity features have a high, but not the highest, degree of irreplaceability and/or vulnerability. Although a level below critical habitat in sensitivity, they still require careful consideration during project assessment and impact mitigation.

The objectives of PR6 are to protect and conserve biodiversity; maintain core ecological functions of ecosystem services and biodiversity they support; adapt the mitigation hierarchy approach; and promote the sustainable management of living natural resources through the adoption of good international practices.

PR6 identifies two classes of important biodiversity, likewise based on the principles of threat (vulnerability) and geographic rarity (irreplaceability):

- Priority Biodiversity Features and
- Critical Habitat

4.2 Assessment of Critical Habitat

Based on the broad pool of data collected with consideration to available literature data and the updated biodiversity and habitat data based on field surveys, an assessment of CH/PBF was done following the criteria of the EBRD's Guidance Note 6: Biodiversity Conservation and Sustainable Management of Living Natural Resources (Table 7):

- ✓ Threatened ecosystems;
- ✓ Vulnerable, critically endangered and/or endangered species and their habitats;
- ✓ Endemic and/or restricted-range species and their habitats;
- ✓ Migratory and congregatory species and their habitats;
- ✓ Areas associated with key evolutionary processes

Table 7 Criteria and conditions for identifying priority biodiversity features and critical habitats*

Criterion	Priority Biodiversity Feature	Critical Habitat
1. Priority ecosystems		
Threatened ecosystems **(a) Habitats listed in Annex 1 of EU Habitats Directive** **(b) IUCN Red-List EN or CR ecosystems**	(PR6 para. 12-i) (a) EAAA is habitat type listed in Annex 1 of EU Habitats Directive	(PR6 para. 14-i) (a) EAAA is habitat type listed in Annex 1 of EU Habitats Directive marked as "priority habitat type"

[21] EIB (2018) Environmental and Social handbook. Environment, Climate and Social office. Projects Directorate.
[22] EBRD Guidance Note 6: Biodiversity Conservation and Sustainable Management of Living Natural Resources (v. September, 2022)

Criterion	Priority Biodiversity Feature	Critical Habitat
	(b) EAAA** < 5% of the global extent of an *ecosystem* type with IUCN status of CR or EN	(b) EAAA ≥5% of global extent of an ecosystem type with IUCN status of CR or EN (c) EAAA is ecosystem determined to be of high priority for conservation by national systematic conservation planning
2. Priority Species and their Habitats		
Threatened species **(a) Species and their habitats listed in EU Habitats Directive and Birds Directive / Bern Convention** **(b) IUCN Red List EN or CR species** **(c) IUCN Red List VU species** **(d) Nationally or regionally (e.g., Europe) listed EN or CR species**	(PR6 para. 12-ii) (a) EAAA for species and their habitats listed in Annex II of Habitats Directive, Annex I of Birds Directive, Resolution 6 of Bern Convention (b) EAAA supports < 0.5% of global population OR < 5 reproductive units of a CR or EN species. (c) EAAA supports VU species (d) EAAA for regularly occurring nationally or regionally listed EN or CR species	(PR6 para. 14-ii) (a) EAAA for species and their habitats listed in Annex IV of the Habitats Directive (b) EAAA supports ≥ 0.5% of the global population AND ≥ 5 reproductive units of a CR or EN species (c) EAAA supports globally significant population of VU species necessary to prevent a change of IUCN Red List status to EN or CR, and satisfies threshold (b) (d) EAAA for important concentrations of a nationally or regionally listed EN or CR species
Range-restricted species	(PR6 para. 12-ii) (a) EAAA for regularly occurring range-restricted species	(PR6 para. 14-iii) (a) EAAA regularly holds ≥ 10% of global population AND ≥ 10 reproductive units of the species***
Migratory and congregatory species	(PR6 para. 12-ii) (a) EAAA identified per Birds Directive or recognized national or international process as important for migratory birds (esp. wetlands)	(PR6 para. 14-iv) (a) EAAA sustains, on a cyclical or otherwise regular basis, ≥ 1 percent of the global population at any point of the species' lifecycle (b) EAAA predictably supports ≥10 percent of global population during periods of environmental stress

*Quantitative thresholds derived from IUCN Key Biodiversity Area Standard and aligned with International Finance Corporation's (IFC) Guidance Note 6 (rev. 2019)

**EAAA = *ecologically appropriate area of analysis*, as defined above

***The IUCN Key Biodiversity Areas standard cites the following definition for reproductive unit: "the minimum number and combination of mature individuals necessary to trigger a successful reproductive event at a site. Examples of five reproductive units include five pairs, five reproducing females in one harem, and five reproductive individuals of a plant species." Eisenberg, 1977. The Evolution of the Reproductive Unit in the Class Mammalia.

Following EIB requirements, a summary overview of urban and semi-modified habitats is also provided.

The species assessment/valorisation was done by employing the following criteria: EU Habitat Directive, Bird Directive, IUCN Global and European Red List, National Red Lists of Mammals, Reptiles and Plants, Bern Convention and the applicable national legislation (List of Strictly Protected and Protected Species of the Law on Nature Protection of North Macedonia).

4.3 Critical Habitats Assessment – Outcome

4.3.1 Priority ecosystems

4.3.1.1 Threatened ecosystems

While the area of interest supports habitats that are listed under Annex I of the Habitat Directive, including those marked as "priority habitat type", most were assessed as not representative as a large portion of the habitats were found to be in different stages of degradation, largely due to ongoing construction activities related to other infrastructural projects implemented in the area of interest (SHPP "Kriva Reka", PCC HYDRO; Kriva Palanka Road Rehabilitation Project; Expressway A2, LOT 2: Sub-section Kriva Palanka).

None of the habitats were determined to be of high priority for conservation by national systematic conservation planning and no high nature value forests have been identified[23]. North Macedonia has no reference to the IUCN Red list of threatened ecosystems.

The critical habitat assessment for habitats is presented in Table 8 below. Management actions and mitigation measures with the aim of achieving no net loss/net gain of both PBF and CH are outlined in section 5 and 6 of this report and further elaborated in detail in the Biodiversity Management Plan, prepared as a standalone document.

Table 8 Critical habitat assessment in accordance with the EBRD PR6 requirements

EUNIS reference	**Habitat Directive reference**	**Qualifies in accordance with the EBRD PR6 requirements**	
		Priority biodiversity feature	**Critical habitat**
G1.76 Balkano-Anatolian thermophilous [*Quercus*] forests - G1.762 Helleno-Moesian [*Quercus frainetto*] forests	**Annex I** 9280 *Quercus frainetto* woods	Yes	No
Although protected under the Habitats Directive, widespread habitat type in the country, which is largely disturbed and degraded in the project area, and hence it is not representative. However, care should be taken to avoid any additional negative impacts during construction of the railway line.			
G1.7641 Helleno-Moesian *Quercus petraea* forests **G1.761 : Helleno-Moesian Quercus cerris forests**	**Annex I** 91M0 Pannonian-Balkanic turkey oak-sessile oak forest	Yes	No.

[23] Macedonian Ecological Society (2022) Identification of high nature value forests at the national level and development of guidelines for the management of two selected pilot HNVFs sites (Bukovic and Belasica). STAR 5 – Achieving biodiversity conservation through the creation and effective management of Protected Areas and mainstreaming biodiversity into land use planning. UNEP, MoEPP.

EUNIS reference	Habitat Directive reference	Qualifies in accordance with the EBRD PR6 requirements	
		Priority biodiversity feature	**Critical habitat**
Patches of this habitat type were also found at various degradation stages, particularly at forest edges and nearby settlements where human impact is more notable. This habitat type is considered as being of conservation importance under the Habitats Directive; however, this habitat has much larger availability of less disturbed and more natural habitats outside of the area of interest. Nonetheless, care should be taken to avoid any additional negative impacts during construction of the railway line.			
G1.691 Southwestern Moesian Beech Forests	**Annex I** 91W0 Moesian Beech Forests	Yes	No
Patches of this habitat type were assessed as representative, except at forest edges and nearby settlements where human impact is visible. Beech forests have larger availability of less disturbed and more natural habitats outside of the area of interest. However, due to its international conservational importance, care should be taken to avoid any additional negative impacts during construction of the railway line.			
G1.11 Riverine [Salix] woodland - **G1.112 Mediterranean tall [*Salix*] galleries (G1.1121 Mediterranean white willow galleries)**	**Annex I - priority habitat type** 92A0* *Salix alba* and *Populus alba* galleries	No	Yes
Well-preserved, representative riparian willow-poplar woodlands have very limited distribution along the railway corridor of interest for this study. The most representative habitat patch was recorded between Zhidilovo and Uzem. However, even here, degradation is notable, as the site is being affected by the Kriva Palanka Road Rehabilitation Project, for which construction activities that are ongoing. A notable portion of this habitat has also been degraded due to ongoing construction activities, for the construction of the SHPP Kriva Reka PCC Hydro. However, due to its limited coverage in the Country and its international conservational importance, this habitat type is sensitive and care should be taken to avoid any additional negative impacts during construction of the railway line.			
F9.12 Lowland and collinear riverine [Salix] scrub - F9.123 Balkan riverine willow scrub **F9.3133 East Mediterranean tamarisk thickets**	**Annex I** 3230 Alpine rivers and their ligneous vegetation with *Myricaria germanica* and 3240 Alpine rivers and their ligneous vegetation with *Salix elaeagnos*	Yes	No
Well-developed riparian willow-poplar belts are a rare find along the Kriva Reka river as most stands were noted to be at various stages of degradation and not representative. As a result, riparian-willow poplar belts in the area of interest often have mixed ingrowth of *Rubus* sp. and the invasive *Amorpha fruticosa.* This habitat type is strongly affected by the ongoing construction activities. However, due to its limited coverage in the Country and its international conservational importance, this habitat type is sensitive and care should be taken to avoid any additional negative impacts during construction of the railway line.			
E1.33 East Mediterranean xeric grassland (E1.332 Heleno-Balkanic shrot grass and therophyte communities)	**Annex I - priority habitat type** 6220* Pseudo-steppe with grasses and	No	Yes

EUNIS reference	Habitat Directive reference	Qualifies in accordance with the EBRD PR6 requirements	
		Priority biodiversity feature	**Critical habitat**
E1.A22 Helleno-Balkanic supra Mediterranean siliceous grasslands	annuals of the *Thero-Brachypodietea*		
Hill pastures in the area of interest are a secondary formation occurring as a result of extensive long-term stockbreeding practices. Due to ongoing abandonment of stockbreeding practices[24], hill pastures are being overgrown with shrubs (elements of the adjacent Thermophilous oak forests). In the vicinity of populated areas, invasion with ruderal species and overgrowth with *Ailanthus altissima* that is an invasive species was also noted. This habitat type is widespread in the Country and is of no high priority for conservation on a national level. Although small areas of representative patches are found around Drenje, Krklja, Zhidilovo and Uzem, the composition of plants at large is not typical and succession processes are visible. However, due to the relatively small area occupied by this habitat along the railway alignment, care should be taken to avoid any additional negative impacts during construction of the railway line.			
E2.238 Southwestern Moesian submontane hay meadows	**Annex I** 6510 Lowland hay meadows (*Alopecurus pratensis*, *Sanguisorba officinalis*)	Yes	No
Meadows found in the AOI are not representative as the plant composition is represented dominantly by several *Trifolium* species. Ruderal plants (*Euphorbia cyparissias, Taraxacum officinale, Plantago lanceolata, Urtica dioica* etc.) are also common. In the area of interest, meadows are managed and/or semi intensively managed, whereas a minor part of them are extensively managed or have been abandoned a number of years before. Most representative patches of this habitat were found in the area of Uzem, village Kostur in the narrow valley of Kriva Reka. However, this habitat type is noted as important for supporting the populations of important insects (particularly relevant for butterflies) and care should be taken to avoid any additional negative impacts during construction of the railway line.			
C2.31 Epipotamal streams **C2.22 Hiporhithral streams**	**Annex I** 3260 Water courses of plain to montane levels with the *Ranunculion fluitantis* and *Callitricho-Batrachion* vegetation	Yes	No
Large portion of Kriva Reka riverbed is heavily altered due to ongoing construction activities of other infrastructural projects in the area of interest (SHPP “Kriva Reka”, PCC HYDRO; Kriva Palanka Road Rehabilitation Project; Expressway A2, LOT 2: Sub-section Kriva Palanka). Anthropogenic disturbance is visible on the site, particularly notable for the lower flow of Kiselichka Reka (due to ongoing construction activities) and the upper flow of Kriva Reka rivers (due to the active mine “Toranica”). However, this habitat type is sensitive and care should be taken to avoid any additional negative impacts during construction of the railway line.			
C2.5 Temporary running waters	**Annex I** 3290 Intermittently flowing Mediterranean rivers of the *Paspalo-Agrostidion*	Yes	No

[24] Jovanovska, D., Melovski, L. (2012). Land cover succession as a result of changing land use practises in Northeast Macedonia. In: Proceedings of the 4th Congress of Ecologists of Macedonia with International Participation pp. 185–196. 4th Congress of Ecologists of Macedonia with International participation. Macedonian Ecological Society, Ohrid.

EUNIS reference	Habitat Directive reference	Qualifies in accordance with the EBRD PR6 requirements	
		Priority biodiversity feature	Critical habitat
This habitat includes the intermittent streams in the area of interest. These streams do not have great importance as water ecosystems as water flow depends on rainwater and snow melting in early spring. Half of the year (more or less) these streams are characterised by a dry bed. However, the ravines through which they flow are regularly covered by denser or sparser woody or herb vegetation. The previous ESIAs noted that in a number of the temporary running waters (as marked on the topographic map) water flow was absent throughout the year, as confirmed during the supplementary field survey conducted in spring 2022. Ongoing construction activities of other infrastructural projects (particularly the HPP construction) in the area of interest might have additionally affected the water flow of temporary streams. Noteworthy intermittent streams in the area of interest are Gabarska Reka, Zhidilovski Dol and Uti Potok. However, this habitat type is sensitive and care should be taken to avoid any additional negative impacts on temporary waters during construction of the railway line.			
C3.62 Unvegetated river gravel banks **C3.61 Unvegetated river sand banks**	**Annex I** 3270 Rivers with muddy banks with *Chenopodion rubri* p.p. and *Bidention* p.p. vegetation	Yes	No
Found not to be a representative habitat of this type, as it has been severely altered due to ongoing construction activities of other infrastructural projects in the area of interest (SHPP “Kriva Reka”, PCC HYDRO; Kriva Palanka Road Rehabilitation Project; Expressway A2, LOT 2: Sub-section Kriva Palanka). However, due to its limited coverage in the Country and its international conservational importance, this habitat type is sensitive and care should be taken to avoid any additional negative impacts during construction of the railway line.			

4.3.1.2 Urban, semi-modified and other natural habitats

In the area of interest, there are a number of other habitat types that although not listed in any of the Directives and Conventions as habitats of conservation importance, are still relevant for sustaining agrobiodiversity and the diversity of other common and widespread species that are not of national and/or international importance for conservation. These are largely secondary coppice forests and semi-modified habitats whose composition has been altered to support human livelihoods (largely food production and residence). These are:

<u>*Natural and semi-modified degraded coppice forests and woodlands*</u>

- G1.7C2 : [*Carpinus orientalis*] woods
- G5.61 : Deciduous scrub woodland

These are largely represented by forests of ass. *Querco-Ostryetum carpinifoliae* and spread in the lower parts of the Kriva Palanka region, taking up the lowest part of the forest belt. The deciduous scrub woodlands includes areas covered by herb vegetation surrounded by oak forest of different degradation stages. Shrubs are represented with species from the extremely degraded forest trees (*Quercus frainetto, Quercus pubescens, Quercus cerris, Fraxinus ornus*), small trees from the subordinate layers of forests (*Carpinus orientalis, Cornus mas, Crataegus monogyna, Pyrus pyraster, Pyrus amygdaliformis, Ulmus* sp.) or true shrub species (*Prunus spinosa, Paliurus spina shristi, Rosa spp., Colutea arborescens, Coronilla emeroides, Evonymus europaeus*) etc.

These habitat types offers niches for many animal species, especially for food and shelter.

Forest plantations

- G1.C3 : [*Robinia*] plantations
- G3.F12 : Native pine plantations
- G4.F : Mixed forestry plantations
- G5.2 : Small broadleaved deciduous anthropogenic woodlands

The forests planted by man in the studied corridor are mostly composed of black locust (*Robinia pseudoacacia*) and black pine (*Pinus nigra*). Pinus nigra is usually planted because of its capability to grow in dry and very unfavourable conditions. The same applies to *Robinia pseudoacacia* but it is planted to stabilise the soil, too. Very seldom Canadian poplar (*Populus X canadensis*) and highstemmed *Populus nigra* cultivars represent the broadleaf plantations in the railway corridor. Along the railway, certain small stands of *Ailanthus glandulosa* (invasive alien species) can be found. However, the latter can be included in the ruderal sites. This habitat types are interesting for both amphibians and reptiles. They usually inhabit it from the neighbouring habitats.

Meadows and grasslands

- E2.7 : Unmanaged mesic grassland
- E3.31 : Helleno-Moesian riverine and humid [*Trifolium*] meadows
- E5.1 : Anthropogenic herb stands
- I1.53 : Fallow un-inundated fields with annual and perennial weed communities

Includes meadows and forest clearings, but also ruderal vegetation and trampled grasslands of abandoned areas formerly used for agriculture. Most of the grasslands in the area in the railway corridor are of anthropogenic origin. Similar to the grasslands of natural origin, they occupy small areas.

Meadows support plant and animal species from the neighboring grassland and forest habitats. Their distinctive feature is that a range of different species of clover (*Trifolium* spp.) are dominant in the floristic structure, different from continental European meadows, where different grass species prevail (*Poaceae*). Mesic grasslands habitat type comprises grassland that are not currently actively mown or used for pasture, but in the past were used for grazing of horses and mowed for providing winter forage.

Anthropogenic herb stands are often presented by ruderal trampled grasslands dominated by weedy and ruderal plant species communities, often found next to transport corridors or borderline with fallow un-inundated fields with annual and perennial weed communities. Abandoning the arable land has been a rather common process in North Macedonia in recent decades. This habitat differs from ruderal habitat due to the development of several tree and bush species as a consequence of natural succession. In addition to the distinctive herb plants defining this habitat mentioned for the previous habitat type, the shrub species growing here (*Paliurus spina christi*, *Rosa* spp., *Prunus spinosa* etc.)

These habitat types offers niches for many animal species, especially for food and shelter.

Agricultural areas

- FB.4 : Vineyards
- G1.D : Fruit and nut tree orchards
- I1.3 : Arable land with unmixed crops grown by low-intensity agricultural methods
- G5.1 : Lines of trees

The agricultural land, in general, is characterised by smaller or larger areas planted with only a single plant species. Biomass production is huge compared to similar natural ecosystems but it is of low

biodiversity value. From nature conservation and preservation point of view, smaller plots of arable land are more appropriate than large fields and plantations.

The agro-ecosystems along the railway corridor are represented by individual parcels of different types of fields, acres, gardens and meadows. The biodiversity value of the agricultural land in this area is higher than normally due to the presence of natural or fruit trees at the boundaries of the fields, which is a very common occurrence (more than a half of the fields are of this type). Tree lines are scattered irregularly throughout the whole area of interest, often representing hedges between fields.

Orchards are presented with and often presented by several small individual parcels. The composition is very diverse and they are primarily of the mixed type. Apricots, apples, cherries, pears, plums, walnuts etc. are the most frequent and almost regularly mixed, often by domination of certain species. Fruit trees are usually planted in the villages and in their close proximity. The production is intended only for individual use. Therefore, orchards occur only sporadically in the studied corridor, and they are with inconsiderable dimensions.

Vineyards are not characteristic for the studied area and for this part of Macedonia; consequently they are represented by a small percentage. The proportion of small parcels and plantations is the same as for orchards and fields.

Fields and acres in the area of the projected railway line are mostly represented by wheat and corn culture. Industrial plants are cultivated very seldom. This habitat type does not have significant value for the biodiversity in the area.

Urban/suburban habitats

- J1.1 : Residential buildings of city and town centres
- J1.2 : Residential buildings of villages and urban peripheries/I1.22 : Small-scale market gardens and horticulture, including allotments
- J1.4 : Urban and suburban industrial and commercial sites still in active use
- J4.2 : Road networks
- J6.1 : Waste resulting from building construction or demolition

The area along the railway line is not very densely populated but the population is relatively regularly dispersed. Only one urban centre – Kriva Palanka is situated partly in the railway corridor. However, its urban characteristics are not typical and it has also rural characteristics on a significant part of the town's surface. The dispersed type of village settlements in north-eastern Macedonia causes distribution of very sparse small groups of houses over large areas, which are then named a village. The presence of isolated houses is also common. These parts are hardly urbanised, they are enclosed by fields, vineyards, orchards, meadows, natural vegetation and individual trees.

The primary feature of urbanised areas as a habitat type is the presence of allochthonous plant species, essentially decorative trees and shrubs, but also fruit trees and vegetable plants. It is also significant that many plant and animal species are strictly adapted to urban conditions such as ruderal and weed plants, specific bird and mammal species etc.

4.3.2 Priority species and their habitats

The aim here is to assess if any priority biodiversity features such as vulnerable species are present in the area of interest and whether the area of interest supports suitable habitats that are critical to the ongoing survival/conservation status of these species. Please note that the proiority species and their habitats are being assessed here in the absence of mitigation. For more information please refer to Section 5 for information on the Supplementary Biodiversity Impact Assessment, and Section 6 for Mitigation and Monitoring.

4.3.2.1 Vulnerable, critically endangered and/or endangered species and their habitats

Based on the findings of the ESIA 2012 and 2017 baseline surveys including desk study and the the supplementary biodiversity field survey carried as part of this study, a number of internationally important species for conservation, were recorded (Table 9). It is also worth noting that as EU Annex IV species can now trigger Critical Habitat, the presence of a species group, such as bats, all trigger CH as all European bat species are Annex IV species. As a result of this, CH is a lot more widespread, than under the previous EBRD PR6 Guidance. Therefore, because of the forest habitats present in the project's AoI, which will be inhabited by bat species, CH can not be completely avoided. What therefore becomes more important with ubiquitous Annex IV species, is the implementation of the mitigation hierarchy, with the aim that there will be no negative residual impacts. Management actions and mitigation measures to ensure no net loss/net gain of both PBF and CH is outlined in section 5 and 6 of this report and further elaborated in detail in the Biodiversity Management Plan, prepared as a standalone document.

Overview of species that qualify as PBF/CH are given in Table 9.

Table 9 Species that qualify as PBF/CH in accordance with the EBRD PR6 requirements.

Species group/Species	Bern/Bonn Convention appendices	Habitat Directive Annexes/ Bird Directive	The IUCN Red List	National Red List / Law on Nature Protection	PBF	CH
MAMMALS						
Brown bear - *Ursus arctos*	II	II/IV	LC	VU/strictly protected	Literature data, not present in the area of interest	
Wolf - *Canis lupus*	II	II/IV	LC	NT		CH
Presence confirmed in the area of interest. In North Macedonia, this is common and widespread species, listed as pest game species according the Law on Hunting of North Macedonia. Wolves are highly adaptable and inhabit a variety of habitats, including forests, shrublands and grasslands with higher preference of forested areas with occasional sallies. Traces of wolf were noted on the adge of mesophilous broadleave forest patches at Uzem and in the transitional woodland-scrubland near Konopnica and Krklja (Zhidilovski Dol). However, with consideration to the IUCN National Red List distribution data it can be estimated that the population in the area of interest is insignificant compared to national level. **Nonetheless, care should be taken to avoid/minimise any negative impacts on this species, through applaying appropriate mitigation measures and management actions to offset habitat loss.**						
Otter - *Lutra lutra*	II	II/IV	NT	VU/ strictly protected		CH
Presence confirmed in the area of interest. Considered as species of particular conservation concern and it is strictly protected under the national legislation. Population size for entire N. Macedonia is estimated to be 350-400 individuals. In the area of interest, signs of otter presence were found on several locations along Kriva Reka and Kiselichka Reka. **No data on otter population in the project area exist, but with consideration to the IUCN National Red List distribution data it can be estimated that the population in the area of interest is insignificant compared to national level. Otters are strongly dependent on riparian vegetation and availability of denning sites, such as holes in the riverbanks or cavities under trees, rocks etc. Most otter activity is found in a narrow strip along the water's edge, but they may be found up to 1 km away from water.** **The otter is a solitary and highly territorial species and their territories can stretch for several km depending on the prey availability. Otter diet is diverse (small mammals, birds, amphibians, crustaceans, snails, snakes and insects) but otters are largely reliant on fish (about 80%).** **Spraints and footprints of otters were found in the riparian areas of Kriva Reka (area of Uzem and Janchevci) and Kiselichka Reka; no otter holts were recorded.**						

Species group/Species	Bern/Bonn Convention appendices	Habitat Directive Annexes/ Bird Directive	The IUCN Red List	National Red List / Law on Nature Protection	PBF	CH
Nonetheless, care should be taken to avoid/minimise any negative impacts on this species, through applaying appropriate mitigation measures and management actions to offset habitat loss.						
European wildcat – *Felis sylvestris*	II	IV	LC	N/A/ strictly protected		CH
Strictly protected under the national legislation. Due to bad tracking conditions, presence of wild cat was not confirmed during the 2022 field surveys, although it is common species in the area registered on many locations during the period 2014-2022. **Previous findings of the European wildcat in the project area are associated with the transitional woodland-scrubland and patches of termophilous woodlands in the area of T'lmince and the mesophilous broadleave woodlands and woodland-scrubland near Kostur. The European wildcat is largely nocturnal and solitary, except during the breeding period and when females have young. It primarily preys on small mammals such as rabbits and rodents.** **No data on European wildcat population in the project area exist, but it can be estimated that the population in the area of interest is insignificant compared to national level.** **Nonetheless, care should be taken to avoid/minimise any negative impacts on this species, through applaying appropriate mitigation measures and management actions to offset habitat loss.**						
BATS						
Common bent-wing bat - *Miniopterus schreibersii*	II	II/IV	LC	N/A		CH
Greater horseshoe bat - *Rhinolophus ferrumequinum*	II	II/IV	LC	N/A		CH
Lesser horseshoe bat - *Rhinolophus hipposideros*	II	II/IV	LC	N/A		CH
The presence of *Miniopterus schreibersii* was not reported in the previous ESIAs studies and its presence was first noted during the supplementary field surveys undertaken as part of this project. There are no data on population sizes of these species on local or national level, but it is considered to be widespread in suitable habitat within southern Europe and as far as the Arabian peninsular. This species favors hardwood forest-rich habitats and mainly roosts in colonies in karst caves, mines and cellars with other cave-dwelling species. **The Greater Horseshoe Bat (*Rhinolophus ferrumequinum*) is also considered to be common species in N. Macedonia. It forages over pastures, deciduous woodland and shrubland.** **During the field surveys, one individual of each species was sighted in an unused artificial tunnel (tunnels already built for Section 2 of the railway line Beljakovce to T'lminci) near v. Psacha-Gradishte (before T'lminci), but which are not yet in use. These tunnels are considered most likely to be used as a temporary shelter. No significant roosting or hibernation sites were noted during the surveys.** **The Lesser Horseshoe Bat (*Rhinolophus hipposideros*) is also a common species found throughout the country. It forages along the edges of broadleaf deciduous woodland, riparian vegetation and shrubland. The presence of the species was confirmed by presence of accumulated excraments in an unused tunnel near Deve Bair.** **Due to the much larger availability of less disturbed and more natural habitats outside of the area of interest, the area is not critical to maintain the conservation status of these species. Nonetheless, care should be taken to avoid/minimise any negative impacts on these species, through applaying appropriate mitigation measures and management actions to offset habitat loss.**						
Soprano pipistrelle – *Pipistrellus pygmaeus*	II	II/IV	LC	N/A		CH

Species group/Species	Bern/Bonn Convention appendices	Habitat Directive Annexes/ Bird Directive	The IUCN Red List	National Red List / Law on Nature Protection	PBF	CH
Not reported in the previous ESIAs studies, and its presence was first noted during the supplementary field surveys undertaken as part of this project. There are no data on population sizes of these species on local or national level. **During the field surveys, this species was recorded with echolocation, in the vicinity of the artificaial rock cavities in the gorge of Kiselichka RekaNo roosting sites were observed. It prefers forests well preserved with large trunks, and it forages mainly close to riparian forests and waterbodies, as well as in villages and city parks. Due to the much larger availability of less disturbed and more natural habitats outside of the area of interest, the area is not critical to maintain the conservation status of this species. Nonetheless, care should be taken to avoid/minimise any negative impacts on this species, through applaying appropriate mitigation measures and management actions to offset habitat loss.**						
Greater mouse-eared bat – *Myotis myotis*	II	II/IV	LC	N/A		CH
Lesser mouse-eared bat - *Myotis blythii*	II	II/IV	LC	N/A		CH
Not confirmed during the 2022 field surveys. Record of this species is provided as part of the "Rapid Biodiversity Assessment Report for the Kriva Palanka Road Rehabilitation Project, 2018" in the vicinity of Krklja. However, the presence was confirmed only once using ultrasound detection, but the identification on species level *Myotis myotis/blythii* was not possible based on the echolocation calls as it is not possible to differentiate these two species with certainty. **Also, it should be taken in consideration that the site is now under disturbance due to ongoing construction activities for the HPP "Kriva Reka-PCC Hydro" which might have affected species presence. There are no data on population sizes of these species on local or national level.** **Nonetheless, care should be taken to avoid/minimise any negative impacts on these species, through applaying appropriate mitigation measures and management actions to offset habitat loss.**						
Common noctule - *Nyctalus noctula*	II	IV	LC	N/A		CH
Recorded at the forest edge near Drenje; no roosting sites were noted. There are no data on population sizes of these species on local or national level. Due to the much larger availability of less disturbed and more natural habitats outside of the area of interest, the area is not critical to maintain the conservation status of this species. **Nonetheless, care should be taken to avoid/minimise any negative impacts on this species, through applaying appropriate mitigation measures and management actions to offset habitat loss.**						
Kuhl's pipistrelle - *Pipistrellus kuhlii*	II	IV	LC	N/A		CH
Nathusius' pipistrelle - *Pipistrellus nathusii*	II	IV	LC	N/A		CH
The common pipistrelle– *Pipistrellus pipistrellus*	II	IV	LC	N/A		CH
Savi's pipistrelle – *Hypsugo savii*	II	IV	LC	N/A		CH
The serotine bat – *Eptesicus serotinus*	II	IV	LC	N/A		CH
The whiskered bat – *Myotis mystacinus*	II	IV	LC	N/A		CH
The species listed above are those which were not recorded during the 2022 field surveys. However, record of these species is provided as part of the "Rapid Biodiversity Assessment Report for the Kriva Palanka						

Species group/Species	Bern/Bonn Convention appendices	Habitat Directive Annexes/ Bird Directive	The IUCN Red List	National Red List / Law on Nature Protection	PBF	CH
Road Rehabilitation Project, 2018". The presence of *Pipistellus kuhlii/nathusii* was confirmed using ultrasound detection, but the identification on species level was not possible based on the echolocation calls. **All species were recorded in the area between Drenje and Kiselichka Reka gorge. Due to the much larger availability of less disturbed and more natural habitats outside of the area of interest, the area is not critical to maintain the conservation status of this species.** **Nonetheless, care should be taken to avoid/minimise any negative impacts on these species, through applaying appropriate mitigation measures and management actions to offset habitat loss.**						
AVIFAUNA						
Peregrine falcon – *Falco peregrinus*	II	I	LC	N/A protected	PBF	
The Peregrine Falcon *Falco peregrinus* has a rather favourable status of its global population. It's identified as Least Concern (LC) species in the 2021 IUCN Red List of Birds assessment and marks and increasing population trend. The international valorisation of the species also favours a strong protection status as it is and Annex I species under the Birds Directive. On a national level, the species is listed as strictly protected species under the Law on Nature Protection (67/2004) and non-hunting species under the Law on Hunting (20/96). The Peregrine falcon was not recorded in the area of interest during the supplementary field assessment done as part of none of the surveys related to this or any other infrastructural projects implemented in the area. The literature review and the review of the datasets from the surveys conducted for the purposes of the Second European Breeding Bird Atlas (in the period 2014-2018) also did not uncover any sightings or confirmed breeding of the Peregrine Falcons in the project area. However, there is a positive record of Peregrine falcon flyover observation just before the starting point of Section 3 of the railway, in close surrounding of Chankinci, just before T'lminci (Nakev, S. 2020) indicating that it occasionally might use the area to forage and feed. The closest confirmed breeding and sighting of Peregrine Falcon is in the IBA River Pcinja-river Petrohsnica-river Kriva Reka (located at about 10 km air distance west from the area of interest). While in the area of interest there is no observation of breeding sites of Peregrine falcon, it may occasionally visit the area for feeding and foraging as its home range approximates 20-30 km^2 and care should be taken to avoid/minimise any negative impacts on these species, through applaying appropriate mitigation measures and management actions to offset habitat loss. **Hence, pre-construction checks for species presence should be performed and should the Peregrine falcon be observed in the area of interest, then adequate mitigation and management actions, as specified in the SBA and detailed in the BMP apply.**						
The common kestrel - *Falco tinnunculus*	II	N/A	LC	N/A protected	PBF	
Common buzzard – *Buteo buteo*	II	N/A	LC	N/A protected	PBF	
Black stork – *Ciconia nigra*	II	I	LC	N/A	PBF	
White stork – *Ciconia ciconia*	II	I	LC	N/A	PBF	
Black woodpecker – *Dryocopus martius*	II	I	LC	N/A	PBF	
Syrian woodpecker - *Dendrocopos syriacus*	II	I	LC	N/A	PBF	
Wood lark – *Lullula arborea*	III	I	LC	N/A	PBF	
Red-backed shrike – *Lanius collurio*	II	I	LC	N/A	PBF	

Species group/Species	Bern/Bonn Convention appendices	Habitat Directive Annexes/ Bird Directive	The IUCN Red List	National Red List / Law on Nature Protection	PBF	CH
Species recorded during the 2022 field surveys that qualify as a PBF. **The Black Stork *Ciconia nigra* was first noted during the supplementary field surveys undertaken as part of this project. It is listed as least concern (LC) species in the 2021 IUCN Red List of Birds assessment and marks and increasing population trend. The international valorisation of the species also favours a strong protection status as it is and Annex I species under the Birds Directive. It is protected by the Agreement on the Conservation of African-Eurasian Migratory Waterbirds (AEWA) and the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES).On a national level, the species is listed as strictly protected species under the Law on Nature Protection (67/2004) and non-hunting species under the Law on Hunting (20/96).The occurrence of the Back Stork in the area of interest is an important observation as it breeds in the IBA River Pcinja-river Petrohsnica-river Kriva Reka (no breeding areas were identified in the area of interest). However, it is an occasional visitor as it seems uses the upper streams of Kriva Reka to forage and to feed.** **The Common kestrel and the Common buzzard, along with the Peregrine falcon are strictly protected under the Law on Nature protection and permanently protected under the Law on hunting, primarily to secure protection from bird/wildlife collectors.** **All other species are widespread and hence, the area of interest is not critical to maintain the conservation status of this species. Nonetheless, care should be taken to avoid/minimise any negative impacts on these species, through applaying appropriate mitigation measures and management actions to offset habitat loss.**						
European nightjar – *Caprimulgus europaeus*	II	I	LC	N/A	PBF	
Common kingfisher – *Alcedo atthis*	II	I	LC	N/A	PBF	
Grey-headed woodpecker – *Picus canus*	II	I	LC	N/A	PBF	
Middle spotted woodpecker - *Dendrocopos medius*	II	I	LC	N/A	PBF	
Calandra lark – *Melanocorypha calandra*	II	I	LC	N/A	PBF	
Greater short-toed lark - *Calandrella brachydactyla*	II	I	LC	N/A	PBF	
Tawny pipit - *Anthus campestris*	II	I	LC	N/A	PBF	
Collared flycatcher - *Ficedula albicollis*	II	I	LC	N/A	PBF	
Lesser grey shrike - *Lanius minor*	II	I	LC	N/A	PBF	
Barred warbler - *Curruca (Sylvia) nisoria*	II	I	LC	N/A	PBF	
Semicollared flycatcher - *Ficedula semitorquata*	II	I	LC	N/A	PBF	
Red-backed shrike -	II	I	LC	N/A	PBF	

Species group/Species	Bern/Bonn Convention appendices	Habitat Directive Annexes/ Bird Directive	The IUCN Red List	National Red List / Law on Nature Protection	PBF	CH
Lanius collurio						
Woodlark - ***Lullula arborea***	III	I	LC	N/A	PBF	
European honey buzzard - ***Pernis apivorus***	III	I	LC	N/A	PBF	
Species not recorded during the 2022 field surveys that qualify as a PBF. **However, species presence was confirmed in the previous ESISs studies. Although all these species are widespread in the Country and the area of interest is not critical to maintain the conservation status of this species, care should be taken to avoid/minimise any negative impacts on these species, through applaying appropriate mitigation measures and management actions to offset habitat loss.**						
AMPHIBIANS and REPTILES						
REPTILES						
Spur-thighed tortoise - ***Testudo graeca***	II	II/IV	NT	VU/protected		CH – likely absent in the area of interest
The EAAA is seemingly not regularly used by the Spur-thighed tortoise, despite the IUCN National Red List distribution data[25] and literature indications which indicates that this species has been miss-identified. **No observation of Spur-thighed tortoise in the area of interest. The EAAA is on the edge of this species' distribution range and as such, does not hold any significant proportions of critical habitats for the Spur-thighed tortoise.**						
Hermann's tortoise - ***Testudo hermanii***	II	II/IV	VU	VU/protected		CH
The field surveys performed in the EAAA revealed only two individuals, around T'lmici and near village Kostur. This is a very low number, considering the conspicuous nature of this species and the suitable time period of the survey. The Hermann's tortoises prefers shrubs, or openings in thermophilic forests, in North Macedonia most often oak or degraded forests of predominantly Jerusalem thorn (*Paliurus spina-christi*) and/or False acacia (*Robinia pseudoacacia*). It prefers habitats with preserved mosaic structures with both open patches and dense bush where it can hide during the warmest parts of hot summer days. It can sometimes venture into arable land, particularly vineyards and sometimes orchards, or even urban parks. **In North Macedonia, this is common and widespread species. Hence, the habitats within the area of interest are not considered to be critical to maintain the conservation status of this species. However, with consideration of the rare sightings of the Hermann's tortoise in the area of interest care should be taken to avoid/minimise any negative impacts on this species, through applaying appropriate mitigation measures and management actions to offset habitat loss.**						
Dahl's whip snake - ***Platyceps najadum***	II	IV	LC	NT/protected		CH
This species is very common in the Country (updated distribution data available as part of the National IUCN Red List assessment of amphibians and reptiles); However, the species was not noted in the previous ESIAs and its presence was first noted during the supplementary field surveys undertaken as part of this project. Only one individual was noted during the field surveys, noted basking in the eroded hillside on the edge of Pine plantation woodland below Jankovo, close to Kriva Palanka. This species is associated with dry or xerophytic landscapes. It is found in meadows, but also at the slopes of foothills and mountains covered with bush vegetation and woods, in juniper open woodlands, oak groves and forest edges. It often prefers eroded hillsides, rocky outcrops and boulder formations. Mating occurs in April or May. Due to the						

[25] http://redlist.moepp.gov.mk/

Species group/Species	Bern/Bonn Convention appendices	Habitat Directive Annexes/ Bird Directive	The IUCN Red List	National Red List / Law on Nature Protection	PBF	CH
widespread nature of this species the habitats within the area of interest are not considered to be critical to maintain the conservation status of this species, despite being calssified as CH under PS6 guidance. Tehrefore care will be taken to avoid/minimise any negative impacts on this species.						
Common wall lizard - *Podarcis muralis*	II	IV	LC	LC/protected		CH
European green lizard - *Lacerta viridis*	II	IV	LC	LC/protected		CH
Aesculapian snake - *Zamenis longissimus*	II	IV	LC	LC/protected		CH
All recorded during the 2022 field survey. **The Common wall lizard can be found in a wide range of habitats such as rocky areas, scrubland, deciduous and coniferous woodland, orchards, vineyards, fields, stone walls, and on buildings. It is one of the most successful species in man-made habitats. Mating takes place between March and June.** **The European green lizard is a ubiquitous species in North Macedonia, present in many habitats and localities, and can be found in and around man-made habitat. Multiple sightings in the area of interest.** **The Aesculapian snake has a wide habitat preference, although it is generally found in dry, open woodlands (deciduous, mixed and coniferous), woodland edges, forested ravines, rocky outcrops, field edges, orchards, stone walls and old buildings. Mating occurs in April or May. Observations of these species were made in a scrubland next to the road near Stambolca and below bolder on a forest edge near village Kostur-Uzem.** **Due to the widespread nature of these species the habitats within the area of interest are not considered to be critical to maintain the conservation status of this species, despite being calssified as CH under PS6 guidance. However, care should be taken to avoid/minimise any negative impacts on this species, through applaying appropriate mitigation measures and management actions to offset habitat loss.**						
Erhard's wall lizard - *Podarcis erhardii*	III	IV	LC	LC		CH
Balkan wall lizard - *Podarcis tauricus*	II	IV	LC	NT		CH
Balkan green lizard - *Lacerta trilineata*	II	IV	LC	LC		CH
Smooth snake - *Coronella austriaca*	III	IV	LC	LC		CH
Caspian whipsnake - *Dolichophis caspius*	II	IV	LC	LC		CH
Dice snake - *Natrix tessellata*	II	IV	LC	NT		CH
Nose-horned viper - *Vypera ammodites*	II	IV	LC	LC		CH
Species not recorded during the 2022 field survey are lited in the table above. These species were identified from the previous ESIAs studies. According to the updated IUCN National Red List distribution maps, all species except *Podarcis tauricus* are widespread in the Country. *Podarcis tauricus* is also estimated as widespread, hence, the lack of concrete distribution data is considered to be due to the challenge of noticing and identifying this species on the field. Regardless of these species' wide distribution, care should be taken to avoid/minimise any negative impacts through applaying appropriate mitigation measures and management actions to offset habitat loss.						
AMPHIBIANS						

Species group/Species	Bern/Bonn Convention appendices	Habitat Directive Annexes/ Bird Directive	The IUCN Red List	National Red List / Law on Nature Protection	PBF	CH
Marsh frog - *Pelophylax ridibundus*	II	II	LC	LC	PBF	
Yellow-bellied toad - *Bombina variegata*	II	II/IV	LC	LC		CH
Greek stream frog - *Rana graeca*	III	IV	LC	NT		CH
Agile frog - *Rana dalmatina*	II	IV	LC	NT		CH
European green toad - *Bufotes viridis*	II	II/IV	LC	LC		CH
European tree frog - *Hyla arborea*	II	IV	LC	NT		CH
Common and widespread amphibians in the Country. Regardless of these species' wide distribution, care should be taken to avoid/minimise any negative impacts through applaying appropriate mitigation measures and management actions to offset habitat loss.						
INSECTS						
Great capricorn beetle - *Cerambyx cerdo*	N/A	II/IV	VU	N/A		CH
Longhorn beetle - *Morimus funereus*	II	II	VU	N/A	PBF	
The longhorn beetle *Morimus funereus* and the great capricorn beetle *Cerambyx cerdo* were noted in the previous ESIAs studies as part of the species of insects found in the Mesophilous Oak Forests and Submontane beech forests. However, their presence was not confirmed by the research conducted in the spring of 2022. *Morimus funereus* is distributed throughout the country but no population estimation has been attempted for the species. The research in the Bregalnica watershed (2015-2021) provided significant number of new records of this species (Hristovski & Cvetkovska-Gjorgievska 2021). The national distribution of this species is provided by Hristovski & Cvetkovska-Gjorgievska (2016) and according to this map, there are no records of this species in the area of interest.						
Clouded apolo - *Parnassius mnemosyne*	II	II/IV	NT	N/A		CH
In compliance with the criteria, the Clouded apolo *Parnassius mnemosyne* meets the criteria for CH (Annex II and IV of HD, but also significant biodiversity features identified by a broad set of stakeholders / governments), however it should be taken with a precaution as it is common and widespread species in meadows and forest clearing throughout North Macedonia. During the field work a viable population of *Parnassius mnemosyne* was recorded in the area between the village Uzem and end of the alignment. The populations were recorded in the habitat of lowland hay meadows [EUNIS: E2.238 Southwestern Moesian submontane hay meadows; HD: 6510 Lowland hay meadows (*Alopecurus pratensis, Sanguisorba officinalis*)].						
Southern festoon - *Zerynthia polyxena*	II	II/IV	LC	N/A		CH
Large blue - *Maculinea (Phenagris) arion*	II	II/IV	EN	N/A		CH
Large copper - *Lycaena dispar*	I/II	II/IV	LC	N/A		CH
These butterflies were not recorded during the 2022 field survey. However, their presence was noted in the previous ESIAs studies. These butterflies are also commonly found in meadows and forest clearing.						

Species group/Species	Bern/Bonn Convention appendices	Habitat Directive Annexes/ Bird Directive	The IUCN Red List	National Red List / Law on Nature Protection	PBF	CH
However, due to their international importance for conservation, care should be taken to avoid/minimise any negative impacts through applaying appropriate mitigation measures and management actions to offset habitat loss.						

None of the noted, urban and semi-modified habitats were assessed as critical for supporting population of species important for conservation.

Note: Reference for species presence in the area of interest is provided during the supplementary biodiversity surveys carried as part of the supplementray biodiversity survey, with added consideration of available reviewed assessment, valorization and monitoring reports carried in the frame of infrastructural and conservation project activities in the area and taking into account expert's personal field data i.e. available field data records on species and habitats collected as part of other survey activities in the area of interest.

The only species that is listed in the table and is not present in the area is the Brown bear - *Ursus arctos*, noted in the reviewed ESIAs with reference provided from literature data. The brown bear is not present in the area of interest. With consideration to the IUCN National Red list of amphibians and reptiles, 2021 the Spur thighead tortoise - *Testudo graeca* was included as a target species during the supplementary field surveys. However, its presence in the area of interest is not likely.

The presence breeding pairs of Peregrine falcon – *Falco peregrinus* have not been confirmed. However, there is a positive flyover observation of Peregrine falcon near the starting point of Section 3, before T'lminci it is likely that the Peregrine falcon occasionally uses the area for feeding and foraging. Hence, pre-construction checks for species presence should be performed and should the Peregrine falcon be observed in the area of interest, then adequate mitigation and management actions, as specified in the SBA and detailed in the BMP apply.

4.3.3 Endemic and/or restricted-range species and their habitats

The literature review and the field surveys did not result in identifying records for any species which can be described as endemic or range-restricted.

4.3.4 Migratory and congregatory species and their habitats

No areas of congregation were recorded and the area of interest is not considered to represent a major fly-way[26]. Generally, the area of interest is not recognised as vital for supporting bird diversity. No IBAs are identified in the area of interest. The closes IBA area in the broader region is IBA River Pcinja-river Petrohsnica-river Kriva Reka[27] (located at about 10 km air distance west from the area of interest). The IBA River Pcinja-river Petrohsnica-river Kriva Reka is designated for 17 bird species amongst which the Peregrine falcon and the Black stork are considered likely to occasionally use the area of interest for feeding and foraging. Both species are considered in the critical habitat assessment and adequate

[26] https://migrationatlas.org/?fbclid=IwAR0dlA6Vya8MEwBUK_CCVzGNzsZCdAAAVUMp8rTYYvSuuyCZw11oVFM2CLE

[27] Velevski, M. Hallmann B. Grubač B. Lisičanec T. Stoynov E. Lisičanec E. Avukatov V. Božič L. & Stumberger B. 2010. Important Bird Areas in Macedonia: Sites of Global and European Importance. Acrocephalus 31, no. 147:181-282.
Velevski, M. Grubač B. & Hallmann B. 2008. 2008. Distribution and estimation of the population size of the Black Stork Ciconia nigra in Macedonia. Ciconia 17:14-19.

monitoring and management actions to mitigate andy potential negative impacts are specified in the SBA and further detailed in the BMP apply.

No significant hibernation areas were noted for bat species. Geologically, the area is predominantly of siliceous rocks and rock formation so no significant cave systems favoured by roosting and hibernating bats were noted. As a result, the area of interest is not considered to contain critical habitat in respect of migratory or congregatory species.

4.3.5 Areas associated with key evolutionary processes

The area of interest is not considered to be associated with key evolutionary processes. The natural habitats which are present are largely modified by human activities and the area does not provide niche habitats for the development or evolution of range restricted/ unique species.

4.4 Summary

Due to the anthropological influences on the landscape in terms of both extensive management and use of natural resources (land conversion, coppicing and logging) and the degradation due to ongoing construction of infrastructural projects in the area of interest, a large portion of the natural habitats present in the area of interest and listed under the Annex I of the HD are assessed as not representative. However, in line with the updated EBRD PR6 requirement, a number of habitat types and species in the area of interest were found to qualify as PBF/CH and care will be taken to avoid/minimise any negative impacts through applaying appropriate mitigation measures and management actions to offset habitat loss. Furthermore, in line with the EBRD PR6 requirements, care should be taken to cease further fragmentation of any habitats identified as CH and restoration management actions are provided for all habitats identified as PBF/CH to insure no-net loss and where possible net gain. Overview of species and habitats that qualify as PBF/CH is provided in Table 10-11. Management actions and mitigation measures to ensure no net loss/net gain of both PBF and CH is outlined in section 5 and 6 of this report and further elaborated in detail in the Biodiversity Management Plan, prepared as a standalone document.

Table 10 Summary table of habitats assessed as PBF/CH

EUNIS reference	Habitat Directive reference	PBF	CH
G1.76 Balkano-Anatolian thermophilous [*Quercus*] forests - G1.762 Helleno-Moesian [*Quercus frainetto*] forests	**Annex I** 9280 *Quercus frainetto* woods	Yes	No
G1.7641 : Helleno-Moesian Quercus petraea forests; G1.761 : Helleno-Moesian Quercus cerris forests	**Annex I** 91M0 Pannonian-Balkanic turkey oak-sessile oak forest	Yes	No
G1.691 Southwestern Moesian Beech Forests	**Annex I** 91W0 Moesian Beech Forests	Yes	No
G1.11 Riverine [Salix] woodland - **G1.112 Mediterranean tall [*Salix*] galleries (G1.1121 Mediterranean white willow galleries)**	**Annex I - priority habitat type** 92A0* *Salix alba* and *Populus alba* galleries	No	Yes
F9.12 Lowland and collinear riverine [Salix] scrub - F9.123 Balkan riverine willow scrub **F9.3133 East Mediterranean tamarisk thickets**	**Annex I** 3230 Alpine rivers and their ligneous vegetation with *Myricaria germanica* and 3240 Alpine rivers and their ligneous vegetation with *Salix elaeagnos*	Yes	No
E2.238 Southwestern Moesian submontane hay meadows	**Annex I**	Yes	No

EUNIS reference	Habitat Directive reference	PBF	CH
	6510 Lowland hay meadows (*Alopecurus pratensis*, *Sanguisorba officinalis*)		
E1.33 East Mediterranean xeric grassland (E1.332 Heleno-Balkanic shrot grass and therophyte communities) **E1.A22 Helleno-Balkanic supra Mediterranean siliceous grasslands**	**Annex I - priority habitat type** 6220* Pseudo-steppe with grasses and annuals of the *Thero-Brachypodietea*	No	Yes
C2.31 Epipotamal streams **C2.22 Hiporhithral streams**	**Annex I** 3260 Water courses of plain to montane levels with the *Ranunculion fluitantis* and *Callitricho-Batrachion* vegetation	Yes	No
C2.5 Temporary running waters	**Annex I** 3290 Intermittently flowing Mediterranean rivers of the *Paspalo-Agrostidion*	Yes	No
C3.62 Unvegetated river gravel banks **C3.61 Unvegetated river sand banks**	**Annex I** 3270 Rivers with muddy banks with *Chenopodion rubri* p.p. and *Bidention* p.p. vegetation	Yes	No

Table 11 Summary table of species assessed as PBF/CH

Species group/Species	Bern/Bonn Convention appendices	Habitat Directive Annexes/ Bird Directive	The IUCN Red List	National Red List / Law on Nature Protection	PBF	CH
MAMMALS						
Wolf - *Canis lupus*	II	II/IV	LC	NT		CH
Otter - *Lutra lutra*	II	II/IV	NT	VU/ strictly protected		CH
European wildcat – *Felis sylvestris*	II	IV	LC	N/A/ strictly protected		CH
BATS						
Common bent-wing bat - *Miniopterus schreibersii*	II	II/IV	LC	N/A		CH
Greater horseshoe bat - *Rhinolophus ferrumequinum*	II	II/IV	LC	N/A		CH
Lesser horseshoe bat - *Rhinolophus hipposideros*	II	II/IV	LC	N/A		CH
Soprano pipistrelle – *Pipistrellus pygmaeus*	II	II/IV	LC	N/A		CH
Greater mouse-eared bat – *Myotis myotis*	II	II/IV	LC	N/A		CH
Lesser mouse-eared bat - *Myotis blythii*	II	II/IV	LC	N/A		CH

Species group/Species	Bern/Bonn Convention appendices	Habitat Directive Annexes/ Bird Directive	The IUCN Red List	National Red List / Law on Nature Protection	PBF	CH
Common noctule - *Nyctalus noctula*	II	IV	LC	N/A		CH
Kuhl's pipistrelle - *Pipistrellus kuhlii*	II	IV	LC	N/A		CH
Nathusius' pipistrelle - *Pipistrellus nathusii*	II	IV	LC	N/A		CH
The common pipistrelle– *Pipistrellus pipistrellus*	II	IV	LC	N/A		CH
Savi's pipistrelle – *Hypsugo savii*	II	IV	LC	N/A		CH
The serotine bat – *Eptesicus serotinus*	II	IV	LC	N/A		CH
The whiskered bat – *Myotis mystacinus*	II	IV	LC	N/A		CH
AVIFAUNA						
Peregrine falcon – *Falco peregrinus*	II	I	LC	N/A protected	PBF	
The common kestrel - *Falco tinnunculus*	II	N/A	LC	N/A protected	PBF	
Common buzzard – *Buteo buteo*	II	N/A	LC	N/A protected	PBF	
Black stork – *Ciconia nigra*	II	I	LC	N/A	PBF	
White stork – *Ciconia ciconia*	II	I	LC	N/A	PBF	
Black woodpecker – *Dryocopus martius*	II	I	LC	N/A	PBF	
Syrian woodpecker - *Dendrocopos syriacus*	II	I	LC	N/A	PBF	
Wood lark – *Lullula arborea*	III	I	LC	N/A	PBF	
Red-backed shrike – *Lanius collurio*	II	I	LC	N/A	PBF	
European nightjar – *Caprimulgus europaeus*	II	I	LC	N/A	PBF	
Common kingfisher – *Alcedo atthis*	II	I	LC	N/A	PBF	
Grey-headed woodpecker – *Picus canus*	II	I	LC	N/A	PBF	
Middle spotted woodpecker - *Dendrocopos medius*	II	I	LC	N/A	PBF	

Species group/Species	Bern/Bonn Convention appendices	Habitat Directive Annexes/ Bird Directive	The IUCN Red List	National Red List / Law on Nature Protection	PBF	CH
Calandra lark – *Melanocorypha calandra*	II	I	LC	N/A	PBF	
Greater short-toed lark - *Calandrella brachydactyla*	II	I	LC	N/A	PBF	
Tawny pipit - *Anthus campestris*	II	I	LC	N/A	PBF	
Collared flycatcher - *Ficedula albicollis*	II	I	LC	N/A	PBF	
Lesser grey shrike - *Lanius minor*	II	I	LC	N/A	PBF	
Barred warbler - *Curruca (Sylvia) nisoria*	II	I	LC	N/A	PBF	
Semicollared flycatcher - *Ficedula semitorquata*	II	I	LC	N/A	PBF	
Red-backed shrike - *Lanius collurio*	II	I	LC	N/A	PBF	
Woodlark - *Lullula arborea*	III	I	LC	N/A	PBF	
European honey buzzard - *Pernis apivorus*	III	I	LC	N/A	PBF	
AMPHIBIANS and REPTILES						
REPTILES						
Spur-thighed tortoise - *Testudo graeca*	II	II/IV	NT	VU		CH
Hermann's tortoise - *Testudo hermanii*	II	II/IV	VU	VU		CH
Dahl's whip snake - *Platyceps najadum*	II	IV	LC	NT		CH
Common wall lizard - *Podarcis muralis*	II	IV	LC	LC		CH
European green lizard - *Lacerta viridis*	II	IV	LC	LC		CH
Aesculapian snake - *Zamenis longissimus*	II	IV	LC	LC		CH
Erhard's wall lizard - *Podarcis erhardii*	III	IV	LC	LC		CH
Balkan wall lizard - *Podarcis taurica*	II	IV	LC	NT		CH
Balkan green lizard - *Lacerta trilineata*	II	IV	LC	LC		CH
Smooth snake - *Coronella austriaca*	III	IV	LC	LC		CH

Species group/Species	Bern/Bonn Convention appendices	Habitat Directive Annexes/ Bird Directive	The IUCN Red List	National Red List / Law on Nature Protection	PBF	CH
Caspian whipsnake - *Dolichophis caspius*	II	IV	LC	LC		CH
Dice snake - *Natrix tessellata*	II	IV	LC	NT		CH
Nose-horned viper - *Vipera ammodytes*	II	IV	LC	LC		CH
AMPHIBIANS						
Marsh frog - *Pelophylax ridibundus*	II	II	LC	LC	PBF	
Yellow-bellied toad - *Bombina variegata*	II	II/IV	LC	LC		CH
Greek stream frog - *Rana graeca*	III	IV	LC	NT		CH
Agile frog - *Rana dalmatina*	II	IV	LC	NT		CH
European green toad - *Bufotes viridis*	II	II/IV	LC	LC		CH
European tree frog - *Hyla arborea*	II	IV	LC	NT		CH
INSECTS						
Great capricorn beetle - *Cerambyx cerdo*	N/A	II/IV	VU	N/A		CH
Longhorn beetle - *Morimus funereus*	II	II	VU	N/A	PBF	
Clouded apolo - *Parnassius mnemosyne*	II	II/IV	NT	N/A		CH
Southern festoon - *Zerynthia polyxena*	II	II/IV	LC	N/A		CH
Large blue - *Maculinea (Phenagris) arion*	II	II/IV	EN	N/A		CH
Large copper - *Lycaena dispar*	I/II	II/IV	LC	N/A		CH

The PR6 compliance review is detailed in Table 12.

Table 12 Summary PR6 compliance overview

PR6 Compliance criteria	Supporting information	Outcome	Further actions
No viable alternative / no technically or economically	See Addendum, Project description: Details on consideration of Detailed description of alternatives - Alternative A: Reference Alignment and Alternative B: Alternative	Compliant	Appropriate mitigation measures and management actions, should reduce any

PR6 Compliance criteria	Supporting information	Outcome	Further actions
feasible alternative.	Alignment and selection criteria available in ESIA 2012, 2017. All criteria considered, the Reference alignment was assessed as preferred regarding Sections 1 and 2 (Kumanovo to Kriva Palanka (T'lminci). Considering criteria and aspects of infrastructure works (engineering risk, construction cost, operation cost and preliminary public consultation) the Reference Alignment was also assessed as preferable for Section 3. However, the Alternative alignment on Section 3 was more suitable when operation/transit time, environmental and social criteria were considered. With consideration to Environmental criteria both the Reference and the Alternative alignment were assessed to have same impact with reference to soil, water, climate, landscape and air. Still, being approximately 3.5 km shorter, the Alternative alignment was assessed to affect lesser area of natural habitats and was hence preferred when impact on biodiversity was considered. However, given the changes in the area impact the Reference alignment benefits over the Alternative alignment because: □ the selected alignment (Refernece Alignment) is routed close to the under-construction road and hence, fragmentation is confined to a corridor which today is already degraded at places and therefore impacts associated with habitat loss, fragmentation and 'new' disturbance impacts at these sections are minimised. □ Lower impact on 6220* Pseudo-steppe with grasses and annuals of the *Thero-Brachypodietea* (CH) □ Lower impact on 91M0 Pannonian-Balkanic turkey oak-sessile oak forest and 91W0 Moesian Beech Forests (PBF) □ the Reference Alignment is predominantly routed through tunnels and bridges (9 km of tunnels and 4.4 km of bridges and viaducts) and hence negative impacts on sensitive habitats are largely avoided (particularly during operation).		likely negative effects during construction.
Stakeholders are consulted in accordance with PR10.	In coordination with the social baseline analysis, the perceived effect of the project implementation by various stakeholders on local level (gatherers of plants, mashrooms and fruits, fisherman, tourist facilities holders, locals etc.) was assessed as part of the ecosystem service assessment (see Results, section 3.2.8). Consultation with critical stakeholders (biodiversity specialists, protected areas,	Compliant	No further actions

PR6 Compliance criteria	Supporting information	Outcome	Further actions
	MoEPP) was also carried in order to identify any potential gaps with reference to species and habitat findings, identified impacts and corresponding mitigation and management actions elaborated in the SBA and BMP.		
The project is permitted under applicable environmental laws, recognising the priority biodiversity features.	Permitted. See ESIA 2012,2017. Also, see section Project status in Addendum.	Compliant	No further actions
The project does not lead to Measurable adverse impacts on those biodiversity features identified as PBF or those for which the Critical Habitat was identified (by this assessment).	Full impact assessment provided in Section 4, Table 8 and Table 9	Compliant assuming appropriate mitigation as per Section 6	Species-specific actions within a Project Biodiversity Management Plan (BMP).
The project is designed to deliver net gains for Critical Habitat impacted by the project/at least no net loss for Priority Biodiversity Features.		Compliant assuming appropriate management actions to acheave NNL/NG as per Section 6, Table 18	Specific actions outlined within the Biodiversity Management Plan (BMP).
The project is not anticipated to lead to a net reduction in the population of any endangered or critically endangered species.	None expected	Compliant	No further actions
The project is not expected to have an adverse effect on protected areas	The alignment does not cross any designated/protected areas and EMERALD sites. The railway alignment intersects with one area proposed for protection, “Kiselichka Reka gorge” as Nature park (IUCN cat. IV) and two proposed Emerald sites with no management plans in place, details provided in Section 5.5. and Section 7, Appendix 1 – Appropriate assessment. With appropriate mitigation measures and management actions in place, it is assessed that the project will not have an adverse effect	Compliant	Specific actions outlined as part of management actions for habitats and species within the Biodiversity Management Plan (BMP).

PR6 Compliance criteria	Supporting information	Outcome	Further actions
	on the proposed protected area and the Emerald sites and any likely impacts will not have a significant effect on population of species and habitats in the area.		
Appropriately designed, long-term biodiversity monitoring and management plan and programme will be produced.	Along with Environmental and Social Management Plan (ESMP) a Biodiversity Management Plan is produced in line with PR6	Compliant	BMP
The overall benefits outweigh the project impacts on biodiversity.	The Project is part of an overall strategy to close gaps, remove bottlenecks and technical barriers, as well as to strengthen social,economic and territorial cohesion along Corridor VIII. See Project description in Addendum, further details provided in ESIA 2012, 2017	Compliant	No further actions

5 SUPPLEMENTARY BIODIVERSITY IMPACT ASSESSMENT

5.1 Introduction

The habitats and species brought forward for further assessment, are those which were found or identified as likely being present during the 2022 survey period and are of sufficient conservation value (IUCN + national red list VU, CR, EN; Annex I, II or IV of the EU Habitats Directive; Birds Directive/Bern Convention and/or are Nationally or regionally listed as EN or CR species) and hence qualify as CH/PBF.

In this report, a significant impact, in ecological terms, is defined as an impact (whether negative or positive) on the integrity of a defined site or ecosystem[28] and/or the conservation status[29] of habitats or species within a given geographical area.

The approach adopted here aims to determine an impact to be significant or not on the basis of the ecological significance of an impact taking into consideration the value of the feature in question. This impact assessment is also based on impacts in the absence of mitigation. Only embedded mitigation, or mitigation by design (avoidance) has been taken in to account were relevant. For the purposes of this report, impacts have been characterised simply as *significant*, or *non-significant*.

The project's mitigation strategy is set out in Section 6. The residual effects are summarised at the end of Section 7 and take into account the mitigation, compensation and enhancements which have been proposed.

5.2 Habitats assessment

5.2.1 Construction

The following natural/semi-natural habitat types were identified as present in the area of interest: E1: Dry grasslands; E4: Alpine and subalpine grasslands; G1: Broadleaved deciduous woodland; G3: Coniferous woodland; G4: Mixed deciduous and coniferous woodland (for details see section 2.1, Figure 2, Table 1).

Habitats within a buffer of 500 m along the railway line were assessed in more detail as this is considered to the maximum likely zone of influence of the project, on adjacent habitat, during both the construction and operation phase. Due to the anthropological influences on the landscape in terms of both extensive management and use of natural resources and the degradation in place due to ongoing construction of infrastructural projects in the area of interest large portion of the natural habitats present in the area of interest are not representative. However, some, particularly forests were assessed to qualify as PBF/CH. The following natural/semi-natural habitat types were identified as present and those marked in bold qualify as PBF/CH:

- **C2.22: Hiporhithral streams; and C2.31: Epipotamal streams;**
- **C2.5 Temporary running waters;**
- **C3.62: Unvegetated river gravel banks; and C3.61: Unvegetated river sand banks;**
- **E1.33: East Mediterranean xeric grassland; and E1.A22: Helleno-Balkanic supra Mediterranean siliceous grasslands;**

[28] Integrity is the coherence of ecological structure and function, across a site's whole area, that enables it to sustain a habitat, complex of habitats and/or the levels of populations of species

[29] Conservation status for habitats is determined by the sum of the influences acting on the habitat and its typical species that may affect its long-term distribution, structure and functions as well as the long-term survival of its typical species within a given geographical area. Conservation status for species is determined by the sum of influences acting on the species concerned that may affect the long-term distribution and abundance of its populations within a given geographical area.

- **E2.2 : Low and medium altitude hay meadows**;
- E2.7: Unmanaged mesic grassland;
- E3.31: Helleno-Moesian riverine and humid [*Trifolium*] meadows;
- **G1.11: Riverine [*Salix*] woodland; and F9.12 Lowland and collinear riverine [*Salix*] scrub - F9.123 Balkan riverine willow scrub**
- **G1.69: Moesian [*Fagus*] forests;**
- **G1.76: Balkano-Anatolian thermophilous [*Quercus*] forests; - G1.762 Helleno-Moesian [Quercus frainetto] forests**
- **G1.7641: Helleno-Moesian *Quercus petraea* forests; and G1.761: Helleno-Moesian *Quercus cerris* forests;**
- G1.7C2: [*Carpinus orientalis*] woods;
- G1.C3: [*Robinia*] plantations;
- G3.F12: Native pine plantations;
- G4.F: Mixed forestry plantations (for details see section 2.1, Figures 8-10, Tables 4 and 5).

Temporary and permanent removal of vegetation during the process of construction of the railway line, as well as clearing vegetation to create access tracks, will result in habitat loss. Although it is difficult to estimate the exact habitat loss that will occur as a result of the construction of the railway, a conservative approach has been taken. It has therefore been assumed that indirect habitat impact will be most likely to occur in a buffer of 100 metres (50 m on each side) along the railway alignment. Permanent habitat loss has been assessed as most likely to occur in a buffer of 20 meters (10 m on each side). Although, taking into consideration already existing access roads and the habitat degradation in place occurring due to the construction of other infrastructural projects in implementation in some areas, habitat loss will likely be less than this. However, accounting for the monitoring in place and further considering the management actions and mitigation measures outlined for this and other infrastrucutal projects in the area, it is expected that impacts on species and habitats will be mitigated and with consideration to habitat restoration requirements, including no-net loss and net gain management actions any habitat loss would be compensated for. Habitat impact calculated in a buffer of 100 m along the railway line including permanent habitat loss (area taken for the installation and operation of the railway alignment) is provided in Table 13. The exception to this is where tunnels are present, apart from the tunnel entrance where habitat loss has been accounted for, there will be no additional habitat loss for the habitats overlying the tunnel route.

Table 13 Habitat loss along the railway line calculated in a 100m buffer. Natural/semi-natural habitats are marked in bold. Habitat assessed to have largest loss are marked in blue

Habitat type with reference to EUNIS	Habitat Directive reference	PBF/CH	Habitat impact most likely to occur in a buffer of 100 metres		% Area loss of national coverage[30]	Permanent habitat loss, assessed in a buffer of 20 meters	
			Area (ha)	Area (%)	%	Area (ha)	Area (%)
C2.22: Hiporhithral streams	3260 Water courses of plain to montane levels with the Ranunculion fluitantis and Callitricho-Batrachion vegetation	PBF	0.7	0.5		0.04	0.1
C2.31 Epipotamal streams		PBF	0.0	0.0		0.01	0.0
C3.62: Unvegetated river gravel banks ; C3.61: Unvegetated river sand banks	3270 Rivers with muddy banks with Chenopodion rubri p.p. and Bidention p.p. vegetation	PBF	0.1	0.1		0	0
E1.33: East Mediterranean xeric grassland; E1.A22: Helleno-Balkanic supra Mediterranean siliceous grasslands	6220* Pseudo-steppe with grasses and annuals of the Thero-Brachypodietea	CH	5.6	3.5	<0.001	1.3	4.2
E2.2: Low and medium altitude hay meadows	6510 Lowland hay meadows (Alopecurus pratensis, Sanguisorba officinalis)	PBF	3.7	2.4		0.5	1.7
E2.7: Unmanaged mesic grassland		N/A	2.8	1.8		0.8	2.7
E3.31: Helleno-Moesian riverine and humid [*Trifolium*] meadows		N/A	0.9	0.6		0	0
E5.1: Anthropogenic herb stands		N/A	1.5	1.0		0.3	0.9
G1.11: Riverine [*Salix*] woodland incl. riparian [*Salix]* scrub	92A0* Salix alba and Populus alba galleries	CH	2.2	1.4		0.2	0.6

[30] For habitats where significant habitat impact is anticipated (100 m buffer); assessed according to CLC 2018). The % area that is considered to be permanently lost (20 m buffer) is negligible

Habitat type with reference to EUNIS	Habitat Directive reference	PBF/CH	Habitat impact most likely to occur in a buffer of 100 metres		% Area loss of national coverage[30]	Permanent habitat loss, assessed in a buffer of 20 meters	
			Area (ha)	Area (%)	%	Area (ha)	Area (%)
G1.76: Balkano-Anatolian thermophilous [*Quercus*] forests; - G1.762 Helleno-Moesian [Quercus frainetto] forests	9280 Quercus frainetto woods	PBF	6.2	4.0		1.3	4.0
G1.69: Moesian [Fagus] forests	91W0 Moesian Beech Forests	PBF	10.7	6.9	<0.007	2.5	7.8
G1.7641: Helleno-Moesian *Quercus petraea* forests; G1.761: Helleno-Moesian *Quercus cerris* forests	91M0 Pannonian-Balkanic turkey oak-sessile oak forest	PBF	20.5	13.1		4.3	13.9
G1.7C2: [*Carpinus orientalis*] woods		N/A	12.1	7.7		2.8	9.1
G1.C3: [*Robinia*] plantations		N/A	12.0	7.7		2.1	6.6
G1.D: Fruit and nut tree orchards		N/A	0.1	0.1		0.0	0.0
G3.F12: Native pine plantations		N/A	19.1	12.2	<0.04	4.0	12.8
G4.F: Mixed forestry plantations		N/A	8.8	5.6		1.8	5.8
G5.1: Lines of trees		N/A	0.2	0.1		0.1	0.2
G5.2: Small broadleaved deciduous anthropogenic woodlands		N/A	1.3	0.8		0.3	0.8
G5.61: Deciduous scrub woodland		N/A	24.7	15.8	0.005	5.5	17.6
I1.3: Arable land with unmixed crops grown by low-intensity agricultural methods		N/A	2.1	1.4		0.4	1.4
I1.53: Fallow un-inundated fields with annual and perennial weed communities		N/A	2.6	1.7		0.4	1.2

Habitat type with reference to EUNIS	Habitat Directive reference	PBF/CH	Habitat impact most likely to occur in a buffer of 100 metres		% Area loss of national coverage[30]	Permanent habitat loss, assessed in a buffer of 20 meters	
			Area (ha)	Area (%)	%	Area (ha)	Area (%)
J1.1: Residential buildings of city and town centres		N/A	9.3	5.9		1.3	4.3
J1.2: Residential buildings of villages and urban peripheries/I1.22: Small-scale market gardens and horticulture, including allotments		N/A	5.3	3.4		0.8	2.6
J1.4: Urban and suburban industrial and commercial sites still in active use		N/A	0.3	0.2		0.1	0.3
J4.2 Road networks		N/A	0.5	0.3		0.1	0.3
J6.1: Waste resulting from building construction or demolition		N/A	3.1	2.0		0.3	1.0
Total		N/A	**156.5**	**100.0**		**31.3**	**100**

The largest habitat loss is assessed to occur for pine plantations and transitional woodland-scrubland followed by broadleaved oak and beech forests. However, it should be noted that affected patches of broadleaved oak and beech forests will predominantly constitute edge habitat, as blocks of woodland are largely crossed with a tunnel, so impacts have generally been avoided, and those that occur are considered to be negligible and therefore non-significant.

Considering that North Macedonia has more than 30% forest coverage (not accounting for the thermophillous coppice forests and woodlands) estimated forest habitat loss for the construction of the railway line is assessed as negligible. The habitat losses will largely be of secondary forest and degraded forest; therefore, the loss of forest habitats are considered overall as non-significant. However, for habitats assessed as PBF/CH no net loss/net gain management actions apply to compensate the permanent habitat loss (see Table 13 and Section 6.1.1).

Impacts on habitats of conservation importance, that will be affected by the railway construction area assessed in Table 14. The loss amounts presented in Table 13 will be used to inform the level of mitigation required to achieve no net loss for PBF and no net loss, with a preferable net gain for CH.

Table 14 Impact on sensitive habitats/ habitats of conservation importance

Habitat type EUNIS reference	Habitat Directive reference	Impact
G1.69: Moesian [Fagus] forests	**91W0 Moesian Beech Forests**	Railway construction will affect the edge of the beech forest near the village of Kostur (from km 81 + 500 to 82 + 600 km). The remaining portion of this habitat, will not be affected as this part of the railway line largely goes through tunnels. Possible impacts on these habitats were assessed as non-significant, however no net loss/net gain management actions, as specified in Section 6.1.1 apply to compensate any loss or degradation on habitats.
G1.7641: Helleno-Moesian *Quercus petraea* forests; G1.761: Helleno-Moesian *Quercus cerris* forests	**91M0 Pannonian-Balkanic turkey oak-sessile oak forest**	Patches of this habitat type were also found at various degradation stages, particularly at forest edges and nearby settlements where human impact is more notable. Railway construction will affect this habitat near village Vitanovci (from km 86+395 to 87+405) and near Zhidilovo (from km 80+200 to km 80+707). The remaining portion of this habitat, will not be affected as this part of the railway line largely goes through tunnels. However, the patch at near village Vitanovci was noted as representative, and hence possible impacts on this habitat was assessed as significant. No net loss/net gain management actions, as specified in Section 6.1.1 apply to compensate any loss or degradation on habitats.

Habitat type EUNIS reference	Habitat Directive reference	Impact
G1.76: Balkano-Anatolian thermophilous [*Quercus*] forests; - G1.762 Helleno-Moesian [Quercus frainetto] forests	**9280 Quercus frainetto woods**	This habitat type is widespread in the Country and along the railway line, it is largely represented by stands at various stages of degradation i.e. second-growth forest that are dominated by *Carpinus orientalis* and assessed as not representative. Impacts will be most notable at the gorge of Kiselichka Reka (from km 76+278 to 76+520) in a total length of 222 m. Hence, possible impacts on these habitats were overall assessed as non-significant, however no net loss/net gain management actions, as specified in Section 6.1.1 apply to compensate any loss or degradation on habitats.
G1.11: Riverine [Salix] woodland	**92A0* Salix alba and Populus alba galleries**	Considering the limited coverage in the AOI, riverine and riparian woodlands are considered as sensitive habitats. Most of these habitats will be bridged, however, during the construction of the bridges (piers), damage is expected to the riparian forests and willow and poplar belts. Possible impacts on these habitats are assessed as temporary due mainly to the fact that this type of habitat can regenerate relatively easily, in the absence of more formal management. As a result, impacts to limited areas of this habitat type, at bridge crossings is considered to be non-significant, however no net loss/net gain management actions, as specified in Section 6.1.1 apply to compensate any loss or degradation on habitats.
F9.12 Lowland and collinear riverine [Salix] scrub - F9.123 Balkan riverine willow scrub	**3230 Alpine rivers and their ligneous vegetation with Myricaria germanica and 3240 Alpine rivers and their ligneous vegetation with Salix elaeagnos**	
E1.33: East Mediterranean xeric grassland **E1.A22: Helleno-Balkanic supra Mediterranean siliceous grasslands**	**6220* Pseudo-steppe with grasses and annuals of the Thero-Brachypodietea**	Considering that this habitat type is widespread in the Country and further noting that along the railway line, this habitat type is largely non-representative and succession of scrubs (and invasive species at places) is notable, possible impacts on these habitats are assessed as non-significant, however no net loss/net gain management actions, as specified in Section 6.1.1 apply to compensate any loss or degradation on habitats.
E2.238 Southwestern	**6510 Lowland hay meadows (Alopecurus pratensis, Sanguisorba officinalis)**	Railway construction will only a very small, negligible area of this habitat, none in the area

Habitat type EUNIS reference	Habitat Directive reference	Impact
Moesian submontane hay meadows		of Uzem and Kostur where this habitat type was assessed as most representative. This is because at the locatons where this abitat is noted to be present and representative, the railway line largely goes through tunnels or bridges. Hence, possible impacts on these habitats were assessed as non-significant however no net loss/net gain management actions, as specified in Section 6.1.1 apply to compensate any loss or degradation on habitats.
C3.62: Unvegetated river gravel banks; C3.61: Unvegetated river sand banks	**3270 Rivers with muddy banks with Chenopodion rubri p.p. and Bidention p.p. vegetation**	Negative impacts on this habitat type, is expected to occur during the construction of bridges. However, due to the fact that this habitat type is already severely degraded and not-representative within the AOI, any Project derived impacts on these habitats were assessed as not-significant however no net loss/net gain management actions, as specified in Section 6.1.1 apply to compensate any loss or degradation on habitats.
C2.22: Hiporhithral streams C2.31 Epipotamal streams	**3260 Water courses of plain to montane levels with the Ranunculion fluitantis and Callitricho-Batrachion vegetation**	Since bridges drainage pipes are installed, the ephemeral flows will not be impeded. Hence, impacts are assessed as non-significant. However, care should be taken to avoid added pollution caused by incidental spillage of pollutants.
C2.5 Temporary running waters	**3290 Intermittently flowing Mediterranean rivers of the Paspalo-Agrostidion**	In the detailed plan provided in the ESIA, 2017 four intermittent streams are noted to be subject to temporary diversion, due “cut and cover” (Jankovo, before the town of Kriva Palanka, Drenje and Zhidilovo). However, during the 2022 field surveys all were found to be without water (possibly due to disruptions from ongoing construction activities for other infrastructural projects in the area). Hence, should mitigation apply impact from the temporary diversion are assessed as non-significant.

5.2.1.1 Added habitat impacts during construction

Construction of the railway will have some added impacts on habitats resulting from habitat degradation on sites used as borrow pits and landfills.

5.2.2 5.2.2 Operational phase

Excluding the maintenance clearings of vegetation in the immediate surrounding of the railway line (1m on each side) no additional habitat loss is anticipated during the operation phase, as land take will occur only during construction. However, mitigation for reducing the spread of invasive species should be imposed as in the absence of mitigation invasive species already present in the project area, like *Amorpha fruticosa* along the river Kriva Reka riverbed and *Ailanthus altissima* invading the pastures in the surroundings of Kriva Palanka that are no longer grazed can advance. Care should be taken to minimise that potential introduction of the Japanise knot weed *Reynoutria japonica* that is present in the area of interest.

5.3 Faunal Assessment

5.3.1 Construction phase

Railway construction will impact species through range of disturbances including noise from earth moving machines, workers and transport vehicles and construction work, which will result in habitat loss; but could also result in habitat severance, death and injury.

The most significant impacts on species populations are related to the loss and degradation of their habitats. Table 15 below provides an assessment of impact, during the construction phase, of all of the faunal species considered to be of conservation importance, those species which are listed on the IUCN or National Red List as CR, EN or VU; Annex II or IV of the EU Habitats Directive; resolution 4 of the Bern Convention; Annex I of the EU Birds Directive; and/or as nationally protected. The impacts have been considered in the absence of mitigation. Mitigation has been set out in Section 6 and aims to achieve no net loss for BPF and a net gain for CH.

Table 15 Construction impacts on species considered to be of conservational importance

MAMMALS	
Eurasian otter (***Lutra lutra***)	During the construction work, in the absence of mitigation, otter population might be impacted by increased presence of workers, construction machinery and vehicles and subsequent increased level of noise and vibration in the area which may cause disturbance and their migration in the neighbouring areas; Risk of pollution of the habitats due to solid waste and dust from construction works and pollution from construction machinery and vehicles (motor oils and lubricants in particular) could add towards the current disturbance of the local rivers and streams and hence have impact otter populations by affecting their foraging habitat. Although, otter presence was confirmed in spite of ongoing disturbance from implementation of infrastructural projects in the area, care should be taken during the bridge construction at the crossing of Kiselichka Reka gorge and at Kriva Reka near Uzem.
Wolf (***Canis lupus***)	Although these species are common and widespread, it is possible that the construction will impact wolf and wildcat populations, primarily in terms of increased noise and disturbance which might also affect foraging. However, as these are both highly mobile species, it is considered likely that they would only be temporarily displaced during the construction phase, and hence the impacts are considered to be non-significant.
European wildcat (***Felis sylvestris***)	
All bat species ***Chioptera***	The bat population within the project area uses the leftover tunnels and excavation sites as habitat. Other common habitat for bats are mature trees too, and the old cold war bunkers and even buildings/houses. Hence, continuation of the railway construction work, in the

(species listed in Table 10, Section 4.4)	absence of mitigation, will have significant effect on the bat population. Increased level of noise and vibration in the area resulting from increased presence of workers, construction machinery and vehicles may cause disturbance and their migration in the neighbouring areas;
ORNITHOFAUNA	
Peregrine falcon **(*Falco peregrinus*)**	The Peregrine falcon was not confirmed to nest in the area of interest. However, there is a positive observation for a Peregrine falcon flyover in the surroundings of T'lminci, indicating that it may occasionally use the area for feeding and foraging. During the construction work, in the absence of mitigation, the species might be impacted by the increased level of noise and vibration, which may cause disturbance and less frequent/no use of the sites for feeding. However, since the species was observed in the area where a significant disturbance from the ongoing construction of infrastructural projects is already in place, and alternative habitats in the broader area of interest, the impact are assessed as non-significant.
Black stork **(*Ciconia nigra*)**	The black stork was not confirmed to nest in the area of interest, instead this species was found to only use the site for feeding and foraging. During the construction work, in the absence of mitigation, the species might be impacted by the increased level of noise and vibration, which may cause disturbance and less frequent/no use of the sites for feeding. However, since the species was observed in the area where a significant disturbance from the ongoing construction of infrastructural projects is already in place, and alternative habitats in the broader area of interest, the impact are assessed as non-significant.
Falco tinnunculus *Buteo buteo* *Ciconia ciconia* *Dryocopus martius* *Dendrocopos syriacus* *Lullula arborea* *Lanius collurio* with further reference to: *Caprimulgus europaeus* *Alcedo atthis* *Picus canus* *Dendrocopos medius* *Melanocorypha calandra* *Calandrella brachydactyla* *Anthus campestris* *Ficedula albicollis* *Lanius minor* *Curruca (Sylvia) nisoria* *Ficedula semitorquata* *Lanius collurio* *Lullula arborea* *Pernis apivorus*	Other bird species recorded during the 2022 field surveys (and others noted in the previous ESIAs) are widespread and hence, the area of interest is not critical to maintain the conservation status of this species. Nonetheless, during the construction work, in the absence of mitigation, the species might be impacted by the increased level of noise and vibration, which may cause disturbance and less frequent/no use of the sites for breeding and feeding, particularly relevant for bird species that nest and feed in forests. However, considering the availability of alternative habitats in the broader area of interest, the impacts are assessed as non-significant.
AMPHIBIANS and REPTILES	
REPTILES	

Spur-thighed tortoise **(*Testudo graeca*)**	Spur-thighed tortoise is not assessed to be present in the area, therefore no impacts are predicted.
Hermann's tortoise **(*Testudo hermanni*)**	In the absence of mitigation, the highest impact pertains to tortoise nests. Adult individuals are likely to escape disturbances (as long as there is no burning of habitats), but lightly burrowed tortoise nests are extremely prone to destruction. Unfortunately, it is not clear when and how many clutches tortoises lay annually in the region, but expert judgement concludes that in the EAAA they probably lay one to two clutches per year. Additionally, this is likely to vary with annual environmental conditions. Young individuals, up to five years of age are also likely to suffer as they are still small, less capable of managing their environments successfully, have a softer shell, and still experience lower annual survival probabilities than adults. While possible tortoise casualties in the area of interest may be assessed as not significant for the population present in N. Macedonia, mitigation will be provided to avoid and minimize impact where possible.
Dahl's whip snake (*Platyceps najadum*) Aesculapian snake *(Zamenis longissimus)* _____ with further reference to: ***Dolichophis caspius*** ***Natrix tessellata*** ***Coronella austriaca*** ***Vypera ammodites***	All snakes recorded during the 2022 field surveys (and others noted in the previous ESIAs) are common and widespread and hence, the area of interest is not critical to maintain the conservation status of this species. However, in the absence of mitigation, the species might be impacted by increased presence of workers, construction machinery and vehicles and subsequent increased level of noise and vibration in the area which may cause disturbance and affect pray availability; Possible risk of illegal hunting/accidental killing of animals by workers is also feasible. Although impacts are assessed as non-significant, mitigation will be provided to avoid and minimize impact where possible.
Podarcis muralis ***Lacerta viridis*** _____ with further reference to: ***Podarcis erhardii*** ***Podarcis tauricus*** ***Lacerta trilineata***	All lizards recorded during the 2022 field surveys (and others noted in the previous ESIAs) are also common and widespread and hence, the area of interest is not critical to maintain the conservation status of this species. With consideration to species ecology, impacts are assessed as non-significant. Nonetheless, mitigation will be provided to avoid and minimize impact where possible.
AMPHIBIANS	
Pelophylax ridibundus ***Bombina variegata*** ***Rana graeca*** ***Rana dalmatina*** ***Bufotes viridis*** ***Hyla arborea***	Where works occur close to water courses or ponds, these species could be impacted through loss of habitat or death through injury. These species have wide distribution and a tolerance of a broad range of habitats; also estimated large population in the area of interest. Hence, the loss of a small number of individuals, or their habitat is likely to have a non-significant impact on the conservation status of these species. Nonetheless, mitigation will be provided to avoid and minimize impact where possible.
INSECTS	
Capricorn beetle ***(Cerambyx cerdo)***	No observation of *Capricorn beetle* or *Morimus funereus* in the area of interest, hence no impacts are expected.
Morimus funereus	
Parnassius mnemosyne	

With further reference to: Zerynthia polyxena Maculinea (Phenagris) arion Lycaena dispar	These butterflies are also commonly found in meadows and forest clearings. Considering that the area under meadows that will be affected by the railway construction is negligible, the impacts are assessed as non-significant. Nonetheless, mitigation will be provided to avoid and minimize noise and disturbance where possible.

5.3.2 Operational phase

During the operational phase, it is anticipated that there will be no impacts on fauna through habitat loss; however, noise, disturbance and collisions may cause impacts. Even if impact during the operational phase are assessed as non-significant, mitigation will apply to minimise any adverse effects that the railway operation will have on species. Anticipated impacts from the operational phase with reference to species/species groups are provided in Table 16.

Table 16 Faunal Species Operational Impacts

Species/Species group	Impact description	Assessment of impact
MAMMALS	It is anticipated that during operation, the railway line will have a non-significant impact on otters, as habitats suitable for feeding and foraging will be crossed by bridges. In this regard it is noteworthy that approximately 2/3 of the the alignment is routed through tunnels and bridges (23.4 km total length with 22 tunnels with a total length of about 9 km and 52 bridges and viaducts with a total length of 4.4 km) and hence negative impacts are largely avoided (particularly during operation). In this regard the second half of the railway section that cuts through habitats with higher sensitivity, where mammal findings were most frequent, is approximately 70% routed through tunnels and bridges. Locations for underpasses and overpasses are determined and detailed in the project design. Still, should the pre-construction surveys and monitoring outline a the need to adapt/modify the design of curret underpasses and bridges in order to improve their functionality in facilitating animal movements and increase likelihood of use, particularly in the area between Zhidilovo and Uzem,	Non-significant

Species/Species group	Impact description	Assessment of impact
	then the project design should be adapted accordingly. While the operation of the railway line may alter the movement corridors used by large mammals, the wolf and the European wildcat are highly agile and responsive species so it is anticipated that during the operational phase, if death through collision does occur, numbers would be very low, and so would be non-significant, in terms of an impact to local populations.	
BATS	It is anticipated that while a low-level impact may occur, largely linked to disturbance. However, new study shows that occasionally passing train is not lilely to present a problem for bat populations, as although bat activity falls for 30-50% when train passess, it ususally takes minutes to recover [31]Collision death will be non-significant.	Non-significant
AVIFAUNA	It is anticipated that during operation, strike and noise disturbance would be the only impacts which may occur. 70% of the second section of the railway line is under bridges and tunnels (of which 80 % tunnels) and the maximum train speed will be 100 km/h. Hence, with added consideration of the terrain, the habitat specifics (largely forested) and species present (none of the identified bird species are in high risk of collision) it is anticipated; that while a low-level impact collision between trains and birds may occur; the numbers would be low, and so the impact is assessed as non-significant in terms of impact to the local populations. Traction power will be provided by the Traction Power Substation (TPS) of Kratovo and will be connected to the grid via the existing OCL 110kV, while	Non-significant

[31] Jarem P. & Mathews F. *Passing rail traffic reduces bat activity*. Scientific Reports 11.1. (2021) 1-9

Species/Species group	Impact description	Assessment of impact
	signalling will be electronic interlocking system designed in compliance with ERTMS (European Railway Transport Management System) requirements; hence, should the appropriate measures to avoid and minimise electrocution on the overhead electricity transmission lines be implemented, the impact is assessed as non-significant.	
REPTILES	During the operational phase, rail kill may result in the loss of a small number of individuals. Hence, it is likely to have a non-significant impact on the conservation status of these widespread species.	Non-significant
AMPHIBIANS	During the operational phase, rail kill may result in the loss of a small number of individuals. Hence, it is likely to have a non-significant impact on the conservation status of these widespread species. In absence of mitigation, wash off pollution and spillage may negatively affect tadpoles. Locations for culverts are determined and detailed in the project design. The project design provides for placement of culverts at each point of intersection of intermittent streams and the alignment. Projected culverts are as such assessed as potentially effective, especially for amphibians and reptiles. Still, should the pre-construction surveys and monitoring outline a the need for additional culverts, then the project design should be adapted accordingly.	Non-significant
INVERTEBRATES	During operation impact on aquatic fauna will be limited to wash-off pollution, that with consideration to the pollution already noted, is considered to have a non-significant impact; Impact on Invertebrates will be limited to collision, assessed as non-significant	Non-significant

The aquatic fauna of the AOI, was surveyed and documented in the ESIA, 2017 and was found to include nine species of fish. All the recorded species of fish were assessed as widespread, and none were assessed as of conservation concern, therefore none qualify for priority biodiversity feature/critical habitat. However, general mitigation measures will be provided to avoid and minimize impacts where possible to the aquatic environment, including pre-construction surveys for any river crossings with extensive in-river works.

5.4 Ecosystem services

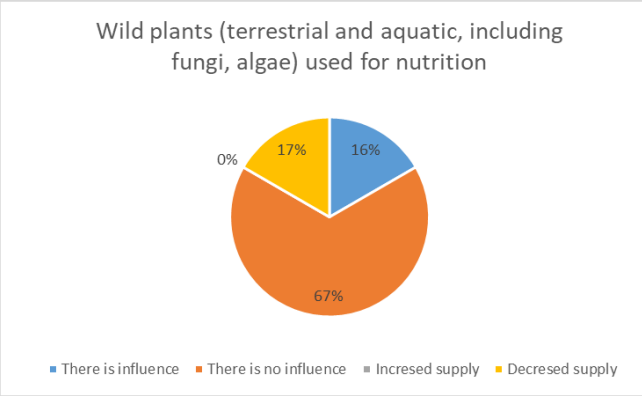
5.4.1 Construction phase

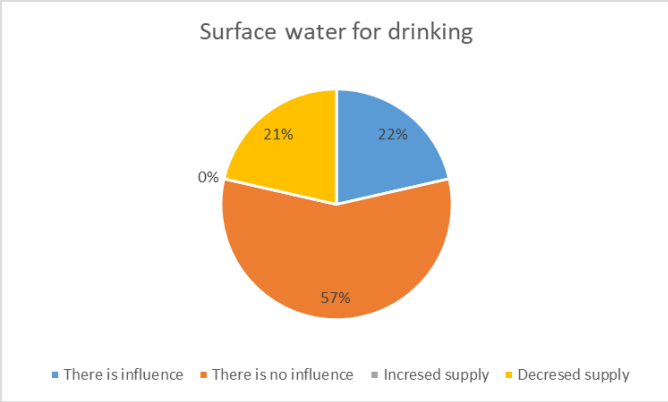
Impacts of construction activities were assessed by exploring respondents' perception of changes in ecosystem service supply in the AOI. However, the impact on ecosystem provision is assessed as overall non-significant and temporary.

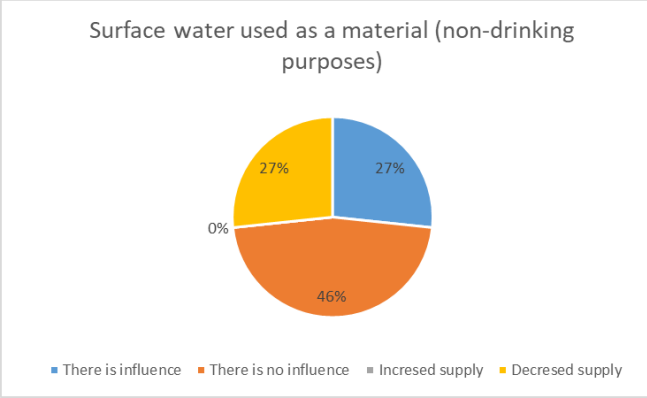
5.4.1.1 Perception of change in ecosystem services supply from the local stakeholders/ecosystem services direct beneficiaries

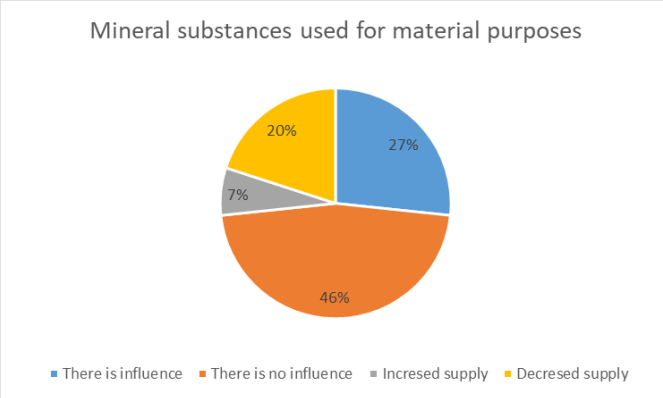
High proportion of respondents answered that the construction of the railway will/do not have influence to the supply of the previously assessed ecosystem services. This is especially emphasized for the cultural ecosystem services. In most of the cases where the answer was positive (that the construction of the railway has influence), the additional respond was that this influence will negatively affect the ecosystem services supply (Figure 14).

Provisioning

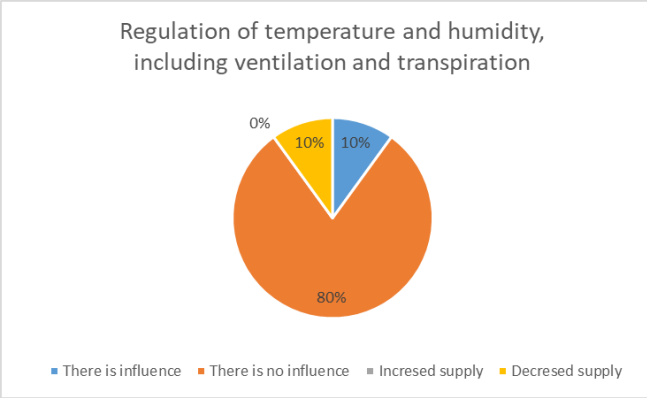


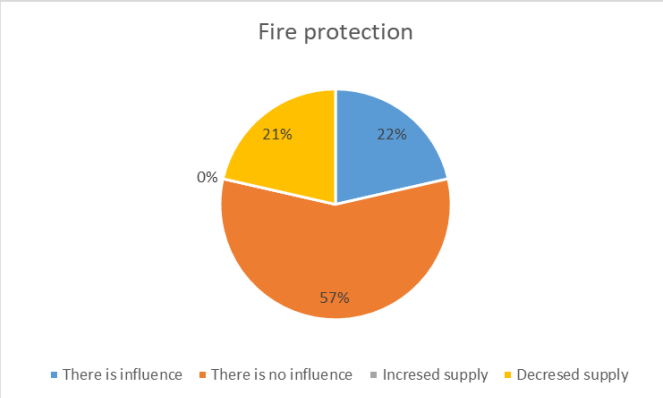


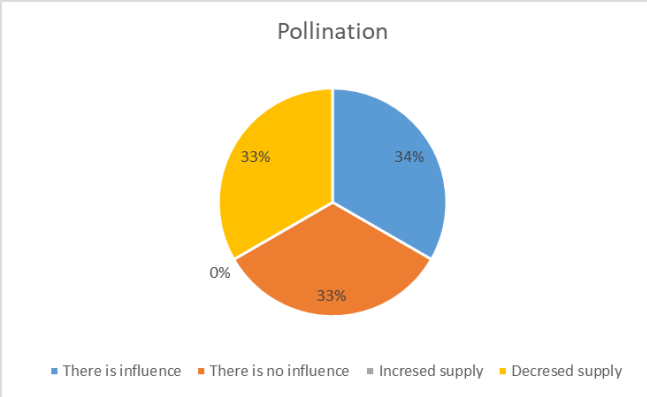


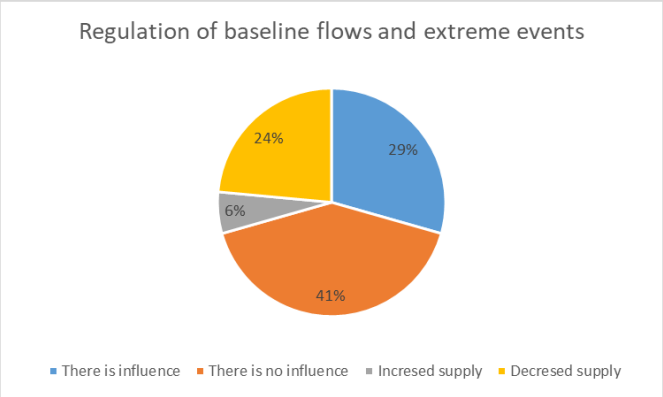


Regulating









Cultural

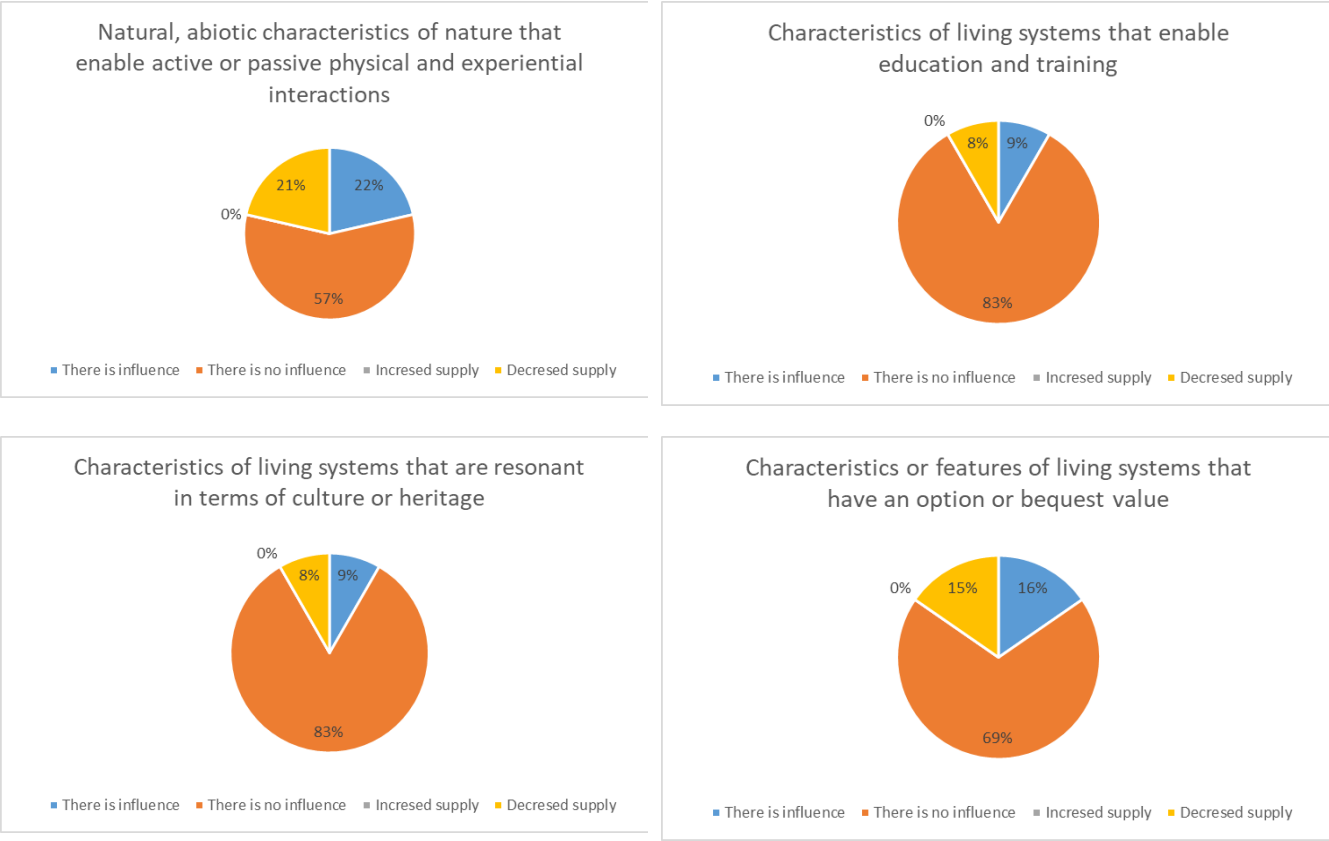


Figure 14 Perception on change in ecosystem supply for 12 ecosystem services

5.4.1.2 Identification of threats and pressures on ecosystem services supply

Respondents valued 10 common threats that can potentially decrease the supply of ecosystem services. The additional task of this question was for the respondents that have identified a threat to rank it in correspondence to its intensity in the study area. Table 17 shows identified threats assorted according to their ranking (see also Figure 15). The railway construction was pointed as apparent threat according to two respondents only. However, it positioned last on the rank list of threats.

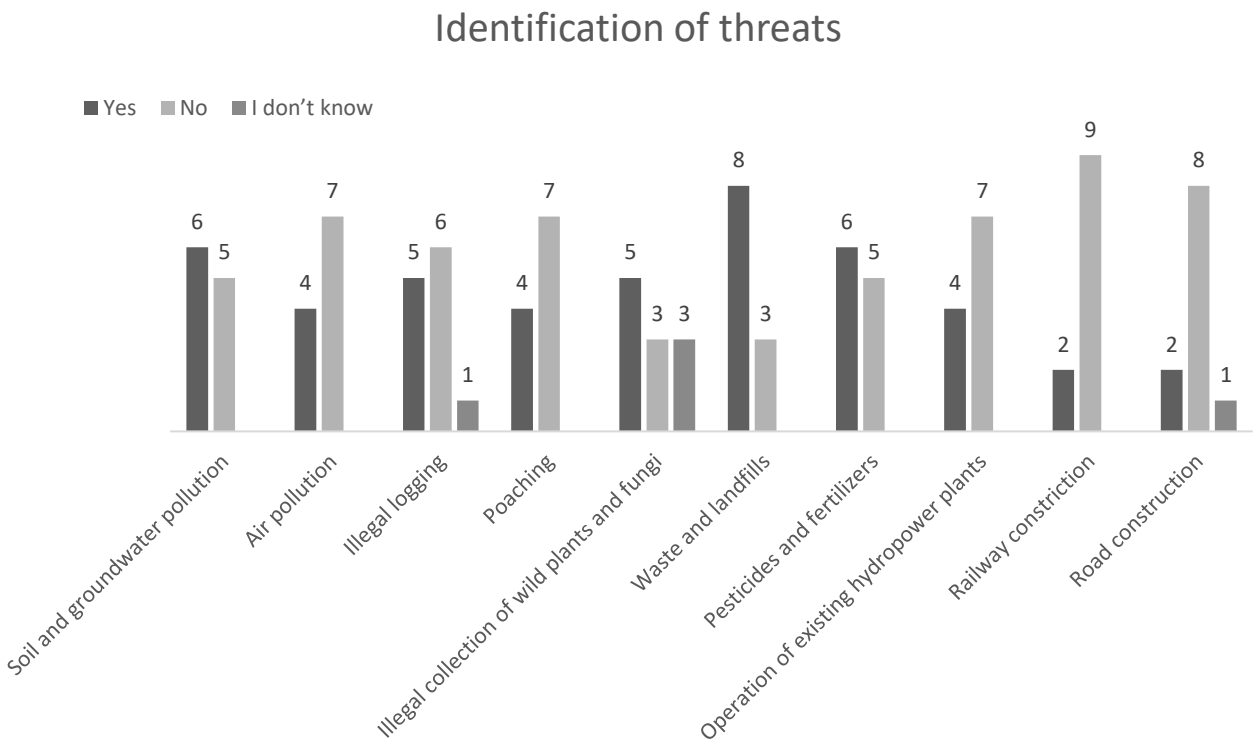


Figure 15 Identification of the suggested threats as relevant for the study area

Table 17 List of identified threats in the study area assorted according to their score for intensity

Rank	Identified threats
1	Waste and landfills
2	Air pollution
3	Soil and groundwater pollution
4	Illegal logging
5	Illegal collection of wild plants and fungi
6	Operation of existing hydropower plants
7	Pesticides and fertilizers
8	Road construction
9	Poaching
10	Railway constriction

The last question from the questionnaire form required direct response on the impact of the railway construction to the benefits that respondents' enjoyment of nature. Even though the railway construction was not perceived as high threat towards the supply of ecosystem services, it was interesting to see that regarding this question, the opinions were almost equally divided (60% of the respondent answered that

nothing will change – 40% of the respondent answered that the construction will decrease the ecosystem services that they receive from nature). None of the respondents answered positively (that the construction of the railway will increase the supply of ecosystem services). However, construction activities are not anticipated to seize access to foraging areas and loss of availability to household and farmland water supply. Impacts to people and livelihoods linked to disturbance, noise and pollution should be minimised following mitigation detailed as part of the Social Impact Assessment study.

5.4.2 Operational phase

Respondents' did not indicate any negative impacts on the provision of ecosystem services during the operational phase. However, it was noted that the operation of the railway will decrease the provision of clean air and the noise will affect livelihoods of people that are in the immediate vicinity of the railway line. According to the design specifics provided in ESIA, 2017 total of 19 underpasses and crossings are projected. Some of them are located in areas of bridges or tunnels and have no interference with the future railway line; other crossings are solved through an underpass and for some, an overpass is designed. Crossings, underpasses and overpasses are projected to mitigate any potential impediments to people's movement in the area of interest and their access to foraging areas. Benefits from cultural ecosystem services were noted to increase due to expected increase of frequency of visitors in the area.

5.5 Protected Areas

5.5.1 Background

Although North Macedonia is not an EU member, the EIB and the EBRD abides to the European Principles for the Environment[32] and therefore require that an Article 6 assessment is undertaken for this project, as there are Natura 2000/Emerald sites within the zone of influence of the Project. The Appropriate Assessment has been undertaken and can be found as a separate report in Annex 1.

5.5.2 EMERALD sites

Emerald Network is a network of Areas of Special Conservation Interest (ASCI) designated for the purpose of preserving the natural habitat network and is developed in the territory of the Member States of the Berne Convention (Convention for the Conservation of Wildlife and Natural Habitats in Europe).

The Republic of Macedonia, as a member state of the Berne Convention (ratified in 1997 with the Law on Ratification, Official Gazette of the Republic of Macedonia No. 49/97) implemented four projects for the development of the National Emerald Network in the period from 2002 to 2008, during which total of 35 areas of conservation interest were identified and they were proposed to the Bern Convention Secretariat for their inclusion in the national Emerald Network[33].

In the wider area of the railway corridor there are two proposed Emerald areas: Pchinja-German MK0000029 and Osogovo Mountains MK0000026 (Figure 16).

5.5.2.1 Emerald site Pchinja-German – MK0000029

The area covers an area of 63,490 ha. This area has been identified on the basis of multiple criteria: a number of species i.e. 29 bird species, 6 mammals, 7 amphibians and reptiles, 1 fish and 2 invertebrates listed under Resolution No. 6 of the Bern Convention.

[32] The European Principles for the Environment (EPE) were adopted by the Council of Europe Development Bank, the EBRD, European Investment Bank, Nordic Environment Finance Corporation and Nordic Investment Bank. The EPE is an initiative launched in response to the drive for increased harmonisation of environmental principles, practices.
[33] https://emerald.eea.europa.eu/

Specifics on qualifying species and ecological specifics of the site are available here and provided in Section 7, Appendix 1 - Appropriate Assessment:
https://natura2000.eea.europa.eu/Emerald/SDF.aspx?site=MK0000029&release=2#top

The alignment of the railway passes within but on the outskirts of the Emerald area Pchinja-German from km 75 + 213 to km 77 + 070 i.e. in length of 1.8 km. Of these, 1.4 km pass through tunnels or bridges. The alignment passes through pine plantations, black locust plantations, degraded thermophilic oak forests and mesophilic oak forests.

5.5.2.2 Emerald site Osogovo – MK0000026

The site covers an area of 56,674 ha. This site has been identified on the basis of a significant number of species from Resolution No. 6 of the Bern Convention: 27 bird species, 3 mammals, 2 and 3 invertebrates.

Specifics on qualifying species and ecological specifics of the site are available here and provided in Section 7, Appendix 1 - Appropriate Assessment:
https://natura2000.eea.europa.eu/Emerald/SDF.aspx?site=MK0000026&release=2#top

The alignment of the railway passes the Emerald area of "Osogovo Mountains" through tunnel from km 83 + 080 to km 83 + 630 i.e. in length of 0.5 km so there would be no significant negative effects on site integrity.

5.5.2.3 Impacts

The alignment of the railway passes within but on the outskits of the proposed **Emerald site Pchinja-German** from km 75 + 213 to km 77 + 070 i.e. in the length of 1.8 km. Of these, 1.4 km pass through tunnels or bridges. However, the railway construction is estimated to affect the following habitats: 0.4 ha of G1.76 Balkano-Anatolian thermophilous [Quercus] forests (PBF) and 0.4 ha of E1.A22 Helleno-Balkanic supra Mediterranean siliceous grasslands (CH). The effects on C2.22 : Hiporhithral streams (0 ha); C2.31 Epipotamal streams (0 ha); G1.11 : Riverine [Salix] woodland (0.1 ha); E2.2 : Low and medium altitude hay meadows (0.1 ha); G1.7641 : Helleno-Moesian Quercus petraea forests and G1.761 : Helleno-Moesian Quercus cerris forests (0.2) are assessed as negligible since these habitat types are crossed with a bridge, the impact will be temporary. Total of 1.3 ha of other habitat types will also be affected including degraded termophillous *Carpinus orientalis* woodlands (0.3 ha), black pine plantations (0.3 ha) and anthropogenic woodland and scrubland (0.3 ha) as scale market gardens and horticulture, including allotments (0.4 ha).

In this area no significant populations of species with high conservation significance were identified i.e. none of the qualifying species for this Emerald site were recorded in this area. On this basis, it can be concluded that these habitats, and their associated qualifying faunal species will not be significantly degraded, fragmented, or disturbed by the project activities. The impact is therefore assessed as negligible.

In the proposed Emerald site of **Osogovo Mountains**, the alignment of the railway passes from km 83 + 080 to km 83 + 630 i.e. through a space in which no significant populations of species with high conservation significance have been identified. The railway alignment intersects with only one significant habitat - G1.69: Moesian [Fagus] forests, in total length of 550 metres. However, the whole area of intersection is crossed with tunnel with no consequent habitat loss; hence no adverse impacts on the associated flora and fauna are expected.

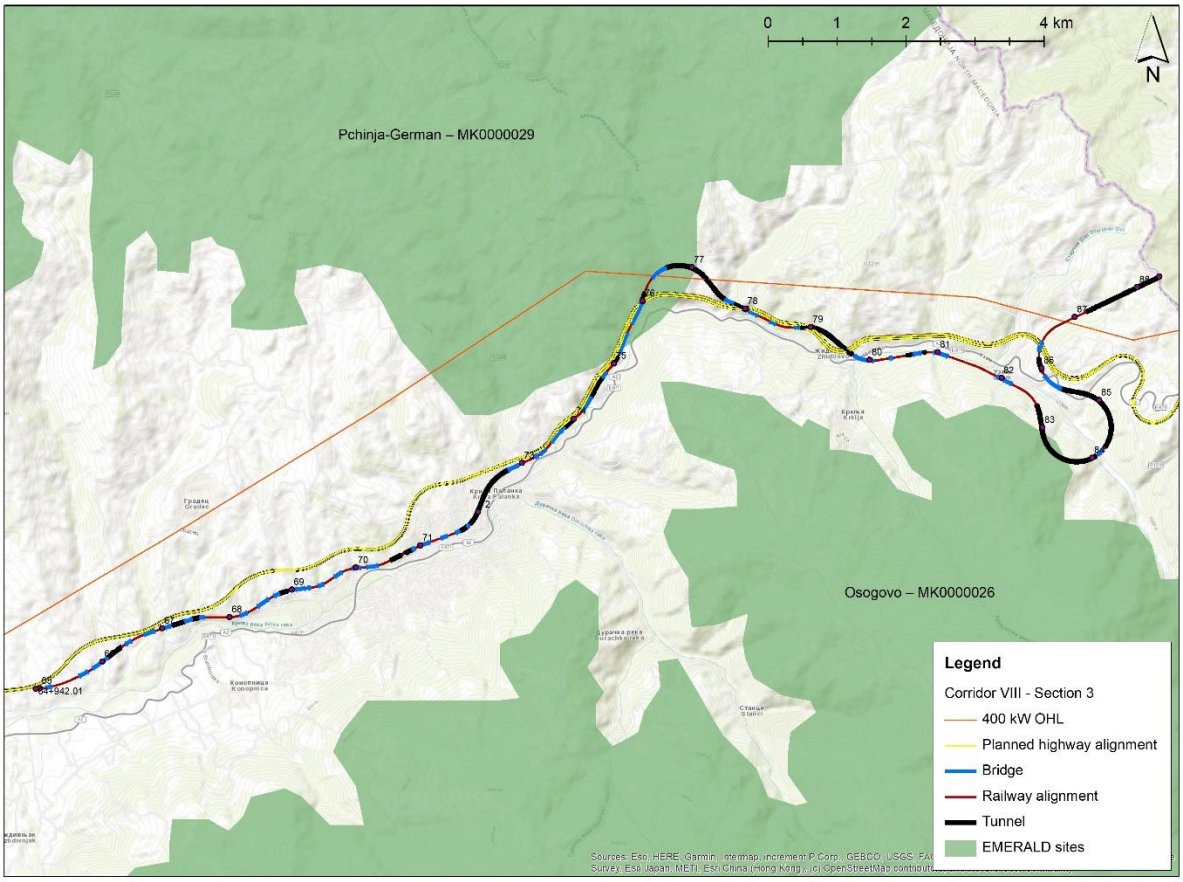


Figure 16 Proposed Emerald sites along the railway alignment

5.5.3 National system of protected areas

Near the analysed railway corridor, there are no significant spaces that are included in the national system of protected areas. Such areas have not been identified either in the Biodiversity Strategy, the Strategy for Nature Conservation or in the Natural Heritage Study of the Spatial Plan of the Republic of Macedonia.

5.5.4.1 Proposed protected area – nature park Kiselichka Reka Gorge

The area was proposed within the Representative Network of Protected Areas[34]. The main reason for the proposal is the presence of the *otter*. The area is proposed for protection in the category "Nature park" (Figure 16).

However, a decade after, this area still has no legal protection which in turn has resulted in partial loss of its natural values, particularly at the lower boundary of the proposed area. The degradation in place is primarily linked to building weekend houses, but also to ongoing construction work related to the rehabilitation of the state road A2, section Kriva Palanka – Deve Bair.

[34] MES (2011). Strengthening the Ecological, Institutional and Financial Sustainability of Macedonia's National Protected Areas System (Project 00058373 - PIMS 3728.). Development of Representative National System of Protected Areas (Project activity Ref. RFP 79/2009). UNDP, Ministry of Environment and Physical Planning of the Republic of Macedonia, Macedonian Ecological Society.

The railway alignment of the railway crosses the area at place where degradation and disturbance due to residence development and ongoing construction is already at place (km 75 + 146 to km 77 + 512 i.e the total length of 2.4 km, of which 1.9 km pass through tunnels or bridges). The railway construction will affect total of 0.5 ha of G1.76 Balkano-Anatolian thermophilous [Quercus] forests and 0.3 ha of black pine plantations. Hence, although the overall impact could be assessed as non-significant, care should be taken to mitigate impacts and avoid additional disturbances during construction and operation of the railway.

5.5.4.2 Established protected area "Protected landscape of the Osogovo Mountains"

Osogovo was proposed within the Representative Network of Protected Areas with a coverage of 77226 ha. The Osogovo Mountains possess significant values from a biological point of view. A number of internationally and nationally significant species of flora and fauna have been identified, of which a significant proportion are affected, endemic or rare species. The interaction between people and the nature of Osogovo is characteristic and resulted with the formation of the Osogovo mountain rural landscape, that is site specific and hence sustaining its character is of great importance.

The borders of the area of Osogovo initially proposed for protection[30], were revised as part of the Valorisation study for establishing a protected area on Osogovo Mts[35]. Following the revalorization of the area, the site was protected under IUCN Category V – Protected landscape "Osogovo", established in 2020. (Figure 17).

The railway line is projected outside of the wider project area of influence. Hence, no negative impacts are expected during construction and operation of the railway.

[35] https://www.moepp.gov.mk/wp-content/uploads/2015/01/Studija-ZP-Osogovo-24.07.2019-Final.pdf

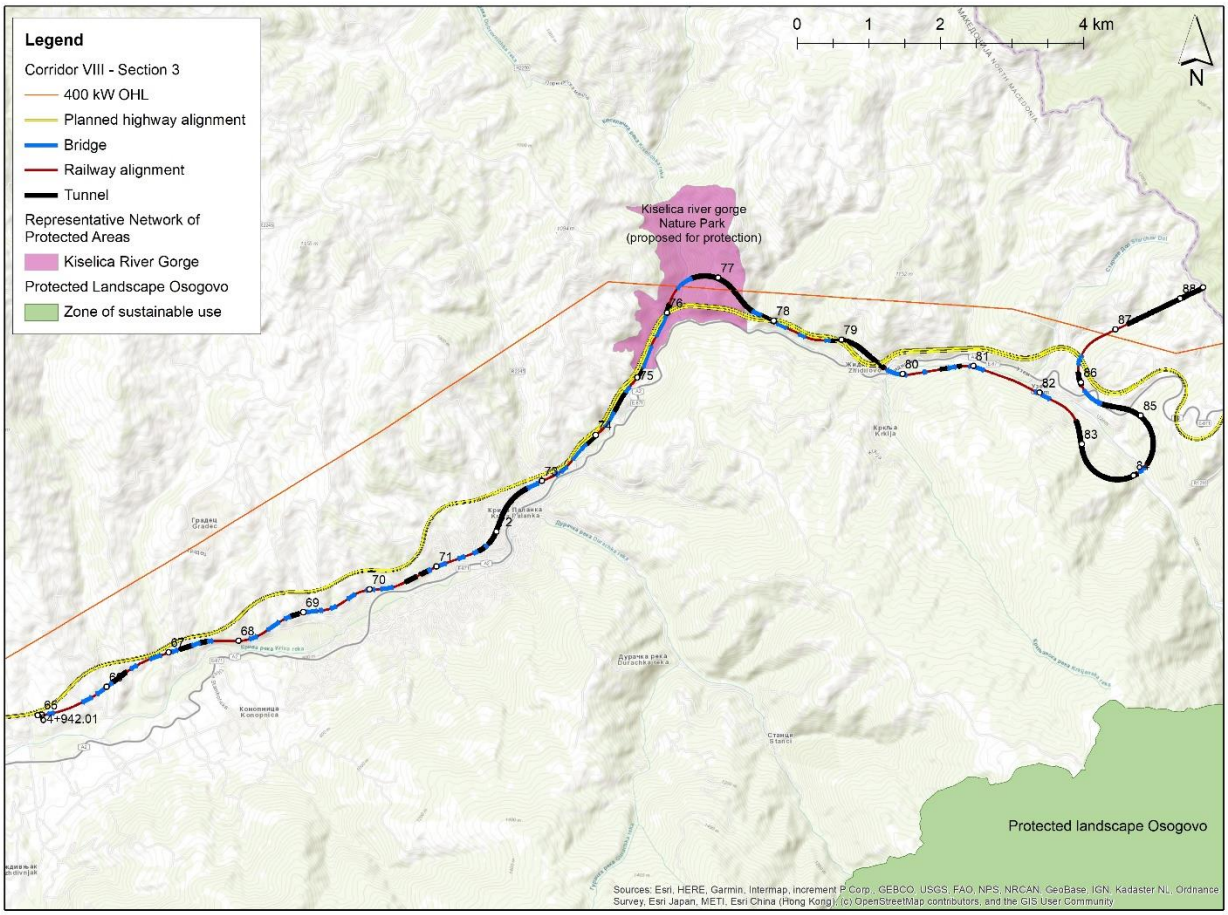


Figure 17 Areas proposed for protection and protected areas in the area along the railway alignment

5.5.4.2.1 Impacts

In the absence of mitigation, most of the impacts on the proposed protected areas during construction phase will relate to habitat degradation and/or disturbance due to increased presence of workers, construction machinery and vehicles and subsequent increased level of noise and vibration in the area. Disturbance effects (noise, vibration) will also linger in the operational phase.

However, bearing in mind that in the area proposed for protection the railway line passes mainly through tunnels, no significant impacts are expected.

It is also important to emphasize that the area under consideration does not have legal protection. Also, with due consideration of disturbance and degradation in place, it is noteworthy that should an initiative for protecting Kiselichka Reka gorge be raised, the area would need to go through process of revalorisation and revision of borders.

5.5.5.1 Cumulative impacts

It should also be noted that in the AOI there is ongoing construction linked to other infrastructural projects: Kriva Palanka Road Rehabilitation Project; Expressway A2, LOT 2: Sub-section Kriva Palanka – Dlabocica and SHPP “Kriva Reka”, PCC HYDRO (Figure 18). Degradation resulting from construction activities is

notable in sensitive habitats, particularly thermophillous forests and riparian woodlands and belts. The degradation from the ongoing construction of the Expressway A2, LOT 2: Sub-section Kriva Palanka – Dlabocica is most notable from T'lminci to Stambolica where there is no intersection with any of the proposed or protected areas in the AOI. The planned highway alignment was re-projected to be implemented as expressway at one section as A2, LOT 2: Sub-section Kriva Palanka – Dlabocica going from Dlaboochica to Kriva Palanka to merge with the regional road to Bulgaria, that is now in phase of rehabilitation: Kriva Palanka Road Rehabilitation Project from Kriva Palanka to Deve Bair. The construction of the remaining portion of the Expressway A2 - Kriva Palanka to Deve Bair initially planned to cut through Kiselichka Reka gorge does hence not seem feasible at the time.

Most relevant in terms of cumulative impacts is the noted disturbance at Kiselichka Reka valley, where habitat disturbance has occurred due to residence development and the ongoing reconstruction and rehabilitation of the A2 state road, section Kriva Palanka – Deve BairThe effects of the Kriva Palanka A2 Road Rehabilitation Project projected alongside the railway line have however been accounted for in the expressway ESIA that assumes no significant impact. The footprints of all infrastructural projects currently implemented in the area area of Kiselichka Reka are discrete, since there is no intersection with the railway alignment. Hence, accounting for the monitoring in place[36] and further considering the management actions and mitigation measures outlined for both, including the revegetation planned to offset the habitat loss, no significant cumulative impacts are expected.

[36] Reports on supplemental assessment of impacts on and monitoring of biodiversity from project activities in the area of the Osogovo-German bio corridor during construction of Expressway A2, LOT 2: Sub-section Kriva Palanka – Dlabocica, 2020-2021, Geonatura Zagreb
Survey of the large mammal fauna during construction of Expressway A2, LOT 2: Sub-section Kriva Palanka – Dlabocica, Field report VI, October - December 2020
Field report VII, January - February 2021
Field report VIII, March - May 2021
Final assessment of impacts on biodiversity from project activities in the area of the Osogovo-German bio corridor during construction of Expressway A2, LOT 2: Sub-section Kriva Palanka – Dlabocica, Biodiversity Management Plan

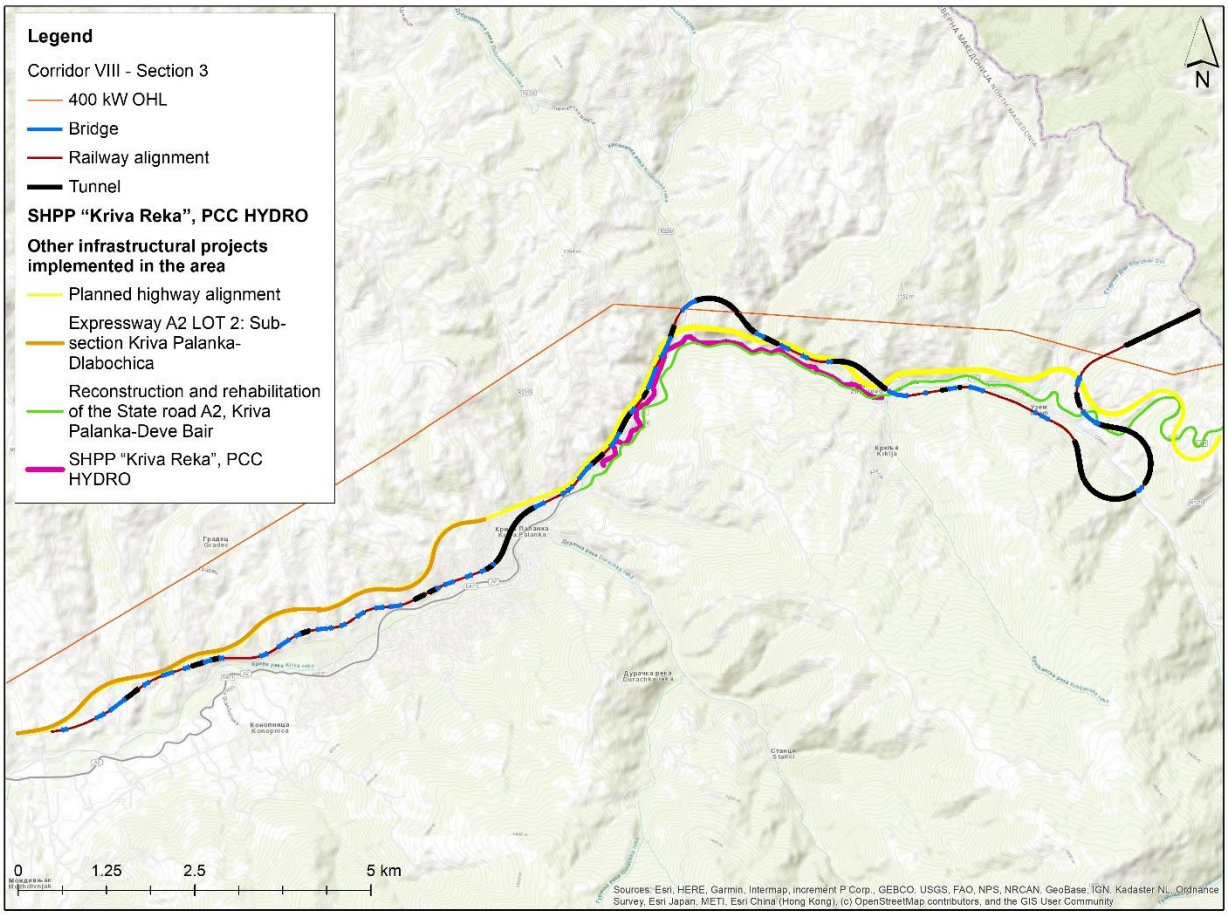


Figure 18 Map of infrastructural projects, planned and under implementation, in the AOI

5.5.4 Bio-corridors

Bio-corridors are important as these enable various daily, periodical or seasonal movements and migrations of different animals or dispersal of plants. The most important role for bio-corridors in the area of project, are two south-north routes, recognized as important corridors for large mammals in Macedonian Ecological Network[37]. These are the Osogovo-German landscape corridor and the Osogovo-Bilina Planina (Deve Bair) linear corridor. They are important because they secure the connection of Osogovo Mountains with the range of mountains on the border with Serbia (Kozjak, German and Bilina Planina) (Figure 19).

[37] Brajanoska, R., Melovski, L., Hristovski, S., Sarov, A., Avukatov, V. (2011). Brown Bear Corridor Management Plan. Report under the Project: "Development of the National Ecological Network in the Republic of Macedonia (MAK-NEN). Macedonian Ecological Society, Skopje, 114 p.
MAK-NEN – Macedonian Ecological Network was elaborated by Macedonian Ecological Society and European Center for Nature Conservation (Netherlands), still expected to be approved by the Ministry of Environment and Physical Planning

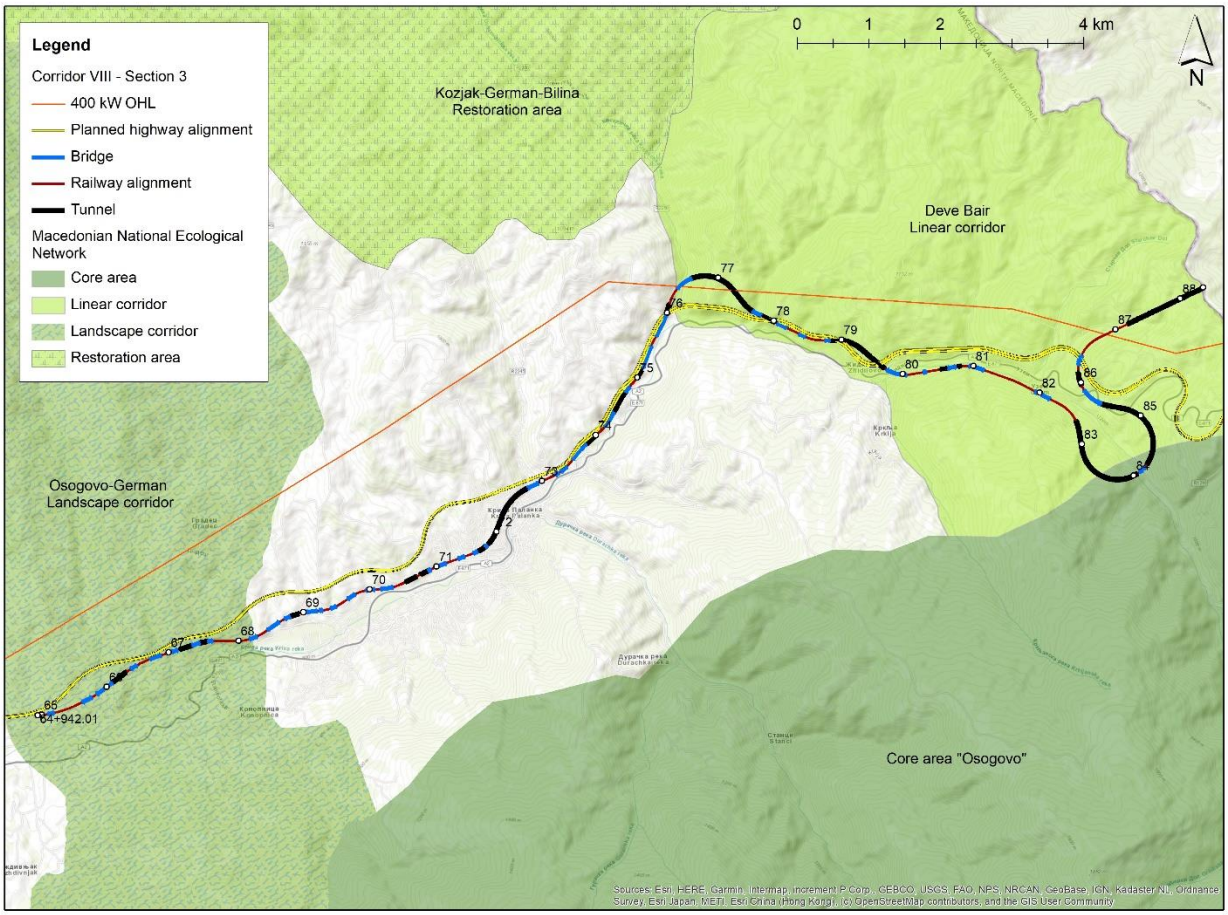


Figure 19 Bio-corridors along the railway alignment

Bio-corridors were assessed and established with consideration of the brown bear habitat requirement - movements for searching food and migration; however, as noted previously, the presence of the brown bear in the area of interest has not been recorded for at least two decades.

However, these corridors are also important for the grey wolf - movements for searching pray; ungulates, particularly roe dear - movements and seasonal migration for grazing; and small mammals - periodical and seasonal movements.

The railway line cuts both above mentioned bio-corridors.

The railway line cuts through the Deve Bair bio-corridor with a total length of 12 km of which 6.2 km through tunnels and 1,8 km under bridges. Else, the railway line intersects with G1: Broadleaved decisuous woodland and I1 : Arable land and market gardens.

The railway line cuts through the Osogovo-German bio-corridor with a total length of 3.3 km of which 0.5 km through tunnels and 1.2 km under bridges, intersecting through G5 : Lines of trees, small anthropogenic woodlands, recently felled woodland, early-stage woodland and coppice and I1 : Arable land and market gardens. It intersects with E1: Dry grasslands in a length of only 0.7 km.

5.5.5.1 Impacts

Considering that the intersection of the railway line with the Osogovo-German landscape corridor affects largely anthropogenically altered and/or managed habitats, no significant impacts are expected. However, in absence of mitigation, certain risk of reducing the permeability of the landscape in terms of migrations exists.

In absence of mitigation, the implementation of the project in the construction and operational phase (particularly operational), will have impact on the functions of one of the wildlife corridors – Deve Bair. Nonetheless, due to the large number of tunnels (with no surface features) in total length of 6.7 km and bridges (where animals can pass under) in total length of 3 km it is expected that the functional characteristics of the landscape won't be significantly affected in terms of migration of large animals. Furthermore, projected box culverts in the area of intersection (5), as well as amphibian tunnels, and underpasses should be maintained to allow a safe crossing; whereas where neceserry (with consideration to recommendations from monitoring carried during construction and operation of the railway), exclusion fences, olfactory repellents, sound signals and sound barriers can be implemented to further prevent any potential crossings, most relevant for the area of Uzem (Ljuti Rid) from km 81.4 to km 82 and km 82.4 to km 82.8.

6 MITIGATON AND MONITORING

6.1 Mitigation

All infrastructural projects should aim to avoid impacts, but where impacts cannot be avoided, they should be minimised. If an impact cannot be minimised so that it is non-significant in nature, then further mitigation and compensation may be required. Enhancement may also be regarded as a form of mitigation. Finally, if an impact cannot be mitigated for within the project footprint, then off-setting can be considered; though this should be of last resort, were possible. From inception to completion the aim of a project should be to achieve no net loss of biodiversity, and where possible, net gain. This section outlines the 'General Mitigation Measures' taking into account habitat and species impact assessment provided in Section 5 of the SBA and added consideration of mitigation strategies proposed in the 2017 ESIA. 'General mitigation measures' outlined here are then further taken forward and compiled into a Biodiversity Management Plan.

Summary of biodiversity mitigation measures, including a no-net loss/net gain management actions are outlined below:

6.1.1 HABITAT MIGATION MEASURES AND ACTIONS

Construction

Actions:

- Conduct continuous monitoring, by an independent expert (biologist/ecologist) during the construction of the bridges particularly where the following habitats occur: willow and poplar woodlands, stands and belts; beech forests, hilly pastures; rivers and streams.
- Where feasible, access roads should not pass through the following habitats: Beech forests; Willow and poplar woodlands, stands and tree belts, Gravel banks of watercourses (rivers and streams), wherever they are found in the project area – except for clearing vegetation necessary for the construction works and the arrangement of the rails. If not feasible, then the Biodiversity Supervisor must be consulted to provide advice on minimising the impact.
- Clearly mark areas for vegetation clearance and worksite boundaries to prevent unnecessary loss of vegetation in the Project area
- Use extant or/and carefully plan the construction of temporary access roads, formation of borrow pits and disposal areas in order to avoid degradation of habitat patches assessed as representative, particularly in the area of Drenje (pastures), Ksielichka Reka, Uzem –Kostur (beech forests, Quercus forests and meadows), Zhidilovo (Riparian woodland).
- Planned temporary diversion on four intermittent streams should be carried during summer, where it is least likely for water flow to occur and that these are not used as a habitat for amphibian sprawl.
- Prevention against uncontrolled disposal of construction material and prevention against sloughing of construction material down the slope on hillsides and instead the use of formal spoil disposal areas.
- Continuous supervision by Supervision Engineer during construction works is required to prevent unnecessary movement of vehicles outside of area designated for implementation of construction activities to preserve surrounding vegetation
- Spraying and wetting of the temporary traffic lanes to prevent generation of dust and sedimentation of dust on nearby vegetation

- Removal of invasive species where present and take adequate measures to prevent further spread

Following a review of the locations for proposed borrow pits[38] and landfills[39] (Figure 20) it is strongly advised to abandon any landfill and/or borrow pit site that intersects with habitats assessed as as PBF/CH. Furthermore, all borrow pits and disposal sites should be subject to E&S assessment by the Contractor and include design specifics to insure erosion control, drainage and final reinstatement.

Hence, alternative borrow pit site should be provided for the one assigned to exploit alluvial and sediments between T-19 and T-20, that is located in the immediate vicinity of C3.62: Unvegetated river gravel banks; C3.61: Unvegetated river sand banks and F9.12 Lowland and collinear riverine [*Salix*] scrub (22°26'13.08"E; 42°12'49.91"N) in the area of Uzem. Alternatively, materials should be procured from outside of the area of interest.

Alternative landfills should be provided for the ones affecting habitats assessed as PBF/CH. These are:

- Landfill No 18 (22°21’1.64’’E; 42°13’0.90’’N) affecting G1.11: Riverine [*Salix*] woodland and C2.22: Hiporhithral streams
- Landfill No 26 (22°24’2.40’’E; 42°13’26.68’’N) affecting representative C2.22: Hiporhithral streams; E2.2: Low and medium altitude hay meadows and mesophillous oak forests
- Landfill No 28 (22°25’4.19’’E; 42°13’24.67’’N) affecting G1.11: Riverine [*Salix*] woodland
- Landfill No 29 (22°25’43.79’’E; 42°13’9.24’’N) affecting E2.2: Low and medium altitude hay meadows and mesophillous oak forests and G1.69: Moesian [Fagus] forests
- If feasible, Landfill No 30 (22°25’4.19’’E; 42°13’24.67’’N) affecting the edge of mesophillous oak forest

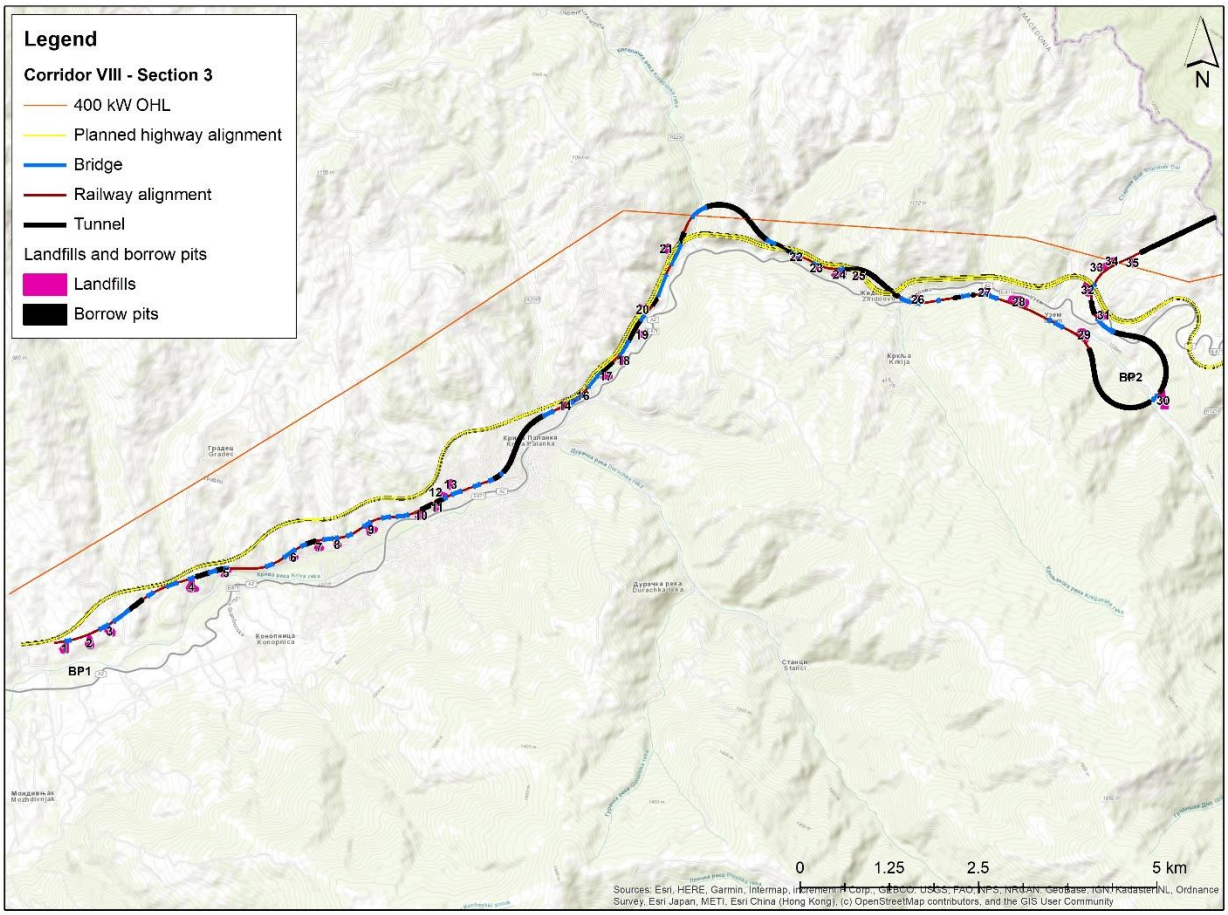
Operation

Actions:

- Maintenance and annual survey of restoration areas is needed; done annually for the first three years, with replanting where required.

[38] Review of borrow pits along the project corridor. Info provided in Report on Materials, Borrow Pits and Landfills Version B, 30th October 2017 EuropeAid/136050/IH/SER/MK

[39] Review of landfills in need of review along the project corridor (from 35 in total). Info provided in Report on Materials, Borrow Pits and Landfills Version B, 30th October 2017 EuropeAid/136050/IH/SER/MK



Rephrased

Figure 20 Planned locations of landfills and borrow pits along the railway alignment

6.1.1.1 No net loss/ net gain management actions

Considering that North Macedonia has more than 30% forest coverage (not accounting for the thermophillous coppice forests and woodlands) estimated forest habitat loss for the construction of the railway line is assessed as negligible. However, temporary and permanent removal of vegetation during the process of construction of the railway line, as well as clearing vegetation to create access tracks, will result in habitat loss. The exception to this is where tunnels are present, apart from the tunnel entrance and exit where habitat loss has been accounted for, there will be no additional habitat loss for the habitats overlying the tunnel route. Although it is difficult to estimate the exact habitat loss that will occur as a result of the construction of the railway, a conservative approach has been taken.

Habitat impact calculated in a buffer of 100 m along the railway line including permanent habitat loss (area taken for the installation and operation of the railway alignment) calculated in a buffer of 20 m along the railway line is provided in Table 18.

Recommended restoration area was calculated follwong EBRD PR6 reccomendations for loss-gain analysis for CH i.e. Area of Project Impact (ha) x Habitat Quality (Q) x 2 and PBF Area of Project Impact

(ha) x Habitat Quality (Q). To increase the feasibility of achieving no net loss/net gain the quality of all habitats has been assessed as 1. To ease assessment of success of NNL/NG management actions, general field estimate of habitat quality is provided under Recommended actions to achieve no net loss/net gain (Table 18). However, these need to be confirmed during pre-construction surveys.

[Salix] woodland also accounts for no net loss of C2.22 and C2.31. Presuming that the r/evitalization of riparian forests is not affected by other disturbances (natural disasters, trampled by humans, cattle etc.) the success of revegetation is expected to be high. Restoration practices for riparian forests should be prioritised.

To account for the loss of oak forests replanting with seedlings seeds and seedlings harvested locally from the same forests is recommended only in areas of project related forest cut. Instead a biodiversity offset in form of active forest management to improve integrity of adjascent coppice oak forests is advised to compensate for the habitat loss. Hence, it is advised to increase the restoration areas under oak forests for 30% so that larger areas are covered (indicated in brackets).

Accounting for the length of time for natural regrowth and regeneration of the forest, a biodiversity offset is proposed to compensate for negative impact on beech forests. Biodiversity offset for beech forests will focus on reinforcing and restoring beech forest degraded by impacts unrelated to the project and hence the target area to offset degradation and loss of beech forests has been calculated by applying CH loss-gain analysis.The AOI is characterised by continental climate and riparian zones are characterised by high underground water; hence re-vegetated areas should be allowed to re-establish naturally i.e. no irrigation is necessarry.

Table 18 Permanent habitat loss along the railway line and recommended actions to acheave no net loss/net gain. Natural/semi-natural habitats are marked in bold

Habitat type with reference to EUNIS	Permanent habitat loss, assessed in a buffer of 20 meters	**No net loss (PBF)**	**Net gain (CH)**	**Recommended actions to achieve no net loss/net gain**
	Area (ha)	Area (ha)	Area (ha)	
C2.22: Hiporhithral streams	0.04	0.04		Effects on streams are assessed as temporary. Accounting for the disturbance due to ongoing construction activities of other infrastructural projects implemented in the area of interest, the Company should aim to restore banks of affected streams to compensate impacts. Restoration should include removing any hydromorphological alterations made to the banks, to equate the affected area in order to achieve no net loss. Actions proposed for achieving net gain for the G1.11: Riverine [Salix] woodland incl. riparian [Salix] scrub apply as
C2.31 Epipotamal streams	0.01	0.01		

Habitat type with reference to EUNIS	Permanent habitat loss, assessed in a buffer of 20 meters	**No net loss (PBF)**	**Net gain (CH)**	**Recommended actions to achieve no net loss/net gain**
	Area (ha)	Area (ha)	Area (ha)	
				revegetating banks subjected to disturbance would largely contribute to restoring the ecological integrity of the streams in the area of interest. Continuous monitoring from Biodiversity specialist during first year of finishing construction activities and once a year for the consecutive 5 years of operation of the railway.
C3.62: Unvegetated river gravel banks ; C3.61: Unvegetated river sand banks	0	/		Restoration should include removing any hydromorphological alterations made. Continuous monitoring from Biodiversity specialist during first year of finishing construction activities and once a year for the consecutive 5 years of operation of the railway.
E1.33: East Mediterranean xeric grassland; E1.A22: Helleno-Balkanic supra Mediterranean siliceous grasslands	1.3		2.6	Actions proposed to achieve net gain of grasslands with habitat quality that closely corresponds to field estimates of habitat quality (0.4 to 0.7) shall focus on improving the representativeness of grasslands under succession i.e. In coordination with PE “Pastures” remove shrubs in the area of Prisojarci km 69 to km 70 to achieve net gain. Continuous monitoring from Biodiversity specialist during first year of finishing construction activities and once a year for the consecutive 5 years of operation of the railway.
E2.2: Low and medium altitude hay meadows	0.5	0.5		Subsidise traditional management and mowing activities in abandoned meadows in the area of Uzem/v. Kostur in an area adequate to achieve no net loss. PE ZRSMI in coordination with Municipality of Kriva Palanka and the Ministry of agriculture, forestry and waters (MAFWE)
E2.7: Unmanaged mesic grassland	0.8			
E3.31: Helleno-Moesian riverine and humid [*Trifolium*] meadows	0			

Habitat type with reference to EUNIS	Permanent habitat loss, assessed in a buffer of 20 meters	**No net loss (PBF)**	**Net gain (CH)**	**Recommended actions to achieve no net loss/net gain**
	Area (ha)	Area (ha)	Area (ha)	
E5.1: Anthropogenic herb stands	0.3			
G1.11: Riverine [*Salix*] woodland incl. riparian [*Salix]* scrub	0.2		0.4	Replanting with native Salix species (Salix alba, Salix purpurea and Salix triandra) and Poplar (Populus alba) in as appropriate should take at points of bridge construction in an area adequate to achieve net gain with habitat quality that closely corresponds to field estimates of habitat quality (0.5 to 0.7). In collaboration with environmental NGO, PE “National Forests”. Continuous monitoring from Biodiversity specialist during first year of finishing construction activities and once a year for the consecutive 5 years of operation of the railway.
G1.76: Balkano-Anatolian thermophilous [*Quercus*] forests	1.3	1.3 (1.7)		Although replanting with seedlings is feasible, replanting will take areas of natural grasslands and hence, it is not recommended. With added consideration to success rates and length of time for regrowth of plantated seedlings, a biodiversity offset is advised to compensate the induced habitat loss and acheave habitat quality that closely corresponds to field estimates of habitat quality (0.6 to 0.8). Biodiversity offset will take form of active forest management of coppice forests to improve forest integrity and restore oak forests degraded by impacts urelated to the project. Planting with seeds and seedlings harvested locally from the same forests is recommended in areas of project related forest cut, where feasible. There should be no habitat conversion due to restoration. Active management should take place in an area occupied by G5.61: Deciduous scrub woodland; for G1.76 in the area of Momica (Kiselcihka Reka gorge) and for the G1.7641/G1.761 in the area between
G1.7641: Helleno-Moesian *Quercus petraea* forests; G1.761: Helleno-Moesian *Quercus cerris* forests	4.3	4.3 (5.6)		

Habitat type with reference to EUNIS	Permanent habitat loss, assessed in a buffer of 20 meters	No net loss (PBF)	Net gain (CH)	Recommended actions to achieve no net loss/net gain
	Area (ha)	Area (ha)	Area (ha)	
				Vitanovci and Janchevci (km 85 to 86) where the railway line goes through a tunnel. In cooperation with PE “National Forests”. Continuous monitoring from Biodiversity specialist during first year of finishing construction activities and once a year for the consecutive 5 years of operation of the railway. To account for the possible low to medium success rate in replanting oak forests from seedlings it is advised to double the recommended area for restoration to acheave no net loss/net gain.
G1.69: Moesian [Fagus] forests	2.5	4.4		These are natural beech forests; hence although replanting with seedlings is feasible, replanting will take areas of natural grasslands and hence, it is not recommended. Instead, due to biodiversity disturbance, induced habitat loss and the length of time for natural regrowth and regeneration of the forest, a biodiversity offset is proposed to acheave habitat quality that closely corresponds to field estimates of habitat quality (0.8). Biodiversity offsets will take the form of reinforcing and restoring beech forest degraded by impacts unrelated to the project. In the area of Ljuti Rid and Straovica, apply active management to beech forests to improve integrity and forest quality. In cooperation with PE “National Forests”. Continuous monitoring from Biodiversity specialist during first year of finishing construction activities and once a year for the consecutive 5 years of operation of the railway. To account for the possible low to medium success rate in replanting beech forests from seedlings it is advised to double the recommended

Habitat type with reference to EUNIS	Permanent habitat loss, assessed in a buffer of 20 meters	No net loss (PBF)	Net gain (CH)	Recommended actions to achieve no net loss/net gain
	Area (ha)	Area (ha)	Area (ha)	
				area for restoration to acheave no net loss/net gain.
G1.7C2: [*Carpinus orientalis*] woods	2.8			
G1.C3: [*Robinia*] plantations	2.1			
G1.D: Fruit and nut tree orchards	0			
G3.F12: Native pine plantations	4			
G4.F: Mixed forestry plantations	1.8			
G5.1: Lines of trees	0.1			
G5.2: Small broadleaved deciduous anthropogenic woodlands	0.3			
G5.61: Deciduous scrub woodland	5.5			
I1.3: Arable land with unmixed crops grown by low-intensity agricultural methods	0.4			
I1.53: Fallow un-inundated fields with annual and perennial weed communities	0.4			
J1.1: Residential buildings of city and town centres	1.3			
J1.2: Residential buildings of villages and urban peripheries/I1.22: Small-scale market gardens and horticulture, including allotments	0.8			
J1.4: Urban and suburban industrial and commercial sites still in active use	0.1			
J4.2 Road networks	0.1			
J6.1: Waste resulting from building construction or demolition	0.3			
Total	**31.3**			

If feasible, it is also recommended to compensate, by replanting, the permanent loss of areas under G1.C3: [Robinia] plantations (2.1 ha); G3.F12: Native pine plantations (4 ha); and G4.F: Mixed forestry plantations (1.8) to acheave a no net loss in a ratio of 1:1.

6.1.2 SPECIES MIGATION MEASURES AND ACTIONS

MAMMALS

Pre-construction

Actions:

- Due to confirmed presence of the otter *Lutra lutra*, undertake pre-construction surveys for otter at all bridge locations prior to construction. If otter holts or lie-ups are found, then further advice from a suitably qualified ecologist should be sought. There are two bridges that are significant from this aspect, and special attention should be given to the big bridge no. 32 at km 76 + 402 to 76 + 611.5.
- Low numbers of bats were found to roost in the railway tunnels constructed during construction operations that took place in previous phases of the implementation of this project (tunnels before T'lminci that fall under Section 2 of the railway line (Beljakovce-T'lminci, and the tunnel entry to the border crossing with Bulgaria). Summer season pre-construction tunnel entries should be blocked to prevent bats roosting. Prior installing a blockage, tunnels should be checked for summer roost (used by males and non-breeding females) by a suitably qualified ecologist. Should a roost be found, they will be transported to another appropriate location away from the railway construction area. The ecologist can also advise on the remedial actions required.

Construction

Actions:

- Area and habitats affected by the construction should be minimized during the construction works by using fencing to minimise disturbance areas;
- Promoting practices for restoration of native habitats when needed;
- Appropriate construction and maintenance of wildlife passages (tunnels, viaducts, underpasses, overpasses etc.); The study undertaken in the frame of the ESIA 2012 and 2017 was sufficient to adequately inform the number of underpasses. According to the design specifics provided in ESIA, 2017 total of 19 underpasses and crossings are projected. Some of them are located in areas of bridges or tunnels and have no interference with the future railway line; other crossings are solved through an underpass and for some, an overpass is designed. Considering the terrain and hydrography specifics of the area, as well as species field data it is considered that projected crossings, underpasses and overpasses can adequately facilitate movement of animals. Still, should the pre-construction surveys and monitoring outline a the need for additional wildlife passages in the area of Uzem from km 81.4 to km 82; km 82.4 to km 82.8 and km 86.6 to km 87.3, then the project design should be adapted accordingly.
- Use appropriate preventive equipment (fences, signalization etc.) in order to avoid endangering the important habitats and mammal species;
- Control the pollution of the area through proper waste disposal;
- Undertake preventive measures to avoid accidental pollution;
- Minimize the construction works close to the river and away from known otter habitat, particularly at the crossing of Kiselichka Reka gorge;
- Ensure protection of sites with active otter holts or bat summer and winter roosts;
- Avoid construction work during night;
- Prohibition of illegal hunting from workers/visitors
- Monitor the presence and distribution of species noted to be of conservational importance.

Operation

Actions:

- Prioritise restoration management actions of riparian habitats
- In coordination with local hunting societies, construction and maintenance of alternative feeding facilities for large mammals.
- The railway maintenance service is obliged to record collision cases and keep running log of rail kill. If specific areas are more prone to rail kill than others, then remedial mitigation should be considered.

AVIFAUNA

Construction

Actions:

- Where possible, all vegetation clearance will be undertaken outside of the bird nesting period (March to August inclusive, see Table 19); however, to further comply with the EU BD, during vegetation clearance a Biodiversity specialist should first survey for nesting birds. Should bird nests be found, halt construction and in consultation with an experienced ornithologist/biodiversity expert decide whether to move the nest with minimum disturbance caused or defer the clearance until young have fledged.
- No demolition, mining or vehicle disturbance in Kiselichka Reka valley and T'lminci in the period February-April through mid May when the falcons are not tied to their nesting territory.
- If a Peregrine Falcon nesting territory/territories are discovered in future, artificial nest on adjacent cliffy structure should be provided

Operation

Actions:

- Overhead power lines and catenary shall be signalled to avoid bird collisions. Isolate those stretches of the overhead power line where the catenary is double to avoid the death of birds by electrocution upon contact with the catenary. To further reduce risk of electrocution avoid the use of rigid insulators in the towers supporting the catenary and use suspended insulators instead.

AMPHIBIANS

Construction and operation

Actions:

- Box culverts, amphibian tunnels, and underpasses should be maintained to allow a safe crossing, whereas exclusion fences, olfactory repellents, sound signals and sound barriers will further prevent any potential crossings. Total of 11 culverts are projected, according to the design specifics provided in ESIA, 2017. Locations of projected culverts are shown on Figure 21. Still, should the pre-construction surveys and monitoring outline a the need for additional wildlife passages in the

area of Uzem from km 81.4 to km 82; km 82.4 to km 82.8 and km 86.6 to km 87.3, then the project design should be adapted accordingly.

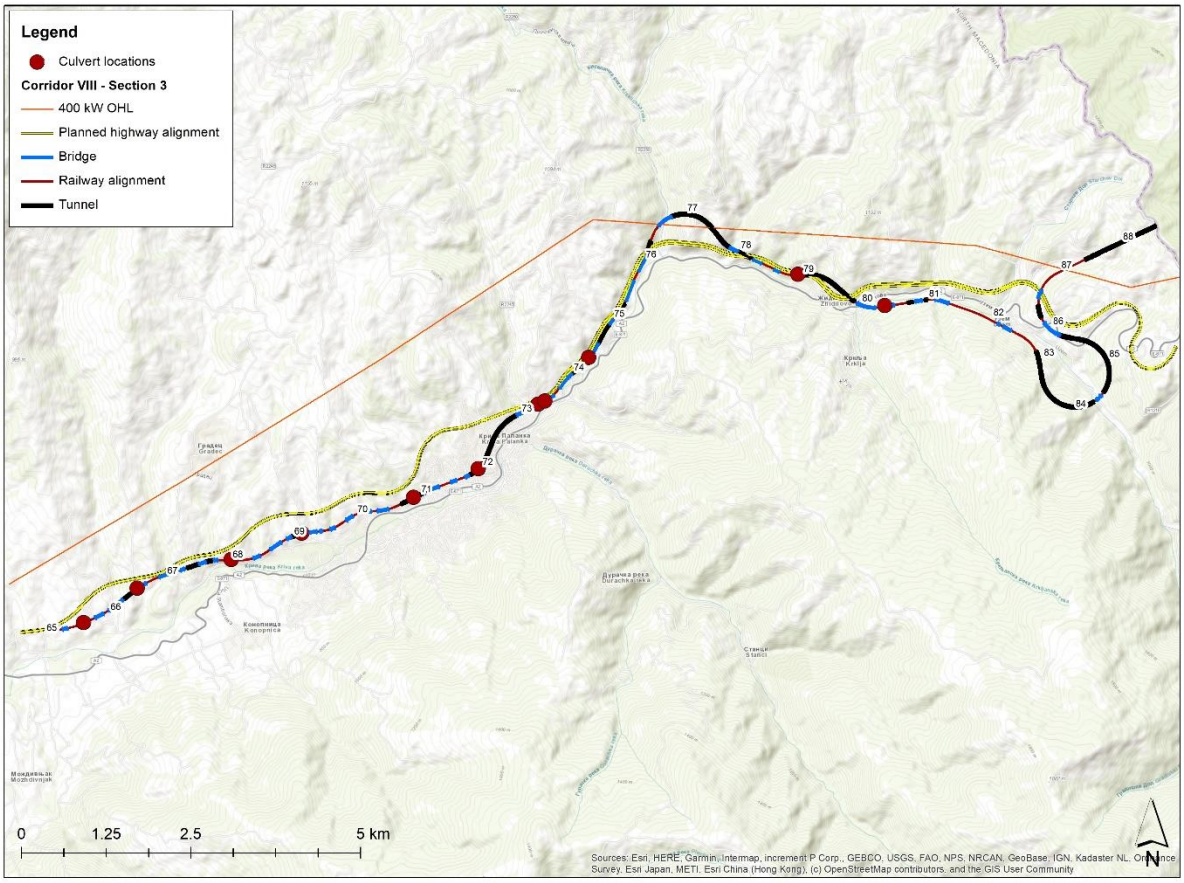


Figure 21 Culvert locations

REPTILES

Construction and operation

Actions:

- With reference to tortoises the construction phase should take place after the spring months (late June, the earliest), when activity is lower, at least one successful clutch has likely hatched, and when the vegetation is not as lush and high, so individuals, particularly juveniles (30-70mm long) can be spotted more easily and transported before construction activities cause them harm.
- In the area of T'lminci and Kostur-Uzem minimise construction activities in the period from October to March (see Table 19) as tortoises often burry and can easily fall victims to land alterations.
- As road mortality has been identified as one of the dominant threats to tortoises in the country, every infrastructural undertaking that could pose additional threats of this kind, should be prevented. Hence, installation and use of appropriate preventive equipment (exclusion fences, olfactory repellents, sound signals and sound barriers) that prevent the crossing of railways is recommended to minimise mortality in the operation phase of the railway.
- Underpass tunnels, box-culverts should be constructed and maintained, as they benefit, not only tortoises, but also other reptile species (both snakes and lizards).

INVERTEBRATES and AQUATIC FAUNA

Construction

Actions:

- Prevent leakage of oils to avoid contamination of water and adverse impacts to aquatic species
- Implement mitigation measures related to preservation of good water quality (installation of drainage structures and oil separators)
- Ensure natural fish pass during construction (e.g. during construction of bridges).
- Avoid movement of heavy machinery in water courses wherever possible to prevent adverse impacts on aquatic species.
- Prevent chemical leakage to avoid contamination of water and adverse impacts to macroinvertebrates. Implement pollution prevention control measures.
- Sediment control can also be achieved through construction phasing to minimise activities which cause disturbance and the greatest impact e.g. during the wettest periods of the year.
- Use extant or/and carefully and adequately plan the construction of temporary access roads, formation of borrow pits and disposal areas in order to avoid degradation of hay meadows patches assessed as representative, particularly in the area of Uzem –Kostur.
- Prevention against uncontrolled disposal of construction material nearby rivers and prevention against sloughing of construction material down the slope on hillsides
- The ends of the bridges should be embanked and secured against erosion during construction phase.
- Installation of drainage infrastructure to prevent erosion should be undertaken. Open cuts near the river will need to be re-vegetated as soon as possible to prevent soil erosion.
- Revegetation should be undertaken as soon as possible.

Operation

Actions:

- Adequate maintenance of drainage structures and oil separators as set out in the Pollution Prevention Control Plan.

With reference to all animal species, the implementation of the following measures is recommended:

- To avoid unnecessary destruction of important habitats (see mitigation measures for impacts on habitats)
- Do not kill and pose serious injuries to the native fauna during clearing of vegetation. This especially goes for reptiles
- To inform and educate the workers that killing of animals is prohibited within the project area during construction (amphibians, reptiles, birds, mammals)
- To inform hunting societies for the timeframe of construction works. Hunt should be prohibited within the project area
- To minimize large trees destruction

Table 199 Recommended construction timeline

Species group	Species	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec
Mammals													
	Otter												
	Wolf												
	European wildcat												
	Bats												
Reptiles													
Birds	Raptors and falcons with consideration to all other birds												

Minimise construction activities in preserved forests with presence of large tree trunks to avoid disturbance during hibernation; if vegetation clearance is to take place during the bird nesting season, then first with presence of Biodiversity Supervisor/Specialist perform a survey for nesting birds. Halt construction, if bats roosts are noted and following consultation with the Biodiversity Supervisor/Specialist resolve as per recommendation

No demolition, blasting, borrow pit quarrying or vehicle disturbance with emphasis to Kiselichka Reka valley

Throughout the year, should any nesting sites, holts or roosts be found, halt construction and following consultation with the Biodiversity Supervisor/Specialist resolve as per recommendation

6.2 Monitoring

Monitoring would take place at predefined locations with focus on locations where sensitive habitats/ habitats of conservation value are identified (see Figure 21). The monitoring is to include all seasons and it is anticipated that this type of monitoring may be required annually during construction, and for the first three years during operation. Following the conclusions from the supplementary biodiversity assessment, monitoring could likely be undertaken three times a year during the first year of operation, then monitoring survey on year five in the phase of operation, with focus on species of conservation concern, whose presence was confirmed during the supplementary biodiversity assessment with an option to widen the scope and/or review the ongoing need for monitoring should other species of conservational importance be noted during the monitoring.

Based on the type of features present and the mitigation proposals, additional monitoring actions have not been proposed, other than to monitor success of the revegetation of cleared areas and to implement remedial action if required, during the maintenance period. Monitoring of wildlife passages with focus on locations where sensitive habitats/ habitats of conservation value are identified (see Figure 22) is recommended to insure that the railway operation will not impede species movement. A running log of rail kill should also be kept. If specific areas are more prone to rail kill than others, then remedial mitigation should be considered.

Monitoring, mitigation and management actions and responsibilities are further elaborated in the Biodiversity Mangement Plan.

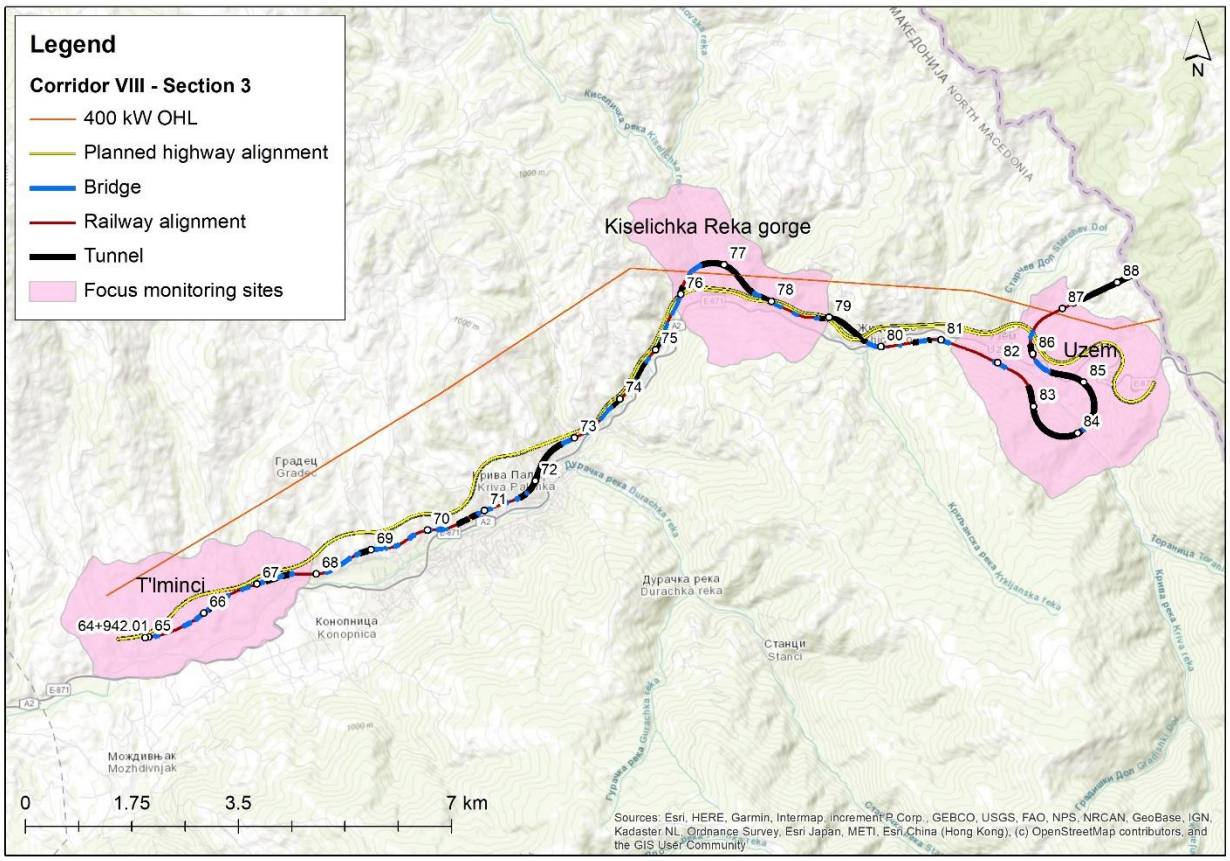


Figure 22 Outline of focus monitoring sites

6.3 Biodiversity Management Plan

The Biodiversity Management Plan has been developed as a standalone document. The Biodiversity Management Plan not only sets out the monitoring, mitigation and management measures and actions described above, but also seeks to clarify the roles and responsibilities for their implementation.

6.4 Summary of Residual Effects

Based on the results of the impact assessment and the mitigation outlined in Tables 13-15 above, it is considered likely that there will be no significant residual effects from the project on biodiversity. This does however depend upon the mitigation being implemented through the Biodiversity Management Plan. The summary of residual effects is provided on Table 20.

Table 20 Summary of impacts and commitments

Biodiversity or habitat feature	Impact producing factor	pre-construction	construction	operation	Impact	Assessment of significance without compensation or mitigation	Commitments	Predicted residual impact
						High/Low	Key mitigation, compensation, or Management measures	Low (no net loss/net gain) /High (net loss)
Habitats assessed as PBF	Area subject to permanent loss of vegetation		x	x	Total loss of vegetation is assessed to 8.6 ha. It is permanent and irreversible and hence, assessed as significant	High	Continuous monitoring, by an independent expert (biologist/ecologist) during the construction. Where feasible, access roads should not pass through the habitats assessed as PBF/CH. Planned temporary diversion on four intermittent streams should be carried during summer where it is least likely for water flow to occur. Prevention against uncontrolled disposal of construction material. Continuous supervision of Supervisory Authority during construction works. Restoring areas will be monitored and mowing regimes used to control growth of invasive species. Provide alternative borrow pit site should be provided for the one assigned to exploit alluvial and sediments between T-19 and T-20 and alternative landfills should be provided for the ones affecting	Low - Compensation of offsetting as outlined in section 6.1.1 (replanting/improved management) applies to achieve no net loss
	Areas subjected to direct impact/ possible temporary loss of vegetation		x	x	Total area of vegetation assessed to be impacted by the railway (permanent and temporary) during construction is 41.2 ha. In the absence of mitigation, revegetation would likely take 3 to 10 years.	Low		Low - Compensation of offsetting as outlined in section 6.1.1 (replanting/improved management) applies to achieve no net loss
Habitats assessed as CH	Area subjected to permanent loss of vegetation		x	x	Total loss of vegetation is assessed to 1.5 ha. It is permanent and irreversible and	High		Low - Compensation of offsetting as outlined in section 6.1.1 (replanting/improved

Biodiversity or habitat feature	Impact producing factor	pre-construction	construction	operation	Impact	Assessment of significance without compensation or mitigation	Commitments	Predicted residual impact
					hence, assessed as significant		habitats assessed as PBF/CH During the restoration phase, mitigate the impact of fragmentation by replanting / managing and monitoring naturally restoring habitats. To account for the possible low to medium success rate in replanting oak and beech forests from seedlings it is advised to double the recommended area for restoration to acheave no net loss/net gain.	management) applies to achieve net gain
	Areas subjected to direct impact/ possible temporary loss of vegetation		x	x	Total area of vegetation assessed to be impacted by the railway (permanent and temporary) during construction is 7.8 ha. In the absence of mitigation, revegetation would likely take 3 to 10 years.	High		Low - Compensation of offsetting as outlined in section 6.1.1 (replanting/improved management) applies to achieve net gain
Species	Disturbance (noise, vibration, light etc.)	x	x	x	All species will be affected by noise and vibrations. The disturbance will be particularly notable during construction; highest relevance with regards to mammals and birds	High	Adhere to recommended construction timeline and avoid construction work during night in areas marked as sensitive, specifically: In the area of Kiselichka Reka gorge at km 76.09 to km 76.6 avoid demolition and blasting and minimize vehicle disturbance in the period February to mid May. In the area of T'lminci at km 66 to km 66.7 minimize vehicle disturbance in the period February to mid May.	Low

Biodiversity or habitat feature	Impact producing factor	pre-construction	construction	operation	Impact	Assessment of significance without compensation or mitigation	Commitments	Predicted residual impact
							Minimise construction activities in preserved forests with presence of large tree trunks to avoid disturbance during hibernation, relevant for the area of Kostur-Uzem at km 81.3 to km 82.7 and km 86.13 to km 87; if vegetation clearance is to take place during the bird nesting season, then first with presence of Biodiversity Supervisor/Specialist perform a survey for nesting birds. Halt construction, if bats roosts are noted and following consultation with the Biodiversity Supervisor/Specialist resolve as per recommendation. The site will not be lit except in exceptional circumstances. Where lighting is required it will be directional and the lighting strategy will be designed with the input of a Biodiversity Specialist. Only non-UV lighting sources will be employed.	
	Pollution (waste disposal; motor oils and lubricants)		x	x	Pollution impacts will have adverse impact on terrestrial habitats (waste disposal), particularly on aquatic habitats (Hyporhitral, Epipotamal and	High	Take actions necessary to prevent leakage of oils, e.g. using double bunds surrounding fuel oil tanks, to avoid contamination of water and adverse impacts to aquatic species (installation of drainage structures and oil separators). Avoid movement of heavy machinery in	Low

Biodiversity or habitat feature	Impact producing factor	pre-construction	construction	operation	Impact	Assessment of significance without compensation or mitigation	Commitments	Predicted residual impact
					Temporary streams) although less likely. Impacts link to habitat degradation, habitat loss, availability of drinking water etc.)		watercourses wherever possible to prevent adverse impacts on aquatic species.	
	Disturbance/loss of feeding and foraging sites		x		Construction will have adverse effect on availability and accessibility of feeding and foraging sites. Particularly relevant for large mammals (wolf, European wildcat and the otter); but also relevant for birds (Storks and birds of prey).	High	Mitigation for habitat loss and loss of foraging sites will be undertaken during the process of restoration/revegetation in line with Landscape management plan	Low - Compensation of offsetting as outlined in section 6.1.1 (replanting/improved management) applies to achieve no net lsos/net gain
	Loss of tunnels, bunkers, barns/houses used by bats	x	x	x	Construction will cause loss of roosting sites for bats. Demolition of houses could also lead to potential loss of roosting sites for bats.	High	Pre-construction checks for bat presence in tree, bunkers and other shelters to avoid accidental deaths and injuries Summer season pre-construction tunnel entries should be blocked to prevent bats roosting. Prior installing a blockage, tunnels should be checked for summer roost (used by males and non-breeding females) by a suitably qualified ecologist. Should	Low - there may be a short term net loss (tree cutting) but accounting for management actions managing/reforesting and area for compensation/offset, no net loss/net gain for birds and bats is

Biodiversity or habitat feature	Impact producing factor	pre-construction	construction	operation	Impact	Assessment of significance without compensation or mitigation	Commitments	Predicted residual impact
							a roost be found, a suitably qualified ecologist should advise on actions. Ensure protection of sites with active bat summer and winter roosts; Avoid construction work during night;	expected in the future.
	disturbance/loss of nesting sites	x	x		Forest cut and vegetation removal will lead to loss of nesting/roosting sites. Particularly relevant for birds and bats	High	During vegetation clearance conduct walkthrough (rapid assessment) surveys immediately prior to works commencing (tree removal; tunnel construction in the bird nesting season. Should bird nests be found, halt construction and in consultation with an experienced ornithologist/biodiversity expert decide whether to move the nest with minimum disturbance caused or defer the clearance.	Low - there may be a short term net loss (tree cutting) but accounting for management actions managing/reforesting and area for compensation/offset, no net loss/net gain for birds and bats is expected in the future.
	Collision/electrocution death		x	x	Death from collision will be imminent during operation. Particularly relevant for mammals and birds, also reptiles, insects, amphibians and bats	Medium/low	Visual inspection of possible dead animals due to collision with trains. Establish database (species, data, and coordinates, comments) in order to respond timely with additional protection measures. Areas of high wildlife use will be indicated through appropriate signage along access roads where	Low

Biodiversity or habitat feature	Impact producing factor	pre-construction	construction	operation	Impact	Assessment of significance without compensation or mitigation	Commitments	Predicted residual impact
							potential exists for train/wildlife collision Wildlife passages (underpass tunnels, box-culverts) will be constructed, maintained, and monitored (for assessing success of application and frequency of use) as they benefit a significant portion of biodiversity. Overhead power lines and catenary shall be signalled to avoid bird collisions. Isolate those stretches of the overhead power line where the catenary is double to avoid the death of birds by electrocution upon contact with the catenary. To further reduce risk of electrocution avoid the use of rigid insulators in the towers supporting the catenary and use suspended insulators instead.	
	illegal hunting/accidental killing of animals	x	x		Increased accessibility (opening of access roads) and high frequency of human presence (workers) increases possibilities for illegal hunting and death by killing (accidental or fear induced). Particularly relevant for wolfs, reptiles	low	To inform and educate the workers that killing of animals is prohibited within the project area during construction (amphibians, reptiles, birds, mammals). Information materials to be prepared for this purpose Prohibition of illegal hunting from workers/visitors; Inform hunting societies for the timeframe of construction works.	Low

Biodiversity or habitat feature	Impact producing factor	pre-construction	construction	operation	Impact	Assessment of significance without compensation or mitigation	Commitments	Predicted residual impact
					(snakes), but also amphibians		Hunt should be prohibited within the project area	

Appendices

Appendix 1. - Appropriate Assessment

7 Appendix 1. - Appropriate Assessment

Under Article 6(3) of the Habitats Directive (92/43/EEC), an Appropriate Assessment is required where a plan or project is likely to have a significant effect upon a European site, either individually or in-combination with other projects. A European site, referred to as a Natura 2000 site, is one which has been designated as a result of the EU Habitats Directive or EU Birds Directive criteria.

Any plan or project not directly connected with or necessary to the management of the site but likely to have a significant effect thereon, either individually or in-combination with other plans or projects, shall be subject to Appropriate Assessment of its implications for the site in view of the site's conservation objectives Article 6(3).

Although North Macedonia is a non-EU member, Bern Convention and the Habitats Directive (1992) principles and objectives apply. Both, the Bern Convention (1979) and the Habitats Directive (1992) are international legal instruments aimed at the conservation of wild flora, fauna and natural habitats. While the two have complete coincidence of objectives they differ in terms of the territory they apply to: the Directive applies to European Union member States; and the Bern Convention applies to whole of Europe and part of Africa.

The Habitats Directive was designed to convey recommendations on habitat conservation contained in the Bern Convention, improving and reinforcing its application in the member States of the European Union. The member States of the European Union satisfy the habitat requirements of the Bern Convention through the designation of Natura 2000 areas. An equivalent for the non-EU member states is the designation of Emerald sites, as foreseen in Resolution No. 5 of the Bern Convention.

Not excluding the Natura 2000 and Emerald sites, areas with existing or planned legal conservation protection in the relevant jurisdiction(s) should also be considered.

An appropriate assessment is required where a plan or project is likely to have a significant effect upon a European site, either individually or in combination with other projects. Any plan or project not directly connected with or necessary to the management of the site but likely to have a significant effect thereon, either individually or in combination with other plans or projects, shall be subject to appropriate assessment of its implications for the site in view of the site's conservation objectives Article 6(3).

This Article has been interpreted as meaning that any project is to be subject to an appropriate assessment if it cannot be proven, beyond reasonable scientific doubt, that there is no significant effect on that site (a precautionary approach), either alone or in combination with other plans or projects.

If necessary, the Appropriate Assessment process progresses through four stages. If at any stage in the process it is determined that there will be no significant effect on any Natura 2000 site, the process is effectively completed. The four stages are as follows:

• Stage 1 – Screening of the Proposed Works;

• Stage 2 – Appropriate Assessment of the Proposed Works;

• Stage 3 – Assessment of alternative solutions; and

• Stage 4 – Assessment of compensatory measures.

Stages 1 and 2 relate to Article 6(3) of the Habitats Directive; and Stages 3 and 4 to Article 6(4).

When working in non-EU countries, there should be a clear reason or rationale for which sites should be subject to appropriate assessment: a) the site is an official site or candidate site, b) has been created as an Emerald Site.

Emerald Network is a network of Areas of Special Conservation Interest (ASCI) designated for the purpose of preserving the natural habitat network and is developed in the territory of the Member States of the Berne Convention (Convention for the Conservation of Wildlife and Natural Habitats in Europe).

The Republic of Macedonia, as a member state of the Berne Convention (ratified in 1997 with the Law on Ratification, Official Gazette of the Republic of Macedonia No. 49/97) implemented four projects for the development of the National Emerald Network in the period from 2002 to 2008, during which total of 35 areas of conservation interest were identified and they were proposed to the Bern Convention Secretariat for their inclusion in the national Emerald Network[40].

7.1 Screening

The aim of Stage 1, 'Screening' is to determine whether or not Stage 2, the Appropriate Assessment is required, i.e. to determine whether or not the Plan is likely to negatively affect the conservation objectives on any Emerald/Natura 2000 site. This is done by examining the design of the proposed project; and the conservation objectives of any Emerald/Natura 2000 sites that might potentially be affected. The data relating to the species and habitats, which are present on the Emerald site, and for which it has been evaluated are listed on what is called the Emerald – Standard Data Form. It should be noted that the AA only has to take into account these listed or qualifying features. Other features not listed, that may be present and considered of conservation concern do not form part of the AA assessment. The AA screening is very specific, any only targeted to the features listed on the Emerald Standard data form.

7.1.1 Description of the main aspects likely to cause impacts from project implementation

In the wider area of the S3 Kriva Palanka (T'lminci) – Deve Bair railway corridor there are two relevant Emerald areas: Pchinja-German MK0000029 and Osogovo Mountains MK0000026 (Figure 23). No zoning or management plans are available for the two proposed Emerald sites.

[40] https://emerald.eea.europa.eu/

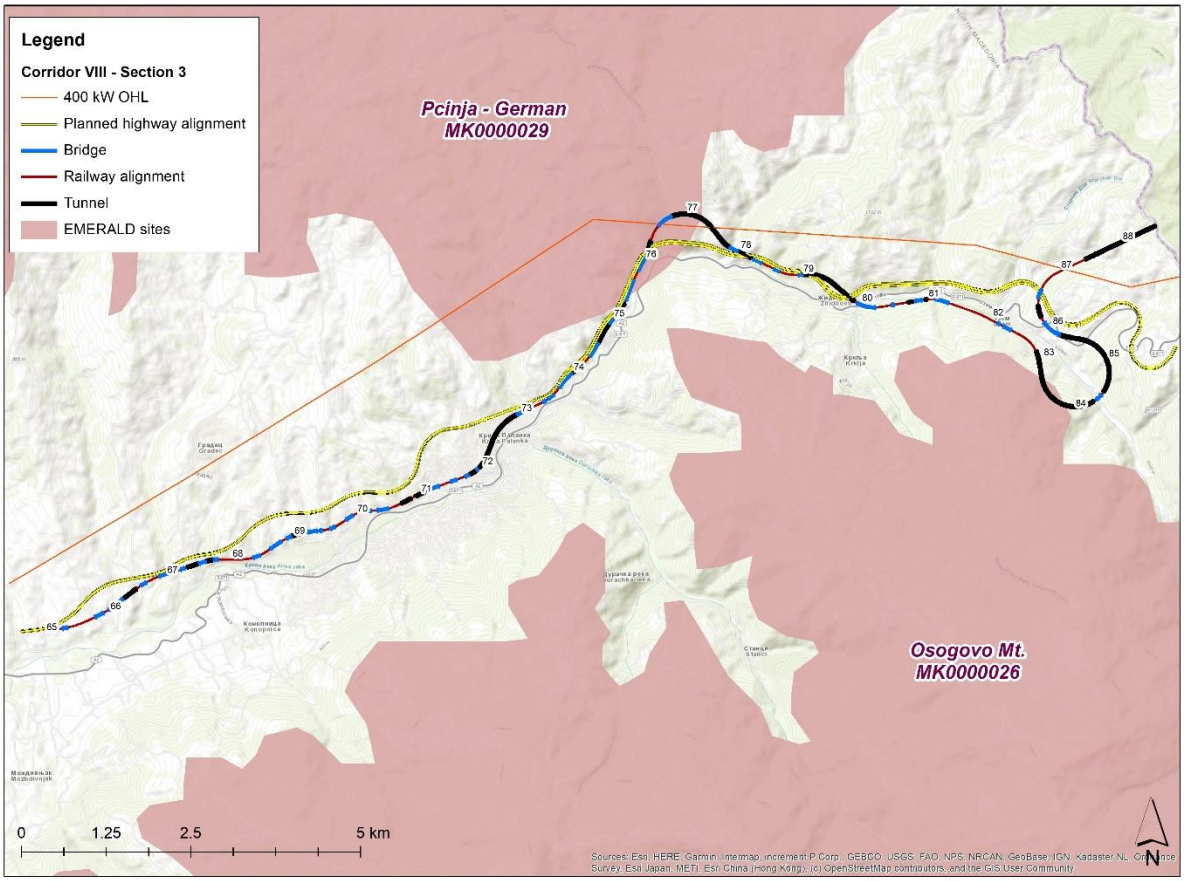


Figure 23 EMERALD sites along the railway alignment Kumanovo-Deve Bair: S3 Kriva Palanka (T'Iminci) – Deve Bair

7.1.2 Summary description of the Emerald sites and their key features

7.1.2.1 Emerald site Pchinja-German – MK0000029

The Emerald site covers an area of 63,490 ha. This area has been identified as Type C: sites important for birds and other species and/or habitats. The site supports a number of species i.e. 29 bird species, 6 mammals, 7 amphibians and reptiles and 2 invertebrates listed under Resolution No. 6 of the Bern Convention.

The area is noted to support the following species listed in Resolution 6 and site evaluation for them/population:

Invertebrates: Lucanus cervus (B), Rosalia alpine (B)

Amphibians: Bombina variegata (B), Triturus karelinii (C)

Reptiles: Elaphe quatuorlineata (C), Elaphe situla (B), Emys orbicularis (C), Testudo graeca (A), Testudo hermanni (B)

Birds: Alcedo atthis (C), Anthus campestris (C), Aquila heliacal (B), Bubo bubo (B), Buteo rufinus (B), Calandrella brachydactyla (C), Caprimulgus europaeus (B), Circaetus gallicus (B), Coracias garrulous (B), Dendrocopos medius (B), Dendrocopos syriacus (C), Dryocopus martius (C), Emberiza hortulana (B),

Emberiza melanocephala (C), Falco biarmicus (A), Falco peregrinus (B), Falco vespertinus (C), Hippolais olivetorum (C), Lanius collurio (B), Lanius minor (C), Lanius nubicus (B), Lanius senator (B), Lullula arborea (B), Melanocorypha calandra (C), Neophron percnopterus (B), Oenanthe hispanica (C), Otus scops (B), Pernis apivorus (C), Picus canus (B).

Mammals: Canis lupus (B), Miniopterus schreibersi (B), Myotis myotis (C), Rhinolophus Euryale (C), Rhinolophus ferrumequinum (B), Rhinolophus hipposideros (B)

All species listed above were assessed as B/C under criterias conservation.

Other important species of flora and fauna listed for the area are:

Invertebrates: Heterocypris incongruens, assessed as B i.e. Endemics

Plants: Dianthus ernesti-mayeri and Stachys horvaticii assessed as B i.e. Endemics

Amphibia: Bufo bufo, Bufo viridis, Hyla arborea, Rana dalmatina, Rana ridibunda and Salamandra salamandra, all assessed as C i.e. listed in International Conventions.

Reptiles: Anguis fragilis, Coluber caspius, Coluber najadum, Lacerta viridis, Natrix natrix, Podarcis erhardii, Podarcis taurica, Telescopus fallax, Vipera ammodytes, all assessed as C i.e. listed in International Conventions.

Mammals: Capreolus capreolus, Felis silvestris, Glis glis, Lepus europaeus, Martes foina, Meles meles, Mustela nivalis, Mustela putorius, Nannospalax leucodon, Vormela peregusna, all assessed as C

Specifics on qualifying species and ecological specifics of the site are available here: https://natura2000.eea.europa.eu/Emerald/SDF.aspx?site=MK0000029&release=2#top

7.1.2.2 Emerald site Osogovo – MK0000026

The site covers an area of 56,674 ha. This area has been identified as Type C: sites important for birds and other species and/or habitats. The site supports a number of species i.e. 27 bird species, 3 mammals, 2 and 3 invertebrates listed under Resolution No. 6 of the Bern Convention.

The area is noted to support the following species listed in Resolution 6 and site evaluation for them/population:

Invertebrates: Euphydryas aurinia (A), Lucanus cervus (C), Rosalia alpine (C)

Amphibians: Bombina variegate (C), Triturus karelinii (B)

Birds: Anthus campestris (B), Aquila chrysaetos (B), Aquila pomarina (C), Bonasa bonasia (C), Bubo bubo (B), Buteo rufinus (B), Caprimulgus europaeus (B), Ciconia nigra (C), Circaetus gallicus (B), Crex crex (B), Dendrocopos leucotos (B), Dendrocopos medius (B), Dendrocopos syriacus (B), Dryocopus martius (B), Emberiza hortulana (B), Falco biarmicus (B), Falco peregrinus (B), Ficedula albicollis (C), Ficedula parva (C), Lanius collurio (A), Lanius senator (B), Lullula arborea (A), Neophron percnopterus (B), Otus scops (B), Pernis apivorus (B), Phoenicurus phoenicurus (B), Picus canus (B)

Mammals: Canis lupus (B), Lutra lutra (C), Rhinolophus ferrumequinum (C)

All species listed above were assessed as B/C under criterias conservation.

Other important species of flora and fauna listed for the area are:

Fish: Salmo macedonicus (B); Endemic

Amphibians: Bufo bufo, Bufo viridis, Hyla arborea, Rana ridibunda, Rana temporaria, Salamandra salamandra , all assessed as C i.e. listed in International Conventions.

Reptiles: Anguis fragilis, Coluber caspius, Lacerta viridis, Lacerta vivipara, Natrix natrix, Podarcis erhardii, Vipera ammodytes, Vipera berus, all assessed as C i.e. listed in International Conventions.

Mammals: Capreolus capreolus, Dryomys nitedula, Felis silvestris, Glis glis, Martes foina, Meles meles, Muscardinus avellanarius, Mustela nivalis, Mustela putorius, Nannospalax leucodon, all assessed as C i.e. listed in International Conventions.

Specifics on qualifying species and ecological specifics of the site are available here: https://natura2000.eea.europa.eu/Emerald/SDF.aspx?site=MK0000026&release=2#top

7.1.3 Description of individual project aspects that could generate impacts on the Emerald sites

7.1.3.1 Emerald site Pchinja-German – MK0000029

The alignment of the railway passes through the **Emerald site Pchinja-German** from km 75 + 213 to km 77 + 070 ie in the length of 1.8 km (this will include pine plantations, black locust plantations, degraded thermophilic oak forests and mesophilic oak forests). Of these, 1.4 km pass through tunnels or bridges. From the significant forests, the alignment passes through thermophilic oak forests from km 76 + 550 to km 76 + 740 of which 130 m pass through a tunnel, and the remaining 60 m below the bridge.

Temporary and permanent removal of vegetation during the process of construction of the railway line, as well as clearing vegetation to create access tracks, will result in habitat loss (Table 1A).

From the species with A, B or C site assessment in the Data form, only the following have been confirmed during the 2022 fieldwork: birds (*Dendrocopos syriacus; Dryocopus martius*; and *Lullula arborea*) and mammals (*Canis lupus, Lutra lutra*). The presence of other qualifying bird species amongst which *Falco peregrinus* (breeding pairs) and noted bats (*Miniopterus schreibersi, Myotis blythii, Myotis myotis*) were not confirmed in the area of the Emerald site but should not be excluded from this assessment.

Impacts related to habitat degradation/fragmentation, noise, disturbance, pollution during construction and those related to collision, noise, pollution during operation are feasible.

7.1.3.2 Emerald site Osogovo Mt. – MK0000026

The alignment of the railway passes through the Emerald area of "Osogovo Mountains" from km 83 + 080 to km 83 + 630 i.e. in length of 0.5 km. the whole area of intersection is crossed with tunnel with no consequent habitat loss; hence no adverse impacts on the associated flora and fauna are expected. Tunnel entry and exist points are outside the boundaries of the proposed Emerald site (measured distance of tunnel entry is 410 m and 460 m for tunnel exit)

7.1.4 Likely impacts in combination with other plans or projects

7.1.4.1 Emerald site Pchinja-German. – MK0000029

Impacts in combination with the construction of the Expressway A2, LOT 2: Sub-section Kriva Palanka – Dlabocica projected alongside the railway line are not likely since the planned highway alignment was re-projected to be implemented as expressway at one section as A2, LOT 2: Sub-section Kriva Palanka – Dlabocica to merge with the regional road to Bulgaria, that is now in phase of rehabilitation: Kriva Palanka Road Rehabilitation Project from Kriva Palanka to Deve Bair. The construction of the remaining portion of what was initially a planned highway alignment - Kriva Palanka to Deve Bair does hence not seem feasible at the time.

The regional road to Bulgaria, that is now in phase of rehabilitation: Kriva Palanka Road Rehabilitation Project from Kriva Palanka to Deve Bair only touches the outer boundary of the proposed Emerald site (delineated to align to the existing road) and construction activities are confined within the corridor of an existing and operating road route. However, possible negative impacts resulting from ongoing activities linked to Kriva Palanka Road Rehabilitation Project from Kriva Palanka to Deve Bair add to the habitat disturbance in the valley of Kiselichka Reka and should be considered.

7.1.4.2 Emerald site Osogovo Mt. – MK0000026

None, as the whole area of intersection is crossed with tunnel with no consequent habitat loss. Tunnel entry and exist points are outside the boundaries of the proposed Emerald site (measured distance of tunnel entry is 410 m and 460 m for tunnel exit)

7.1.5 Significance of impacts in view of the site specific conservation objectives

7.1.5.1 Emerald site Pchinja-German. – MK0000029

According to the project design railway line will occupy a band with a width of 12 metres, including the tracks and the adjacent slopes of embankments or cuttings, which will be kept free of wild vegetation on a permanent basis. However, a conservative approach has been taken and direct land take (permanent habitat loss) has been assessed as most likely to occur in a buffer of 20 meters (10 m on each side). Overview of permanent habitat loss (area taken for the installation and operation of the railway alignment) is provided in Table 21.

Table 21 Habitats within Emerald site Pchinja-German, affected by railway construction. Habitats that will result in permanent loss are marked in bold. No qualifying habitats are noted in the site designation form.

EUNIS habitat type reference	Area ha	Impact
C2.22 : Hiporhithral streams	0.0	Crossed with a bridge/No impact/temporary impact
C2.31 Epipotamal streams	0.0	Crossed with a bridge/No impact/temporary impact
G1.11 : Riverine [Salix] woodland	0.1	
E2.2 : Low and medium altitude hay meadows	0.1	
G1.7641 : Helleno-Moesian Quercus petraea forests; G1.761 : Helleno-Moesian Quercus cerris forests	0.2	

EUNIS habitat type reference	Area ha	Impact
E1.A22 Helleno-Balkanic supra Mediterranean siliceous grasslands	0.4	Permanent loss
G1.76 Balkano-Anatolian thermophilous [Quercus] forests	0.6	Permanent loss
G1.7C2 [Carpinus orientalis] woods	0.3	
G1.D : Fruit and nut tree orchards	0.0	
G3.F12 Native pine plantations	0.3	
G5.2 Small broadleaved deciduous anthropogenic woodlands	0.2	
G5.61 : Deciduous scrub woodland	0.1	
J1.2 : Residential buildings of villages and urban peripheries/I1.22 : Small-scale market gardens and horticulture, including allotments	0.4	
J4.2 Road networks	0.0	
Total	2.7	

The degree of habitat loss within the Emerald site is negligible as 48 % of the affected habitats are anthropogenic/modified; habitat loss of natural habitats is assessed as total 52%, of which 15% will be affected only temporary due to bridge construction and the 37% of the directly affected natural habitats are the E1.A22 Helleno-Balkanic supra Mediterranean siliceous grasslands (CH) and the G1.76 Balkano-Anatolian thermophilous [Quercus] forests (PBF); both widespread in the area of interest.

No qualifying habitats are noted in the site designation form. Furthermore, all noted species are widespread in the area of interest and further considering the specific management actions and mitigation measures proposed (see summary table of impacts provided in section 6.4 of the Supplementary Biodiversity Assessment), no likely significant impacts are expected.

Considering that the railway line will impact the edge of the proposed Emerald site, should appropriate mitigation measures and management actions apply, no significant risk of species populations' displacement, reduction of species home range, feeding area, refuge areas, and alteration of favourable condition for breeding is expected.

Possible impacts on both species and habitats have been elaborated and accounted for within the Supplementary Biodiversity Assessment and detailed in the Biodiversity management plan.

Impacts in combination with the construction of the Expressway A2, LOT 2: Sub-section Kriva Palanka – Dlabocica projected alongside the railway line are not likely since the planned highway alignment was re-projected to be implemented as expressway at one section as A2, LOT 2: Sub-section Kriva Palanka – Dlabocica to merge with the regional road to Bulgaria, that is now in phase of rehabilitation: Kriva Palanka

Road Rehabilitation Project from Kriva Palanka to Deve Bair. The construction of the remaining portion of what was initially a planned highway alignment - Kriva Palanka to Deve Bair does hence not seem feasible at the time.

The regional road to Bulgaria, that is now in phase of rehabilitation: Kriva Palanka Road Rehabilitation Project from Kriva Palanka to Deve Bair only touches the outer boundary of the proposed Emerald site (delineated to align to the existing road) and construction activities are confined within the corridor of an existing and operating road route. Possible negative impacts resulting from ongoing activities linked to Kriva Palanka Road Rehabilitation Project from Kriva Palanka to Deve Bair have been accounted for in the road rehabilitation project ESIA that assumes no significant impact.

Hence, accounting for the monitoring in place[41] and further considering the NNL/NG management actions and mitigation measures outlined for both, no significant cumulative impacts are expected.

7.1.6 Conclusions

Based on the above information, it is assessed that the project will not have an adverse effect on the Emerald sites and with appropriate mitigation measures and management actions any likely impacts will not have a significant effect on population of species and habitats in the area.

[41] Reports on supplemental assessment of impacts on and monitoring of biodiversity from project activities in the area of the Osogovo-German bio corridor during construction of Expressway A2, LOT 2: Sub-section Kriva Palanka – Dlabocica, 2020-2021, Geonatura Zagreb
Survey of the large mammal fauna during construction of Expressway A2, LOT 2: Sub-section Kriva Palanka – Dlabocica, Field report VI, October - December 2020
Field report VII, January - February 2021
Field report VIII, March - May 2021
Final assessment of impacts on biodiversity from project activities in the area of the Osogovo-German bio corridor during construction of Expressway A2, LOT 2: Sub-section Kriva Palanka – Dlabocica, Biodiversity Management Plan

8 Appendix 2. – List of species, common English and Latin names included

8.1 FLORA

Acer campestre - Field maple

Achilea coarctata - Yarrow

Agrostis alba - Black bent

Ailanthus altissima - Tree of heaven

Alnus glutinosa - Common alder

Alopecurus pratensis - Meadow foxtail

Alopecurus utriculatus - Foxtail
Amorpha fruticosa - Desert false indigo

Astragalus onobychis - Milkvetch

Carpinus betulus - European hornmeam

Carpinus orientalis - Oriental hornbeam

Cornus mas - Cornelian cherry

Cornus sanguinea - Common dogwood

Corylus avellana - Common hazel

Crataegus monogyna - Common hawthorn

Euonymus verrucosa - Spindle tree

Euphorbia cyparissias - Cypress spurge

Fagus sylvatica - Beech

Festuca callieri - Fescue

Fraxinus ornus - Manna ash

Ligustrum vulgare - Common privet

Mallus sylvestris - European crab apple

Myricaria germanica - German tamarisk

Ostrya carpinifolia - European hop-hornbeam

Petesites alba - White butterbur

Plantago lanceolate - Ribwort plantain

Poa sylvicola - Meadow-grass

Populus alba - Silver poplar

Quercus cerris - Turkey oak

Quercus frainetto - Italian oak

Quercus petraea - Sessile oak

Quercus pubescens - Pubescent oak

Ranunculus trichophyllus - Threadleaf crowfoot

Rhamnus frangula - Alder buckthorn

Rosa arvensis - Liege-rose

Rosa galica - Rose

Rubus sp. – Raspberry/Blackberry

Salix alba - White willow

Salix elaeagnos - Bitter willow

Salix fragilis - Crack willow

Salix purpurea - Purple willow

Salix triandra - Almond willow

Sambucus nigra - Elder

Sanguisorba officinalis - Great burnet

Senecio rupestre - Barberton groundsel

Sorbus torminalis - Wild service tree

Taraxacum officinale - Dandelion

Trifolim resupinatum - Clover

Trifolium balansae - Clover

Trifolium filiforme - Clover

Urtica dioica - Common nettle

Verbascum sp. - Mullein

Viburnum opulus - Guelder-rose

8.2 FAUNA

8.2.1 Mammals

Canis lupus - Wolf

Felis sylvestris - European wildcat

Lutra lutra - Otter

Ursus arctos – Brown bear

8.2.1.1.1 Bats

Eptesicus serotinus - The serotine bat

Hypsugo savii - Savi's pipistrelle

Miniopterus schreibersii - Common bent-wing bat

Myotis blythii - Lesser mouse-eared bat

Myotis myotis - Greater mouse-eared bat

Myotis mystacinus - The whiskered bat

Nyctalus noctula - Common noctule

Pipistrellus kuhlii - Kuhl's pipistrelle

Pipistrellus nathusii - Nathusius' pipistrelle

Pipistrellus pipistrellus - The common pipistrelle

Pipistrellus pygmaeus - Soprano pipistrelle

Rhinolophus ferrumequinum - Greater horseshoe bat

Rhinolophus hipposideros - Lesser horseshoe bat

8.2.2 Avifauna

Alcedo atthis - Common kingfisher

Anthus campestris - Tawny pipit

Buteo buteo - Common buzzard

Calandrella brachydactyla - Greater short-toed lark

Caprimulgus europaeus - European nightjar

Ciconia ciconia - White stork Ciconia ciconia

Ciconia nigra - Black stork

Curruca (*Sylvia*) *nisoria* - Barred warbler

Dendrocopos medius - Middle spotted woodpecker

Dendrocopos syriacus - Syrian woodpecker

Dryocopus martius - Black woodpecker

Falco peregrinus - Peregrine falcon

Falco tinnunculus - The common kestrel

Ficedula albicollis - Collared flycatcher

Ficedula semitorquata - Semicollared flycatcher

Lanius collurio - Red-backed shrike

Lanius collurio - Red-backed shrike

Lanius minor - Lesser grey shrike

Lullula arborea - Wood lark

Lullula arborea - Woodlark

Melanocorypha calandra - Calandra lark

Pernis apivorus - European honey buzzard

Picus canus - Grey-headed woodpecker

8.2.3 Amphibians and Reptiles

8.2.3.1.1 Reptiles

Coronella austriaca - Smooth snake

Dolichophis caspius - Caspian whipsnake

Lacerta trilineata - Balkan green lizard

Lacerta viridis - European green lizar

Natrix tessellata - Dice snake

Platyceps najadum - Dahl's whip snake

Podarcis erhardii - Erhard's wall lizard

Podarcis muralis - Common wall lizard

Podarcis taurica - Balkan wall lizard

Testudo graeca - Spur-thighed tortoise

Testudo hermanii - Hermann's tortoise

Vipera ammodytes - Nose-horned viper

Zamenis longissimus - Aesculapian snake

8.2.3.1.2 Amphibians

Bombina variegata - Yellow-bellied toad

Bufotes viridis - European green toad

Hyla arborea - European tree frog

Pelophylax ridibundus - Marsh frog

Rana dalmatina - Agile frog

Rana graeca - Greek stream frog

8.2.4 Insects

Cerambyx cerdo - Great capricorn beetle

Lycaena dispar - Large copper

Maculinea (*Phenagris*) *arion* - Large blue

Morimus funereus - Longhorn beetle

Parnassius mnemosyne - Clouded apolo

Zerynthia polyxena - Southern festoon

9 Appendix 3. – Figures and maps

List of provided maps and figures

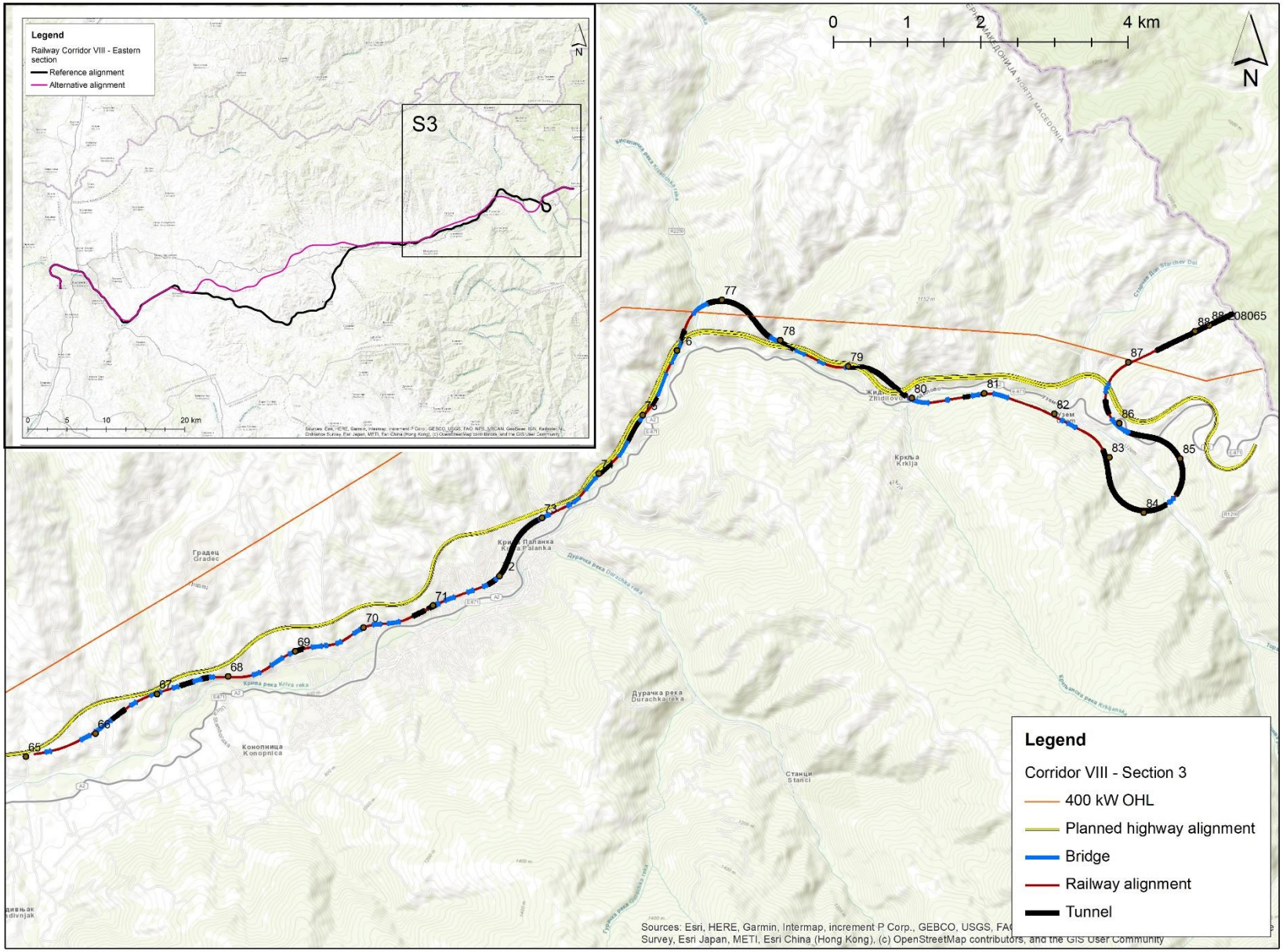


Figure 24 Overview of the railway alignment

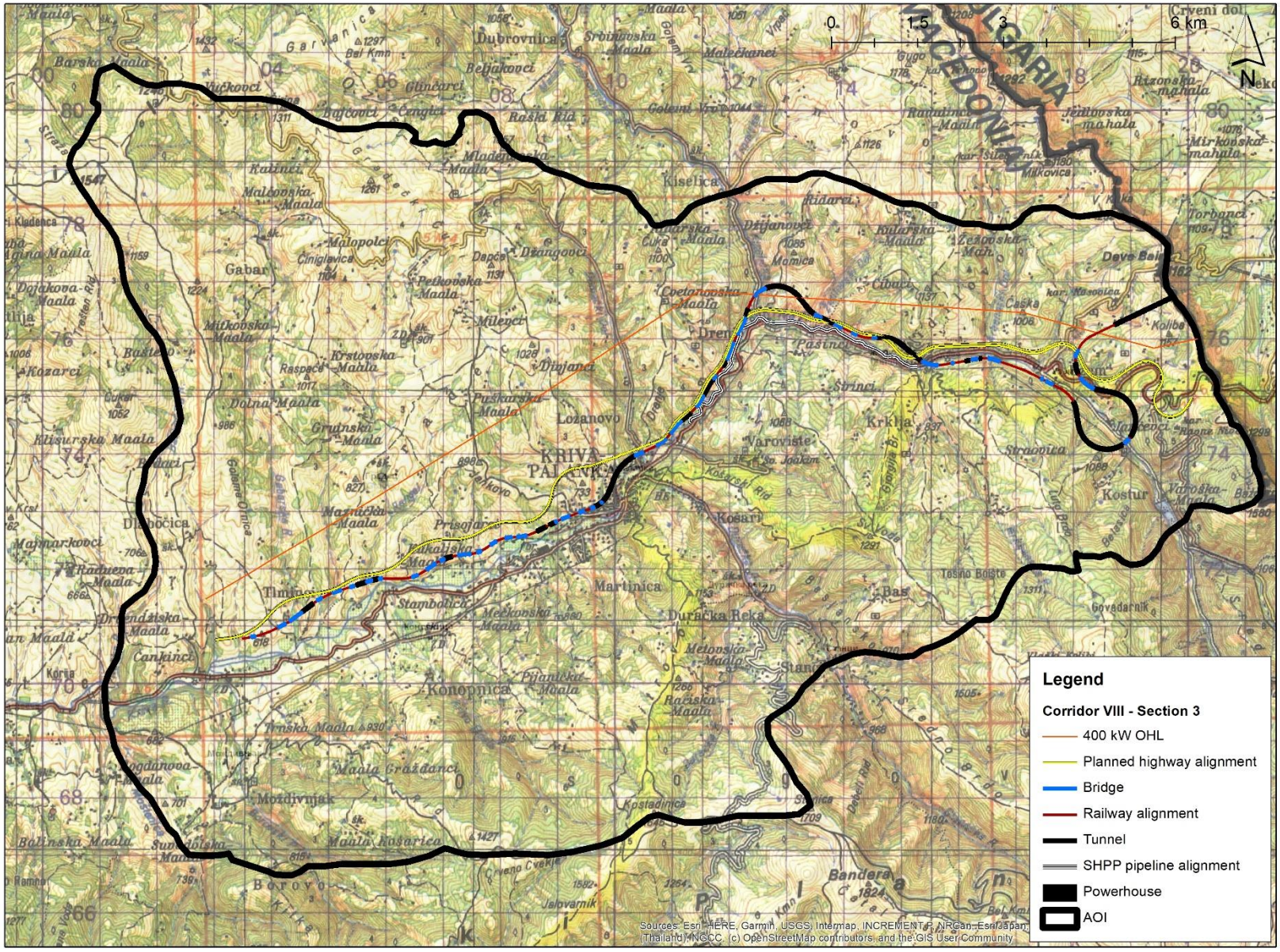


Figure 25 Area of Interest (AOI) as defined for the Supplementary biodiversity assessment

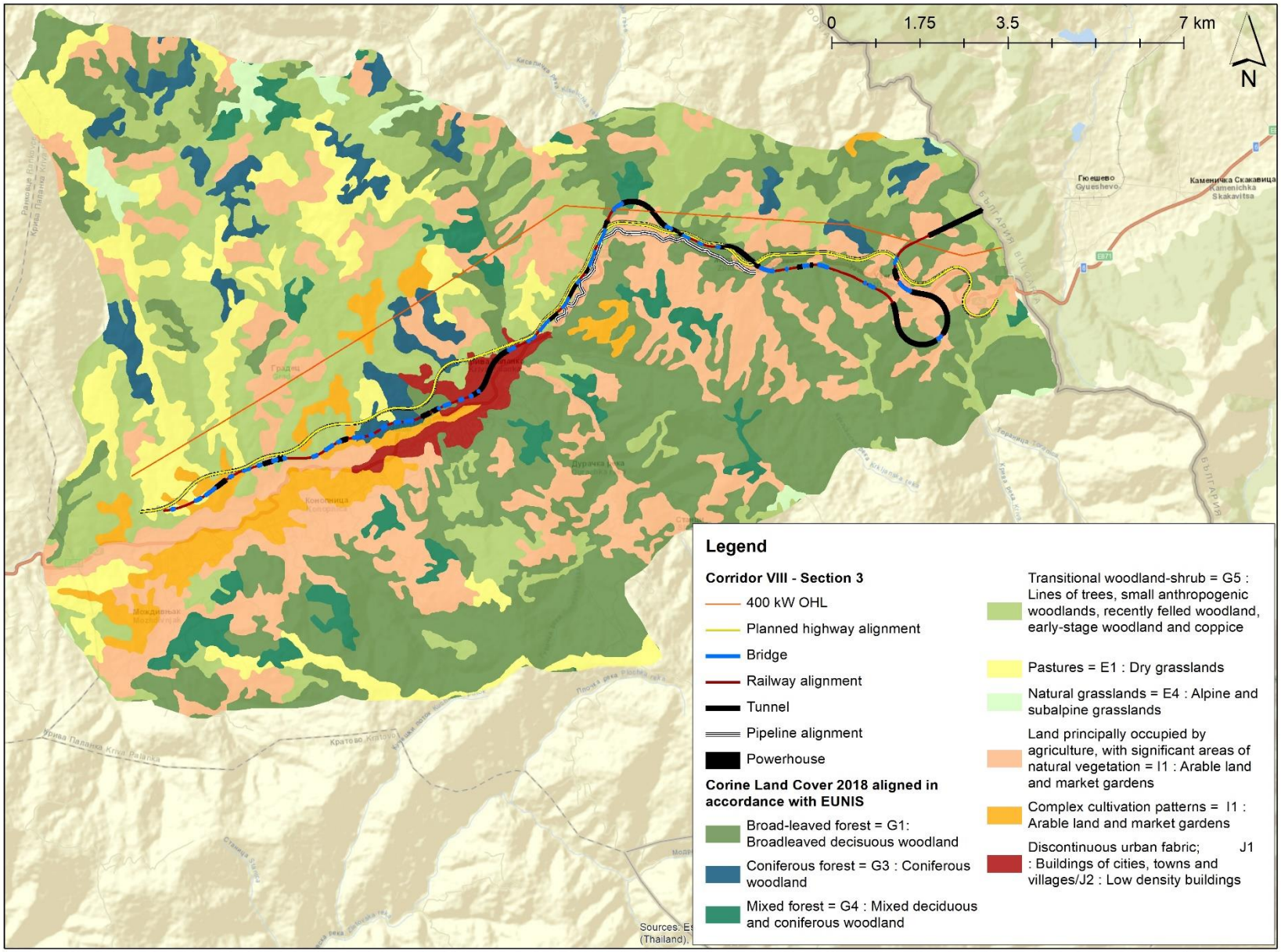


Figure 26 Land cover specifics of AOI according to Corine Land Cover data, 2018 aligned with EUNIS

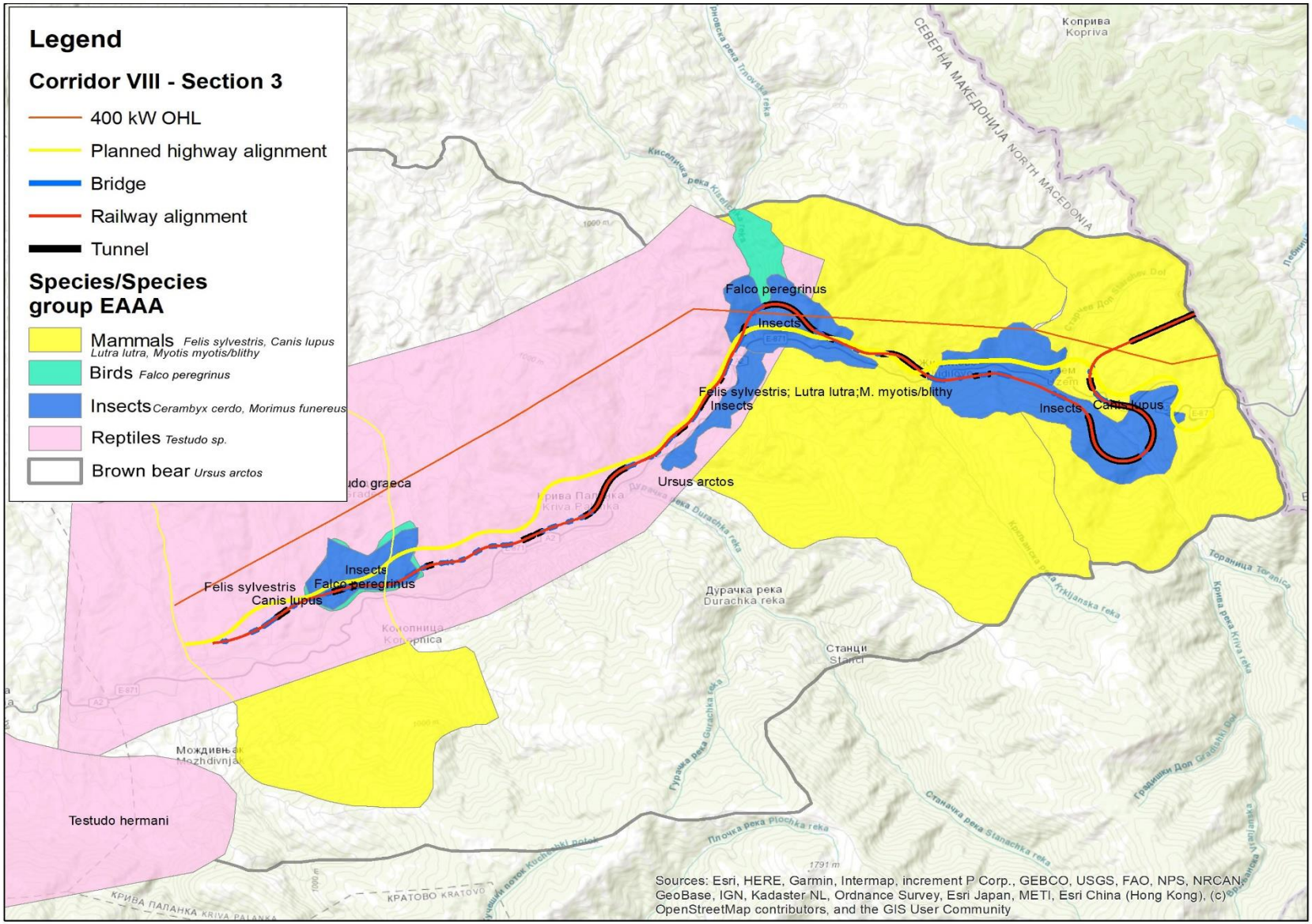


Figure 27 Joint presentation of delineated EAAA for target species/species groups in the AOI. Please note that EAAAs for some species overlap. The Brown bear EAAA is shown separately from other mammal species EAAAs as it delineates the AOI

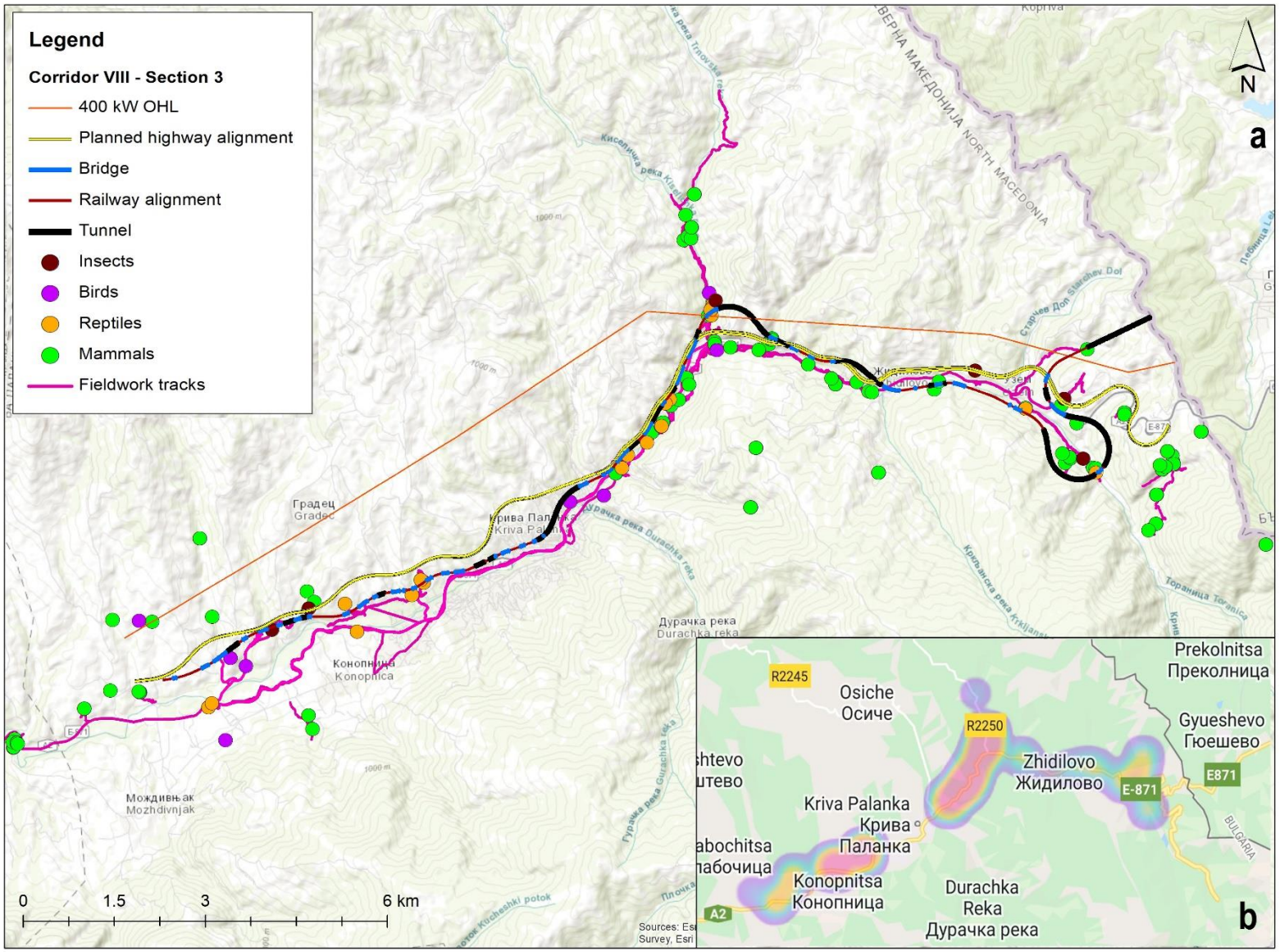
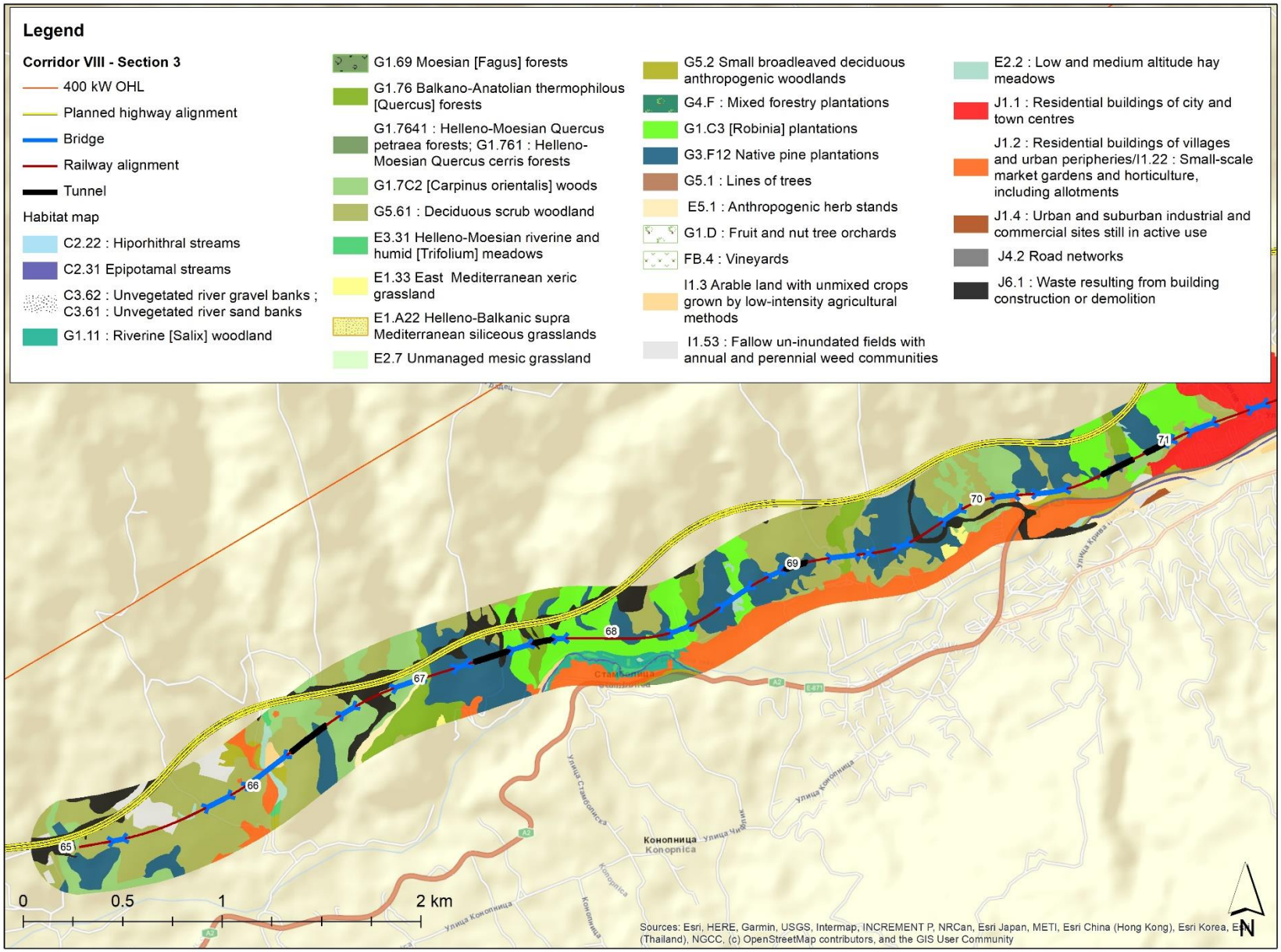


Figure 28 Cumulative representation of fieldwork survey routes and species findings along the railway alignment (a) and overview of area covered during fieldwork research indicating frequency of visit from red (most frequent) to blue (less frequent) (b)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Bridge
Railway alignment
Tunnel
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J1.4 : Urban and suburban industrial and commercial sites still in active use
J4.2 Road networks
J6.1 : Waste resulting from building construction or demolition
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Sources: Esri, HERE, Garmin, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI, Esri China (Hong Kong), Esri Korea, Esri (Thailand), NGCC, (c) OpenStreetMap contributors, and the GIS User Community
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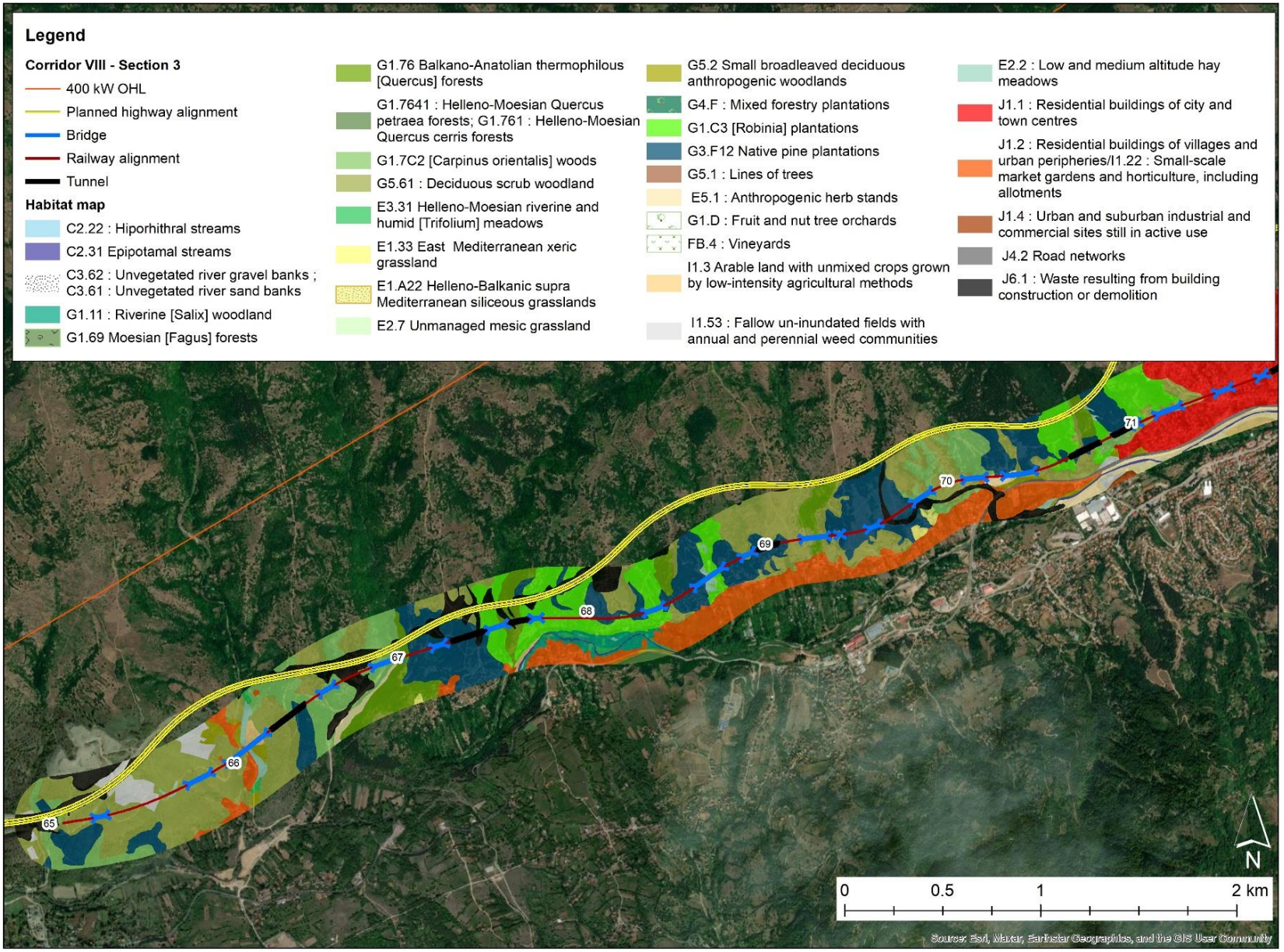
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Source: Esri, Maxar, Earthstar Geographics, and the GIS User Community

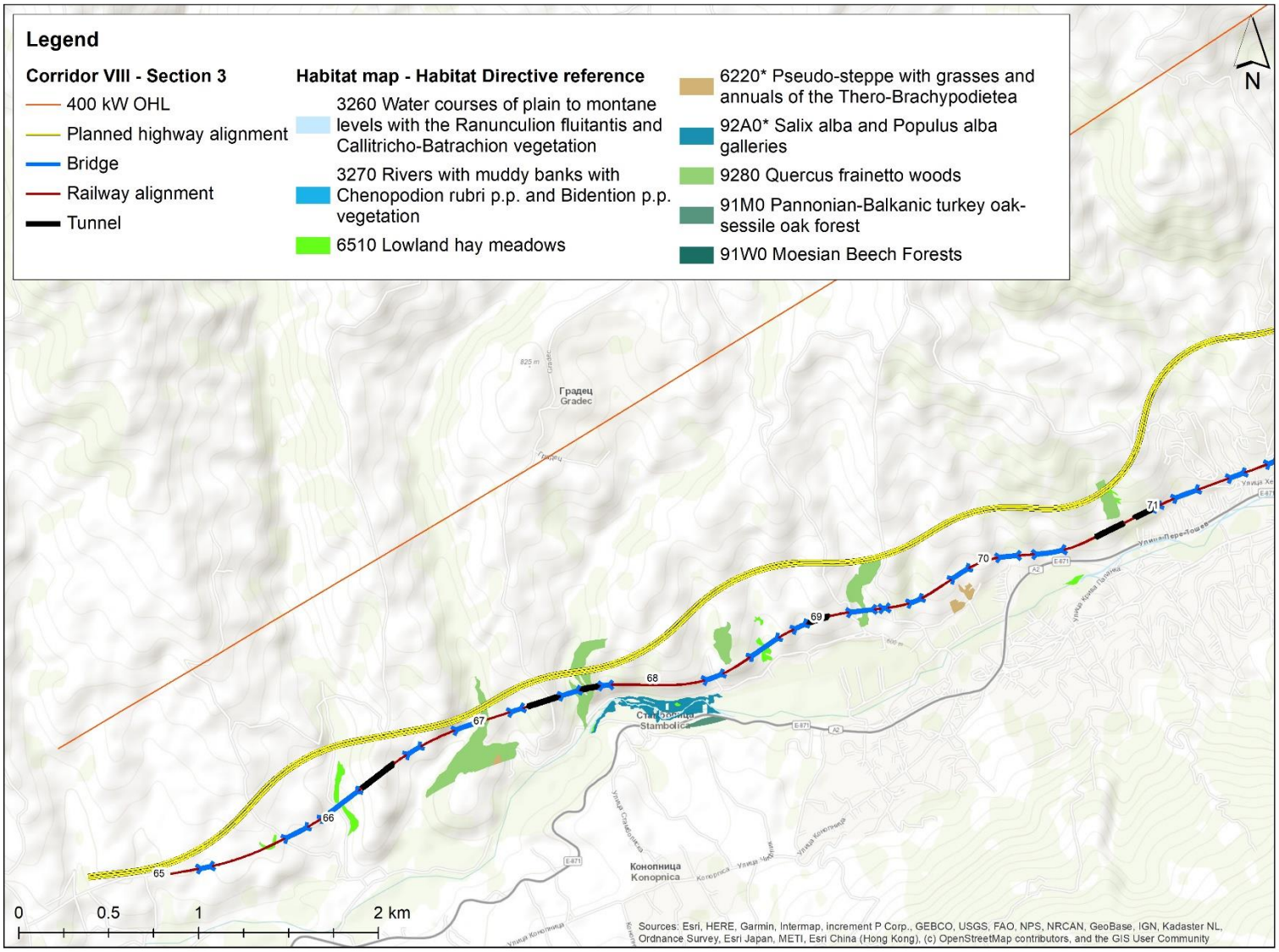
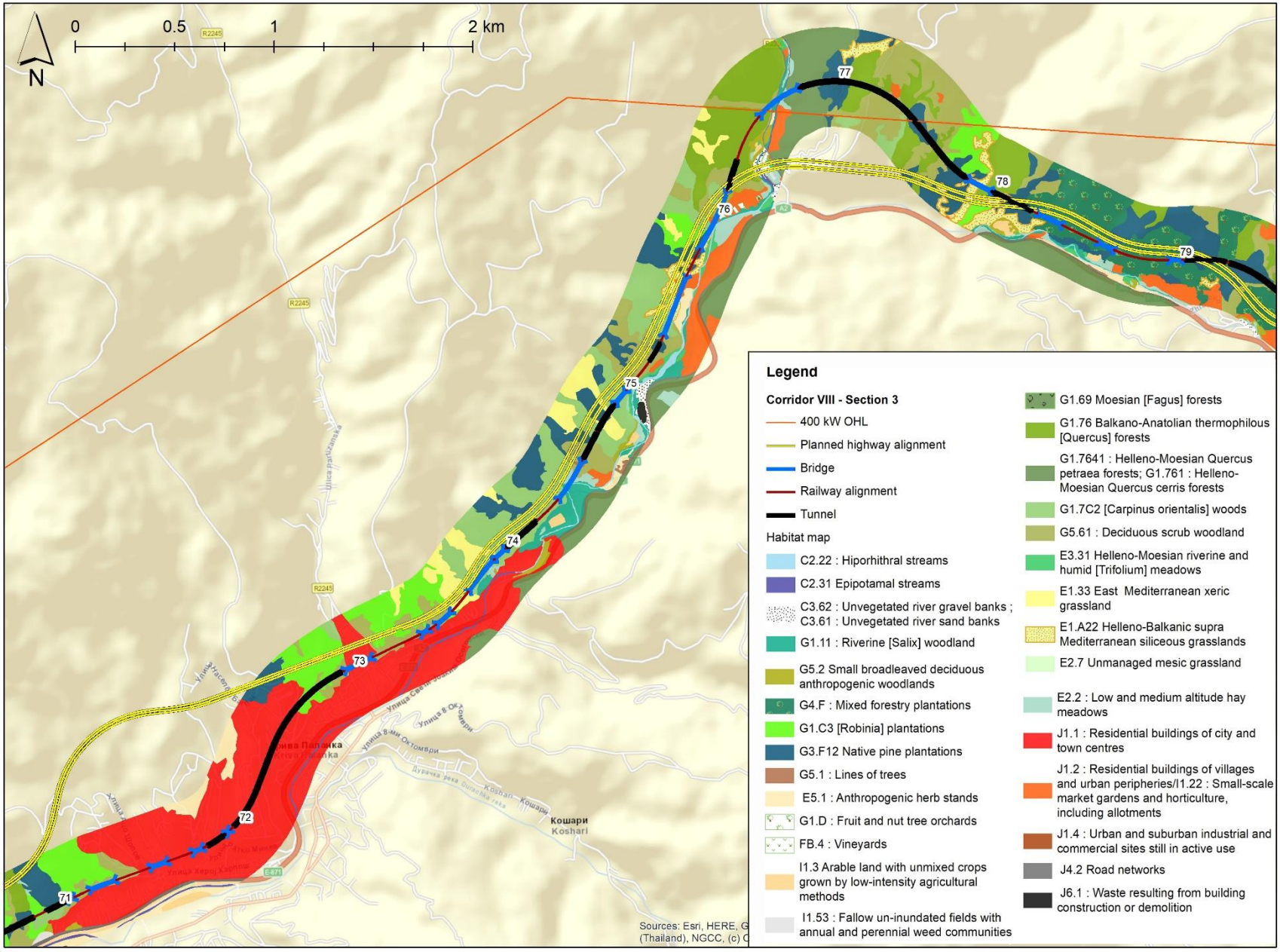


Figure 29 Habitat types along Kumanovo-Deve Bair railway line, Section 3 – Kriva Palanka (T'lminci) to Deve Bair: part 1 – T'lminci to Kriva Palanka. Reference to EUNIS and Habitat Directive provided on separate maps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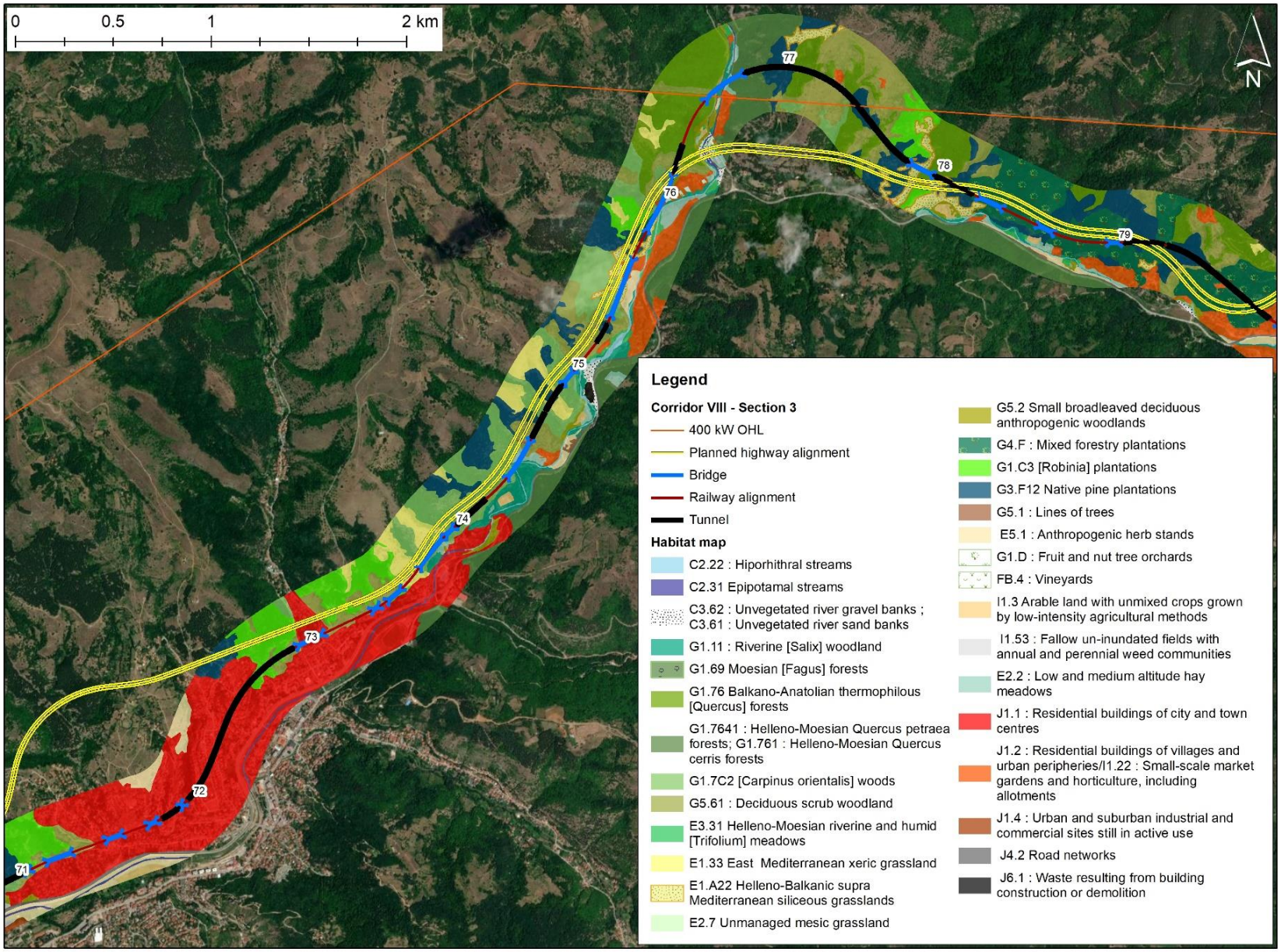
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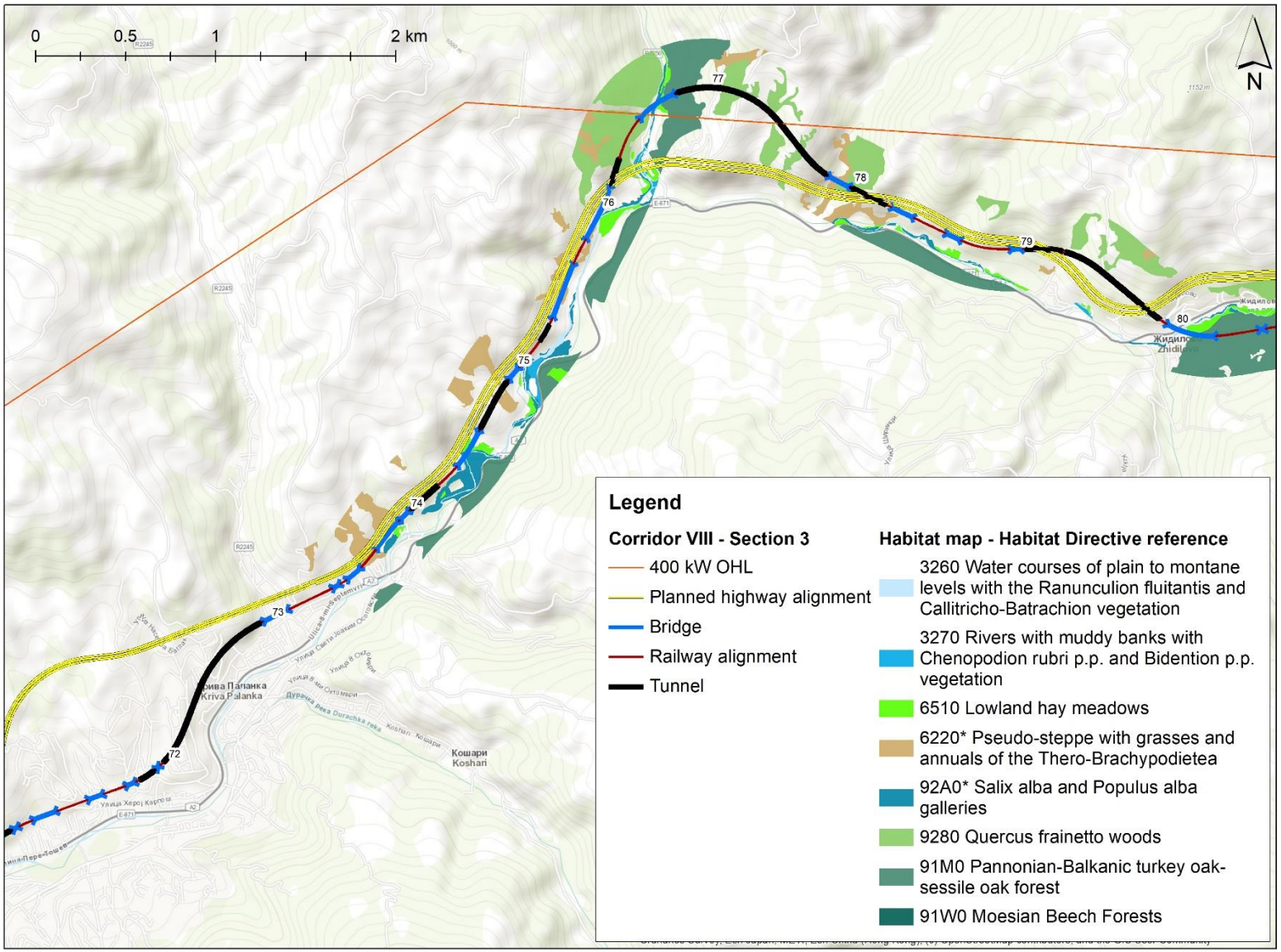
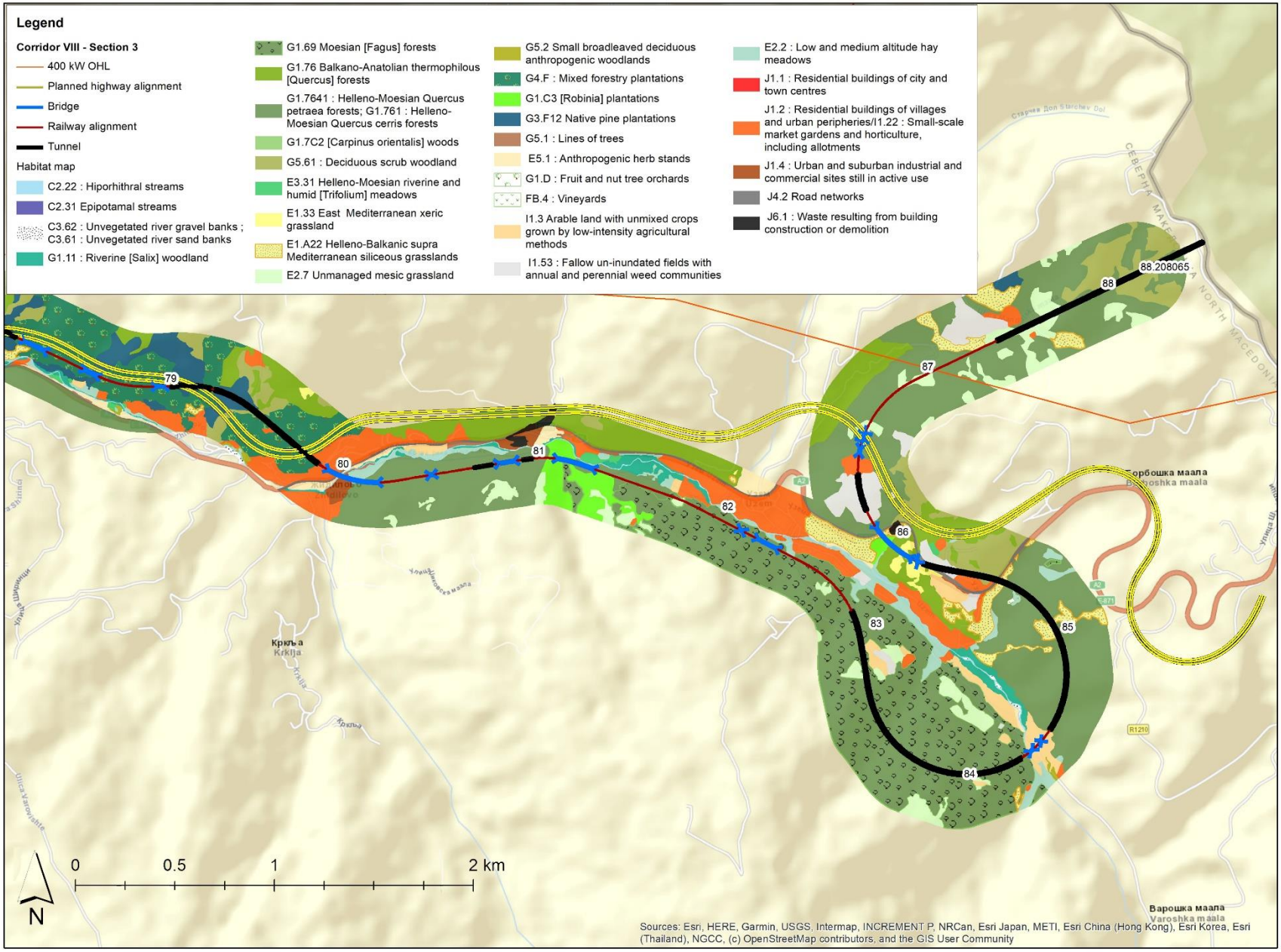


Figure 30 Habitat types along Kumanovo-Deve Bair railway line, Section 3 – Kriva Palanka (T'lminci) to Deve Bair: part 1 – Kriva Palanka to Zhidilovo. Reference to EUNIS and Habitat Directive provided on separate maps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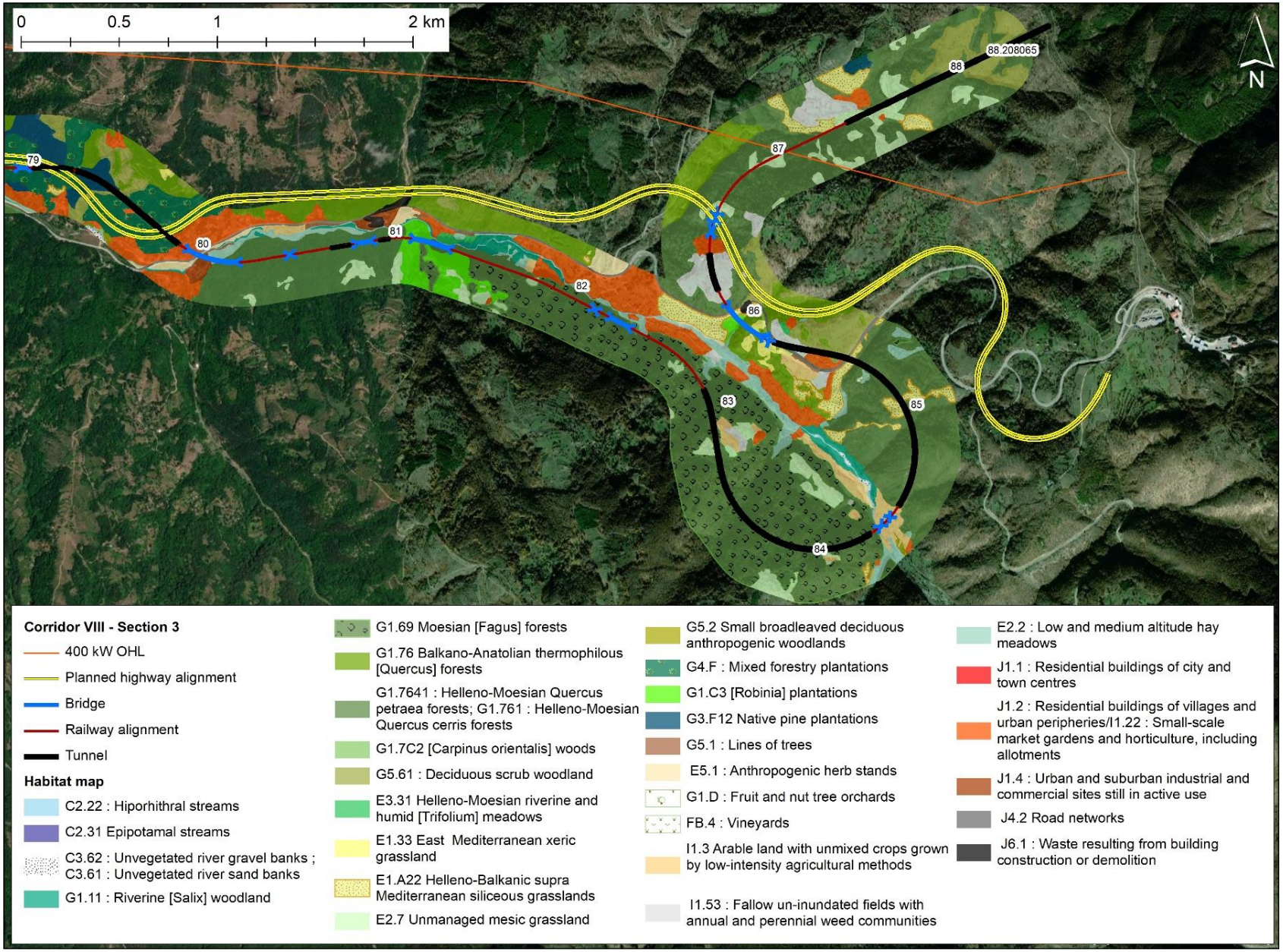
Sources: Esri, HERE, Garmin, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI, Esri China (Hong Kong), Esri Korea, Esri (Thailand), NGCC, (c) OpenStreetMap contributors, and the GIS User Community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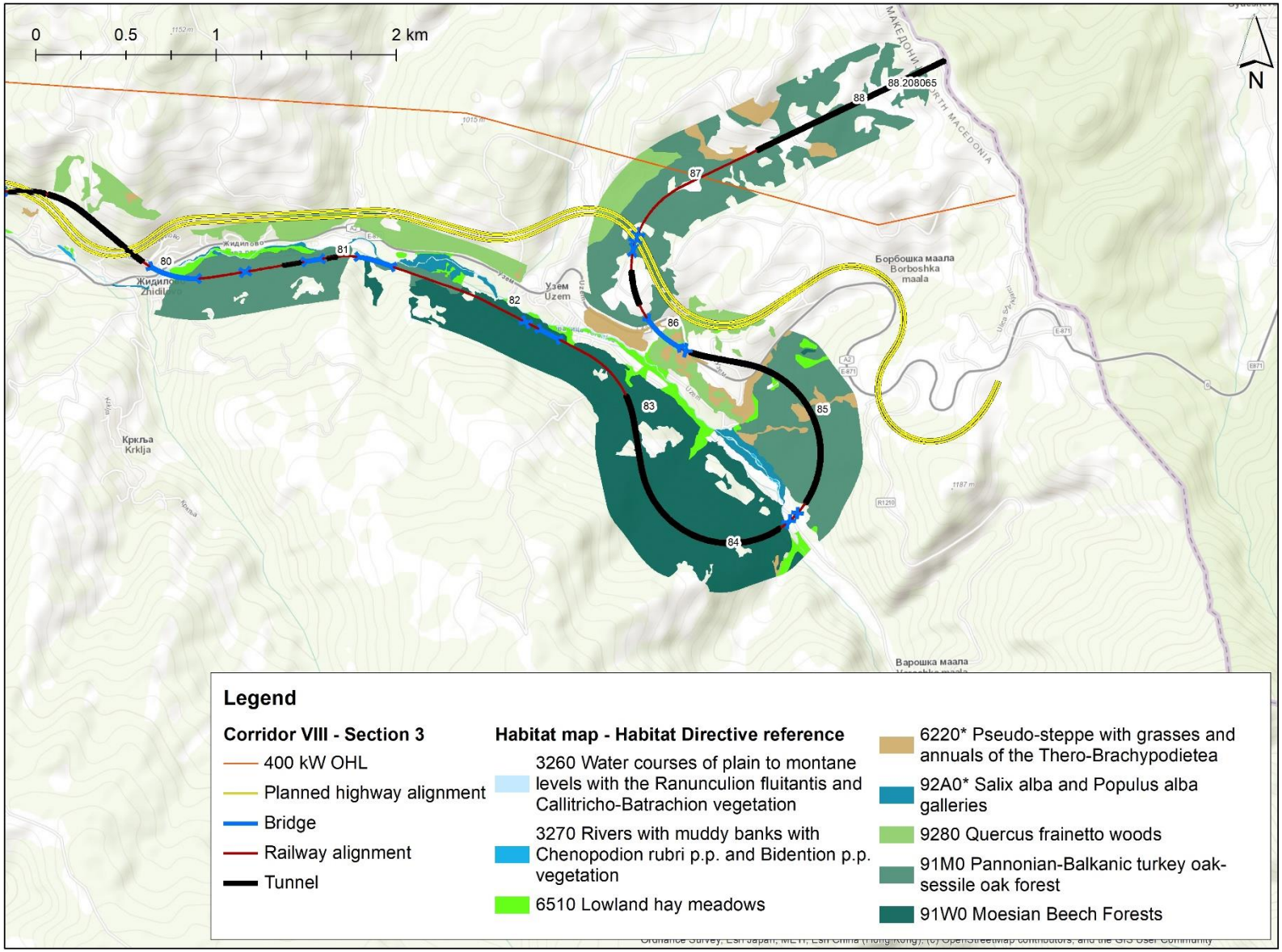
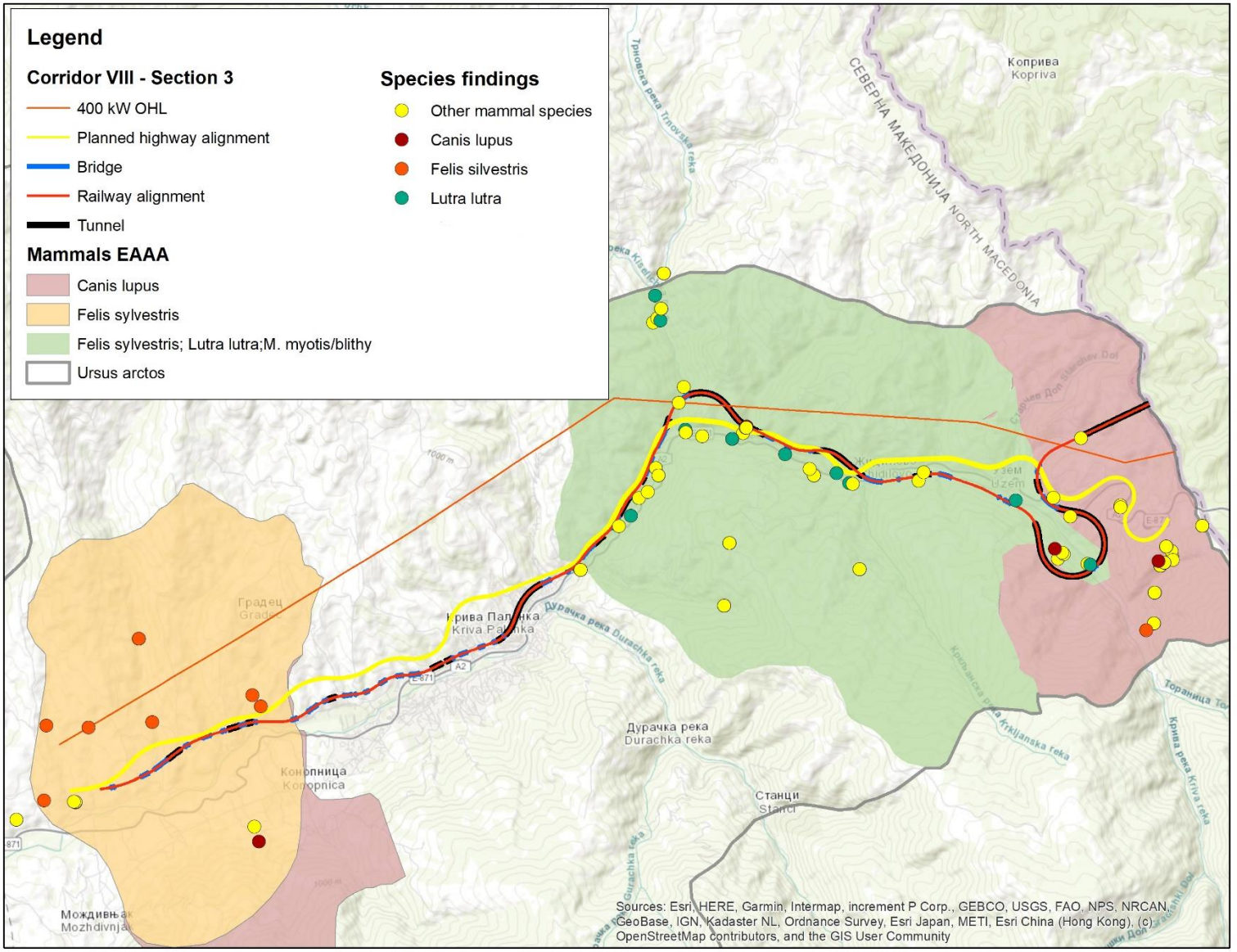
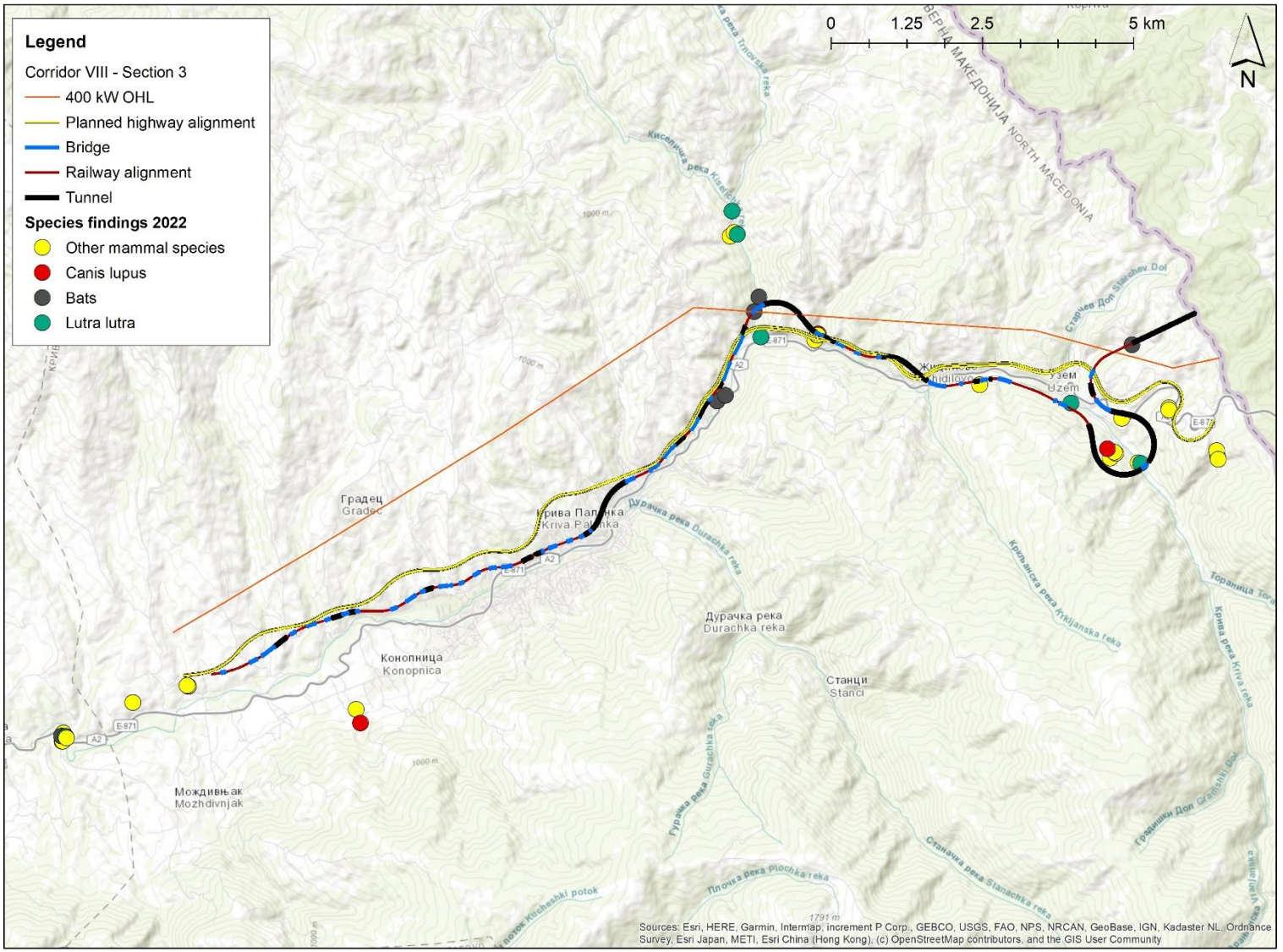


Figure 31 Habitat types along Kumanovo-Deve Bair railway line, Section 3 – Kriva Palanka (T'lminci) to Deve Bair: part 1 – Zhidilovo to Deve Bair. Reference to EUNIS and Habitat Directive provided on separate maps



a) Mammal species in the area of interest, including expert's personal field data from previous research



b) Mammal species recorded during the supplementary field survey in 2022 (May-June)

Figure 32 Locations of species findings – mammals

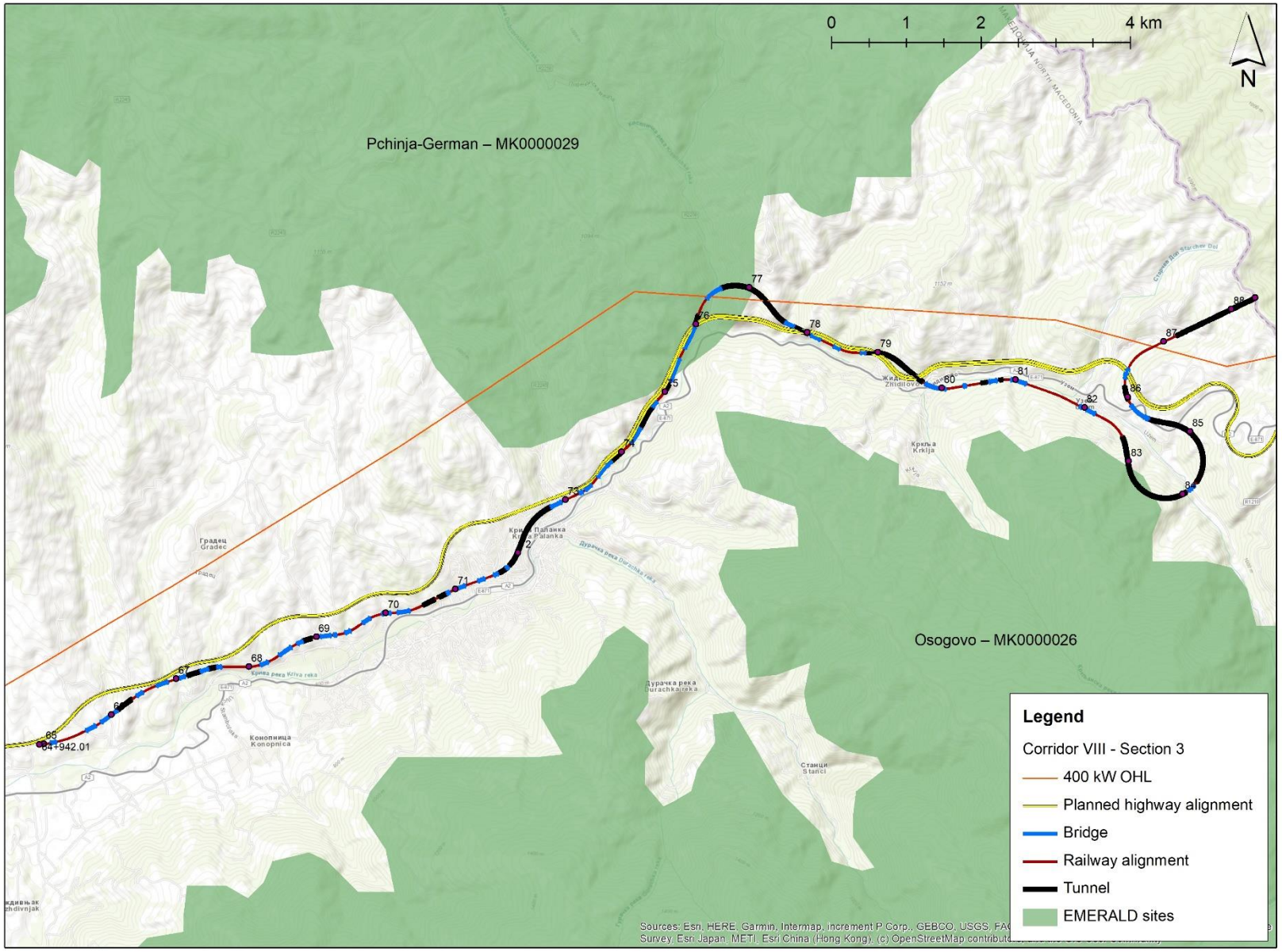


Figure 33 Proposed Emerald sites along the railway alignment

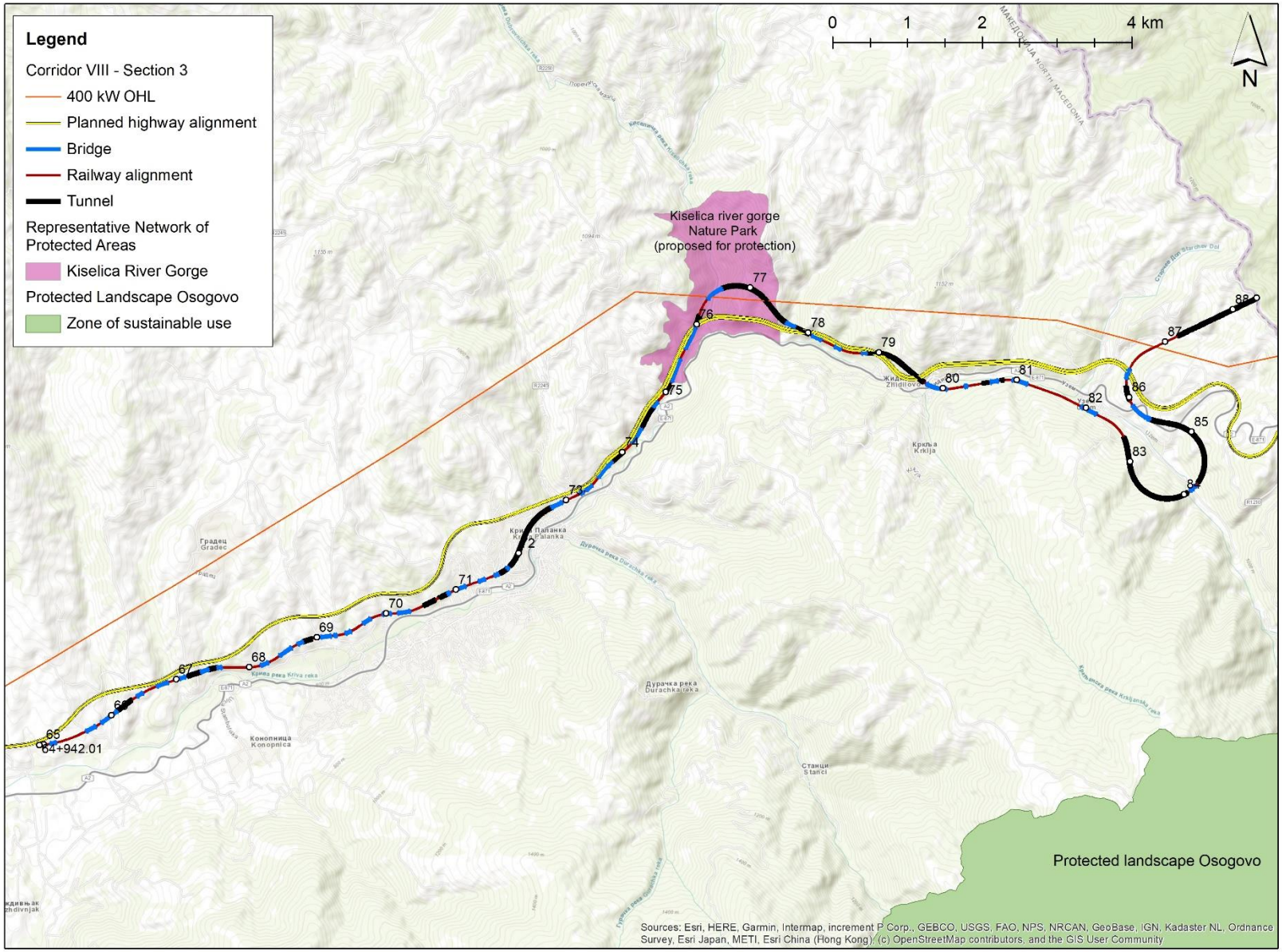


Figure 34 Areas proposed for protection and protected areas in the area along the railway alignment

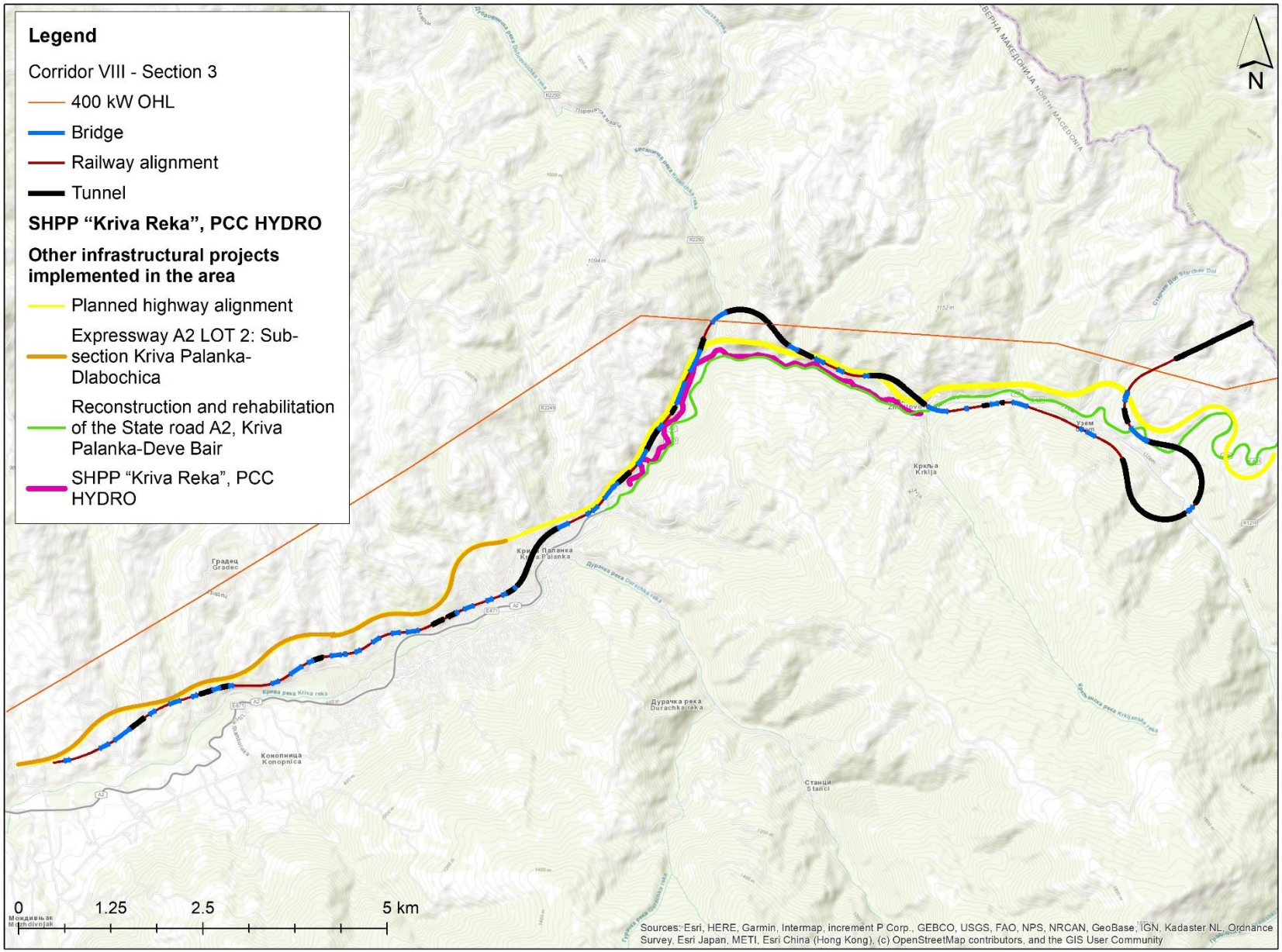


Figure 35 Map of infrastructural projects, planned and under implementation, in the AOI

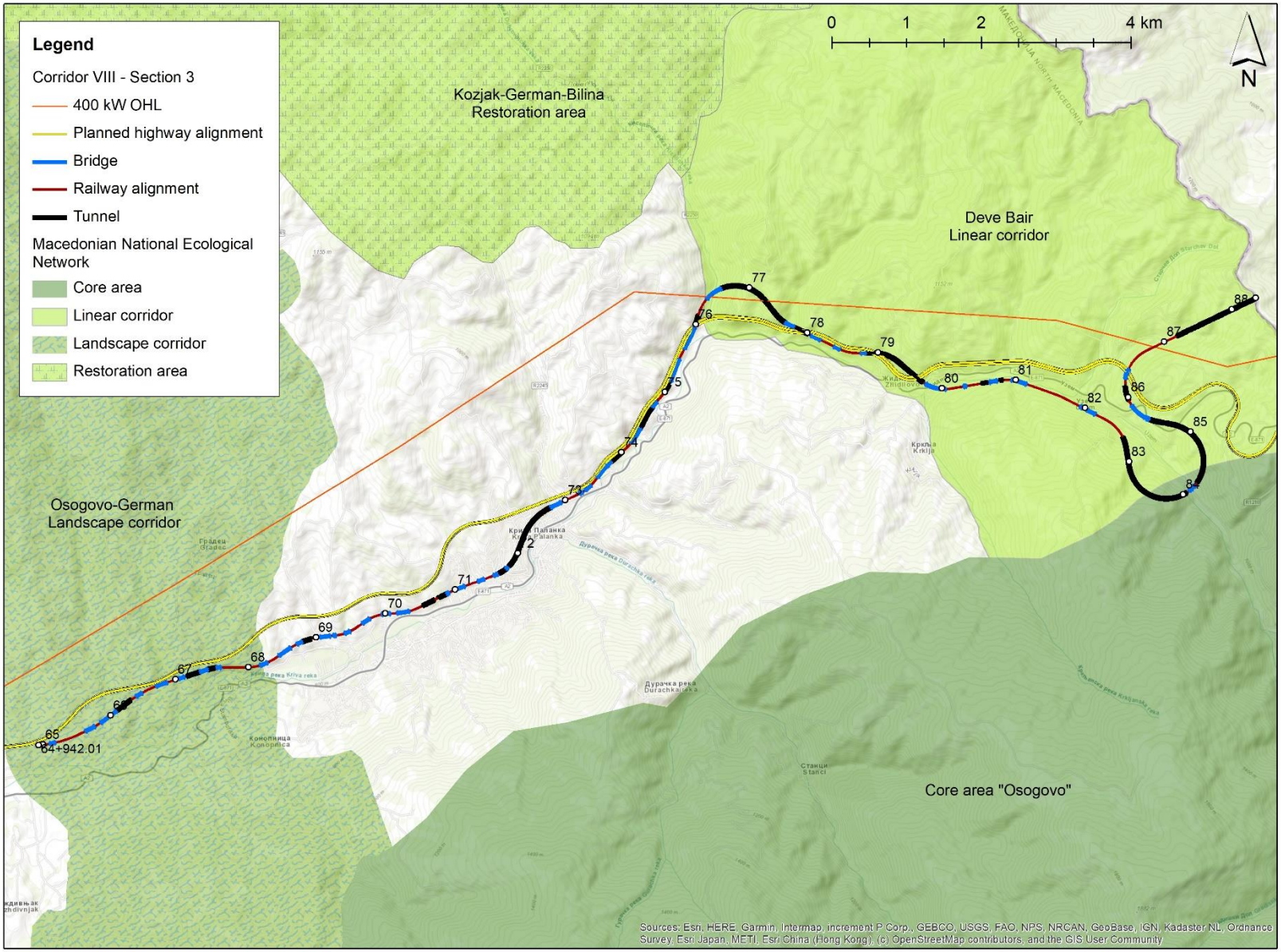


Figure 36 Bio-corridors along the railway alignment

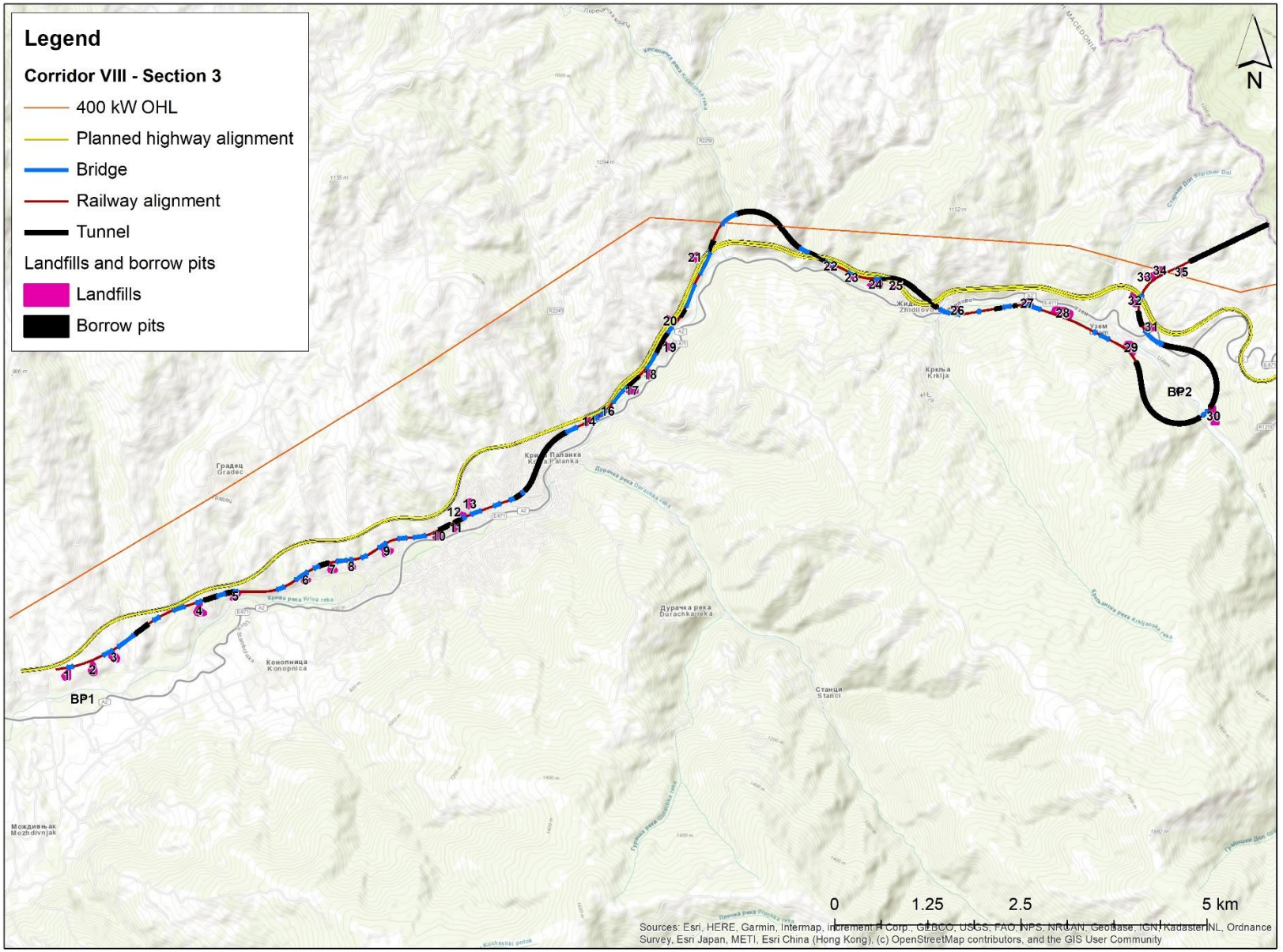


Figure 37 Planned locations of landfills and borrow pits along the railway alignment

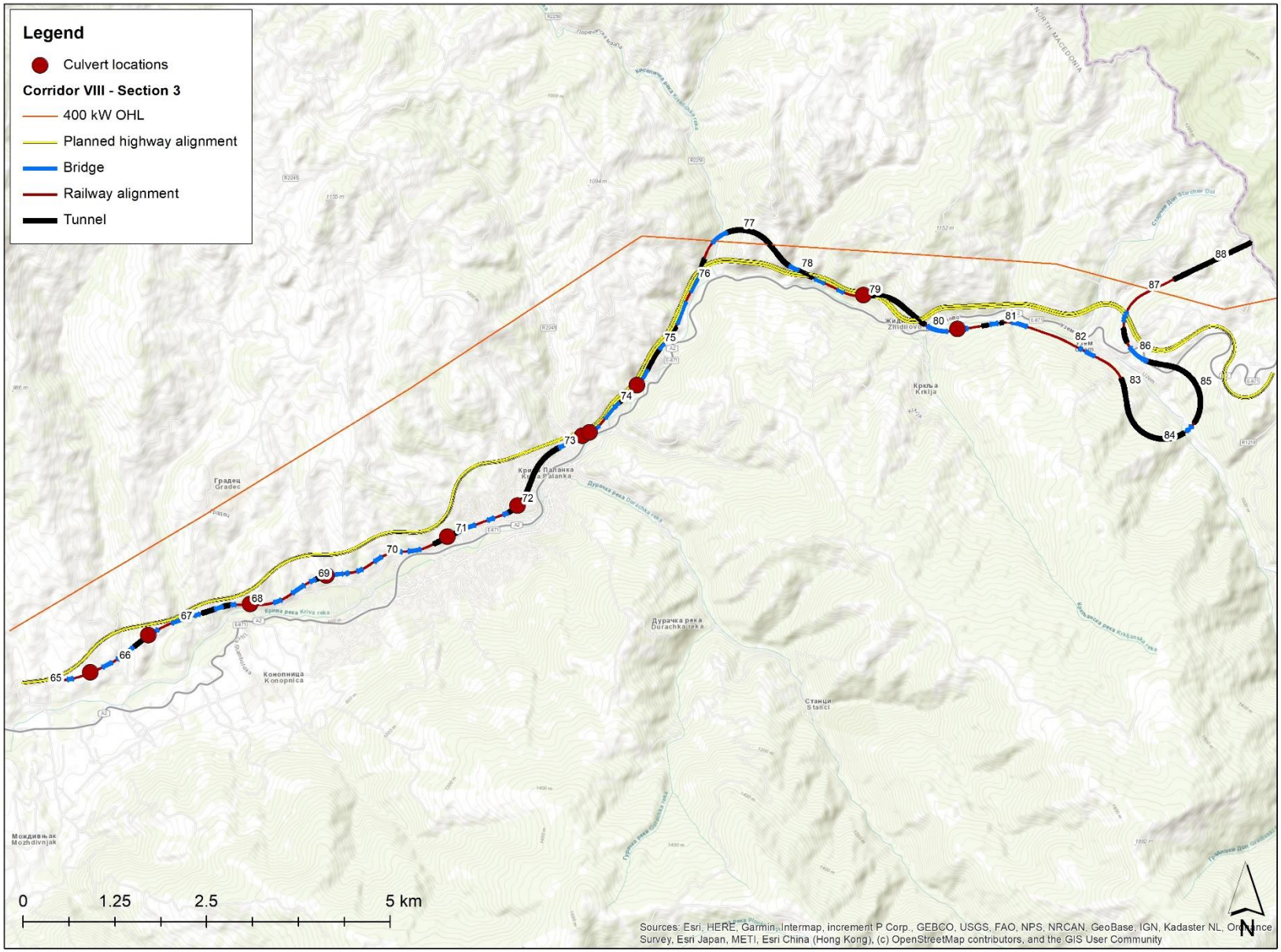


Figure 38 Culvert locations

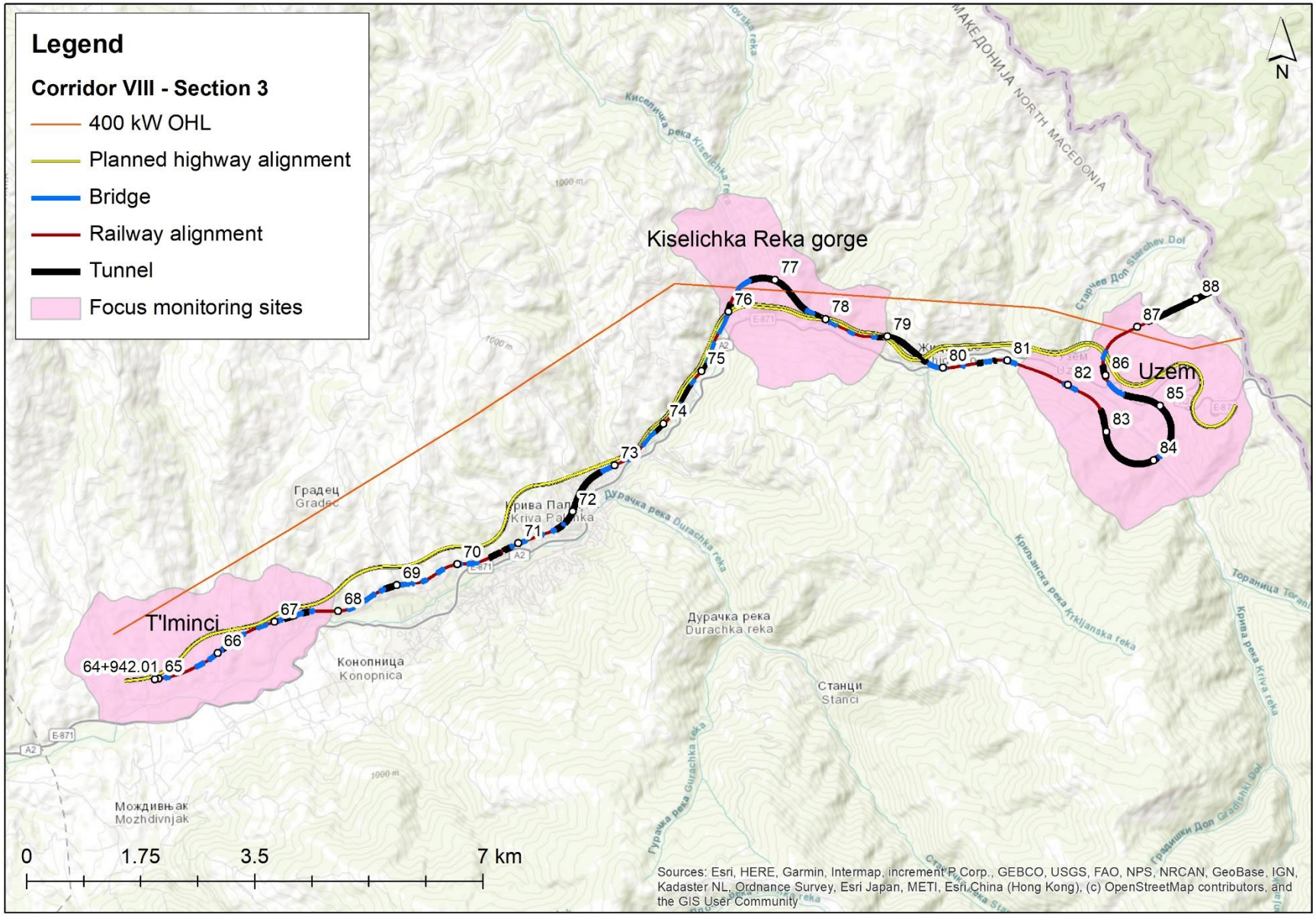


Figure 39 Outline of focus monitoring sites