Morava Corridor Motorway Project, Serbia

Supplemental Lenders Information Package - Ecosystem Services Assessment

March 2021

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Frequently Used Acronyms

AOI	Project's area of influence
BEJV	Bechtel-ENKA Joint Venture
BMP	Biodiversity Management Plan
CHA	Critical Habitat Assessment
CoS	Corridors of Serbia
EHS	Environmental, Health and Safety
EIA	Environmental Impact Assessment
EN	Endangered
ES	Ecosystem Service
ESA	Ecosystem Service Assessment
ESA	Ecosystem Services Assessment
ESHS	Environmental, Social, Health and Safety
ESIA	Environmental and Social Impact Assessment
ESMP	Environmental and Social Management Plan
ESMS	Environmental and Social Management System
IFC	International Finance Corporation
IUCN	International Union for Conservation of Nature
MA	Millennium Assessment
MIGA	Multilateral Investment Guarantee Agency
NNL	No Net Loss
OHS	Occupational Health and Safety
PS	Performance Standard
RLRF	Resettlement and Livelihood Restoration Framework
SLIP	Supplementary Lender Information Package
TBC	The Biodiversity Consultancy

1 Introduction

The Morava Corridor Motorway Project (the Project) is a 112 km motorway development in the West Morava River Valley in the Republic of Serbia (Serbia). The Project is approximately 200 km south of Belgrade city, in the West Morava River Valley, with the planned motorway running from the Pojate village to Preljina near Čačak city. Section-1 provides a connection between Ćićevac and Varvarin municipalities and the city of Kruševac, Section-2 provides a connection between Trstenik and Vrnjačka Banja municipalities and the city of Kraljevo and Section-3 provides a connection between the cities of Kraljevo and Čačak.

The Project is jointly designed and built by Bechtel and ENKA (BEJV), on behalf of the Ministry of Construction, Transport and Infrastructure and Corridors of Serbia (the Project owners). Construction of the Project will require approximately 2,495 hectares (ha) of land for project facilities such as construction campsites, borrow pits, material storage sites, asphalt plants and concrete batching plants (ESIA, Chp1). Substantial modification of the Morava River and its floodplain is also involved as part of the Project, including 18 hydrotechnical structures, 'cut-offs' (straightened, channelised sections of river), revetments and reconstruction of embankments. River regulation design is the responsibility of Jaroslav Cerni Water Institute (JCWI). Further indirect modifications may occur.

Bechtel-ENKA joint venture (BEJV) is the contractor responsible for the design and construction of the Project. An Environmental and Social Impact Assessment (ESIA) has been conducted for the Project by 2U1K Engineering and Consultancy Inc. (hereafter referred to as 2U1K). RINA Consulting S.p.A. (RINA) was commissioned to develop a Supplementary Lender Information Package (SLIP) to address specific lender requirements, including the requirement to conduct an Ecosystem Services Assessment (ESA) (this document).

The Morava River Corridor is Natural Habitat, based on the IFC PS6 definitions and supports threatened or priority ecosystems and biodiversity of national importance, as indicated in the Critical Habitat Assessment conducted for the Project (TBC, 2020). People living in and near the corridor benefit from Ecosystem Services (ES) to obtain food, fresh water supply, enjoyment of traditional rural activities such as hunting, fishing and collection of wild foods and a degree of protection from flooding. Decline in ES-supply or use/access due to the Project could therefore affect the livelihoods or wellbeing of people living in the project affected area. The Project could exacerbate existing pressures on ecosystems supplying services or introduce new pressures.

The ESA was desk-based and did not include any direct engagement with users or beneficiaries of ES but results of stakeholder engagement that took place as part of the ESIA process by 2U1K were used. The ESA also drew on the results of consultations carried out as part of the Informed Consultation and Participation (ICP) for river regulation and operational noise conducted by RINA, the Biodiversity Offset Strategy Workshop conducted by TBC and the Resettlement Action Plan (RAP) developed by ARUP. Ecosystem services were not the primary objective of these consultations, but relevant discussions took place. This report addresses potential impacts of the Project on ES, in accordance with financial lenders' requirements (UKEF, JPM and MIGA), to the extent possible based on available data and information.

1.1 Objectives of the Study

The ESA aims to identify how the productivity and capacity of ecosystems to supply ES and the ability of different people to use and access them may change as a result of the Project; then to consider how these changes can be expected to play out in terms of people's livelihoods or wellbeing.

The Project has developed various environmental and social mitigation plans (including the Resettlement and Livelihood Restoration Framework (RLRF) and Resettlement Action Plan) to ensure that people and communities affected by the Project through physical or economic displacement do not experience any significant economic or social impact. The ESA identifies requirements for mitigation to maintain the productivity of ecosystems supplying ES to people or to maintain the benefits derived where these are not already addressed through existing management or mitigation arrangements. It is assumed that existing plans address or mitigate for changing access to agricultural land and other livelihood impacts, however further specific interventions may be needed to ensure that people and the project can continue to benefit from use of/ access to priority ES.

1.2 Contents of this Report

This report presents the results of a desk-based ESA for the Morava Corridor of Serbia. Gaps in data are identified and steps needed to fill them are suggested.

Table 1-1:Summary of content

Section	**Summary of Content**
1 (this section)	Introduces the report, provides brief information on the background to the assessment and lists the objectives.
2	Summarises the approach and methods used to undertake the ESA, including information sources, guidance and standards, spatial scope, an explanation of the approach used to identify and classify ecosystems and an outline of key terms and definitions.
3	Identifies "relevant ecosystem services" based on the ecosystem types that are represented in the AOI and a review of ES supplied by those ecosystems for which there are confirmed uses (within the AOI or downstream)
4	A determination of priority ES (ES on which users or beneficiaries depend strongly, with limited access to acceptable alternatives)
5	Baseline based on available information, describing levels of use and benefit in the absence of the Project
6	Anticipated changes in priority ES as a result of the Project.
7	Mitigation measures.

2 Approach and Methodology

2.1 Requirements and Standards

In accordance with the Terms of Reference, this ESA was conducted in accordance with IFC Performance Standard 6 (PS6) and its Guidance Note (GN6), which MIGA and UKEF align with. IFC's PS6 was updated in 2012 and the accompanying guidance in 2019 (IFC 2012, 2019). These documents refer to the need to maintain the capacity of ecosystems to supply services and the levels of benefit derived. The ESA also needs to ensure that the Project's dependencies on ES for planned operational performance can be met.

2.2 Guidance

The Terms of Reference for this ESA referred to use of WRI's guidance on Ecosystem Services Review for Impact Assessment (ESR and IA) (Landsberg *et al*. 2013). This provides step-by-step guidance on how to address ES impacts and dependencies for third party users of ES and for Projects depending on ES for their planned operational performance. To the extent possible with existing data, the WRI Guidance has been followed for this review. The WRI outlines the following 6 steps:

Step 1

- Identify relevant services

Step 2

- Prioritise relevant services

Step 3

- Define Scope and information needs

Step 4

- Establish baseline for priority services

Step 5

- Assess project impacts and dependencies

Step 6

- Mitigate impacts, manage project dependencies

The WRI guidance is intended to inform ESIA scoping and provide input to stakeholder engagement and data gathering from the beginning of the ESIA process: it suggests use of ES-prioritisation workshops to conduct steps 1, 2 and 3, for example. This ESA is based on existing data and information and has not included any direct stakeholder engagement. As a result, it has been necessary to make certain assumptions regarding levels of dependence on ES and the likely adequacy of livelihood restoration proposals.

The outputs of the ESR for IA include:

- Identification of ecosystems supplying ES that will change as a result of the Project.
- Ecosystem services supplied by these ecosystems.
- Identification of ES users or beneficiaries.
- Identification of Priority ES (for people affected by the project and for the project itself).
- Assessment of project impacts and dependencies on priority ES.
- Measures to mitigate project impacts and manage project dependencies on priority ES, for inclusion in environmental and social management plans.

2.3 Spatial Scope

The spatial scope for ESA needs to incorporate areas where ES are supplied and also areas where they are used. For ES such as water supply or flood attenuation, ES may be used at some distance from where they are supplied.

The scale at which ES should be assessed may vary depending on the relationship between where they are supplied and where they are used or accessed (adapted from Balmford *et al*., 2008), for example

- *Local ES*: when beneficiaries access the ES within the ecosystem that supplies it (e.g., mushroom collecting within a forest). Note that beneficiaries may live locally or travel considerable distances when accessing local services.
- *Long-distance directional ES*: when beneficiaries access the ES far from the ecosystem supplying it, with services flowing in specific directions (e.g., people benefitting from flood protection downstream as a result of flood attenuation within the Project area) and;
- *Globally distributed ecosystem services*: when beneficiaries access the ecosystem service anywhere irrespective of where the ecosystem supplying it is located (e.g., carbon sequestration by forests).

The ESIA used an Environmental AOI which incorporates the Zapadna Morava River and the surrounding area. As well as the proposed Motorway alignment, this includes locations of access roads, quarries, asphalt and batch plants, maintenance areas, and construction camps, as well as the limits of receptors such as surface- and groundwater that may be affected by the Project.

A Social AOI was also established for the ESIA which incorporates wider areas of indirect and induced (socio-economic) impacts (but a map is not included in the ESIA).

The Environmental and Social AOIs were not designed explicitly to incorporate locations of ES supply and use. For this ESA the Environmental AOI was buffered by an additional 2km (see figure below) to incorporate ecosystems directly affected by the Project and the main users and beneficiaries of the ES they supply. This means there is some difference in total study area between this ESA and the Critical Habitat Assessment for the Project. The ESA study area does not necessarily include all communities or beneficiaries that could experience a change in flood regime/ risk from the Project, but this cannot be confirmed until ongoing 2D modelling is completed.

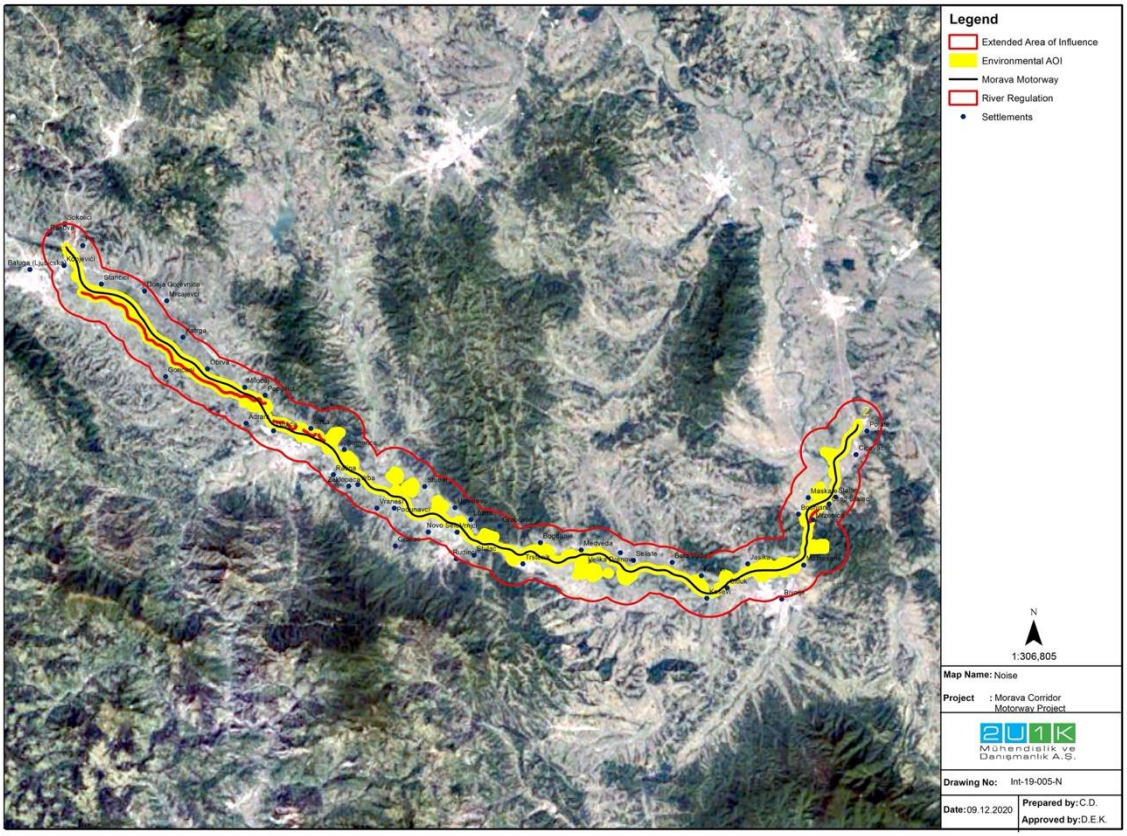


Figure 2.1: ESA Spatial Scope extending environmental EOI by 2km

2.4 Definitions and key concepts

ES are the direct and indirect contributions made by ecosystems to human wellbeing and also to project-performance.

The Millennium Assessment (MA) categorised ES into four main categories (MA, 2005). This ESA focuses primarily on provisioning and regulating ES as required by relevant standards and guidance. However, implications for supporting services were considered due to the presence of Natural Habitat[1] (per IFC PS6, 2012) and there are some important cultural services supplied and used in the Study Area also.

(i) *Provisioning services*: goods or products obtained from ecosystems, such as food, timber, fuelwood, fibres, and freshwater (for consumption, washing etc.),
(ii) *Regulating services*: contributions to human well-being arising from an ecosystem's control of natural processes, such as climate regulation, disease control, erosion prevention, water flow regulation, and protection from natural hazards,
(iii) *Cultural services*: non-material contributions of ecosystems to human well-being, such as recreation, spiritual values, and aesthetic enjoyment,
(iv) *Supporting services*: natural processes, such as nutrient cycling and primary production, that maintain ecological and evolutionary processes.

To represent both the environmental and social components of ES, we need to differentiate between ecosystems themselves (their different types and conditions), the services they provide, the different ways in which these are used by particular beneficiaries and benefits obtained as a result of this use. The definitions below are taken from the MEA (2005) and WRI (2013).

- An *ecosystem* is a dynamic complex of plant, animal, and microorganism communities and their nonliving environment interacting as a functional unit (UN, 1992). When the environmental practitioners are using finer units of analysis than ecosystems (e.g., habitat or land cover / use classes), these units of analysis can be used as long as these units can be linked to the supply of ecosystem services.
- *Ecosystem service supply* is the maximum level of ecosystem service that the ecosystem can provide without undermining its future provisioning capacity (adapted from UNEP-WCMC., 2011 and Kareiva *et al*., 2011).

1 E-DNA studies were completed after the ESA was conducted which confirmed that the Morava River is Natural Habitat per IFC PS6 criteria, and that Sections 1 and 2 are Critical Habitat for Striped nerite.

- *Ecosystem service use* is the level of ecosystem service actually consumed or enjoyed by the beneficiaries (adapted from Boyd and Banzhaf, 2007). It can be consumptive (e.g., agriculture crops for food, water for drinking) or non-consumptive (e.g., recreational and spiritual appreciation of a landscape or wildlife, pollination of crops by bees).
- *Ecosystem service benefit* is the gain in human wellbeing derived from the use of an ecosystem service, often in combination with other inputs (e.g., labor and capital) (adapted from van Oudenhoven *et al*., 2012).

This differentiation enables us to understand the various relationships between them.

- *Relationship between ecosystem and ecosystem service supply*: Ecosystem service supply depends on ecosystem type and condition. It is usually modelled based on ecological production functions (Kareiva *et al*., 2011; NRC, 2005). For example, the type and condition of agricultural land determines its inherent maximum productivity and crop yields; the type and condition of vegetation cover determines its maximum soil retention; and the type and condition of a forest determines its maximum sustainable timber yield. As a function of ecosystem type and condition, changes in ecosystem service supply can be linear (e.g., decrease in freshwater quality directly relates to the increased pollution of a river); or non-linear, where small ecosystem change may have disproportionate effects on ecosystem service supply (e.g., small additional nutrient loading leads to algal blooms and kills fish).
- *Relationship between ecosystem service supply and ecosystem service use at a given time*: The relationship (or absence thereof) between ecosystem service supply and use depends on whether the use is consumptive or non-consumptive:
    - When non-consumptive, ecosystem service use equates with ecosystem service supply (e.g., the decrease in flooding events experienced by floodplain households is equal to the maximum flood protection that the wetland, based on its type and condition, can provide).
    - When consumptive, ecosystem service use does not always have a direct relationship with ecosystem service supply: if the level of use is below the level of supply, the ecosystem service is being underexploited. Conversely, if the level of use exceeds the level of supply, the ecosystem service is being overexploited. In the latter case, the level of use undermines the capacity of the ecosystem to supply the service in the future and is therefore unsustainable. When dealing with consumptive use, maximum sustainable use is determined by ecosystem service supply, which in turn depends on the type and condition of ecosystem.
- *Relationship between ecosystem service use and ecosystem service benefit*: The relationship between ecosystem service benefit and use can be linear or non-linear:
    - In a linear relationship, the benefit is proportional to the use (e.g., the more floodwater stored, the more the avoided real property damage).
    - In a non-linear relationship, benefit and use are not proportional (e.g., the cleaner the water, the healthier the population up to a certain water quality level beyond which an increase in water quality leads to negligible gain in health).

2.5 Sources of Information

Available sources of information were reviewed to identify important gaps in data needed to support development of an effective method for ESA. They included published literature, the ESIA report

and associated technical annexes and results of meetings and consultations. This includes correspondence with 2U1K, JCWI and BEJV regarding specialist technical studies that have been conducted for the Project or were ongoing when the ESA was conducted.

2.5.1 ESIA and associated studies

- Morava Corridor Motorway Project Environmental and Social Impact Assessment Report (2U1K, 2020, Chapters 1-10)
- Morava Corridor Motorway Project Environmental and Social Impact Assessment Report Non-Technical Summary (2U1K, Sep 2020).
- Morava Corridor Motorway Project National Environmental Impact Assessment Report – Sector-1 (RoS, 2019)
- Morava Corridor Motorway Project National Environmental Impact Assessment Report – Sector-8 (RoS, 2019)
- Morava Corridor Motorway Project National Environmental Impact Assessment Report – Sector-9 (RoS, 2019)
- Morava Corridor Motorway Project Lender's Technical Advisor Report (Ramboll, 2020)
- Morava Corridor Motorway Project Gap Analysis Report (Ramboll, 2020)
- Morava Corridor Motorway Project, Serbia. *Supplementary Lenders Information Package –*
- *Cultural Heritage Impact Assessment (CHIA)*
- Critical Habitat Assessment, Morava Corridor Motorway Project (TBC, 2020)
- Updated Biodiversity Impact Assessment, Morava Corridor Motorway Project (TBC, 2020)
- Resettlement and Livelihood Restoration Framework for Morava Corridor Motorway Project (2U1K, 2020
- Regulation of The Zapadna Morava River Within the Infrastructure Corridor of the E-761 Motorway Basic information and key viewpoints (JCWI, May 2020).
- Resettlement Action Plan Execution Plan (ARUP, 2020)
- Resettlement Action Plan- Sectors 1 and 3 (ARUP, 2021)
- Morava Corridor Motorway Project, Climate Change Risk Assessment (Ramboll, 2020).
- Various emails including discussions with 2U1K, emails from JCWI and technical information from BEJV.
- Kmz, Shapefiles and technical documents for the route alignment, facilities and constraints Informed Consultation and Participation Report for River Regulation Works. Report by RINA, February 2021

2.5.2 Meetings and consultation

Results of stakeholder consultation carried out for the ESIA were used (as summarised in Chapter 5 of the ESIA) to identify ES-beneficiaries, as well as the extent to which the project can be expected to impact the levels of benefit derived from a particular service.

Some additional consultations and meetings were held with Project engineering and environmental consultants and specialists (JCWI, TBC, RINA and Arup) to discuss:

- River regulation works and restoration plans, including proposals for borrow pits; how river flow regime will be maintained and the rationale for removal of river meanders due to their close proximity to the proposed motorway route (JCWI and RINA as part of the ICP process).
- How the riverine environment will change and its implications for aquatic species and quality of water abstracted by people in the catchment.
- Biodiversity Offset strategy (workshop conducted by TBC).

- Risks to local communities from flooding within the project and downstream due to river modification, including shortening and straightening. Flood risk assessment in the river valley is ongoing, using hydrological and hydraulic models, with a report anticipated in March. The main emphasis is on flood protection for the motorway itself as well as management of erosion risk, but it is understood that flood protection to communities is also being given further consideration and it is assumed that the ongoing study will consider implications for downstream settlements and land. Engineers state that the flood regime will remain the same, but also that positive impacts are anticipated in terms of flood risk, suggesting the situation is not entirely clear-cut. (ARUP).

2.5.3 Spatial Data

Figures included in this report are based on analysis of data contained in ESIA and other Lender Support package documents and GIS layers supplied by the client.

3 Identification of Relevant Ecosystem Services

An ES is considered relevant to assessment of project impacts in ESIA (World Resources Institute, WRI, 2014) if:

1. it occurs in the AOI;
2. it is potentially affected by the Project;
3. it potentially provides an ES to someone; and
4. beneficiaries of the impacted service can be confirmed.

In other words, ES are relevant if a pathway can be established from a Project-related change in an ecosystem, to a specific benefit to someone. People may obtain benefits from several ES to meet their needs, especially in rural areas where there is a high level of dependence on natural resources. The purpose of this section of the ESA is simply to establish, in broad terms, whether there are any “relevant ES” for which these conditions are met.

3.1 Ecosystems in the AOI

Existing project information on CORINE land-cover, EUNIS habitats (2U1K, 2020) and analysis of Natural and Modified Habitat (TBC, 2020) was reviewed to determine the types, extent and distribution of ecosystems in the ES AOI (see Figure 3.1 below). Table 3-1 shows the broad types of ecosystem types used for the ESA (there isn’t sufficient precision around how people use specific habitat types to make more detailed classification necessary or appropriate).

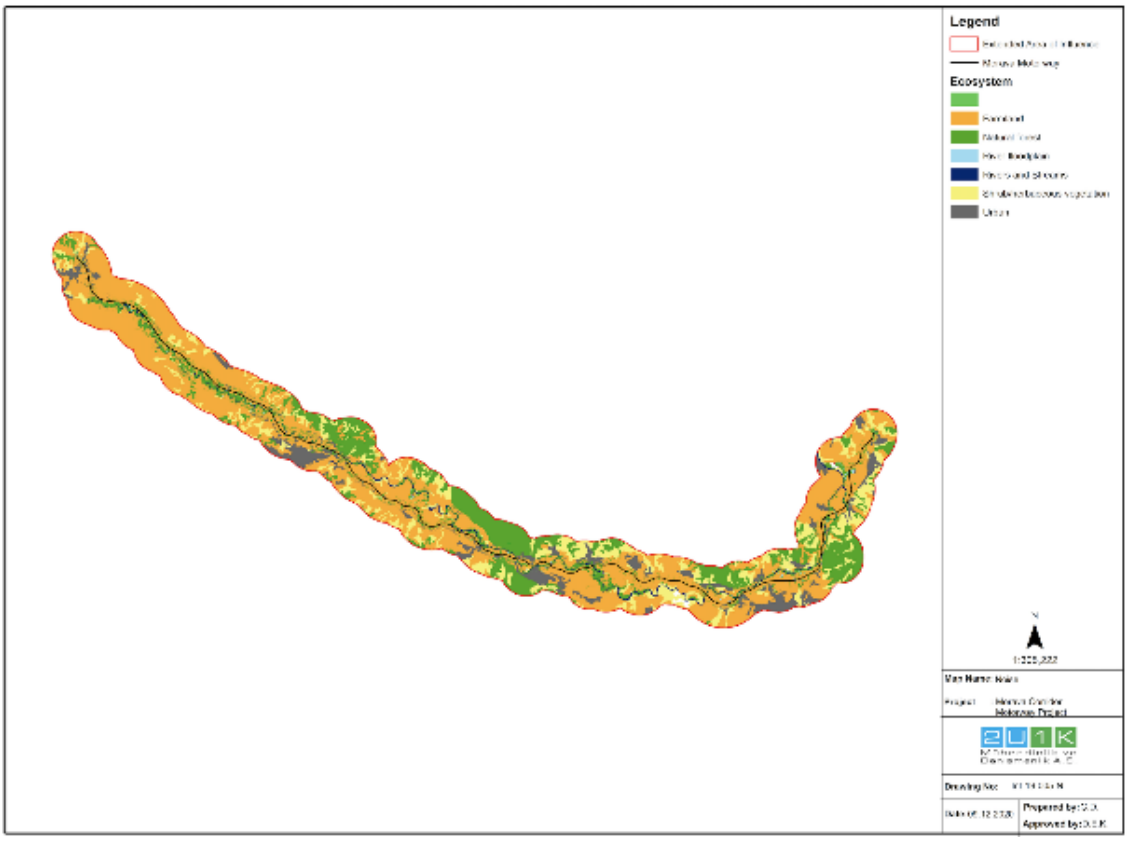


Figure 3.1: Ecosystems in the AOI (Corine Land Cover and EUNIS habitat mapping)

Table 3-1:Relationship between Ecosystems and EUNIS/ Corine Land Cover categories.

Ecosystem categories used in the ESA	EUNIS Habitat Types (including EUNIS code)	Corine LandCover
Farmland	I1.1 Intensive unmixed crops	Non-irrigated arable land
		Pastures
		Complex cultivation patterns
Rivers and Streams	C2.3 Permanent non-tidal, smooth-flowing watercourses	Water courses
River floodplain	J5.3 Highly artificial non-saline standing waters	
Woodland and forest (“natural forest”)	G1.1 Riparian and gallery woodland, with dominant Alnus, Betula, Populus or Salix	Broad-leaved forest
	G1.7 Thermophilous deciduous woodland	Mixed forest

Shrub and/or herbaceous vegetation	E2.1 Permanent mesotrophic pastures and aftermath-grazed meadows	Land principally occupied by agriculture, with significant areas of natural vegetation
		Transitional woodland-shrub
Urban	J1.2 Residential buildings of city and town centres	Discontinuous urban fabric
	J2.3 Rural industrial and commercial sites still in active use	Industrial or commercial units
	J3.2 Active opencast mineral extraction sites, including quarries	Airports
		Mineral extraction sites
		Green urban areas
		Sport and leisure facilities
Wetlands		Inland marshes

The capacity of ecosystems to supply ES generally declines as landscapes become increasingly modified. The Project has assessed and identified areas of Natural and Modified Habitat in the areas exposed to direct impacts from construction and operation (i.e., within a corridor of 1 km width along the proposed motorway alignment). Figure 3.1 shows the importance of some parts of the floodplain for gallery woodlands and forest which are classified as “natural habitat” according to IFC PS6 (2012) criteria and include vegetation types listed as Annex 1 priority habitats by the EU Habitats Directive. Table 3-1 shows the main “natural” and “modified” habitats in the AOI based on the EUNIS classification.

68% of the total 18306 ha in the environmental AOI was identified in the ESIA as having more ‘modified’ land cover types (including agricultural fields, borrow areas in the alluvial plain and settlements) (ESIA, Chapter 5, 2U1K, CHA, 2020, TBC, 2020) (Table 3-2). Agricultural areas dominate along the proposed highway alignment, represented by different types of cultivated crops of orchards and vegetable gardens (ESIA, 2018, p 141). The entire area has become increasingly modified by agricultural activity, settlements and related infrastructure, resulting in decline of the pedunculate oak and ash tree forests that were characteristic of the area in the past and more extensive. In general, forests have become increasingly fragmented. Some land has been partially abandoned and become occupied by ruderal vegetation such as areas of scrub. Previously abandoned borrow pits for sand and gravel have also resulted in creation of artificial water bodies and wet areas. (ESIA, 2018, p 139).

Table 3-2: Natural and Modified Habitat in the Environmental AOI (2U1K, 2020)

EUNIS Level 3 Code	EUNIS Name	Current Extent (ha)
Natural Habitats		
C2.3	Permanent non-tidal, smooth-flowing watercourses	686
E2.1	Permanent mesotrophic pastures and aftermath-grazed meadows	188
G1.1	Riparian and gallery woodland, with dominant Alnus, Betula, Populus or Salix	2711
G1.7	Thermophilous deciduous woodland	2212
J5.3*	Highly artificial non-saline standing waters	20
Modified Habitats		
I1.1	Intensive unmixed crops	11312
J1.2	Residential buildings of city and town centres	864
J2.3	Rural industrial and commercial sites still in active use	143
J3.2	Active opencast mineral extraction sites, including quarries	74
J5.3	Highly artificial non-saline standing waters	97

*A proportion of borrow pits defined as EUNIS type J5.3 have become naturalised over time, to the point where some meet criteria for Natural Habitat included in IFC PS6.

3.2 Ecosystems affected by the Project

Ecosystems that could undergo changes beyond natural variations as a result of the project were identified.

The proposed project is located in the West Morava River Basin, with the proposed motorway route following the river opposite to the flow direction (west to south). The River catchment area is 7,925 km^2, providing significant benefits to those in the AOI and further. Based on the description of the project's activities, the project may alter the morphology and flow regime of the River and its tributary streams due to the installation of hydrotechnical structures for river regulation, channel straightening, bank reinforcement and other activities. The Project will have a direct physical footprint on areas of riverine and other woodland and agricultural land (arable and pasture) and will also modify the floodplain in terms of its morphology and potentially its function.

Some areas of inland rock or aggregate will be used for construction material. Other ecosystem types such as shrub vegetation and wetlands are also affected but no statistics are available in the ESIA to know the extent of likely change from the Project.

Based on the description of the project's activities, the existing land cover map, and the extent of damage or loss of habitats as provided in Table 2 of the ESIA, the ecosystems, (or parts thereof), identified in Table 3-3 are considered to be impacted (or potentially impacted) by the Project. Impacts on the capacity of ecosystems to supply ES are considered further in Section 5.

Table 3-3:EUNIS habitats and the footprint of the proposed motorway alignment

EUNIS Level 3 Code	EUNIS Habitat Name	Current Extent (ha) in Environmental AoI	Damage or loss of habitats due to permanent structures (motorway and river regulation footprint) (ha)	(%)
Natural Habitats				
C2.3	Permanent non-tidal, smooth-flowing watercourses	686	65	9.5
E2.1	Permanent mesotrophic pastures and aftermath-grazed meadows	188	13	6.8
G1.1	Riparian and gallery woodland, with dominant Alnus, Betula, Populus or Salix	2711	208	7.7
G1.7	Thermophilous deciduous woodland	2212	71	3.2
J5.3*	Highly artificial non-saline standing waters	20	0	0
Modified Habitats				
I1.1	Intensive unmixed crops	11312	749	6.6
J1.2	Residential buildings of city and town centres	864	8	0.9
J2.3	Rural industrial and commercial sites still in active use	143	2	1.0
J3.2	Active opencast mineral extraction sites, including quarries	7	2	2.7
J4.2	Road networks (asphalt roads)	131	26	19.6
J5.3	Highly artificial non-saline standing waters	97	2	2.4

The table uses EUNIS codes for habitats. The main “relevant” broad ecosystem categories identified for the ESA are therefore:

- Rivers, streams and watercourses (Figure 3.2)
- Agricultural land (arable or croplands)
- Agricultural land: permanent pastures and grasslands
- “Natural forest”, (including riparian and gallery woodlands, with dominant Alnus, Betula, Populus or Salix and other deciduous woodlands and forests).
- Inland rock
- Wetlands

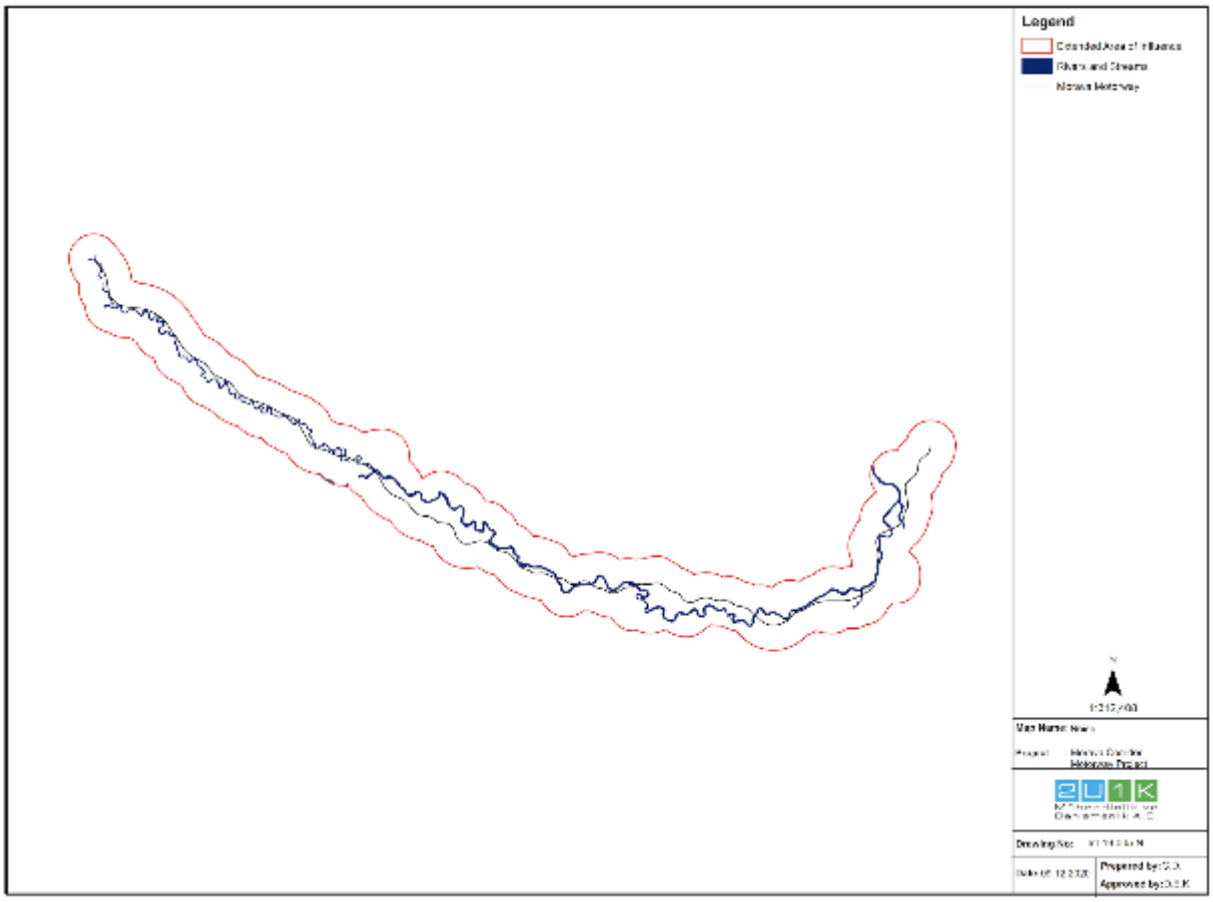


Figure 3.2: Rivers and streams in the AOI

3.3 ES supplied and used in the AOI

The ecosystems identified in section 3.2 are associated with nine provisioning and regulating ES, as summarised in Table 3-4 and Table 3-5:. We have used the Millennium Assessment (MA) classification to identify 2 types of ES: Provisioning and Regulating. The Project’s Community Relation Officers provided input on ES that could not be verified using ESIA data, based on their local knowledge.

3.3.1 Provisioning Services

Provisioning services that are potentially supplied by the ecosystems identified in the previous section and are believed to have a confirmed use within the AOI are shown in Table 3-4. A question mark indicates that an ES may be supplied by that ecosystem, but that use in the AOI cannot be

confirmed from available data. In some cases, an indirect ES is provided, for example woodlands, agricultural land and shrub and herbaceous vegetation all play a part in regulating surface water run-off and affect water supply and quality, thereby influencing the provisioning ES of freshwater used for drinking and other domestic purposes.

Table 3-4:Provisioning services in the AOI (obtained from Community Relations Officers of BEJV)

Ecosystem service	Natural woodland or forest	Agricultural land	Shrub and or herbaceous vegetation	Rivers and streams (Morava River)	Wetlands/ swamp	Inland Rock	River functional floodplain
Provisioning							
Crops	-	X	-	X	-	-	X
Livestock products (meat and milk from cattle, sheep, pigs, poultry)	-	X	X	X	-	-	X
Capture fisheries	-	-	-	X	-	-	-
Wild food (mushrooms, nuts, fruit, hunting game)	X	X	X	-	-	-	-
Biological raw materials	X	X	X	X	-	X	-
Timber	X	-	-	-	-	-	-
Firewood	X	-	-	X	-	-	-
Sand, murram, gravel and stone	-	-	-	-	-	X	X
Biochemicals, natural medicines	-	-	-	-	-	-	-
Freshwater (drinking, domestic use)	-	-	-	X	X	-	X
Genetic resources	-	-	-	-	-	-	-

3.3.2 Regulating ES in the AOI

Regulating ES supplied from ecosystems that will be affected by the Project are shown in Table 3-5:.

Table 3-5:Regulating services in the AOI

Ecosystem service	Natural forest	Agricultural land	Shrub and or herbaceous vegetation	Rivers and streams (Zapadna Morava River)	Wetland/ swamp	Inland Rock	River floodplain
Regulating							
Air quality regulation	X	X	X	-	X	-	X
Regional/local and/or global climate regulation	X	X	X	X	X	-	-

Water regulation	X	X	X	X	X	-	X
Erosion regulation	X	X	X	X	X	-	X
Water purification	X	X	X	X	X	-	X
Waste Treatment	-	-	-	-	-	-	-
Disease regulation	-	-	-	-	-	-	-
soil quality regulation	X	X	X	X	X	-	-
Pest/invasive species regulation	X	-	-	-	X	-	-

3.3.3 Other ES

The focus of this ESA is on provisioning and regulating ES. Implications for cultural heritage have been considered primarily through the Cultural Heritage Impact Assessment which was done as part of the Supplementary Lenders' Information Package (which included consideration of natural Cultural Heritage) and the ESIA process which noted the presence of river-transportation and leisure activities based on the River. People have strong cultural attachments to hunting, fishing and collection of wild foods and may object to loss of benefit from these ES when the Project is constructed and operated.

Ecosystems in the AOI also provide essential supporting services to habitats and species of conservation importance and stakeholder interest. The Critical Habitat Assessment (CHA) conducted by The Biodiversity Consultancy (TBC, 2020) and subsequent e-DNA studies determined that the Zapadna Morava River is Natural Habitat according to the criteria and thresholds in IFC PS6 (IFC, 20212). It supports species of stakeholder interest and conservation importance, notably freshwater mussel and crayfish.

3.4 Beneficiaries can be confirmed

To confirm which of the ES identified in the previous section are "relevant" to the ESA, it is necessary to confirm their use by specific beneficiaries: ES do not exist without beneficiaries or users. Beneficiaries are those individuals or communities that depend on a particular ES to maintain their livelihoods or wellbeing. Beneficiaries can also include institutions and companies. Precise definition of users and beneficiaries improves the ability to identify appropriate mitigation interventions in the event that significant impacts occur, sometimes reducing the need for general compensation Figure 3.3 illustrates the main settlements in the AOI, giving an indication of population size.

Benefits from ES typically fall into the following categories (MA, 2005):

- Basic material for a good life (e.g., secure and adequate livelihoods, enough food at all times, shelter, clothing, access to goods).
- Health (e.g., clean air and access to clean water).
- Security (e.g., secure access to natural and other resources, personal safety, security from natural and human-made disasters).
- Good social relations (e.g., social cohesion, mutual respect, ability to help others).

Most ecosystems provide more than one ES and people often use several ES, resulting in complex patterns of use to obtain a range of benefits. The extent to which people use and rely on a particular ES depends on the specific benefits they derive and the existence of alternative ways to secure these benefits if the supply of a service declines. This is addressed in Section 4 of this ESA.

The figures presented below in this section give indicative estimates of levels of resource-use based on available data, however the sample size at the individual community level is small, so estimates of numbers of beneficiaries using each ES in the ESIA should be regarded as indicative.

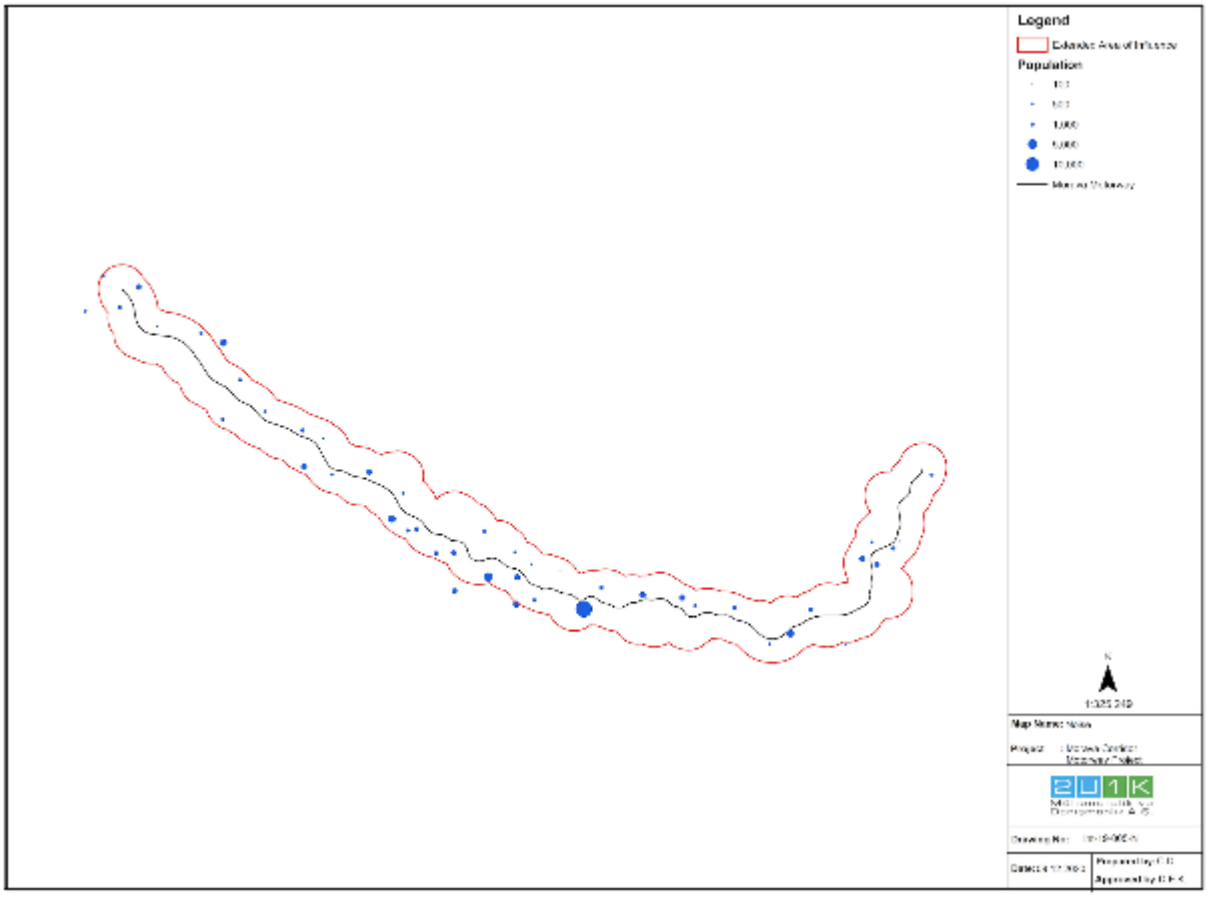


Figure 3.3: Potential beneficiaries of ES (population by settlement) Data source: (ESIA, 2020)

The following sections summarise the confirmed uses of ES in the Study Area, based on information from the ESIA and associated studies on livelihoods.

3.4.1 Freshwater from Rivers and Streams

The ESIA indicates that the Zapadna Morava River provides freshwater to the surrounding communities from the river itself, its tributaries or from groundwater sources accessed through wells and springs. Community- and household-level surveys carried out by 2U1K for the development of the ESIA baseline suggested that freshwater sourced from the Zapadna Morava River is used by some households and agricultural businesses for domestic use or irrigation (ESIA, Chp6). The Agency for Environmental Protection, however, reports that the Zapadna Morava River is not of suitable quality for drinking (http://www.sepa.gov.rs/download/KvalitetVoda2017.pdf)

unless treated. Correspondence with JCWI suggests that direct use of the River for dinking water purposes is highly unlikely.

Freshwater for drinking and domestic use is obtained from over 15 groundwater sources. The majority of abstraction facilities in the area are wells providing public water supply to rural settlements and some industrial plants. Unconfined aquifers are the main groundwater source in the Project area and are located on the valley sides (ESIA, Chp5 p163).

Wells are located:

- in the area of the Čačak-Kraljevo valley (including the alluvial plain Ibra);
- on the right valley side of the West Morava River in the area of Ratino-Oslonica Basin;
- on the left and right side of West Morava in the area of the Reed Basin;
- on the left and right sides of the West and the Great Morava in the area of Bošnjani Varvarin; and
- in the West and South Morava intersections and on the right valley side of the Great Morava.

The main sources of domestic water supply for selected villages are shown in Table 3-6, derived from social studies carried out for the ESIA.

Table 3-6: Sources of freshwater used by selected municipalities

Kruševac	Groundwater via public wells and springs or private sources
Trstenik	“water supply networks”, springs, water tanks and wells.
Vrnjačka Banja	springs and wells
Čačak	spring, wells and water networks
Ćićevac	groundwater from springs, or water from the river
Kaljevo	“rural water supply, springs and wells.

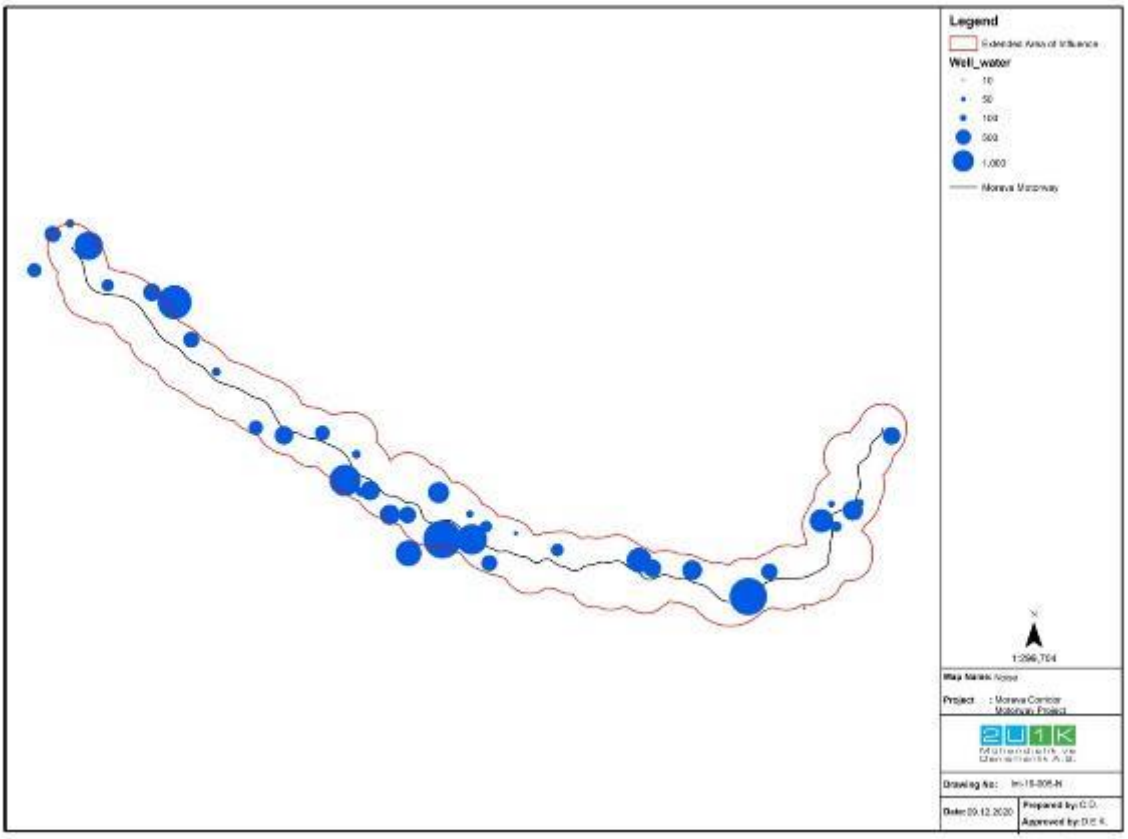


Figure 3.4: Estimate of number of residents by settlement reliant on well water. Data source: (ESIA, 2020)

Groundwater is not usually considered to be an ecosystem and does not appear in the ecosystem classification; however, groundwater recharge depends on water balance from precipitation, evapotranspiration and surface water 'yields'. Several ecosystems in the project affected area provide an intermediate service to the provisioning ES of freshwater for drinking, domestic use or irrigation by regulating surface water run-off and influencing water quality. There is also potentially some connectivity between the Zapadna Morava River and its tributaries and groundwater supply.

This needs to be better understood to evaluate potential risks to drinking water supply from modification of the River and its floodplain. Consultation with the JCWI as part of the ESA suggests that most water supply systems in this area use groundwater springs and springs for water supply, some of which are in the zone of influence of the highway and the River Zapadna Morava. In the Municipality of Vrnjacka Banja, some drinking water is taken from the alluvium of the River. Springs "Vitojevac" and "Ugljarevo" are in the zone of influence of the highway and the Zapadna Morava River. In the Municipality of Trstenik**,** the springs "Zvezdan" and "Staro korito" are located between the old and the new riverbed of the West Morava and are also in the zone of possible impact of the highway (JCWI, 2021|). The term "zone of influence" was used by JCWI in correspondence to indicate springs that could be potentially affected in some way, hence further investigation is recommended to preclude risks to any users of these sources.

3.4.2 Food from irrigated crops

Water from the river and groundwater are used by farmers for irrigation purposes to provide water and nutrients to agriculture to support the yield of crops. The Zapadna Morava River was reported to be used to provide irrigation water for crops by 7,797 households out of 60,000 households in the social AOI (13% of households), with systems of irrigation channels in place to deliver irrigation water to the fields where it is used. The river was named as the source of water for irrigation of crops in the Municipality of Čačak, for example.

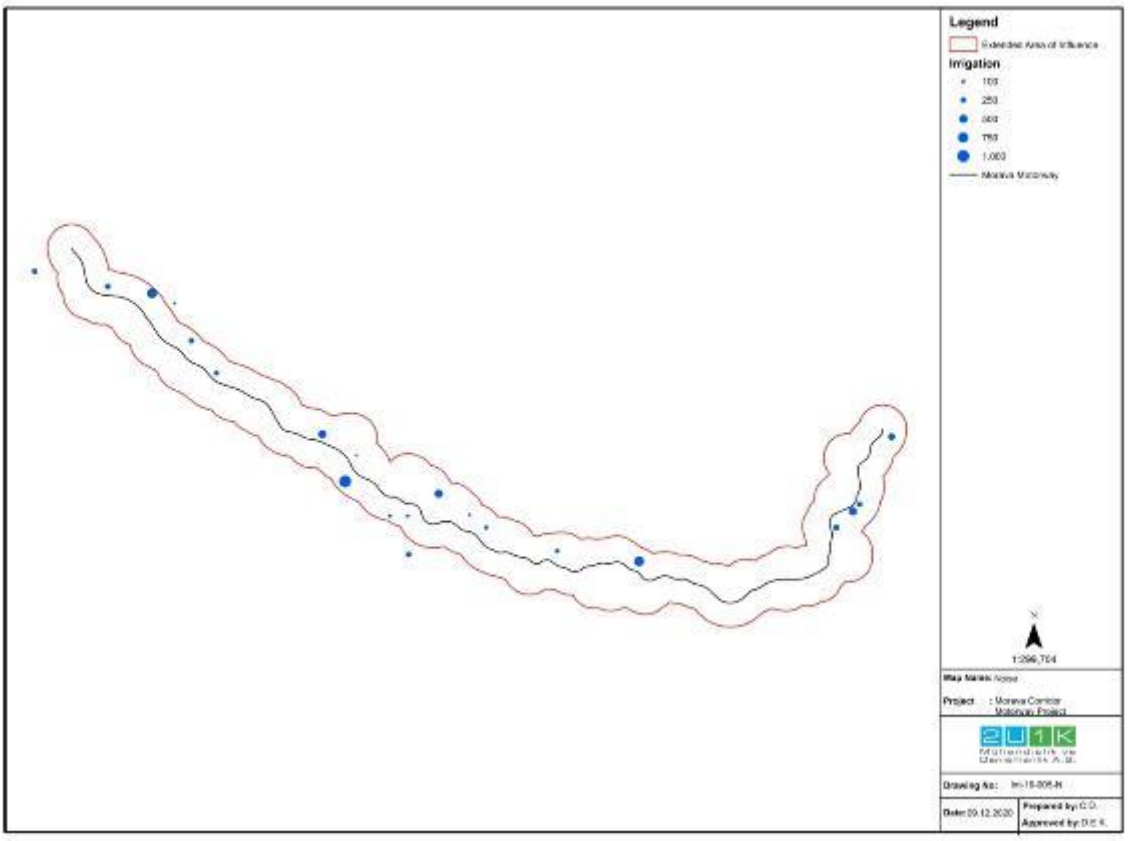


Figure 3.5: Estimate of number of residents by settlement that use irrigation. Data source: (ESIA, 2020)

3.4.3 Protein from Fish

Approximately 15% of residents in all municipalities use the West Morava River and its tributaries to catch fish for household consumption (ESIA, 2020). Fishing is an important recreational activity (Cultural ES), but also provides protein in the diet (provisioning ES) for households with members who fish. Pike, chub, catfish, skobalj and “white” are caught in the Spring and Autumn. In the Čačak Municipality the annual quantity of fish caught and consumed per household is 18 kg a year on average. Sale of fish is not a significant source of income in the area (ESIA, Chp6).

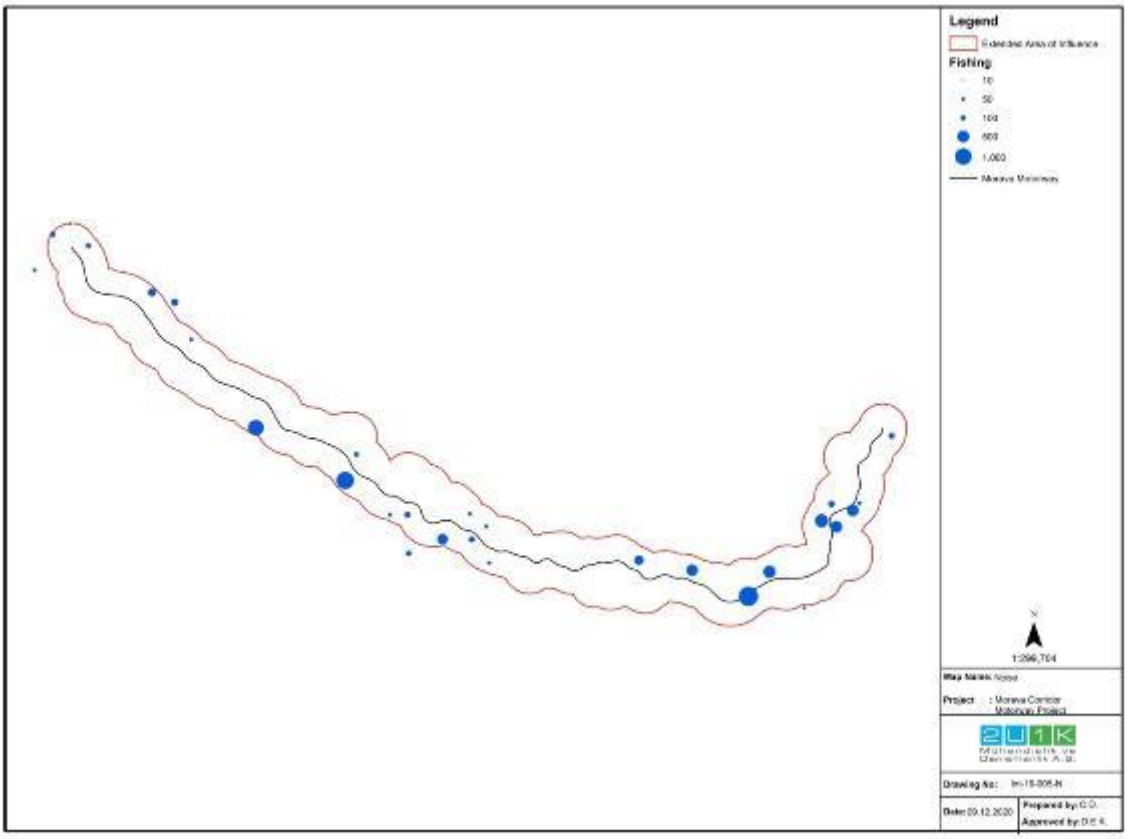


Figure 3.6: Estimate of number of residents by settlement using the West Morava River for fishing. Data source: (ESIA, 2020)

3.4.4 Flood protection to people, property and farmland

The Project includes some artificial flood protection in the form of hydraulic structures to prevent flood risk to the road. The Project will also improve standards of flood protection for some communities and farmland in the road corridor. The current flood protection structures in the region are designed on the basis of previous (prior to 2014) 100-year max flood disaster levels. During the disclosure period of the Spatial Plan from July to August 2019, 22 of 48 villages within the AOI expressed concerns about flood risk during the Project's Operational phase and how this might change (ESIA, Chp 2). Residents of all of these villages are considered as sensitive receptors (ESIA, Chp 6, pg 258). According to the Preliminary Economic Analysis and Feasibility Study, the goals of the Project include reduction of flood risk in the region for people, property and farmland. However, a degree of flood protection is provided by the River's naturally functioning floodplain in the baseline situation, and this constitutes an ES supplied in the Study Area and provided to beneficiaries within it and downstream. The magnitude of this benefit downstream is not known. The Lenders' Technical Advisor Report recommended further 2D modelling to supplement the River Regulation Flood Model developed for the Project. This is being carried out by the JCWI, anticipated to be completed in mid-March 2021. In effect, the Project will substitute artificial flood protection for the ES of flood protection provided by unconstrained floodplain, but the beneficiaries are different (local vs downstream, and including some who may be outside the limits of the AoI used for this ESA).

In addition to modelling, the Project has also undertaken a process of Informed Consultation and Participation (ICP) with affected communities with respect to potentially significant impacts associated with river regulation work (RINA, 2021). Stakeholder meetings were conducted by 21UK with residents of 6 settlements in close proximity to planned river regulation works (0 to 1km). These were the settlements of Mrzenica, Sirca, Grdica, Popovici, Milocaj and Stancici.

3.4.5 Food and income from farming

Agricultural activities are the major source of livelihood and income in the rural settlements. Households grow produce for home-consumption and as a source of income. The area has a mixed farming system. Some people are employed in farming and derive income from employment.

Arable production dominates and although the majority of the villages in the AOI are engaged in livestock farming to some extent, produce is generally for household consumption and not for income-generation. Crops cultivated on agricultural land in the AOI include wheat (19%), barley (8%), oats (8%) and corn (65%). A proportion of grain is fed to pigs, cattle, sheep and poultry and some is sold for income. Meat is primarily consumed within the households (ESIA, 2020).

There are therefore several groups of beneficiaries for the ES of food or income from farming, including landowners, farmers, farmworkers and households who consume crops of animal products (meat, milk, eggs).

3.4.6 Wood from Forests and Woodlands

The majority of households in rural settlements use locally sourced wood to heat their homes in winter, 13.4 m^3, 14.8m^3 and 16.25 m^3 being consumed per household during the winter season in all the villages of the municipalities Čačak, Trstenik and Vrnjačka Banja respectively (ESIA, Chp 5 pg 241). Firewood for heating is generally purchased from local suppliers. Tree-cutting is illegal in Serbia, but local collection of fallen or dead wood occurs (see Figure 3.7).

Timber collection for income generation only occurs in the municipality of Kruševac (70% of the local residents in Jasika Village collect timber to generate income). Commercial timber production for income generation takes place in Miločaj village of Kraljevo (ESIA, 2020).

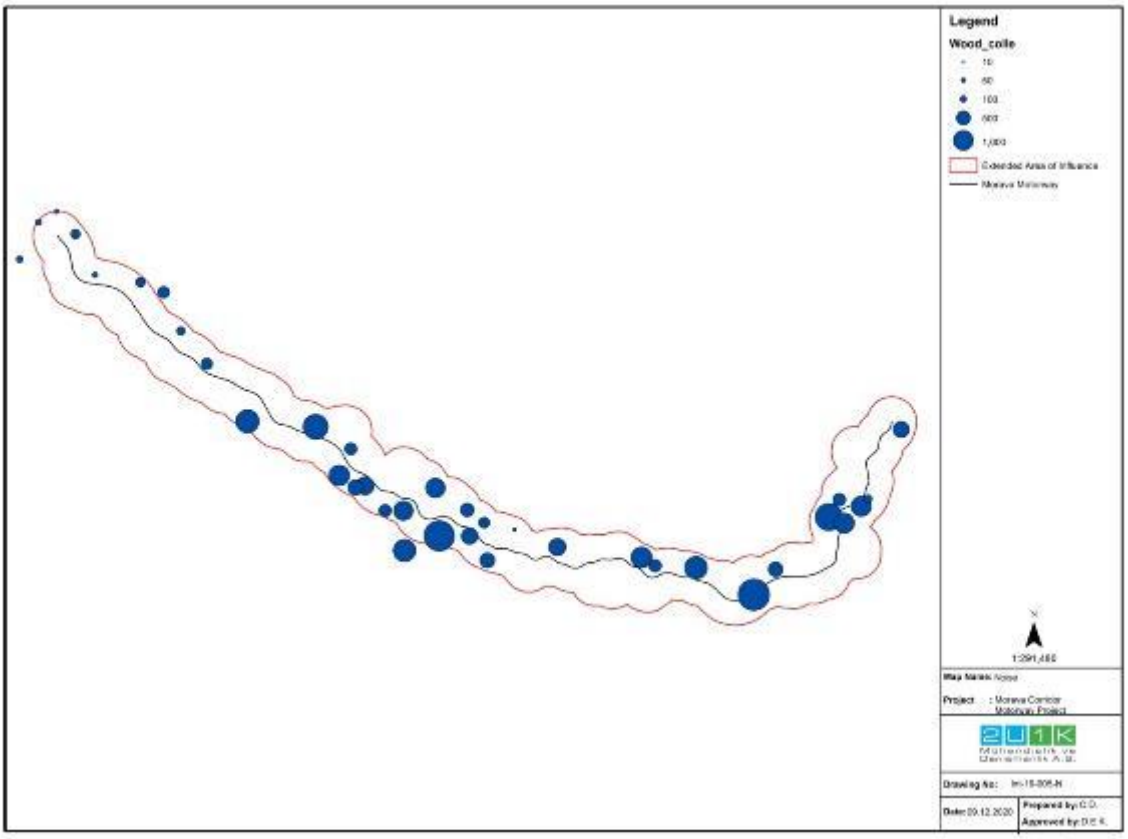


Figure 3.7: Estimate of number of residents by settlement that collect wood for fuel. Data source: (ESIA, 2020)

3.4.7 Wild food

In the municipalities of Trstenik and Vrnjačka Banja the project passes through forest used for collection of nuts, forest fruits and mushrooms, as well as hunting purposes for species such as rabbit, pheasant and wild boar. (ESIA, Chp 6). These activities are conducted predominantly for recreational purposes (Cultural ES) but also provide healthy food for household consumption according to the results of the social field study. In Vrnjačka Banja, Trstenik, Kruševac and Čačak, for example, locals traditionally collect mushrooms from the forest for domestic consumption.

None of the villages within the AOI collect herbs or mushrooms from the forest for income generation, but there could be strong cultural attachments to food gathering and its consumption. Plant collection is only seen in Ćićevac and Varvarin.

Hunting is carried out in all municipalities, with licensed hunting areas varying from 10,455 ha in Vrnjačka Banja to 52,464 ha in Kruševac. Čačak is the only municipality where hunting is a rare occurrence (Figure 3.8).

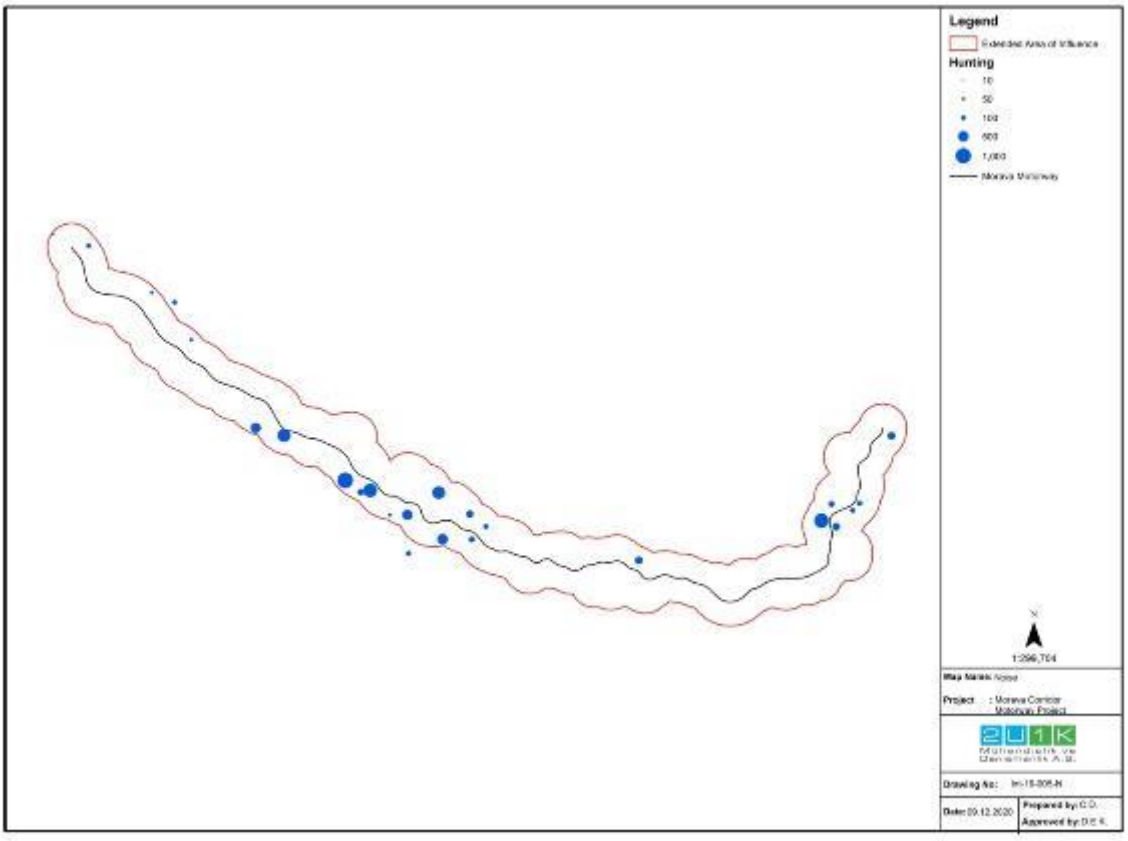


Figure 3.8: Estimate of number of residents by settlement who hunt. Data source: (ESIA, 2020)

3.4.8 Bee-keeping

Apiculture currently takes place close to the motorway route, for example in forested areas at Kruševac and in Mrzenica and Makrasane and some will be displaced by borrow pit construction and use (ESIA, Chp 6, 2020). Beekeepers are a beneficiary group relying on a number of "natural ecosystems" as well as farmland to obtain honey for sale or home consumption. There could also be an indirect ES of pollination from apiculture to crop production.

3.4.9 Overview of beneficiaries

People in much of the AOI probably use a mix of ES to meet their needs for income, a healthy life and wellbeing. This is particularly the case in rural areas. It is worth noting that many Project Affected People are retired and/or elderly (in Sector 1, 63.4% of landowners surveyed to produce the RAP were older than 65 and 44% were drawing a pension). In urban settlements people are typically more able to substitute provisioning ES with purchased substitutes. Table 3-7 summarises the number and percentage of households (Social AOI) involved in activities to obtain firewood, go hunting or fishing and obtain freshwater (ESIA, Chp 6, 2020). Further household surveys would be needed to clarify the extent to which beneficiaries rely on multiple ES and where they are sourced by specific beneficiaries or beneficiary groups. The RAP reports are ongoing and are likely to include aspects of this

Table 3-7:Number and % of households conducting activities to obtain ES (ESIA Chapter 5)

	Irrigation	Wood collection	Spring_ water	Well water	Hunting	Fishing
# of households in rural settlements in AOI	2892	2437	9846	8353	11847	2826
% of all households in rural settlements in AOI	15	13	52	44	63	15

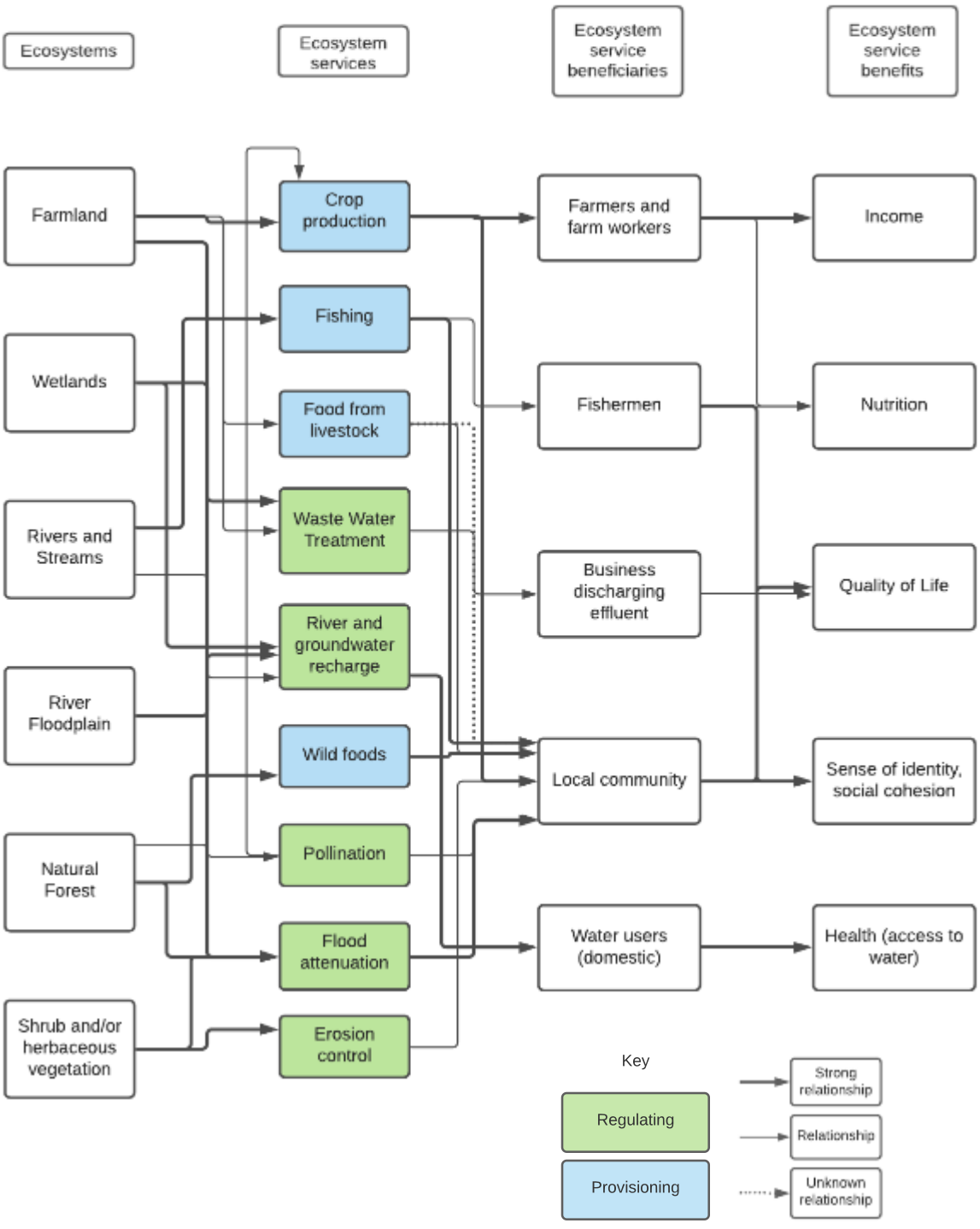


Figure 3.9: Framework diagram for Morava Corridor, arrows representing pathways for people to derive benefits from ecosystems.

4 Priority Ecosystem Services

Some services are a particular 'Priority' because people depend on them to obtain essential benefits for life and are not able to access alternatives to maintain these benefits. If supply of these services is reduced, or access to them is blocked, people's livelihoods and wellbeing's are placed at risk. IFC PS6 (2012) and the WRI ESR for IA method require explicit prioritisation of ES. The ESA assesses impacts only on priority ES, whether these are ES depended on by third parties or by the Project itself.

Dependence on ES is generally high in the area either because people rely on them directly to obtain their basic requirements for life (such as freshwater), or because their income is derived from ES.

4.1 Prioritisation Criteria

IFC PS6 (2012) does not prescribe an approach to prioritisation. This ESA has used the definitions and criteria presented in WRI (2013). Priority ES used by others (Type 1 ES in IFC PS6) are those where:

a) the benefits from the service are likely to be adversely affected by the Project; and

b) beneficiaries have a high level of dependence on the service; and

c) alternatives to the service are either unavailable or limited or are considered unsatisfactory by beneficiaries.

To prioritise ES needed by the Project for its operational performance (Type 2 ES in IFC PS6), the main consideration is sustainable supply for the Project lifetime.

The results of the ES prioritisation process for Type I ES are summarised in Table 4-1:. They align with the conclusions of the social study conducted by 2U1K, which identified "freshwater" and "agriculture" as important ecosystem services in the AOI, though additional priority ES have been identified, including capture fisheries and an obvious dependence on locally sourced firewood for domestic heating.

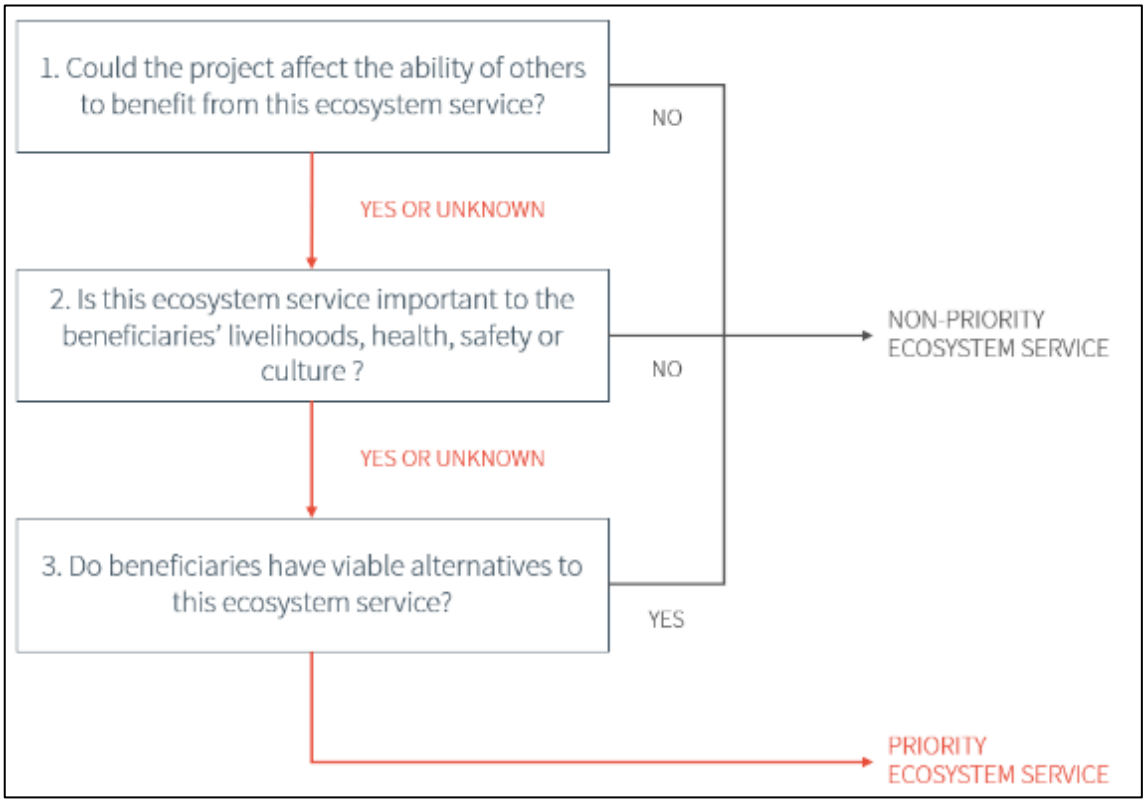


Figure 4.1: Prioritisation flowchart (note that a Priority ES is identified if the answer to question 3 is "No". We also included ES for which the answer to question 3 is "unknown" on a precautionary basis, so that measures could be put in place to reduce uncertainty)

Table 4-1:ES Prioritisation

Ecosystem Service	The project might affect the ability of others to benefit from the service	The affected service is important to beneficiaries' well-being	Beneficiaries do not have viable alternatives for that service	Priority ES?
Freshwater supply for drinking	JCWI reports that most water supply systems use groundwater wells and springs as the basis of water supply, some of which are in the zone of influence of the highway and the river Zapadna Morava and could potentially be affected by modification of the River and floodplain. The Institute also states that the West Morava River is not believed to be used directly, but some water may be taken from tributaries. Supply of freshwater from wells and springs may be affected by change in ground water-levels during construction or by pollution in run-off	Sufficient clean water for drinking is essential to health and is a basic human right. Sufficient water for domestic use is also essential	The Municipality of Vrnjacka Banja: takes some drinking water from the alluvium of the West Morava. Springs "Vitojevac" and "Ugljarevo" are in the zone of influence of the highway and the West Morava River. In the Municipality of Trstenik, the "Zvezdan" and "Staro korito" springs are located between the old and the new riverbed of the West Morava and the zone of possible impact of the highway. Impacts on these sources and the need for alternative provision are identified for further consideration to clarify arrangements.	YES

Ecosystem Service	The project might affect the ability of others to benefit from the service	The affected service is important to beneficiaries' well-being	Beneficiaries do not have viable alternatives for that service	Priority ES?
	during construction/ operation.			
Freshwater supply for irrigation	The Project could affect the amount and quality of water available for crop irrigation, whether this is sourced directly from the Zapadna Morava River and its tributaries of from groundwater sources.	Food produced from crops, gardens and orchards is essential for health and wellbeing. A significant proportion of locally produced food is consumed locally or fed to livestock to produce food which is consumed locally.	The Zapadna Morava River is relied upon as a source of irrigation water in some municipalities. Other sources are from groundwater which could also be affected by changes in groundwater levels or pollution. Alternatives have not been described in any detail.	YES
Food, good nutrition or income from farming	Crop damages or permanent loss of land during the construction or operation of the Project will affect farming businesses and household income and nutrition. Agriculture is the main source of income in most municipalities as well as providing local food security for health and nutrition. Area and productivity of land and	Crop production is the most important source of income in the AOI and provides a direct value to human well-being through income and as a source of nutrition. Crops are also relied on as livestock-feed, providing an indirect service to health and nutrition.	Crop damages or losses of production will be financially compensated in accordance with Serbian legislation and IFC requirements. Unless land for land compensation is given, there could be significant long-term implications in terms of household health and food security.	YES The Project's livelihood restoration program will address any loss of income. The need for any additional measures from an ES point of view is

Ecosystem Service	The project might affect the ability of others to benefit from the service	The affected service is important to beneficiaries' well-being	Beneficiaries do not have viable alternatives for that service	Priority ES?
	access to croplands could be impacted by the project (physical barriers).			considered in Section 7.
	The Project will affect pasture availability and quality. Income for hired workers will be affected as well as food security and access to sufficient healthy food. Impacts on livestock farming are also likely due to changes in flood regime and access to land.	Livestock farming provides nutrition and food security as well as hired workers deriving their main source of income from this source.	Alternative sources of protein (meat, milk, cheese etc) can potentially be purchased with cash compensation, provided sufficient opportunity exists to purchase products at an affordable price.	NO, provided that people losing benefit are prepared to accept cash compensation and/or can access alternative land suitable for production.
Flood protection provided by flood attenuation from floodplain and other natural ecosystems	Changes to forest, wetlands, agricultural lands, the river and the configuration of the floodplain could influence flood mitigation potential in the AOI. Straightening of river meanders will shorten the river, influencing flood regime and extent in the AOI and potentially downstream.	Flooding of transportation routes, agriculture, and settlements threatens the livelihoods and well-being of the residents and can be life-threatening. Analysis has only been conducted on the flood risk to the road at this point.	Flood mitigation measures have been put in place in order to protect the road, and some artificial flood protections in the form of hydraulic structures to some communities and farmland in the road corridor will be provided to improve standards of flood risk. service. However future changes to flood regime with climate change are yet to be	YES Note that key 2D flood modelling studies are ongoing. These may not consider all downstream beneficiaries of the current system, or those potentially affected by

Ecosystem Service	The project might affect the ability of others to benefit from the service	The affected service is important to beneficiaries' well-being	Beneficiaries do not have viable alternatives for that service	Priority ES?
			considered, suggesting flood protection measure may not be sufficient in future.	changes due to the Project.
Biological raw materials: timber for sale	Forest land may be transformed for use of raw materials for the construction of the road, including quarries or construction sites. This would impact individuals that use timber from the forests or benefit from its sale for income. Private owners have parcels close to the Morava River that directly source wood from.	Sale of timber for income is a commercial activity in some communities.	Uncertain: no analysis has been done of Project implications for timber production or sale or impact of project on land parcels for private owners. Beneficiaries are likely to be relatively few.	NO
Heating from firewood	For some villages and households, the Project will alter local supply of firewood or alter ability to access forests and woodlands to obtain it. Some landowners collect wood from their own private woodlands close to	90% of the communities use firewood for heating. 13% households collect it (fallen wood) but the majority are believed to purchase it. Some beneficiaries derive income from sale of firewood to others (ESIA, 2020).	In many cases this is believed to be the only source of domestic heating in winter. Level of dependence for income is unknown.	YES, if households (particularly vulnerable households) lose access to local forest/ woodland/parcels due to land-take for the Project (to

Ecosystem Service	The project might affect the ability of others to benefit from the service	The affected service is important to beneficiaries' well-being	Beneficiaries do not have viable alternatives for that service	Priority ES?
	the River that are potentially affected.			be confirmed when design is finalised).
Protein from Fish caught from the River (and cultural enjoyment)	Changes to freshwater river morphology and regime and the potential pollution from surface run-off or spillage during construction/ operation could reduce fish species composition and biomass in the river, as well as access for fishing.	For people who fish there are strong traditional or cultural attachments to fishing, and fish are a supplementary source of nutrition.	Cultural enjoyment of fishing can potentially be substituted by relocating fishing activity to other locations/ rivers, however people who fish may have strong attachments to current locations, local to where they live. There are also potential alternative sources of protein if these are considered to be acceptable or affordable.	YES, but only for people who fish and their households (primarily the cultural ES of enjoying fishing rather than the provisional ES of deriving protein from home-consumed fish). Willingness to accept alternatives needs to be reviewed for affected people.
Pollination of crops	Natural ecosystems and orchards providing habitat for pollinating insects may be lost or damaged. This	This ES provides an indirect contribution to human well-being by producing crop and plant species.	There is probably sufficient alternative natural habitat and vegetation available to	NO

Ecosystem Service	The project might affect the ability of others to benefit from the service	The affected service is important to beneficiaries' well-being	Beneficiaries do not have viable alternatives for that service	Priority ES?
	includes areas used for apiculture (see below).		support pollination from wild insects or bees.	
Honey for income or consumption	The motorway alignment, quarries, borrow pits and construction activities are close to apicultural activity areas and will displace some (extent unknown).	Provides income and honey consumed locally by apiculturalists, their families and other households in the AOI. Some apiculturalists make hives and frames for sale (using locally sourced wood). E.g., https://www.hivesandframes.com/	There will be some provision through the RAP to identify new locations and provide assistance with relocation of hives. It is not clear whether alternative locations are acceptable, or whether quality of honey would also be affected by road operation for some apiculturalists long term.	UNCERTAIN For a small number of beekeepers and businesses this could be a priority ES, but it is not clear how many beekeepers are affected or whether they are willing to accept alternative locations for production or have, longer term alternatives to income if honey produced near the road is of poor quality or can't be sold. There are proposals to monitor livelihood

Ecosystem Service	The project might affect the ability of others to benefit from the service	The affected service is important to beneficiaries' well-being	Beneficiaries do not have viable alternatives for that service	Priority ES?
				impacts through the RAP and these are expected to ensure that apiculturalists can maintain levels of benefit from bee keeping.
Hunting and wild food collection from woodlands, forests and other natural ecosystems	Hunting activities are carried out by people in all municipalities in the region and are relied upon as a source of nutrition and a sense of identity in numerous villages. Although not generally relied upon as a source of income, hunting of meat and collection of plants, mushrooms and herbs is used for household consumption.	Recreational use and traditional value of hunting may be deemed important to cultural identity. The source of nutrition provided by hunting contributes to a healthy diet and well-being.	For some people alternatives (in terms of cultural experience) may be limited due to distance, or competition with others. Alternative sources of nutrition are available but may not be considered an acceptable substitute.	UNCERTAIN (more detail needed on implications for hunters and wild food gatherers from borrow pit impacts and willingness to accept alternatives).
Regulation of air quality by forests,	Dust generation during construction and the increased emissions from traffic during operation will	Regulation of this service ensures local communities health and well-	Air quality is anticipated to recover after construction in terms of dust. There should be sufficient alternative	NO

Ecosystem Service	The project might affect the ability of others to benefit from the service	The affected service is important to beneficiaries' well-being	Beneficiaries do not have viable alternatives for that service	Priority ES?
wetlands and agricultural land	influence air quality and therefore affect the ability of others to benefit from the service. Forests, wetlands, agricultural land and soils contribute to regulation of air quality. Removal of this service may impact air quality for the local communities.	being considering air quality in Serbia is already a major concern.	ecosystem available to regulate air quality despite losses due to the Project and most households are sufficiently distant from the road due to the wide floodplain.	
Water purification and waste treatment	Wastewater generation during construction activities. Wetlands remove harmful pollutants from water by trapping metals and organic materials. Increased erosion may cause increase in stored pollutants impacting vegetation quality and the ability of landowners to make an income.	Water purification from wetlands and forests ensures that freshwater is available for drinking water in the local communities benefiting health and well-being.	Compensating with man-made substitutes such as wastewater treatment facilities to substitute for loss of wetlands or forests that act as water purifiers is seen as a viable alternative for this service.	NO
Erosion control provided by terrestrial ecosystems or	River regulation works are likely to alter erosion rates and patterns in some locations (by altering	Terrestrial land surrounding the river is important cropland for landowners and is a source of income. Erosion also increases	The project is providing with man-made substitutes to control erosional riverine processes. These may be	NO but downstream

Ecosystem Service	The project might affect the ability of others to benefit from the service	The affected service is important to beneficiaries' well-being	Beneficiaries do not have viable alternatives for that service	Priority ES?
naturally functioning floodplain	sediment dynamics or removing vegetation that protects banks from soil erosion). Scouring and river-bank erosion could increase in some locations, increasing sediment loading in the river. Erosion from terrestrial topsoil could occur due to removal of woodland, forest and other natural ecosystem, or locally due to use of construction machinery.	the risk of landslides which could influence land and crop production.	effective locally, but downstream implications should be considered. Terrestrial erosion should be avoided or managed through appropriate application of the mitigation hierarchy (measures such as footprint control or avoiding work in wet conditions).	implications should be considered.

4.2 Identification of Priority Ecosystem Services for Operational Performance of Project

The road development requires significant amounts of water to support construction and operation and the implications of this have been discussed as a concern. A projected figure of 411,000 tons per year of water required for construction poses the risk to alteration of the groundwater level from the design and construction state of the Project (ESIA, Chp. 8).

The Project has secured permits from Serbia Water to cover its requirements, but implications of this Project-demand for access to freshwater should be reviewed in terms of whether supply is sustainable for the Project and also its implications for uses by others. Another aspect that should be considered is proposed policy for procurement of food for construction teams, and how this could affect local demand and supply relationships.

The Project will also use significant volumes of aggregate and requires a sustainably supply to support construction.

5 Baseline: priority ES in the absence of the project

This chapter summarises the baseline situation for the priority ES identified in chapter 4, i.e., their current status and how future supply might change in the absence of the Project. In the following sections we have attempted to evaluate baseline levels of supply, use and benefit for the priority ES.

There are many pressures already operating in the AOI that could affect future supply of ES in the baseline situation (i.e., without development of the Project). These include:

- Population and demographic change (e.g., in- or out-migration) affecting types and intensity of land use.
- Flooding (farmers in affected villages stated that the income from agriculture has decreased because of the floods from recent years). However, people downstream benefit from a degree of flood attenuation provided by naturally functioning floodplain in this area.
- Ongoing modification of the landscape, including fragmentation of woodland and forest.
- Climate change (e.g., increased need for irrigation).
- Market and economic changes (e.g., transition to more cash-based economy and potentially increased market access through improved road networks).
- Changes in technology (e.g., rural electrification or shift from shallow wells to piped drinking water supplies), which might improve ability of people to access and benefit from ES but could also increase per capita water demand.

It is important to note that data on the number of households using an ES in the following sections was derived from percentages of a sample of households included in the ESIA household surveys. As the sample size was small at the individual community level, these should be regarded as indicative estimates, used for general illustrative purposes.

5.1 Freshwater for drinking and domestic use

In terms of water quality, an ecological status assessment of the Zapadna Morava River concluded that it is impacted by moderate organic pollution as well as various types of structures and modifications at present. Water quality is affected by hydrological and geomorphological pressures from land use activities such as agriculture, industry and mining and therefore the overall status of the river has been assessed as moderate (Novaković 2013).

Any households using the Zapadna Morava directly for water would potentially experience some impact on water quality from river regulation works, however subsequent consultation with JCWI suggests that direct abstraction from the Zapadna Morava for drinking purposes does not occur and prior water treatment is necessary for it to be safe for consumption. Based on this information we have assumed that direct use of the Zapadna Morava river for drinking water does not occur.

Households relying on groundwater sources could also be potentially affected by the Project (Table 5-1). The JWCI has indicated that some springs used for domestic water in the Municipality of Vrnjacka Banja (the Springs "Vitojevac" and "Ugljarevo") and in the Municipality of Trstenik (the springs "Zvezdan" and "Staro korito") are in the zone of possible impact of the highway. Residents of Trstenik requested detailed consideration of the implications of river regulation works for their water supply during stakeholder meetings (see Report by RINA,

(2021) summarizing the results of ICP. Other springs and wells are thought to be outside the zone of influence.

There is no specific evidence to indicate whether current water supplies are considered sufficient for all households in terms of volume or water quality, though some community residents have indicated that some water supplies need improvement, in Stancici Village, for example where water pipelines were damaged in previous floods. There is no information in the ESIA on water-borne disease or other indicators of health based on water supply. No specific vulnerable groups have been identified in the ESIA, but it is possible that such groups exist, with poor water infrastructure, potentially already suffering from poor water quality.

Table 5-1:Settlements using groundwater sources for fresh water.

Municipality	Settlement	Total households	Closest project unit	% of households relying on wells for drinking water		% of houses relying on springs for drinking water	
				%	Number	%	Number
Ćićevac	Stalać	477	Motorway	0	0	24	114
Trstenik	Selište	228	motorway	25	57	0	0
	Velika Drenova	708	motorway	34	241	0	0
	Medveđa	722	batch and river reg	38	274	0	0
	Bogdanje	292	river reg and borrow	0	0	53	155
	Lozna	115	quarry	58	67	42	48
	Ugljarevo	164	Borrow	38	62	13	21
Vrnjačka Banja	Štulac	390	borrow & asphalt	0	0	24	94
	Ruđinci	787	camp & asphalt & borrow	0	0	63	496
	Vrnjci	696	Borrow & Batch	0	0	24	167
	Novo Selo	1331	Motorway	0	0	92	1225

	Podunavci	454	Motorway	0	0	60	272
	Gračac	595	Batch	0	0	20	119
	Vraneši	451	Motorway	0	0	33	149
0Kraljevo	Adrani	726	Borrow & Camp & River Reg	20	145	0	0
	Miločaj	296	River Reg	0	0	8	24
Čačak	Goričani	225	Borrow & River Reg.	4	9	0	0
	Katrga	277	Motorway	11	30	0	0
	Mrčajevci	913	Motorway	2	18	0	0
	Donja Gorevnica	313	Motorway	27	85	0	0
	Konjevići	269	Motorway	15	40	0	0
	Preljina	552	Batch	13	72	0	0
	Rakova	211	Motorway	14	30	0	0

5.2 Freshwater supply for irrigation

The use of irrigation throughout the municipalities in the project area could potentially indicate that water for crop production is already a scarce resource in the AOI, though there is no clear evidence of this. Certainly, there is quite a high level of use of agricultural irrigation supplied by water networks and the river, which contributes to income from crop production as well as food produced for household use. Actual income derived from irrigated farming per se is not known, nor the relative contribution it makes to overall household income, but it is anticipated that this will be factored into livelihood compensation measures.

Table 5-2: Use of the River for irrigation

Municipality	Settlement	Total households	Closest project unit	Households relying on the river for irrigation		Households relying on wells or springs for irrigation		% of agriculture relying on irrigation
				%	Number	%	Number	
Ćićevac	Grad Stalać	202	Borrow pits & batch	22	44	0	0	0
Varvarin	Maskare	172	Borrow pits	0	0	90	155	60
	Bivolje	86	Camp & Dike & Asphalt & Batch	20	17	0	0	0
Kruševac	Jasika	554	Batch & Asphalt & Dike	50	277	0	0	0
	Koševi	97	Borrow pits	63	61	0	0	0
	Kukljin	455	Quarry and borrow pits	40	182	0	0	0
Trstenik	Selište	228	Motorway	0	0	42	96	67
	Velika Drenova	708	Motorway	0	0	46	326	58
	Medveđa	722	Batch and river reg	0	0	82	592	84
	Bogdanje	292	River regulation and borrow pits	0	0	13	38	0
	Grabovac	50	motorway	0	0	33	17	67
	Lozna	115	quarry	0	0	100	115	58
	Ugljarevo	164	Borrow pits	0	0	25	41	63
Vrnjačka Banja	Štulac	390	Borrow & asphalt	0	0	90	351	57
	Ruđinci	787	Camp & asphalt & borrow	0	0	48	378	83
	Vrnjci	696	Borrow pits & Batch	0	0	90	626	69

	Novo Selo	1331	Motorway	0	0	100	1331	65
	Podunavci	454	Motorway	0	0	42	191	75
	Gračac	595	Batch	0	0	80	476	75
	Vraneši	451	Motorway	0	0	65	293	59
Kraljevo	Stubal	357	Borrow pits	0	0	12	43	0
	Zaklopača	341	Motorway	0	0	100	341	0
	Ratina	983	Beam Plant & Motorway	0	0	33	324	0
	Šumarice	168	Borrow pits	0	0	37	62	0
	Adrani	726	Borrow & Camp & River Reg	0	0	100	726	40
	Popovići	92	River Regulation	0	0	36	33	0
	Miločaj	296	River Regulation	0	0	17	50	0
	Obrva	201	Borrow pits	0	0	25	50	0
Čačak	Goričani	225	Borrow pits & River Reg.	18	41	77	173	0
	Katrga	277	Motorway	29	80	64	177	0
	Mrčajevci	913	Motorway	2	18	91	831	0
	Donja Gorevnica	313	Motorway	80	250	20	63	0
	Stančići	83	Batch & Borrow pits	0	0	100	83	0
	Baluga (Ljubićska)	122	Motorway	33	40	58	71	0
	Konjevići	269	Motorway	39	105	61	164	0
	Preljina	552	Batch		0	96	530	0
	Sokolići	56	Motorway	75	42	25	14	0

5.3 Food, good nutrition and income from farming

The vast majority of local residents in the AOI rely on crops as a source of food and nutrition through direct consumption as well as indirect through food for livestock. Crop production for household income is also relied upon by farmers and farm workers.

In the area surrounding the proposed highway, arable land amounts to 81.6% of all agricultural land (Table 5-3), which is considerably higher than the national average (ESIA, 2018, pg. 134). 98% of agricultural land currently in use is privately owned, with the properties managed by 16,585 agricultural households, so that one household uses around 2.8 ha of land, significantly below the national average. To a lesser extent the area has pastures and hay meadows used for livestock.

In the baseline situation, the intensity of agriculture is declining in some areas, with some evidence for rural depopulation. The degree of abandonment suggests there is sufficient supply of land to meet current user requirements, however the productivity of land for crop production is constrained by water supply, hence the importance of irrigation in the AOI. For the purposes of ESA, we are not able to evaluate the extent to which current benefits from farming (income and food) are regarded as "sufficient" by beneficiaries.

Table 5-3: Agricultural land within AOI

Land use	Current extent (ha)
Arable land / crop production (Kosztra *et al.* 2019; 2U1K 2020).	8000
Pastures or meadows with varying frequencies and intensities of mowing and/or grazing covered in natural or sown herbaceous species are located within the wider AOI (Kosztra *et al.* 2019). Within the AOI, regularly grazed mesotrophic pastures are located along the dry riverbed sections of the Zapadna Morava River (2U1K 2020).	56.9
Heterogenous agricultural areas with complex cultivation patterns	5113

5.4 Flood Protection to people, property and farmland

The Zapadna Morava River in the Project location meanders within a wide floodplain, providing some flood storage and flood attenuation, with both local and downstream benefits. However, significant flood events occur and settlement / infrastructure within the floodplain is at risk. The last major event was in 2014 and after this, the Jaroslav Černi Water Institute (JCWI) conducted a Hydrotechnical Study of E-761 Motorway Route, Section Pojate-Preljina to re-determine the 100 year-flood zone line. Significant further changes could occur over the lifetime of the Project and further into the future as a result of climate change, but it is understood that implications of climate change have been considered. The Hydrotechnical study proposed river regulation on the Zapadna Morava River primarily to protect the Project but there could also be some benefit to settlements in the floodplain.

The Zapadna Morava River does not currently have a continuous flood protection system and retains long stretches of watercourses without dikes (or with dikes only along one riverbank). Urban areas have “hard defences”, and agricultural areas are left to flood, currently conferring a degree of flood protection. Establishment of some settlements, farming activity and infrastructure within the floodplain appears to have exposed more receptors to significant local flood risk, however. Current (baseline) flood protection benefits from the attenuation provided by the floodplain in the AOI are probably experienced downstream as much as locally. The ESIA does not discuss floodplain functioning in any detail and it is not possible to quantify the level of flood attenuation provided by the floodplain and its associated ecosystems in the baseline situation for the Project. Numbers of households and people exposed to significant flood risk are also unclear at this stage. It is important to note that unregulated stretches of river with naturally functioning floodplains are increasingly rare, making them of considerable ecological importance. The full extent of potential downstream changes in flood regime is not known at this stage. Ongoing 2D models appear to be limited to the downstream limits of the Project but the possibility of impacts further downstream should be excluded.

A degree of flood protection is derived from ecosystems in the Zapadna Morava River catchment which slow surface run-off, hence modification of land use in river catchments is used increasingly in Europe to attenuate flooding. The original vegetation of the AOI has changed over time with reduced areas of oak forest and more areas with modified, anthropogenic vegetation through the development of agricultural land, settlements and related infrastructure. This will have reduced the functionality of the floodplain in terms of slowing surface run-off, flood storage and attenuation, but there are likely to be opportunities for planned biodiversity mitigation to restore some of this functionality. Further information is on flood regimes and how they will change is being developed through ongoing modelling.

5.5 Heating from firewood

Residents in the AOI use wood sourced from local forests and woodland to heat their homes. In many cases this is the primary source of domestic heating in winter. In 27 settlements all household heating is based on firewood, with a high proportion of households collecting wood for their own use, as shown in Table 5-4.

Firewood is mostly derived from forests and woodlands located out of the floodplain, some of which are identified as areas for borrow pits (Figure 5.1). 90% of communities currently collect firewood from the forest, but the number of households reported to collect wood themselves is smaller than the number saying they use it for heating, so some households must purchase wood from others.

Table 5-4:Settlements where all households use firewood for heating

Settlement	Total households	Closest project component	% of firewood sourced from neighbouring forests	Number of households collecting firewood from forests for household use
Grad Stalać	202	Borrow & Batch	100	202
Jasika	554	Batch & Asphalt & Dike	60	332

Selište	228	Motorway	42	96
Velika Drenova	708	Motorway	83	588
Bogdanje	292	River regulation and borrow pits	73	213
Grabovac	50	Motorway	33	17
Lozna	115	Quarry	83	95
Štulac	390	Borrow pits & asphalt	49	191
Ruđinci	787	Camp & asphalt & borrow pits	28	220
Vrnjci	696	Borrow pits & batch plant	30	209
Ugljarevo	164	Borrow pits	100	164
Novo Selo	1331	Motorway	52	692
Vraneši	451	Motorway	29	131
Vrba	432	Motorway	60	259
Ratina	983	Beam Plant & Motorway	33	324
Sirča	436	River regulation and borrow pits	80	349
Grdica	251	Borrow & River regulation	0	0
Popovići	92	River Reg	88	81
Obrva	201	Borrow pits	50	101
Goričani	225	Borrow pits & river Reg.	14	32
Katrga	277	Motorway	21	58
Donja Gorevnica	313	Motorway	27	85
Stančići	83	Batch & borrow pits	25	21
Baluga (Ljubićska)	122	Motorway	17	21
Konjevići	269	Motorway	8	22

Rakova	211	Motorway	14	30
Sokolići	56	Motorway	33	18

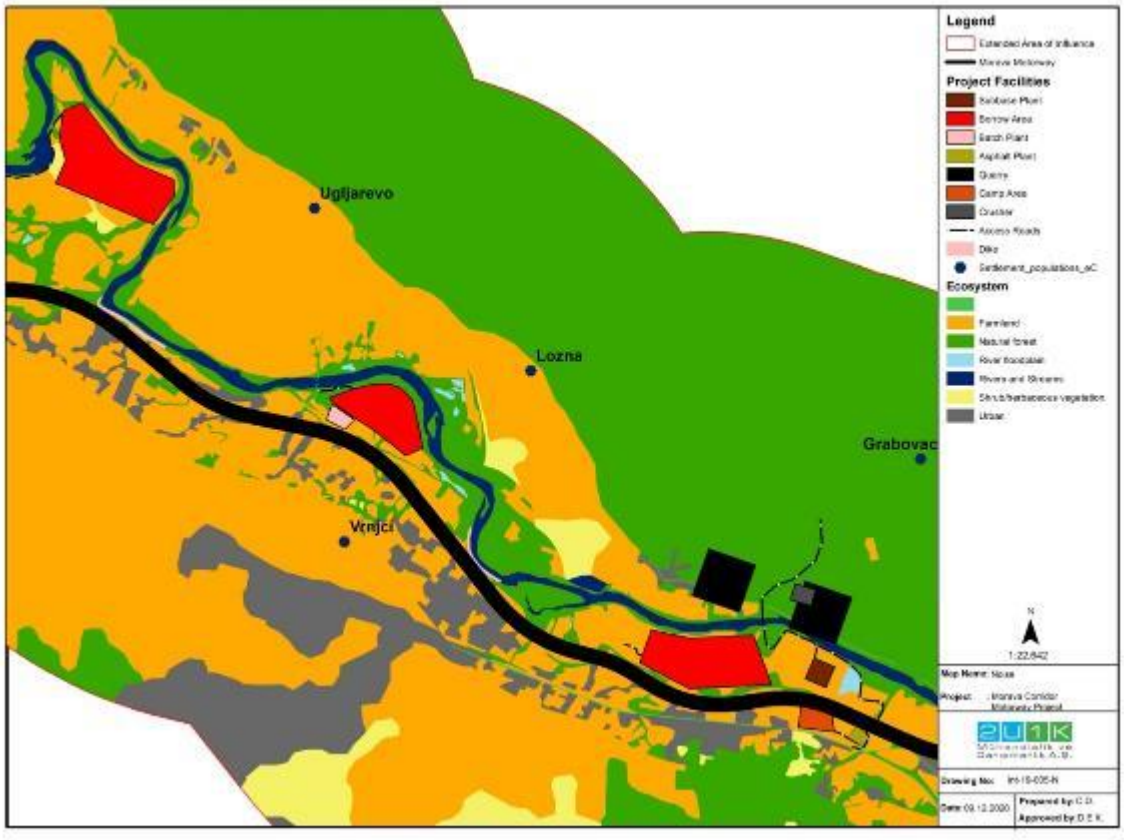


Figure 5.1: Map showing the Vrnjci community detail *Note: Quarry extent indicative only*

Vrnjci was identified as a community that is potentially vulnerable to changes in access to forests to collect firewood and Figure 5.1 is provided for illustrative purposes. The road development potentially cuts off access to the forests on the other side of the river and the construction of quarries, borrow areas and camp facilities may impact the extent of forest land available or accessible to local communities for wood collection.

5.6 Leisure activity of fishing and protein from fish caught from the River

Fishing is largely a recreational activity, but people typically consume the fish that they catch and enjoy them as a source of protein and nutrition. While it is possible to substitute consumption of locally caught fish with other sources of protein and nutrition, the alternatives may not be as attractive to people. In particular, the cultural ES of enjoying fishing for recreational purposes in particular locations can be difficult to substitute, even if other locations for fishing are potentially available.

5.7 Hunting and wild food

Hunting and wild food collection from woodland, forests and other natural ecosystems are a common activity, constituting important provisioning and cultural ES. It is not clear whether there is sufficient area to meet demand in the baseline situation, but it seems likely given the presence of extensive hunting reserves.

6 Assessment of Project-impacts on Priority ES

6.1 Overview of Project-impacts

The ESIA provides a description of the Project and its impacts during construction and operation. A very brief overview is provided here.

- The construction of the motorway will involve direct (temporary and permanent) physical infrastructure, causing some loss of ecosystem in the Project corridor.
- Some sections of the road pass through the floodplain of the Zapadna Morava river and some modifications to the course of the river are planned, as well as extensive riverbank “protection” using revetments, stone and re-profiling for many kilometres.
- The construction of the Motorway and associated river structures may affect the chemical and ecological status of the Zapadna Morava water body and groundwater. Chapter 6 of the ESIA states that impacts are also possible on the Južna Morava and Velika Morava water bodies, downstream from the confluence of the Zapadna Morava. Further information is needed on the extent of these changes and the specific water supplies affected, however it is clear that the Project may affect the supply (volumes and quality) of freshwater to beneficiaries for drinking, domestic use and crop irrigation. Ability to access water may also be affected due to reconfiguration of the River and alteration of its location in relation to users. Finally, the level of benefit derived may be affected, with potential impacts on access to sufficient volumes of water of a suitable quality for healthy life. Altered ability to irrigate crops may also affect income from arable farming.
- The Project design makes provision for collection of surface run-off in trenches with concrete channels (ESIA, 2018), also for some water treatment (e.g., separators to remove hydrocarbons). Water bodies to receive treated run-off have not been identified at this stage.
- All sections of the road currently pass through the potential flood zone of the river and significant modifications to the course of the River are planned, as well as extensive riverbank “protection” using revetments, stone and re-profiling for many kilometres.
- Large amounts of construction material will be transported during highway construction. New borrow pits and unsuitable soil waste areas will be opened. These activities can cause land degradation or permanent soil loss. Land degradation due to landfills and borrow pit-formation, and the excavation of construction material cannot be quantified at this stage as locations and volumes have not been confirmed.

6.2 Changes in ES supply, use and benefit

The Project may affect ES supply, use/ access or benefit either directly (for example by removing an area of ecosystem) or indirectly (for example by altering patterns of land use or causing additional areas of Natural Habitat to become degraded because of concentration of activities in a smaller overall area. Ideally changes in these parameters would be quantified, allowing their significance to be evaluated in terms of the ability of affected people to derive the benefits they need. Reduced supply of an ES will not necessarily be significant if people can still derive sufficient benefit to meet their needs (in other words, level of supply remains sufficient despite project-impacts).

6.2.1 ES supply

Supply of ES depends on the extent (area) and condition of the ecosystems they are sourced from. Table 6-1 shows the direct physical footprint of the Project on broad ecosystem categories, which is an indicator of direct impact on supply. Table 6-2 summarises the estimates generated by TBC using a slightly different study area and EUNIS habitat types. There is a total footprint of 3182 ha (3127 ha excluding urban) and additional indirect effects will also occur, altering the capacity of ecosystems to continue supplying ES. For farmland and forests there will be a permanent loss of capacity to supply ES in future.

Table 6-1:direct physical footprint of the Project on ecosystems supplying priority ES*

Ecosystems	Motorway	Access Roads	Project Facilities	River Regulation	Total
Farmland	1064	119	920	114	2217
Natural forest	215	76	371	141	803
Rivers and Streams	16	6	1	58	80
Shrub and/or herbaceous vegetation	8	2	8	2	20
Urban	43	7	4	1	55
Total	**1348**	**210**	**1307**	**316**	**3182**

*Assumptions:

- Motorway footprint width 120m (not 900m as in project description, which includes the full protection zone)
- Infrastructure included: Motorway, Emergency Lanes, Immediate Protection Zone (See Project Description).
- Infrastructure excluded: Other Protection Zones within the 900m width corridor, interchanges.
- Access roads, including temporary construction access roads, 40m width.
- Project facilities and river regulation – as mapped in client GIS layers.
- No habitat mitigation measures included.

Further footprint is likely from unsuitable soil waste areas, still to be confirmed through the Project design process.

Table 6-2:Direct physical footprint of the Project on EUNIS habitat types using the buffer zone applied by TBC.

Row Labels	Sum of Area (ha)/ EUNIS Habitat type	
C2.3	298	Water courses
E2.1	73	Permanent mesotrophic meadows and aftermath pastures
G1.1	1265	Riparian and gallery woodland
G1.7	883	Thermophilus deciduous woodland
I1.1	5681	Intensive unmixed crops
J1.2	199	Residential buildings
J2.3	43	Rural industrial commercial sites
J3.2	30	Active opencast mineral extraction sites including quarries
J5.3	37	Highly artificial non-saline standing waters
Grand Total	8509	

Figure 6.1 is an example of part of the Project in Section 3, which involves construction of borrow pits, taking land/ ecosysterm and also interruption of access to the River from settlements such as Stancici. Figure 6.2 shows the location of the route in relation to Popovici where at least one stakeholder has land potentially stranded between the old and new river channels, potentially experiencing loss of access to land unless mitigation is provided. Figure 6.3 and Figure 6.4 show locations of borrow pit construction planned for the Project, a significant source of land-take and modification of ecosystems. The ESIA includes a series of such maps for the whole route.

Figure 6.1: Project impacts on ecosystems in section 3 (Sokolici to Obrva)

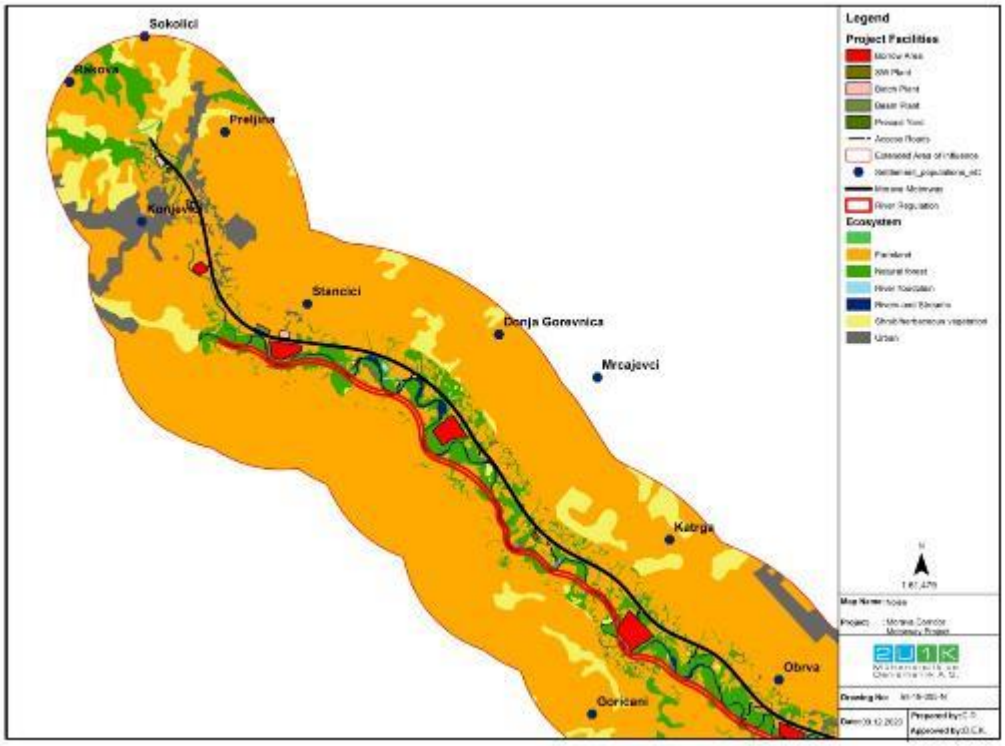


Figure 6.2: Project impacts on ecosystems in sections 2 and 3 (Obrva to Vrba) ***Note: Quarry extent indicative only***

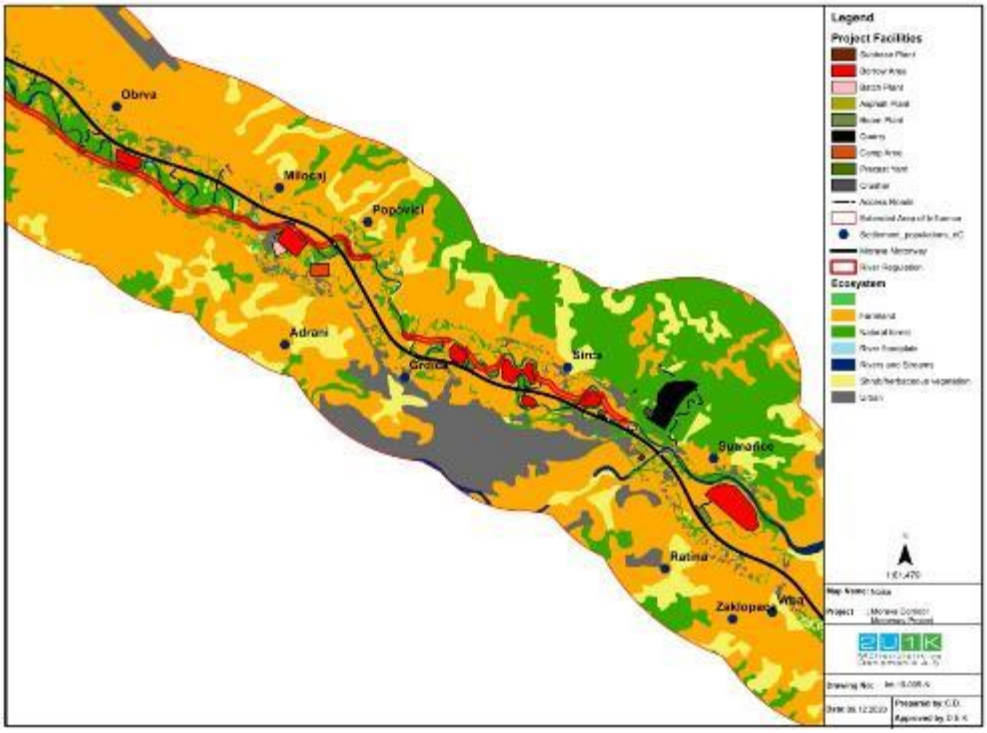


Figure 6.3: Project impacts on ecosystems in section 2 (Sumarice to Trstenik) *Note: Quarry extent indicative only*

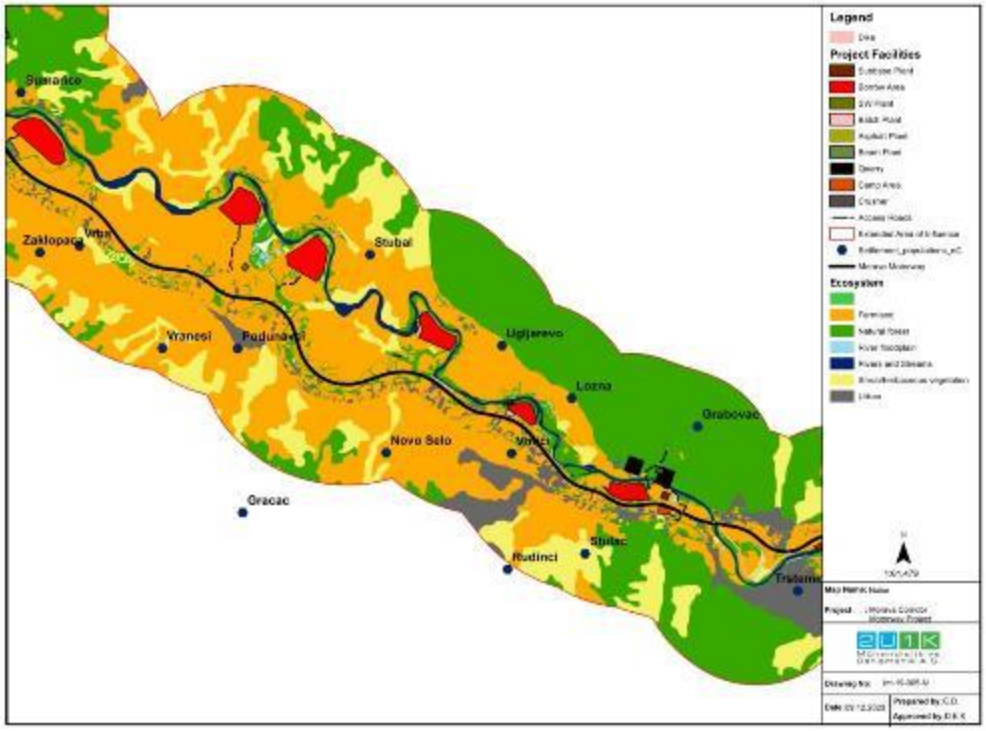


Figure 6.4: Project impacts on ecosystems in section 2 (Trstenik to Kuklkin)

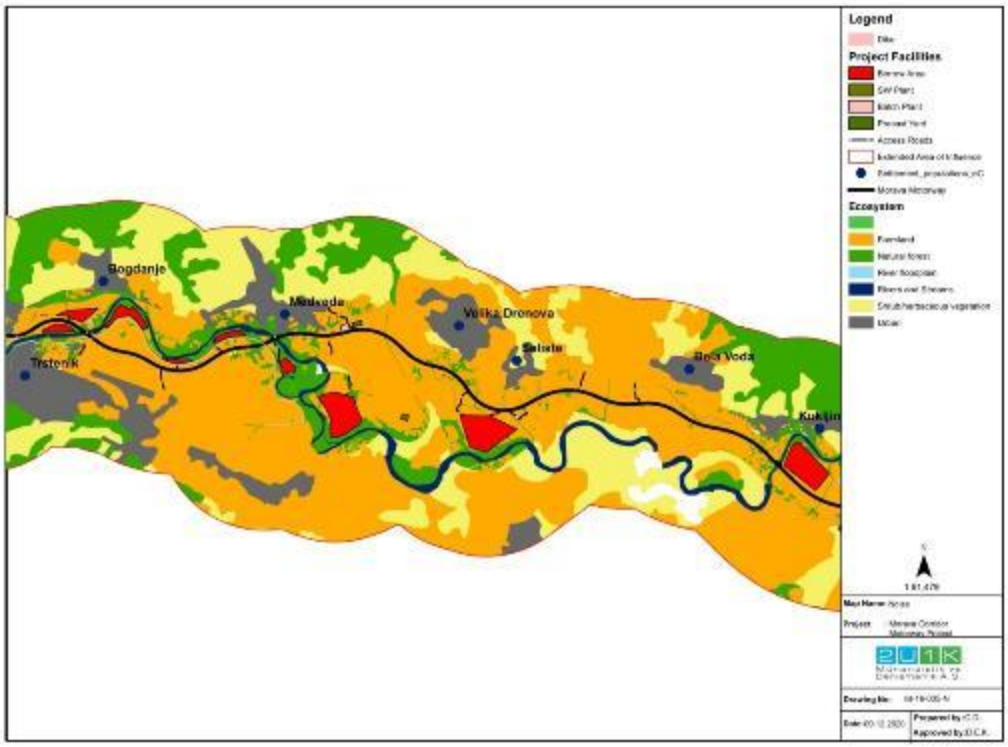


Figure 6.5 Map showing the project elements in section 1 (Kukljin to Stalac) ***Note: Quarry extent indicative only***

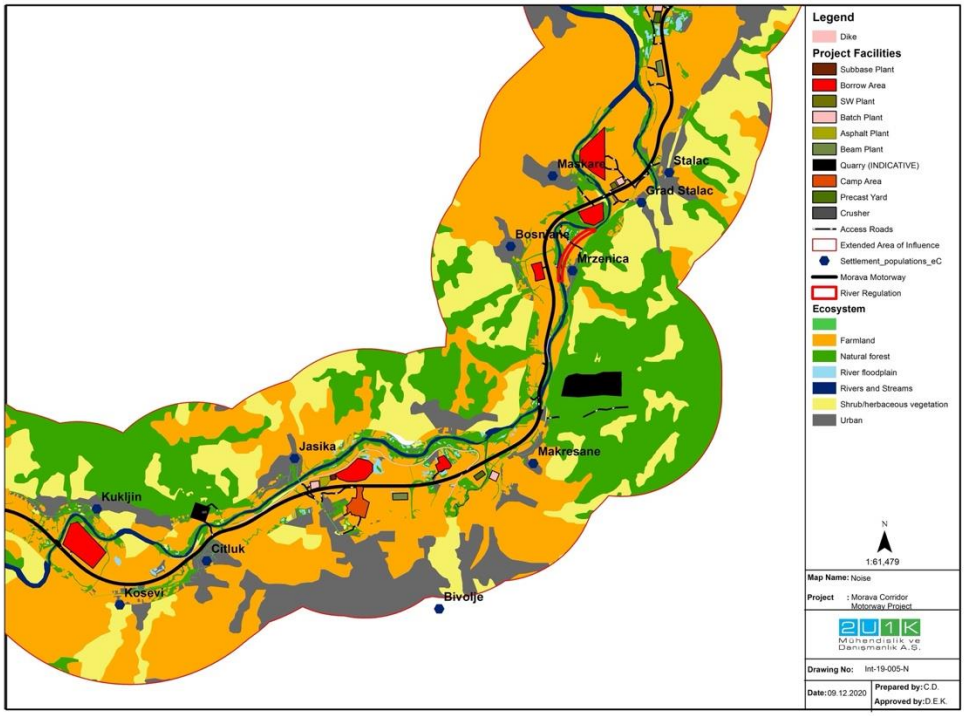
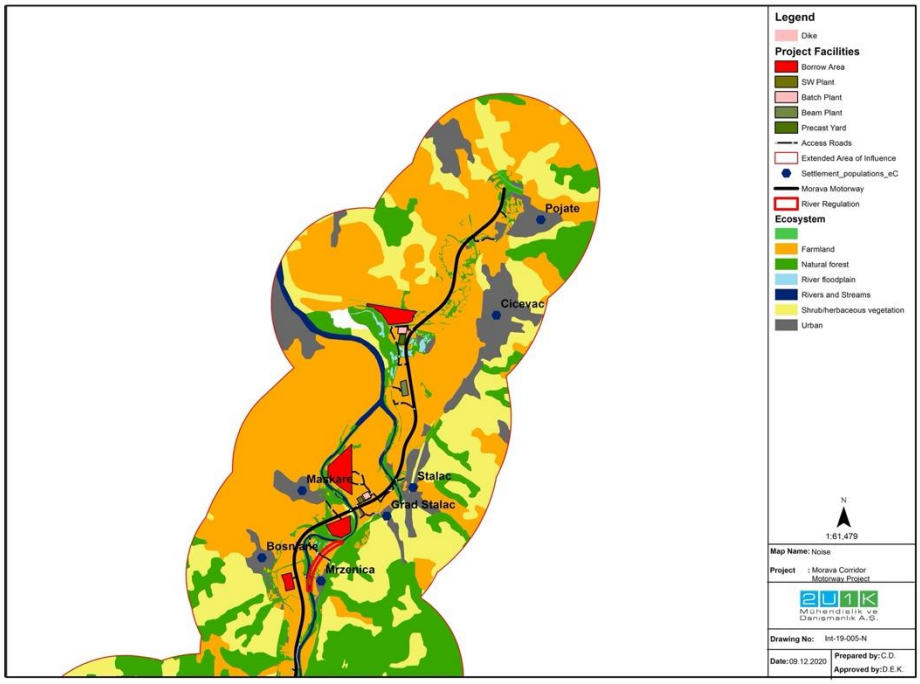


Figure 6.6. Map showing the project elements in section 1 (Mrzenica to Pojate)



6.3 Changes in use/ benefit

Table 6-3 summarises how the ability of people to access or use ES might be affected by the Project and attempts to identify ES for which significant loss of benefit is possible.

Table 6-3: Summary of Project-related changes and potential ES impacts

Ecosystem Service	Impact from the project	Change in ES supply, use or benefit
Freshwater obtained from the River or from groundwater in connectivity with the River	- Use of water by the Project during construction for camps, batch plants, asphalt plants. - Alteration of the river regime and hydrogeomorphology. - Alteration of land use: the new regime could support intensification of farming, with implications for quality of water obtained from groundwater due to increased agricultural run-off. - Unknown effects on the height of the groundwater table and its accessibility via springs and wells, caused by river modification and additional excavation in the floodplain for sand and aggregate. - Polluted surface water run-off to surface water bodies if road drainage is not 100% effective. - Accidental spills of fuel or hazardous wastes affecting water quality and potential toxic effects on aquatic organisms and vegetation.	- Supply of water from the River system will change in terms of flow/volume due to project-related abstraction. - Flows and volumes may not alter significantly due to modification of the river system, but designs are not finalised. - Water quality impacts are possible during construction and operation. - Physical access to abstract river water could be altered by river modifications and the road alignment (changes in access points, water supply infrastructure. - Benefits could be affected if there is any interruption to water use or any deterioration in water quality for any user. - Potential risks are greatest for the households with 100% dependence on “the river” for domestic freshwater requirements. JCWI considers it unlikely that any households fall into this category. - Villages in some municipalities use springs that could be affected by construction or operation of the Project ○ **Municipality of Vrnjacka Banja:** some drinking water taken from the alluvium of the West Morava and the Springs “Vitojevac” and “Ugljarevo” are in the zone of influence of the highway and the river Zapadna Morava.

		○ **Municipality of Trstenik:** The spring "Zvezdan" and the spring "Staro korito" are located between the old and the new riverbed of the West Morava and are in the zone of possible impact of the highway. - River regulation works may also impact water quality by altering the river regime or sediment dynamics. The ESIA stated that there are no wells or springs in this settlement, suggesting that there are not viable alternatives to this ES. (see Figure 6.1 showing the Bosnajane and Makrosane communities' detail). - Batch plants at Velika Drenova and Medveđa use groundwater. These communities also rely on groundwater, with 241 and 274 households from Velika Drenova and Medveđa respectively relying on wells. - Water from public or municipal water supply networks is not expected to be impacted by the project.
Freshwater supply for irrigation	- Alteration of the river regime and hydrogeomorphology. - Unknown effects on the height of the groundwater table and its accessibility via springs and wells, caused by river modification and additional excavation in the floodplain for sand and aggregate. - Alteration of land use and configuration of land holdings. - Potential changes in water quality	- Supply of water for irrigation is unlikely to change. - Use or access could change significantly for those farm holdings relying on irrigation for crop production. Existing abstraction points or water offtakes could disappear, and the new course of the river could be further away from irrigated land than it is in the baseline situation. - Significant loss of benefit could occur to farming households relying on irrigated crop production if they lose access to their current water supply for irrigation.
Food, good nutrition and income from farming	- The Project has direct footprint on farmland and on current arrangements for irrigation.	- Supply of this ES will decline due to direct footprint on farmland and indirect impacts related to irrigation (more intensive production methods may compensate for loss of land).

		- Access to land for management will be altered. For some producers this could be a significant impact, affecting costs of land management. - The majority of settlements in the AOI rely on crop production as a source of food and income and some will lose nutrition or income. - Vulnerable groups that have no alternative source of income are vulnerable to any change related to the project. Although compensation is offered for any damages through the RAP process, the compensation does not account for the sense of identity or cultural importance of crop production for many of the local settlements.
Flood protection to people, property and farmland	- Change in level of flood protection provided by the floodplain to people, property and farming in AOI and downstream (unknown impacts at this stage). - Loss of flood storage capacity in the floodplain due to construction of borrow pits which will be water-filled. - Permanent loss of floodplain as a supporting service to habitats and farming. - Change in soil stability and quality, affecting crop yields and ultimately income from farmers and farm workers - Reduction in natural fertility provided by the floodplain - Decrease in supporting service of floodplain to threatened ecosystems and endangered/ aquatic species.	- Supply of this ES to users and beneficiaries in the AOI and downstream could be permanently reduced through floodplain modifications and cumulative effects of hydro-structures. The ESIA states that the river regime will not alter, but this is work in progress. - Flood attenuation through surface run-off will be reduced by removal of riverine woodland and other natural habitat in the floodplain. - Changes in levels of protection for people, property and farmland in the AOI and primarily downstream, are uncertain (further analysis is ongoing with reports due in March). - Alternative means of substituting flood protection are possible but come at a future maintenance cost. - The supporting service of the floodplain to threatened ecosystems and endangered aquatic species will also be impacted by the project.

	- Benefits of natural defences replaced with hard defences which may offer a higher level of protection locally but potentially increase risks downstream.	- Benefits of the project include the installation of hard flood defences, potentially offering higher levels of protection to flooding locally but potentially increasing downstream.
Heating from firewood	- Some direct loss of forest/ woodland will occur, both due to footprint of the motorway and excavation of borrow pits (800 ha footprint on forest/ woodland).	- Supply of firewood for heating will go down. This may include areas formally and legally harvested for firewood for sale to others and local collection of dead or fallen wood, It is not known if this reduction will affect the ability of specific beneficiaries to meet their needs. - For some users, ability to access forests and woodlands to collect firewood may alter. These effects are expected to be local to a sub-set of communities with traditional dependence on local forest where habitat loss will occur. - Benefits could be significantly affected for some households. Current livelihood compensation arrangements don't appear to cover loss of this ES. Further investigation is needed to ensure that no households or vulnerable groups suffer significant loss of ability to heat their homes in winter because of loss of access to local woodlands or other ecosystems to collect fallen wood.
Fish/ protein in the diet and cultural enjoyment of fishing	- Modified river regulation may impact aquatic species that are relied upon by the local communities - Reduces supply of protein - Access to fishing areas may be reduced, reducing level of benefit - Change in habitats may result in a loss of fish stocks, reducing supply	- Supply of fish (fish stocks and species composition) could be affected by river regulation works and habitat alteration at least in the short term, particularly in Section 2 of the Project. - Development of new habitat in the stretches of replacement channel may take a while to develop. - Access to fishing could change for some settlements due to reconfiguration of the river channel or barrier effect of the new motorway (depending on bridges and new access arrangements). - There could be loss of benefit from fishing for some people due to reduced supply/ access at least during construction.

		- Alternative locations to fish may be available, or planned bridges and crossings may maintain access to preferred, customary locations. - It is likely that people can enjoy a balanced diet without consumption of fish they catch themselves, but they may not prefer or accept the alternatives.
Wildfood collection and hunting	- Some direct loss of forest/ woodland will occur, both due to footprint of the motorway and excavation of borrow pits (800 ha footprint on forest/ woodland).	- Woodlands and forests are preferred for collection of wild food and hunting. - For some people there will be altered arrangements and levels of access to woodland and forest for hunting (reduced area and new barriers to access). - There will be some loss of benefit for affected people in terms of amount of food obtained and potentially their cultural enjoyment of the cultural ES of collecting or hunting (road disturbance and noise, loss of “natural” landscape.
Beekeeping for honey and income	- For a small number of beekeepers and businesses, hives will need to be relocated	For a small number of beekeepers and businesses this could be a priority ES, but available data suggest that a small number of keepers are affected. There are proposals to monitor livelihood impacts through the RAP and these are expected to ensure that apiculturalists can maintain levels of benefit from bee keeping, but it is important to ensure that they are willing to accept alternative locations for production and/or have, longer term alternatives to income if honey produced near the road is of poor quality or can’t be sold.

6.5 ES depended on by the Project

6.5.1 Groundwater

Water is a major requirement of the project. Water required for labour camps is anticipated to be 25,000 tons per month. Batch plants may require 10,000 tons per month and in asphalt plants, there will be monthly consumption of 3,500 tons of water. This totals around 441,000 tons/ year water to be obtained from existing sources and water wells (see Table 6-4). The Project is obtaining permits from the Water Authority who is responsible to ensure that sufficient sustainable water supply to meet these and other potential requirements without adverse consequences for other users.

Table 6-4: Amount of water used during the construction of the project

Description	Water Use (tons/mo)	Utilisation (mo/yr)	Water use (ton/yr)
Labour camps (2 camps)	25,000	12	300,000
Batch plants (inc. concrete production)	10,000	12	120,000
Asphalt plants	3,500	6	21,000
Total	**38,500**		**441,000**

6.5.2 Earth Materials

For the construction of the road itself, numerous materials are going to be needed, including concrete, prefabricated segments, steel, aggregates and asphalt as well as soil and topsoil which will be excavated for the motorway and river regulation works before being used as filling material (ESIA, 2U1K, Chp6). Sources of materials to support construction are not yet confirmed.

Table 6-5: Amount of "earth" materials used during the construction of the project

Description	Earth Materials (ton/month)
Aggregate	36,000
Concrete	7,500
Total	**43,500**

7 Identification of Mitigation Measures

This ESA has identified the relevant and priority ES affected by the Project and the main potential impacts on the supply of these ES or the ability of people to use or benefit from them.

The best way to safeguard ES is to maintain the capacity of ecosystems to provide them by avoiding impacts on them. Several efforts have been made to avoid or minimise the destruction and degradation of some Natural Habitats in the Project AOI, notably avoidance of deforestation through sensitive siting of infrastructure to avoid depletion of forest resources. Naturalised borrow pits have also been avoided, with more modified borrow pits being prioritised for disposal of waste soil. The Project has also explored ways to retain floodplain functioning, by limiting use of “hard” flood defences.

Some follow up is advised to remove residual uncertainty, particularly where results of ongoing assessments are needed to confirm residual impacts, notably 2-D modelling of flood risk and finalisation of afforestation plans. In addition to the need to clarify residual forest losses once exact afforestation plans are known, other issues relate to coverage of the RAP and groundwater issues. The following actions are required to give assurance that potential risks will not be realised:

- assessment of whether specific groundwater sources (those identified by JCWI as being in connectivity with the River) might change as a result of the Project and whether this would have implications for any users of those sources in terms of water supply or quality.

- based on results of 2D modelling, confirm that nobody will experience a significant change in flood protection (whether within or outside the AOI).

- based on final design and plans for afforestation, confirmation that compensation will be provided for any vulnerable households relying on local collection of firewood so that they can heat their homes and/ or that proposed afforestation/woodland planting compensation will ensure that no vulnerable households lose local access for firewood collection in the longer term.

- residual implications of changes in the state and configuration of the River and access to it to enjoy the cultural ES of recreational fishing is discussed with stakeholders and that planned mitigation such as motorway crossings allow them to continue to access customary fishing locations or they have other alternative locations in which to enjoy fishing.

- follow-up to ensure that any land access issues are resolved.

- special provision for vulnerable families (for example elderly landowners) to ensure they can continue to produce or purchase the food they need.

For some priority ES, further investigation is recommended, to exclude the possibility of significant loss of benefit for some users/ beneficiaries due to Project-related changes (ie to establish whether levels of supply or level of use could drop below the level needed for benefits to be maintained. In particular, further information is needed to ensure that no vulnerable people lose benefits from priority ES, as some of them may depend disproportionately on ES for their livelihoods or wellbeing. Additional recommended mitigation measures which target the ability of people to use or access priority ES are summarised in Table 7-1 and include:

- JCWI and BEJV to ensure or confirm that the Project has a sustainable supply of water to meet its own needs and that abstraction of water for the Project from the River/ groundwater sources will not affect other users.

- JCWI and BEJV to ensure or confirm that the Project has a sufficient supply of earth materials secured without further implications for ecosystems in the ESA spatial scope than those identified in this report.
- JCWI and BEJV and other specialists as appropriate to review results of 2D modelling when available to assess the implications of river and floodplain modification in the AOI for people downstream (as far as impacts could extend) in terms of flood protection. Ideally the level of flood protection afforded by the naturally functioning floodplain should be quantified. Although hard defences can be constructed to provide flood protection, climate change impacts over the lifetime of the Project could mean that sufficient defences become increasingly expensive and challenging to maintain, making natural flood attenuation more important over time.
- The Project Owner with BEJV/ their social consultants to verify that:
  - Project mitigation plans make provision for adequate winter heating for any household losing access to land currently providing their firewood, particularly if any vulnerable people (elderly households, single women households or other) are affected. Follow-up is advised for the small number of locations where project infrastructure is within ecosystems used to collect fallen wood locally. It is assumed that commercial sale of firewood will not be significantly affected.
  - Livelihood restoration arrangements cover necessary measures to fix irrigation systems for farmers retaining their land holdings but experiencing any disruption.
  - Livelihood restoration arrangements cover necessary measures to ensure beekeepers have alternative suitable locations for their hives.
  - The motorway does not act as a physical barrier preventing anyone from accessing their land for farm management purposes or add significantly to the cost of management.
  - All households have access to sufficient freshwater for drinking and domestic use, in particular those relying on groundwater sources that are affected by hydrological change or river regulation works.
  - The motorway / new river alignment does not act as a physical barrier to fishers wishing to access the River in their local area.
  - Loss of access to hunting and wild food collection does not affect any vulnerable people who depend on locally collected food for a nutritious diet and that beneficiaries accept arrangements for compensation or alternative provision.
- If the RAP monitoring and Completion Report identified that land abandonment was occurring or there were grievances indicating that such impacts were occurring, an assessment should be conducted to ensure that this has not resulted in loss of access to priority ES by vulnerable families (for example elderly landowners) and/ or to identify any mitigation required to ensure that they can continue to obtain the relevant benefits.

Many of these proposed mitigation measures can be incorporated in the Project's proposed management plans. Most are intended to exclude risks, based on additional stakeholder engagement or collection of additional technical information that would allow a less precautionary position to be adopted.

Table 7-1:Summary of mitigation measures

Priority ecosystem Service	Mitigation measures identified in the ESIA	Suggested additional mitigation measures	Institutional responsibility
Freshwater obtained from from groundwater in connectivity with the River	- Regular monitoring of groundwater levels from existing wells located near construction sites - Groundwater use shall not exceed permitted level - Excessive dredging below groundwater level will not be conducted - Accidental spills and contamination of water courses will be avoided through good practice and restriction of refuelling near watercourses	- Undertake a hydrological and groundwater study to assess whether any groundwater sources will change as a result of the Project. - Review results and identify specific users and beneficiaries of sources that will change. - Conduct a water supply assessment prior to water abstraction to ensure that groundwater abstraction will not impact community water availability, or ecological systems. - Share results of hydro technical studies with stakeholders. - Confirm that no households or stakeholders will experience deterioration in water supply or quality as a result of the Project, making alternative water supply provision if needed.	- JCWI together with the Project Owner and Social Team
Flood protection supplied by the naturally functioning floodplain	- Efforts made to avoid and minimise deforestation by placing infrastructure and borrow pits in modified habitats if possible. - New riverbeds will be made curved and not straight with asymmetrical and relatively “natural” cross sections. - Natural materials will be used to protect and strengthen banks. - Only essential works will be performed to stabilise banks prone to erosion. - Drainage channels and ponds will be built to receive excess surface water discharge. - Flood management and flood escape systems and roads will be constructed - Afforestation activities will be performed as part of the river regulation works in line with the ‘no net loss principle’, i.e., preparation	- Confirm that communities inside and out of the AoI will not experience a significant change regarding flood protection as a result of the Project. This is dependent on the 2D model assessment. The results of the 2D modelling study need to be reviewed, when available, to evaluate future loss of flood protection service from loss of naturally functioning floodplain (if any) for local and/or downstream users. - Ensure that no beneficiaries experience significant change in the level of protection provided by the floodplain with the Project and planned mitigation in place. This should include beneficiaries within and outside the AoI. - Ensure that proposed afforestation/ woodland planting is on a sufficient scale to compensate for effects of river straightening and other losses	- Project Owner, Technical specialists, JCWI.

	of Biodiversity Management Plan and SERL Management Plan. This will compensate for loss of flood attenuation provided by natural habitats in the floodplain.	of wooded ecosystem removed by the Project.	
Protein from fish caught from the River and cultural ES of fishing	- Temporary culverts proposed for river and stream crossings to protect sensitive aquatic habitats (see Water Environment Terrestrial section 6 of the ESIA) designed to allow fish crossing. - The natural structure of vegetation for spawning and sheltering areas of aquatic organisms will be preserved for fish - Abandoned meanders will be left open on the downstream side to allow fish migration into the new river channel. - River regulation works will not occur during the breeding season of fish species (30th April to 15th June). - Monitoring will be done during construction by a specialist subcontractor /biologist. - Compensation will be provided to communities that lose or experience damage, disturbance or loss of access for fishing.	- Proposed mitigation should ensure that "supply" of fish is safeguarded by conserving habitat and avoiding sensitive seasons. - Any impacts on income will be addressed through the livelihood component of the RAP but this will not address loss of the cultural ES of enjoying recreational fishing. - Access could be disrupted for some communities. An additional targeted review should be undertaken to ensure that all affected communities retain access for fishing. - Conduct stakeholder engagement with fishers in communities that will experience loss of access for fishing to establish their willingness to accept alternatives or cash compensation.	- BEJV and Corridors of Serbia / their consultants or community liaison officers.
Heating from firewood	- Avoidance of deforestation through sensitive siting of infrastructure to avoid depletion of forest resources to the extent possible - Local authorities and users of forest lands will be informed in good time before construction activities commence. - Woody vegetation cleared for construction activities	- CLOs to check that project footprint and access arrangements will allow local collection of firewood to continue for communities relying on wood for heating. Also, to check that footprint on woodland/ forest will not affect commercial operations depended on by people to buy affordable firewood. - Some households may be vulnerable to health impacts from loss of winter heating supply and alternative sources	- BEJV and Corridors of Serbia / their consultants or community liaison officers.

	will be made available to settlements. - Households who obtain income from timbering activities commercially will receive compensation according to IFI requirements. - Afforestation activities will take place in line with No net loss principle- e.g., Biodiversity Management Plan and SERL Management Plan	of heating should be provided to compensate for this ES-related loss of benefit if CLOs identify any such risks. - Afforestation plans under SERL should include NATIVE and locally appropriate species, to provide longer term substitution of supply. This is consistent with recommendations arising out of the CHA and no additional compensatory planting is required to compensate for impacts on this ES unless in specific cased identified by CLOs.	
Food, good nutrition or income from crop production	• All users of land will be financially compensated at a full replacement value where crops are lost or affected by damage during construction activities according to Serbian legislation and IFC requirements. • Users of the land will be informed of construction activities planned. • Users of land will be informed a timely fashion when construction is planned to begin and what provision will be made for lost crops and damages will be compensated. • Impacts on crop lands will be minimised as far as possible by narrowing project construction footprint and restoring any damaged areas including re-planting any damaged vegetation.	Arrangements through the RAP will address loss of livelihood through cash compensation. The area of land available for farming will decrease overall. The ability of people to access their land for efficient production and farming activities may also alter and this has been identified by some stakeholders (e.g. landowner in Popovici with land potentially stranded between the old and new river courses). Implications for access therefore need to be assessed when details are available. Cash compensation (instead of "land for land" compensation could have several impacts on future farming, which may intensify (more cash investment in modern methods and equipment) or alternatively further land abandonment could occur. RAP monitoring should consider these impacts in terms of implications for any vulnerable families in the event that (a) the RAP monitoring and completion report identified that land abandonment was occurring or (b) there were grievances that indicated such impacts were occurring. The need for special provision for vulnerable families (for example elderly landowners) to ensure they	BEJV and Corridors of Serbia / their social consultants (as part of RAP monitoring)

		can continue to produce or purchase the food they need should also be checked as part of the livelihood restoration and RAP monitoring process.	

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