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Western Balkans Investment Framework Infrastructure Project Facility Technical Assistance 8 (IPF 8)

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WB19-SRB-TRA-03

Orient/East-Med Corridor: Serbia–North Macedonia Corridor X Rail Interconnection, Niš–Preševo–Border Between the Two States Section

SCOPING REPORT
(Final version)

May 2023

*) This designation is without prejudice to positions on status, and is in line with UNSCR 1244/1999 and the ICJ Opinion on the Kosovo declaration of independence

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Western Balkans Investment Framework (WBIF)

Infrastructure Project Facility Technical Assistance 8 (IPF 8)

Infrastructures: Energy, Environment, Social, Transport and Digital Economy

TA2018148 R0 IPA

WB19-SRB-TRA-03

Orient/East-Med Corridor: Serbia – North Macedonia CX Rail Interconnection, Niš – Preševo – Border Between the Two States Section

SCOPING REPORT

May 2023 (final version)

The Infrastructure Project Facility (IPF) is a technical assistance instrument of the Western Balkans Investment Framework (WBIF) which is a joint initiative of the European Union, International Financial institutions, bilateral donors and the governments of the Western Balkans which supports socio-economic development and EU accession across the Western Balkans through the provision of finance and technical assistance for strategic infrastructure investments. This technical assistance operation is financed with EU funds.

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List of abbreviations

AoI	Area of Influence
BoE	Beneficiary of Expropriation
CITES	Convention on International Trade in Endangered Species
CDF	Central Feedback Desk
CHIA	Cultural Heritage Impact Assessment
CHMP	Cultural Heritage Management Plan
CLO	Chief Liasion Officer
EBRD	European Bank for Reconstruction and Development
EC	European Commission
EIA	Environmental Impact Assessment
EIB	European Investment Bank
ERTMS	European Rail Traffic Management System
E&S	Environmental and Social
ESA	Environmental and Social Advisor
ESIA	Environmental and Social Impact Assessment
ESS	EIB Environmental and Social Standards (2 February 2022)
ESMP	Environmental and Social Management Plan
ESMMP	Environmental and Social Management and Monitoring Plan
ETCS – L2	European Train Control System – Level 2
EU	European Union
EUD	European Union Delegation
EUNIS	European nature information system
GHG	Greenhouse gas
HR	Human Resources
IFI	International Financing Institution
ILO	International Labour Organization
IPPC	International Plant Protection Convention
IUCN	International Union for Conservation of Nature
JASPERS	Joint Assistance to Support Projects in European Regions
LRP	Livelihood Restoration Plan
LGAD	Local Grievance Admission Desk
MCA	Multi Criterial Analysis
MCDA	Multi criteria decision analysis
MEI	Ministry of European Integration
MoCTI	Ministry of Construction, Transport, and Infrastructure
MoM	Minutes of Meeting

NGO	Non-Governmental Organizations
NPAA	National Programme for the Adoption of the Acquis
OESMS	Operational Environmental and Social Management System
OHS	Occupational Health and Safety
PD	Preliminary Design
PFS	Pre-feasibility study
PPPPN	Spatial Plan of the Area of Special Purpose
RAP	Resettlement Action Plan
RoW	Right of Way
RPF	Resettlement Policy Framework
SEA/SH	Sexual Exploitation and Abuse/Sexual Harassment
SEECP	South-East European Cooperation Process
SEETO	South-East Europe Transport Observatory
SEP	Stakeholder Engagement Plan
SRI	Serbian Railways Infrastructure
TEN-T	Trans-European Transport Network
TMP	Traffic Management Plan
ToR	Terms of Reference
TSI	Technical Specifications for Interoperability
UNESCO	United Nations Educational, Scientific and Cultural Organization

Synopsis

Project Title	Orient/East-Med Corridor: Serbia - North Macedonia CX Rail Interconnection, Niš - Preševo - Border Between the Two States Section
Project number	WB19-SRB-TRA-03
Contracting authority	European Investment Bank (EIB)
TA Consultant	IPF8 - COWI |IPF
Main Beneficiary	Ministry of Construction, Transport and Infrastructure of Serbia
Project area	Niš – Preševo – Border of Serbia with North Macedonia
Lead International Financing Institution	European Investment Bank (EIB)
Project Starting Date	22 June 2020
Project Duration	24 months, as indicated in the ToR , 60 months for both IPF8 and IPF11,

1 Executive summary

1.1 Introduction

The project focuses on the preparation of the Preliminary Design and Feasibility Study for the Reconstruction and modernization of the railway line Niš - Preševo. The modernized railway line should meet the requirements defined by the international agreements. The reconstructed and modernized railway for mixed passengers and freight traffic should be equipped with modern ERTMS devices and other characteristics in accordance with the requirements of interoperability.

The reconstruction and modernization of the line are defined as a priority for the future development of the Serbian railway network, due to the high importance of the railway line, as well as its low technical characteristics which affect regular passenger and freight transport.

Under the scope of this study, and in compliance with the environmental and social requirements of the IFIs, a brief scoping report, ESIA, Resettlement Action Plan (RAP) and Stakeholder Engagement Plan (SEP) will be prepared. These reports will be prepared guided by and in compliance with the EIB Environmental and Social Standards (ESS).

The analytical description of the baseline and of the impacts and mitigation measures are described in the Scoping Report. These will be further detailed at the ESIA main stage. The Stakeholder Engagement process is planned as an iterative process, comprehensive and commensurate to the risks, impacts and level of interest of the stakeholders identified in the coming phases of the project.

1.2 Legal framework

Operations and activities for which potential financing from the European Investment Bank (EIB) is sought fall under the application of their respective applicable Environmental and Social Standards.

The EIB Environmental and Social Standards from February 2022 provide an operational translation of the policies and principles contained in the 2022 EIB Statement of Environmental and Social Principles and Standards. They are grouped across 11 thematic areas covering the full scope of environmental, climate and social impacts and issues.

The project will comply with Serbian national requirements including applicable EU Laws and Directives.

1.2.1 Serbian Context

The Serbian legislative framework will be applied for the environmental and social aspects of the project such as Environmental Protection, Water, Waste, Nature Protection, Noise Protection, Air Quality and Cultural Heritage, Safety and Health, Labor Relations, Employment, Social Protection, Property and Expropriation as supplemented to meet the requirements of EIB.

The Environmental Impact Assessment procedure in the Republic of Serbia as governed by the Law on Environmental Impact Assessment is harmonized with the European EIA Directive (85/337/EEC, 97/11/EC, 2003/35/EC and COM 2009/378 as codified by the Directive 2011/92/EU and as amended by the Directive 2014/52/EU).

The EIA Law defines the procedures of impact assessment for the activities that may have significant effects on the environment, the contents of the Environmental Impact Assessment (EIA) Study, the required engagement of authorities and organizations concerned, citizen engagement, trans boundary exchange of information for projects that may have trans boundary impacts, supervision, and other issues of relevance to impact assessment.

Impact assessment is carried out for the future projects and those under implementation, changes in technology, reconstruction, capacity enhancement, closure, and decommissioning activities and for removal of projects that may have significant impact on the environment.

The EIA is applicable to the industry, mining, energy production, transport, tourism, agriculture, forestry, water management, waste management and utility services sectors, as well as for all the projects that are planned in areas of protected natural resources of special value and within the protected zones of immobile cultural resources.

The Decree on Determining the List of Projects for which an Impact Assessment is mandatory and the list of projects for which an Environmental Impact Assessment may be Required ("Official Gazette of the RS", No. 114/08) determines the List I Projects (for which an Environmental Impact Assessment is mandatory) and List II Projects (for which an environmental impact assessment may be required). According to its characteristics, the project in question is classified in List I, under item 7. Construction of: 1) Main railway lines including ancillary facilities (bridges and stations).

1.2.2 International legislative framework

The most relevant Directive is the Directive 2011/92/EC amended by Directive 2014/52/EU. According to the Directive, the proposed project falls into Annex I, Category 7 (a) "Construction of lines for long-distance railway traffic and of airports with a basic runway length of 2100 m or more".

The project is aligned with the requirements deriving from EU Directives (Water Framework Directive, Floods Directive, Groundwater Directive etc.) international agreements and conventions related to environmental and social issues such as the Bern, CITES, ESPOO, ILO, UNESCO conventions etc.

Serbia adopted a third revised version of the National Programme for the Adoption of the Acquis of the European Union (NPAA). NPAA is the most significant and most comprehensive document in the process of European integration of Serbia, since in addition to harmonising the complete domestic legislation with the EU acquis, it also requires the strengthening of administrative capacities during accession negotiations with the EU, as well as long-term financial planning and responsible budget planning.

The Project proposal falls under category "High" of the EIB (those for which an EIA is mandatory (Annex 1 of the Directive).

1.3 Project description

The single-track railway line Niš-Preševo-state border railway line is approximately 157 km long.

This section forms part of Pan-European Corridor X that passes through Austria, Slovenia, Croatia, Serbia, North Macedonia, and Greece.

Generally, the line passes along flat topography, apart from a central section of 32 km between Grdelica and Suva Morava. Here the topography is mountainous, and the line shares a corridor within a river canyon with other major road infrastructure, including the Corridor 10 motorway.

The railway section included in the scope of this sub-project can be divided into three subsections considering distinct terrain conditions, as follows:

Subsection A: Brestovac – Grdelica

The length of Subsection A is about 34 km.

The minimum radius of the horizontal curves is 400 m, before the Grdelica station, where the maximum speed (Vmax) is reduced to 90 km/h. On the rest of the section parameters of horizontal geometry allow speed of 120km/h.

Subsection B: Grdelica – Vladicin Han

The length of Subsection B is about 32 km. The minimum radius of the horizontal curves is 300 m, where the possible speed is Vmax = 80km/h.

Subsection C: Vladicin Han - State border with North Macedonia (Tabanovce)

The length of Subsection C is about 67 km. The minimum radius of the horizontal curves is 300 m, where the possible speed is Vmax = 80 km/h. However, the majority of curves have radii of over 700 m (60% of the total number of horizontal curves), which corresponds to Vmax of 120 km/h.

Throughout the section, the permissible axle load is 225 KN, and permissible load per linear metre 80 KN/m. The key structures along the line are three tunnels (less than 500 m long) and 14 bridges with spans larger than 30 m.

The stations are not well equipped for passenger operations and do not offer sufficient comfort and safety to the passengers.

Originally constructed to a design speed of 120km/h the line has deteriorated to such an extent that operating speeds have been severely reduced in certain sections.

The following sections of the line were rehabilitated during 2017, with the funding of a Russian loan:

- Vinarce–Djordjevo, in Subsection 1 (13.8 km)
- Vranjska Banja–Ristovac, in Subsection 3 (17.7 km), and
- Bujanovac–Bukarevac (12.9 km), also in Subsection 3.

These works included some minimum technical improvements to restore the design speeds, but the operating speeds in these subsections still do not exceed 90-100 km/h. No civil structures (bridges, culverts, or tunnels) were included in those works.

The overview of the existing railway stations and structures is provided in the tables below.

Table 1 Overview of existing buildings and station facilities

No.	Station/Intersection	Location	Station Building and Facilities	Tracks
01	Brestovac Station	km 267+939,19	Station Building, Warehouses, Field Toilets and S&T Facility	3
02	Pecenjevce Station	km 275+564	Station Building, Warehouse, Field Toilets and S&T Facility	3
03	Vinarce Intersection	km 281+974,80	Station Building	2
04	Leskovac Station	km 287+573,90	Station Building and S&T Facility	5
05	Djordjevo Intersection	km 295+779	Station Building and S&T Facility	3
06	Grdelica Station	km 301+863,70	Station Building, Residential Building, Field Toilet, Warehouse and S&T Facility	4
07	Predejane Station	km 312+725	Station Building, Field Toilets, Warehouse and S&T Facility	4
08	Dzep Station	km 319+671	Station Building ETS Facility, Field Toilet, Residential Building and S&T Facility	4
09	Momin Kamen Intersection	km 322+838,23	Station Building, Residential Building with small Warehouse and S&T Facility	3
10	Vladicin Han Station	km 329+591	Station Building, Warehouse and S&T Facility	5
11	Suva Morava Station	km 334+066,50	Station Building, Field Toilet and S&T Facility	4
12	Priboj Vranjski Station	km 341+437	Station Building and S&T Facility	4
13	Vranjska Banja Station	km 348+015,50	Station Building, S&T Facility, ETS Facility, Warehouse, Residential Buildings and Field Toilet not in use	3
14	Vranje Station	km 354+205,70	Station Building, Field Toilet, Small building, S&T Facility, Coffee Peron and Warehouses	5

No.	Station/Intersection	Location	Station Building and Facilities	Tracks
15	Ristovac Station	km 365+725,30	Station Building, Office Building and S&T Facility	6
16	Bujanovac Station	km 373+692,50	Station Building, Field Toilet, Container, Warehouse and S&T Facility	5
17	Bukarevac Intersection	km 386+549,60	Station Building, S&T Facility, Field Toilet and ETS Facility	3
18	Presevo Station	km 392+309	Station Building, S&T Facility, Field Toilets, Police Station, Customs Facility and Warehouse	7

Table 2 Overview of existing bridges

No.	Station/Intersection	Location	length
01	Steel bridge across River Jablanica	km 274 + 097	31,52 m
02	Steel bridge across River Veternica	km 285 + 068	31,52 m
03	Steel bridge across River Južna Morava	km 300 + 327	55,60 m
04	Steel bridge across River Južna Morava	km 302 + 598	55,60 m
05	Steel bridge across River Južna Morava	km 305 + 072	2x44,10 m
06	Steel bridge across River Južna Morava	km 309 + 335	41,80 + 21,28 m
07	Steel bridge across River Južna Morava	km 311+821	2x44 m
08	Steel bridge across River Južna Morava	km 326 + 230	2x34,10 m
09	Steel bridge across River Južna Morava	km 343 + 334	41,80 m
10	Steel bridge across River Južna Morava	km 353 + 109	64,30 m
11	Steel bridge across River Južna Morava	km 364+516	55,90 m

Table 3 Overview of existing tunnels

No.	Station/Intersection	Location	length
01	Tunnel no. 1 "Grdelica"	km 307 + 508 to km 307 + 678	170 m
02	Tunnel no. 2 "Letovica"	km. 324 + 291 to km. 324 + 775	483 m
03	Tunnel no. 3 "Hanski"	km. 328 + 292 to km. 328 + 694	402 m

1.4 Key elements of the environmental and social baseline

This section describes the main components of the physical and natural baseline environment in the area affected by the implementation of the proposed Project. The characterization of the existing environment and identification of sensitivities along the proposed railway alignment have involved a comprehensive desk review of a wide range of existing data sources and desk studies.

1.4.1 Environmental baseline

The climate in the project area is continental to moderate-continental, and the amount of precipitation is usually up to 500-600 mm/year, while the air humidity is moderate. It is characterized by relatively colder winters, warmer autumns than spring and moderately warm summers. More specifically, low annual precipitation

dominates, while the summer precipitation is characterized by strong evaporation due to high temperatures, with frequent occurrence of summer storms and showers. Winds are a very important factor causing differences in temperature, bringing precipitation or drought. Although the wind frequency is high especially in this area, its speed is low.

Landscape characteristics of topographical units that include the analysed corridor are an important element for understanding the overall relationship between the planned object and the environment. The analysis of the terrain established that the sections are provided through areas with different landscape and visual characteristics, which make up:

- The valley of the Južna Morava and the hills on the left bank of the Južna Morava; Grdelica gorge; the Južna Morava valley;
- Contact of hills and plain terrain which is mainly anthropogenically altered arable land;
- Constructed parts of the route where it passes through populated areas (Brestovac, Lipovica, Pečenjevce, Leskovac, Vladičin Han, Vranjska Banja, Vranje, Bujanovac, Preševo) including the E-75 (A1) highway corridor; and other infrastructure facilities.

Throughout the research area, formations of different geological ages are represented. These are the old Proterozoic sediments, the mesozoic sediments, the neogene sediments (these are dacites, andesites and quartzlates, while Miocene deposits are characteristic of this area) and the Quaternary sediments.

In order to determine the seismicity of the terrain, maps of the Republic Seismological Institute of Serbia. The observed area is in the zone of seventh-eighth degree and eighth degrees of seismic scale MSC. The route of the existing line is in the zone of seven-eight degrees of seismic scale.

In the area through which the railway passes, classes of fluvial and fluviogleic soils are characteristic, with azonal soil types standing out, differently developed and differently fertile. The main soil types are: alluvium, alluvium in cultivation, alluvial meadow land. Due to the great erosion in its basin, Juzna Morava is rich in large amount of material that settles in the riverbed.

Based on the map of waste disposal sites of the public utility company and illegal or old dumps, there are a certain number of illegal dumps along the railway line, according to the Environmental Protection Agency.

Potentially contaminated locations along the railway line are not currently known. These data will be further investigated in the subsequent stage of the Environmental Impact Assessment Study.

The network of stations for automatic air quality monitoring is, in accordance with the Law on Air Protection, recognized as a state network for air quality monitoring at the level of the Republic of Serbia. Taking into account the route of the railway, the relevant stations for automatic air quality monitoring are located in Niš and Vranje.

The nearest areas in which noise is measured are Niš, Leskovac and Vranje under the responsibility of the local Public Health Institutes. Taking into account their

scarcity, as well as the distance of the railway line from the measuring stations, the data obtained from them cannot be considered as relevant for the preparation of the noise baseline.

The hydrographic network includes river Juzna Morava and its tributaries.

Based on the Decree on the categorization of watercourses (Official Gazette of the SRS, No. 5/68), the river Juzna Morava belongs to IIa and IIb subclasses of watercourses. Class II includes waters suitable for bathing, recreation and water sports, for the breeding of less noble species of fish (cyprinids), as well as waters which, in addition to normal treatment methods (coagulation, filtration and disinfection), can be used to supply water to beverages and in the food industry.

The most important groundwater aquifer is within the South Morava valley, where there are sands and gravels, river terrace gravels and proluvial deposits. Sensitive areas in respect to risk of groundwater pollution are Vranje, Leskovac and Bujanovac, whose protection zones are near or intersected by the railway, and several other lower public sources in the wider vicinity. Data about water sources near the route are from the Spatial plan of the special purpose area of the infrastructure corridor Nis-border of Bulgaria.

In respect to biodiversity, the Grdelica gorge is the area of the highest sensitivity along the corridor. Although it is not formally protected, the Grdelica area is a refugium for tertiary flora, rare and endangered herbal species and mixed relic vegetation (some in The Red Data Book of Flora of Serbia). Some endangered and protected birds of prey, such as the golden eagle (*Aquila chrysaetos*) and the peregrine falcon (*Falco peregrinus*) are also present in the Grdelica gorge. These two species were identified by the Institute for Nature Protection as highly sensitive, and it will be necessary to protect them from excessive anthropogenic impacts during construction and operation of the whole traffic corridor. Aside from the important species which reside there, the Grdelica gorge also represents a migratory route for some fauna species, from the south to the north. There are no protected areas on the railway route.

Within the affected zone of the railway corridor, ecological corridor of Južna Morava River is identified. This corridor have international importance and present ecological pathway and connections that enable the movement of individuals of populations and the genes flow between protected areas and ecologically important areas, according to the Decree on ecological network According to Law on nature protection, Article 130, The ecological network will be established and become part of the European ecological network Natura 2000 by the day of the accession of the Republic of Serbia to the European Union. Ramsar sites and Emerald Areas are not identified within the area of influence.

1.4.2 Social baseline

Elements of the baseline have been chosen to depict the Project area's sensitivity in terms of potential adverse social impacts and the possibility that the intervention would create, reinforce or deepen inequity and/or social conflict, or that the attitudes and actions of key stakeholders may subvert the achievement of the development objective. The Social baseline has been created observing both greenfield and brownfield portions of the Project.

Serbia constitutes of 29 administrative districts which are not units of local self-governments but are established for purpose of state administration outside the headquarters of the state administration. Administrative districts are established by the RS Government decree, which also included the areas and seats of administrative districts. The railway route passes through Jablanicki and Pcinjski Districts.

Population censuses are the main source of statistical data on the total number, territorial distribution and major characteristics of individuals and households in the Republic of Serbia. The number of population is estimated in the inter-censual period for every year, including the census year. Thus, in 2019 the population of the Republic of Serbia is estimated to 6 945 235. In almost all municipalities through which the railway corridor passes, the decline in population will continue in the future.

Less than a half of the population of the Republic of Serbia is economically active (41.3%), whereby the share of male labour force (57.2%) prevails over the female (42.8%). The number of unemployed per thousand inhabitants was higher than the national average in all municipalities through which the railway corridor passes. All municipalities on the route had an average salary below the national average.

Education is a decisive factor for a person's economic status and ability to generate income, and it is therefore not surprising that lower-educated people are above average at risk of poverty. The highest at-risk-of-poverty rate in 2016 - 2018 period was in the population with primary education and lower than primary school (39.1%), and the lowest in the at-risk-of-poverty population with high school or university education (10.3%). The Poverty Risk Rate is higher than the national average.

Among immovable cultural properties there are 6 monuments of culture in the vicinity (400-700m) of the existing railway line. Impacts to cultural heritage and archaeological sites will be scoped in and will be analysed in details at the Level of ESIA.

Assessment of impacts to CH is constrained to the registered and known sites of tangible cultural heritage sites, while chance finds as per nature are not covered, and will be part of the mitigation strategy through the ESIA and ESMP. Emphasis in the next phase shall be given to impacts from access roads, borrow and deposit areas. In cases of suspected elevated risks, the ESIA shall prepare the Cultural Heritage Impact Assessment and a commensurate Cultural Heritage Management Plan to be developed as a self-standing document.

The Constitution of the Serbia proclaims principles of gender equality. Despite principles however, many women in Serbia face challenges combining paid work and childcare responsibilities. This could be an additional cause for Serbia’s low fertility rate, which is one of the lowest in European countries, and average in the region at 1.46 percent in 2014. The employment rate of women in Serbia (38.3%) is significantly lower than the EU-27 average (58.5%). Of all the employed in the transport sector in Serbia, 20 percent are female and 80 percent are male. Measured by the European Institute for Gender Equality (EIGE) Gender Equality

Index, according to 2016 data, the value of Index for Serbia was 56, which was significantly behind the EU-28 average of 66.

The most prominent inequalities are in the domains of money, time and power, indicating lower economic standard of women, carrying out disproportionately unpaid household work and care for family, and insufficient participation in decision making in positions of political, economic and social power. The labour market participation is much lower for women than for men, as indicated by activity, employment, unemployment and inactivity rates. Vulnerability of women in particular when it comes to the share of ownership has been scoped in.

Vulnerable and disadvantaged groups, will be identified and their drivers of vulnerability scoped in, based on initial screening vulnerable groups, that could be affected by the Project include: retired, elderly and people with disabilities and chronical disease; single parent headed households, male and female; people with low literacy and ICT knowledge; economically marginalized and disadvantaged groups; persons living below the poverty line; women. Since the project location is not yet finally set the granular profile within detected vulnerable groups is not known at this moment.

Roma are one of the most vulnerable groups in Western Balkans, including the Republic of Serbia and are usually exposed to several risks and adverse impacts at once. The 2011 Census, has identified less than 150,000 Roma living in Serbia. Estimates of the actual number of Roma range between 300,000 and 600,000. Among the Roma, the so-called Ethnic mimicry, which makes it impossible to obtain relatively reliable data on the actual number of members of this ethnic group. The assumption is that Roma women use rail transport as the cheapest form of transport to neighbouring settlements in search of most often daily employment such as housework, cleaning services in companies, work in agriculture, etc.

Finally, regarding labour and informal employment, the incidence of informal employment is the highest among the youngest age group (15-19 years), of whom 76% are employed informally. Incidence of informal employment tends to decrease with age. This can be accounted to the low level of professional experience of the youngest age group. Informal employment rates tend to rise again for older workers, with 50% of employees over 55 being informally employed. Broken down by age group, young men and older women are over-represented in informal employment. The Labour Inspectorate reports that 52.375 informal employment cases have been confirmed during the inspections conducted between 2017 and 2019 following which a total of 45.207 was transformed to formal employment.

Recent labour market improvements have also benefited women, older workers, and the youth. Job creation was the strongest in services and industry. Earnings increased alongside the number of jobs, as real wages in the private sector grew by more than 6 percent in 2014–17 and by more than 4 percent in 2018. Despite recent labour market improvements, many people in Serbia are not working or searching for a job. The highest share of informally employed workers of the total number of workers is in the wider project area in South and East Serbia (27.7%). Of those informally employed the vast majority can be found in the agricultural

sector (59.5% of all informally employed), followed by construction (7.1%). In other sectors, the share of informal work is less than 20%.

1.5 Environmental and social evaluation of options

This chapter presents the variants identified and analysed during 1st LoA stage. Based on the characteristics of the project under analysis (multi-stakeholder, concept design phase, both quantitative and qualitative criteria) it was proposed to use a MCA (Multi criteria analysis) with weighting and allowing both quantitative and qualitative criteria. MCA is an approach and a set of techniques, aiming at providing an overall ordering of options, from the most preferred to the least preferred one.

In summary, the steps of the MCA approach are six:

1. Establish the decision context and the aims.
2. Identify the options to be considered and compared.
3. Identify the investment objectives and constraints.
4. Identify the criteria that reflect the value associated with the outcome of each option and "weigh" their relative importance in the scope of the project.
5. Assess the impacts:
    - describe the expected performance of each option against the criteria and "score" the ability of each option for delivered impacts;
    - combine the weights and scores to derive an overall value for each option (total weighted scores) and rank them accordingly.
6. Conduct sensitivity analysis to assess the robustness of MCA results to changes in weights and scores.

The main objective of the project is to modernize the existing railway line in compliance with TEN-T standards, making it a reliable and competitive mode of transport and increasing passenger and freight traffic demand. Furthermore, the objective shall be achieved in a cost effective and sustainable way in compliance with strategic plans at national, regional and local level. It should comply with internationally agreed Technical Specifications for Interoperability and with the technical requirements for the core TEN-T.

In line with the above-stated objectives, the following main criteria are proposed:

1. Strategic relevance
2. Environmental aspects
3. Social aspects
4. Safety
5. Accessibility/Competitiveness
6. Technical aspects
7. Climate Change
8. Financial aspects

These groups of criteria correspond to the project objectives and reflect the nature of the project. The specific sub-criteria under each group were selected in anticipation of the results of the design elaboration of options after having been discussed with the stakeholders. The performance of the options against the criteria has been measured using proper indicators. These indicators can be qualitative or quantitative (monetized or other types of quantities).

1.5.1 Description of the options

The following options, were considered and evaluated with respect to the design speed per sub-section and single/double rail tracks, as it was decided among the stakeholders and documented in the Inception Report:

- **Option 1:** 120km/h-80km/h-120km/h single track
- **Option 2:** 120 km/h -120 km/h -120 km/h single track
- **Option 3:** 160 km/h -120 km/h -160 km/h single track
- **Option 4:** 160 km/h -160 km/h -160 km/h single track
- **Option 5:** 160 km/h -160 km/h -160 km/h double track

Vulnerability to climate change

The line passes through some identified sensitive to erosion and/or flood areas. The criterion for comparing the options was the length of the route through areas subject to flooding/soil erosion.

Environmental conditions in the alternative alignment areas

The rail line follows the South Morava River flowing generally from the South to North direction and crosses the river in several locations. River regulations will be necessary locally in the positions of bridges but also a long river regulation of more than 2 km is necessary in Options 1 and 2. Also, along the line there are several water sources and the line passes through the protection zone of the city water source for about 16 – 17 km, depending on the Option.

With respect to the effects of the Options on environment, it should be noted that none of the Options affects protected areas.

The Options present small differences with respect to the length of crossing green fields, from 21.33km in Option 5 to 28.06 km in Option 2. The potential effect on forest and/or wild vegetation areas also varies from Option 5 presenting less effect, mainly due to tunnels, to Option 2 which presents the max effect due to realignments in open tracks. This effect represents an estimate of the area of the belt of natural greenery (forests, hedges) that the railway line will cut i.e. it corresponds to potential severance.

Landscape and optical intrusion (due to high cuts or embankments) presents greater variations between Options, with Options 4 and 5 being more intrusive and Options 1 and 2 less intrusive.

Social aspects

Realignments will have different effect on the villages along the line. This effect could be beneficial in cases where the rail line is separating or very close to a village, while the realignment bypasses the urban area. The number of villages separated by rail or very close to the rail line, declines from 19 in Option 1 to 16 in Option 2 and to 15 in Options 3, 4 and 5.

Expropriation

In order to estimate the effect of the options, a corridor of 30 m width for the single track options and of 35m width for the two-track option has been reserved

in accordance with the Spatial Plan of the infrastructure corridor Nis - Presevo. The areas of agricultural land to be expropriated under options are the smallest in Option 1, and the largest in Option 5.

The impact of alternative options on displacement was estimated based on the categorization of buildings into residential and industrial. For the estimation of the buildings to be demolished a few assumptions were done: for Options 1 to 4, where there is little or no deviation from the existing alignment, a belt for demolition of buildings of 15 m was adopted. For Option 5, this was raised to 19 m. For all options, on sections where the route deviates from the existing alignment, the belt in which the structures are demolished varies according to the height of the embankment or depth of the cut, as follows:

- cut/embankment up to 3m - belt width 17m (for option 5 belt width 21m)
- cut/embankment up to 6m - belt width 26m (for option 5 belt width 30m).

There will be no demolition on the sections where tunnels are planned.

Cultural heritage

Thirteen sites of cultural heritage have been identified along the corridor. One site is on Subsection A, near Grdelica, where Options 4 and 5 may pass under the site, in a tunnel. Two of the sites are further away from Options 3, 4 and 5 than they are from Options 1 and 2. Nine sites are along Subsection C, with little difference in the alignments on this subsection. Therefore, little difference between the options can be identified. Besides these objects, one graveyard has to be relocated in Subsection B of Option 5.

1.5.2 Scoring and selected option

Scoring of performances is expressed by a number in a 1 to 5 scale for all criteria.

Each option is evaluated for each criterion, according to the above mentioned indicators, and got a performance score in a 1 to 5 scale (higher score for the best option).

The evaluation of the Options was performed by a team of Senior Experts covering technical, environmental, social, traffic and transport planning expertise. In total Option 4 got the higher score. According to the evaluation performed, Option 1 presents higher performances in the financial criteria i.e. due to low construction and maintenance cost only. Option 2 is the least advantageous Option, presenting no top scoring in not one of the criteria. Option 3 presents higher scores in the social criteria, while Option 4 in safety, accessibility/competitiveness and climate change. Option 5 presents higher performances in environment, safety, technical aspects, strategic relevance and climate change, but lower scores in the financial criteria.

In overall, Option 4 got the higher weighted score, Option 3 getting the second highest score. Option 1 follows in scoring.

MCA Sensitivity Analysis

The Sensitivity Analysis provides the result of the MCA assuming different weights were attributed to the criteria. This helps to measure how robust the MCA result is and will show if another option could be considered as optimal. In most cases Option 4 remains the optimum one. In the only case that Option 4 is not the best one, it is ranked second to Option 1. It should be noted, also, that according to the sensitivity results, the second best option varies between Option 3 and Option 5.

It was concluded after the First Level Options Analysis Report (May 2022), that the preferred option for consideration was a combination of Options 1 and 4 in that report, i.e. 160 km/h for Subsections A and C, and 80 km/h for Subsection B. Subsection B passes through the Grdelica gorge and would be very expensive to reconstruct for 160 km/h.

1.6 Key E&S impacts

1.6.1 Environmental impacts

Regarding environmental parameters, no red flags have been identified concerning the reconstruction and modernization of the railway line.

1.6.1.1 Landscape

The landscape parameter will be scoped in.

For most of the length, the railway corridor follows the alignment of the existing railway. This reduces the magnitude of change and impact on surrounding receptors. In these locations, the Project is not expected to be at odds with the existing landscape character.

The construction phase will result in the demolition of a number of residential properties and other above ground structures, and the earthworks will result in a significant perceptual change to the landform within the affected area.

A more in depth assessment of the existing situation (baseline), analysing the existing landscape and visual amenity context of the receiving environment and human receptors will be carried out at the ESIA stage.

1.6.1.2 Air

This parameter will be scoped in.

A number of on-site construction activities will contribute to the increase of dust and PM10 such as site clearance and preparation.

In addition to impacts on local air quality due to on-site construction activities, exhaust emissions from construction vehicles and plant may have an impact on local air quality adjacent to site access routes.

Across demolition, earthworks, and construction receptors sensitive to dust soiling and negative ecological effects additional risk. The Contractor will be required to

apply the proposed guidance and control measures during construction, to avoid the risk of a significant air quality effect. With the application of the mitigation measures described in the ESMP of the ESIA, the generation of dust and PM10 during construction will not result in any significant air quality effect. Residual effects are considered to be negligible (not significant).

The primary effect of the Project during operation is expected to be modal shift of vehicles from road-based journeys to rail-based journeys, leading to a reduction in car, bus and Heavy-Duty Vehicles (HDVs) journeys and therefore emissions, particularly concerning PM10 and NO2 along local road links.

Specific numbers of vehicles and plant associated with the construction phase have not yet been determined. Therefore, a qualitative assessment of the impact of construction vehicles and plant on local air quality will be undertaken at the ESIA stage.

1.6.1.3 Climate change

The climate change parameter is scoped in. The most dominant climate change impact in the wider area is floods, especially in the vicinity of the river Morava. Other climate change incidents will be temperature increase, precipitation decrease (in terms of frequency), precipitation increase (in terms of intensity) and fires.

The key steps of the ESIA for GHG emissions will be to quantify expected changes to GHGs in future years and to explore opportunities for mitigation in the Project design. The ESIA will assess material climate change resilience/adaptation issues and confirmation of climate adaptation measures considered, including the design of railway maintenance, e.g. structures, geotechnics, drainage, and provisions for dealing with extreme weather events (cold, heat, flooding).

1.6.1.4 Noise and vibration

The noise and vibration parameter is scoped in. Several settlements are and will be bisected, where with the appropriate mitigation measures (noise barriers, window facades), any impacts will be dealt with as in all such linear projects.

Construction activities inevitably lead to some degree of noise disturbance at locations near the construction activities. It is however a temporary source of noise.

Noise predictions will be undertaken for a study area of 300m either side of the railway to represent a typical daytime operation. Main core phases can be site preparation, earthworks, bridge construction and rail track construction. It is expected that once good practice measures are implemented the majority of activities will not give raise to significant effects.

Regarding vibration during construction, a desktop assessment will be undertaken in order to determine impacts along the route due to vibration levels arising during the construction phase. This involves assessing annoyance from human receptors and also damage to building structures.

Baseline noise and vibration levels are going to be measured and integrated into the models and impact assessment.

For the estimation of the noise impacts during operation, noise modelling will be carried out, while sensitive receptors will be identified. For the noise modelling, the CadnaA (Computer Aided Noise Abatement) software will be used. The most important source of operational vibration are wheel and rail vibrations induced during contact when trains are passing. Finally, re-radiated noise refers to noise that is experienced within a building due to radiation from vibration building elements (e.g. floors, walls and ceilings). Levels will be calculated for passenger and freight services. The ESIA will assess the potential noise and vibration impacts from both the construction and operational phases of the Project.

1.6.1.5 Waste

These parameters will be scoped in. The ESIA will assess the potential impacts from waste and wastewater generation during construction. The assessment of impacts will be based mainly on the consumption of material resources (from primary, recycled or secondary, and renewable sources, and including products offering sustainability benefits) including the generation and use of arising's recovered during construction phase of the Project and the generation of waste from the construction phase of the Project.

The waste generated during the construction phase will primarily include waste ballast, sleepers, rails, and track fittings. The contractor, with the SRI consent, will prepare a Waste Management Plan to handle this waste. The waste that will be generated during the operation of the planned railway will primarily originate from passengers who will use the stations on the railway: municipal waste, paper and packaging waste.

Waste from the maintenance of the rolling stock, from the maintenance of the railway and the accompanying infrastructure can be expected along the route of the railway. The quantities of this waste will depend on the maintenance activities.

The intensity of these impacts will also be scoped in.

1.6.1.6 Geology and Soils

These parameters will be scoped in. At this project stage, there are no data that can assist in the accurate assessment of impacts, while a preliminary justification of impacts is presented below.

Potential impacts on topsoil maybe provoked from the Leaks/Spills from HGVs, Machinery and Hazardous material storage. Accelerated degradation may lead to a reduction in the quality of topsoil. The construction activities will be limited in time and physical extent and therefore the soil function in the area of project will not be altered. The tracks on these sections would need to be dismantled, and the land may need to be decontaminated.

The groundcover surrounding the project alignment is generally comprised of covered agricultural land, with residential areas. The extent of topsoil fertility has to be assessed. The construction phase of the project will be limited in time and physical extent. Regarding areas that will be temporarily used for construction, these can be restored to agricultural use.

The limited time and scope of construction activities, as well as good implementation of measures can result in an impact of insignificant magnitude.

In the exploitation phase, possible impacts on the quality of the upper layer of soil and soil erosion, which with the implementation of mitigation measures can be insignificant.

The ESIA will assess the potential impact on land and geology based on soil and topographic data, data from existing published sources and geotechnical and soil investigations undertaken as part of the project. According to existing data, erosion is weak.

Further investigation of potentially contaminated locations along the railway will be conducted during the preparation of ESIA. In the event of dismantling the existing railway (at locations where the new route deviates from the existing one) and reusing the land for agricultural or sports and recreational purposes, it is necessary first to examine the soil quality to determine the potential level of contamination and then carry out soil decontamination if required.

1.6.1.7 Waters

These parameters will be scoped in. Pollution risk to surface water bodies from increased sedimentation and spillages is a possible impact that may derive from land clearance, excavation, dewatering of excavations, tunnelling, construction of earth embankments and construction materials such as aggregate and stockpiles of topsoil. Temporary increased sedimentation within watercourses is also likely to occur as a result of the construction of bridge piers with the watercourse channel. Runoff with high sediment load may have adverse impacts on adjacent water bodies through increasing turbidity and by smothering vegetation and be substrates.

Increased pollution risks from the discharge or spillage of fuels or other harmful substances associated with temporary works may also migrate to local surface water receptors. Currently, only the quality of the main river, Juzna Morava is known, while the quality of smaller rivers and streams is not known. Surface water measurements are needed to be carried out at the ESIA so the magnitude and significance of this impact can be estimated.

The ESIA will focus on the potential impacts of the project's activities on water quality for the key receptor, the Juzna Morava River and their tributaries both during construction and operation.

The study area for surface water characterization and assessment is defined according to potential receptors that maybe affected by the project and the surface water catchment within which the project is located. The study area typically encompasses surface water features up to 0.5km from the project that have the potential to be affected directly by the proposed works.

1.6.1.8 Biodiversity

These parameters will be scoped in. The ESIA will assess the potential impacts of the project's construction and operation activities on habitats, fauna and flora in

the study area. The ESIA will pay utmost care in assessing the project Biodiversity impact.

The baseline will provide a description of the habitats and fauna baseline and the wider ecological study area. The Area of Influence may extend up to a precautionary maximum distance of 500m of either side of the project centreline (this could be less, i.e. 200m either side in areas where the existing line will be rehabilitated or constructed, while 500m in areas where appropriate assessment is needed), within which a level of acoustic impact will be experienced during project construction and operation. This zone will be used to inform the scope of receptors requiring consideration through the assessment process (i.e. those potentially impacted) as well as providing the basis for predicting likely impact magnitudes.

All target species surveys will be undertaken in accordance with best practice survey guidance. The findings of the survey work will be analysed and presented in the ESIA chapters. Consistent with requirements of the EU Habitats Directive and Birds Directive, the assessment will also verify any natural protection areas that could be affected by the project. Depending on the outcome of the assessment, there may also be a requirement to develop a specific Biodiversity Action Plan as a key mitigation strategy.

1.6.2 Social impacts

Within the social changes and broader social impacts groups no imminent early substantial unmanageable risk signs i.e., red flag cases have been identified towards the future development phases of the project. The major concern is the impact stemming from involuntary land acquisition and resettlement, in particular at offline sections. However, since the alignment will be kept as much as possible on the existing route, physical displacement impacts should be minimised.

The adverse impacts have been observed against the below social receptors:

1.6.2.1 Community health and safety risk

Community health and Safety risk have been scoped in as risks during construction, reconstruction and operation. It is assessed that risks are constrained to the usual types of risks in similar projects - such as disruption of traffic and pedestrian routes, noise and vibration from equipment, spills /releases, direct mortality – e.g. as a result of increased collision risk with the railway and electrocution power lines, and other on and off-site risks. Given the scale of the project and the reliance on vehicles to access the route, vehicle and road safety was identified as one of the biggest health and safety risks.

1.6.2.2 Labour and OHS risks

Labour and OHS Risks have been scoped in. The OHS risks associated with the activities are usual types of risks i.e. from working at heights, risk from working with electrical circuits, Risk from operation of machinery and equipment, inadequate resources, equipment, procedures, training. Also, construction works on the rail while the regular lines are operating poses significant impact. The ESIA and subsequent management plans will need to discuss and agree with the SRI in

details the mitigation measures for construction works in the area of OHS. In the context of the COVID- 19 outbreak, basic infection prevention measures can help the containment of the spread of the disease and protect the workers and the public but also develop response plans to cover minimising the virus spread. One of the prominent risks in the construction sector as also highlighted in the baseline section is the risk from shadowed and informal Labour. Risk from child and force labour is negligent given the country and project context.

1.6.2.3 Land acquisition and involuntary resettlement

The most prominent impacts relate to the impacts from land acquisition and involuntary resettlement, loss of access to assets and loss of livelihood. The complexity of displacement has been duly appreciated and assessed through the option analysis. These impacts are scoped in and remedy carefully analysed, planned and delivered as it may negatively affect the economic and social well-being of affected people and provoke severe economic and social problems in the origin communities. Project-induced involuntary resettlement shall be minimised by analysing alternative project designs and locations.

However, total avoidance is not feasible and therefore the following impacts are anticipated: Physical and economic displacement and land restrictions, Damages to property and assets, Loss of private and public lands Loss of business lands Temporary land allocation, Damage to land and property impacts and Loss of livelihood. Fragmentation of agricultural land is seen as a significant residual impact based on past large scale infrastructure development projects in Serbia.

Avoidance of highly sensitive densely populated areas are without compromising the health, safety and well-being of affected people. Unavoidable impacts shall be mitigated by implementation of the Resettlement Action Plan (RAP) developed in parallel as a separate social management instrument for the project.

A detailed socio-economic baseline assessment on people affected by the project, including impacts related to land acquisition and restrictions on land use will be part of the project activities focused on the development of Feasibility and ESIA Phase when the Preliminary Design is developed to the higher level of details.

1.6.3 Transboundary Impacts

Potential transboundary environmental impacts are likely to occur at the area of the railway alignment near the North Macedonian border, and these could include impacts to surface water, groundwater, fauna and protected and designated areas.

Potential transboundary social impacts are expected to occur along the railway alignment not only near the North Macedonian border but wider.

The most important transboundary impacts potentially will be the impact on economy and Communities Quality of life.

1.7 Stakeholder engagement

Operations and activities for which potential financing from the European Investment Bank (EIB) is sought fall under the application of their respective applicable Environmental and Social Standards. The EIB Environmental and Social Standards (2022) provide an operational translation of the policies and principles contained in the 2009 EIB Statement of Environmental and Social Principles and Standards and are grouped across 11 thematic areas covering the full scope of environmental, climate and social impacts and issues. In response to the commitment to comply with EIB SEP has been developed as an essential component in project planning, implementation and operation.

The SEP will be developed and is part of an iterative process in communicating with stakeholders who may be affected by or might be interested in the project throughout its life cycle. To allow uptake of Stakeholders concerns, grievances but also positive feedback during all of the project stages a fully functional system introduced by the promoter that affords all stakeholders, in particular impacted individuals and communities, the ability to provide feedback, channel their concerns and, thereby, access information and, where relevant, seek recourse and remedy. The scope of such a mechanism concerns the entire operation, yet it is not intended to serve employer-workforce relations, as a separate grievance structure relevant to workplace grievances is exclusively dedicated to this purpose.

The specific nature of the project requires a broad engagement with various project stakeholders with main discussions between sector specific institutional Stakeholders.

2 Introduction

Serbia's rail network comprises 3,819 km of track. Its backbone is located along the EU's Orient/East-Med Corridor, which links Hamburg with Athens. Within Serbia, the relevant sections are known as Corridor X (Croatian border to North Macedonian border through Belgrade and Niš), with branches Corridor Xb (Hungarian border to Belgrade) and Corridor Xc (Niš to the Bulgarian border). The section between Niš and Preševo, on the border with North Macedonia, is one of the oldest railway lines in Serbia and an important part of the core Corridor X through Serbia.

According to the European AGC Agreement, the Niš–Preševo railway line is part of Route E85, linking Budapest with Athens. As such, it is designated as a principal line of major international importance. It is also included in the AGTC agreement on combined transport, as Route C-E 85. The line has a total length of 151 km and is electrified using a single-phase 25 kV, 50 Hz system over the whole of its length.

WBIF is providing this grant for technical assistance for the preparation of the project for construction, and includes feasibility study, environmental and social impact assessment, preliminary design and tender document preparation. The purpose of this project is to ensure that the Project is appropriate and that the proposals made will enable the best use of the potential investment funds.

2.1 Project objectives

As stated in the Terms of reference, the overall objective of the project is completion, modernisation and sustainable development of the Serbian Railway Transport system within the Pan-European Corridor X, in order to meet the required EU capacity levels and quality standards relevant to the TEN-T network (in terms of track length and lay-outs, signalling and telecommunications systems) and to enhance and reinforce Serbian capacities in the context of the EU pre-accession process.

The implementation of the project will directly affect the improvement of rail connections in the region and will contribute to the integration of Serbia into the transport system of the region and the rest of Europe. The project should fulfil the following objectives:

- Improving the reliability of the railway to increase the volume of traffic,
- Reduction of travel time,
- Reduction of operating costs with regard to vehicles,
- Improving accessibility,
- Facilitating international (import, export) and transit traffic, especially for freight traffic,
- Reducing the number of traffic accidents,
- Improving conditions for environmental protection as well as social conditions and

- Improving regional connectivity, as well as economic development of the region.

2.2 The key institutional stakeholders

The key institutional stakeholders for this project are:

- Serbian Railways Infrastructure JSC,
- Ministry of Construction, Transport and Infrastructure (MCTI),
- European Investment Bank (EIB),
- European Union / DG-NEAR, DG-MOVE, EU Delegation in Serbia,
- Ministry of European Integration (MEI), acting also as NIPAC and
- Municipalities in the project area and along the railway Corridor X.

2.3 Project developer

The Beneficiary of the Project is the Ministry of Construction, Transport and Infrastructure of Serbia (MCTI), with the Serbian Railways Infrastructure JSC (SRI) as the end recipient. The main activities of SRI includes the following:

- the management of public railway infrastructure including maintenance of public railway infrastructure, organization and control of railway traffic,
- the provision of access and use of public railway infrastructure to all interested railway undertakings, as well as to legal entities and individuals performing transport for their own purposes, and
- the protection of public railway infrastructure

2.4 Project rationale

2.4.1 Project inclusion in main strategic documents

The Strategy of transport development on the railway network of the Republic of Serbia is oriented towards a balanced and even development of infrastructure, with a view to create a system in which railway traffic will be operated in a safe, efficient and reliable manner. The construction, reconstruction and modernization of the infrastructure capacities relevant for the implementation of basic principles of development of sustainable transport in the future period should contribute to the realization of the goals related to the improvement of:

- traffic safety and reliability of infrastructure and timetable elements,
- the level and quality of rail infrastructure services,
- implementation of European rail interoperability standards,
- accessibility of railway infrastructure,
- environmental protection, development adjustment and keeping the infrastructure elements in line with environmental requirements,
- energy efficiency,
- railway contribution to regional development.

The main arterial routes of the Serbian railway network stretch along the Pan-European Corridor X. According to the national categorization of railway lines (Official Gazette of RS, No. 50/19), these arterial routes consist of:

- Main line 101: Beograd Centar - Stara Pazova - Šid - State Border - (Tovarnik),
- **Main line 102: Beograd Centar - Rasputnica „G" - Rakovica - Mladenovac - Lapovo - Niš - Preševo - State Border - (Tabanovce),**
- Main line 103: (Beograd Centar) - Rakovica - Jajinci - Mala Krsna - Velika Plana,
- Main line 105: (Beograd Centar) - Stara Pazova - Novi Sad - Subotica - State Border - (Kelebia),
- Main line 106: Niš - Dimitrovgrad - State Border - (Dragoman)

Figure 1 The main arterial routes of the Serbian railway network

Main line 102 belongs to Corridor X, which is one of the Pan-European corridors. It runs between Salzburg in Austria and Thessaloniki in Greece (see Figure 2). The

corridor passes through Austria, Slovenia, Croatia, Serbia, North Macedonia, and Greece, and it has four branches: Xa, Xb, Xc, and Xd. Corridor Xc follows the route Nié – Sofia – Plovdiv – Edirne – Istanbul.

Due to insufficient maintenance and the absence of investments over the past 20 years, rail infrastructure has deteriorated on Corridor X to the extent that it is uncompetitive against other modes of transport, in particular for passenger traffic, but also for time sensitive freight. The railway Corridor X, comprising of international routes C-E 70 and C-E 85, passing through Nis, connects Paris with Istanbul and Budapest with Athens.

Figure 2 Corridor X

The railway line Nis – Presevo is one of the oldest railway lines in Serbia and a part of Corridor X route through Serbia. According to European AGC Agreement, and European Agreement on Important International Combined Transport Lines and Related Installations (AGTC) the railway line Nis – Presevo combines the railway line C-E 85 and has the largest volume of transport operation on the railway lines of JSC "Serbian Railways Infrastructure". The international significance of this route has been confirmed by:

- The Treaty establishing the Transport Community signed in 2017 in Trieste (Italy) and ratified by all partners (Council Decision (EU) 2019/392),
- Commission implementing decision on the compliance of the proposal to establish the Alpine-Western Balkan rail freight corridor (Commission Implementing Decision (EU) 2018/500),

- Commission delegated regulation on the adaptation of the indicative extension of the comprehensive TEN- T maps to Western Balkans countries (Commission Delegated Regulation (EU) 2016/758 amending Regulation (EU) No 1315/2013),
- Stabilization and Association Agreement with Protocol 4 regarding to the land transport, which entered into force in 2013 (Decision 2013/490/EU),
- Agreement on the Establishment of High-Performance Railway Networks in Southeast Europe, signed in Thessaloniki in 2006 within the Southeast European Cooperation Process (SEECP),
- Declaration of the Third Pan-European Transport Conference held in Helsinki in 1997,
- The European Agreement on Main International Railway Lines (AGC) and the European Agreement on Important International Combined Transport Lines and Related Installations (AGTC) done in Geneva in 1985 and 1991 proposed by the United Nations Economic Commission for Europe (UNECE).

Taking into account the importance of the railway route, in the previous period, a number of documents were prepared discussing the plan for its reconstruction and modernization. Some of the most important documents that indicate the need for the modernization and reconstruction of the railway route are:

- Final report of the CONNECTA technical assistance project (Strategic Framework for implementation of ITS on the TEN-T Core/Comprehensive Networks in WB6, Final Report 2018),
- Final report for the Western Balkans region prepared within the study program of the TEN-T corridor Orient / East-Med (Study on Orient / East-Med TEN-T CNC, 2nd Phase, Final Western Balkan Report 2017),
- Multi-annual SEETO development plan 2007-2011 (The Five-Year Plan for the Development of the South- East Europe Core Regional Transport Network for the period 2007-2011),
- Final report for the railway area prepared within the regional project REBIS-Transport (Final Report, Railway study REBIS-Transport 2003),
- National Programme for Public Railway Infrastructure 2017-2021, adopted by the National Assembly of the Republic of Serbia in 2016,
- Long-term and Medium-term Business Strategy and Development Plan for "Infrastructure of Serbian Railways" JSC 2017-2027, adopted by the Government of the Republic of Serbia in 2017,
- Development Plan for Railway, Road, Inland Waterways, Air, and Intermodal Transport in the Republic of Serbia 2015-2020, adopted by the Government of the Republic of Serbia in 2015,
- Master plan for railways prepared in 2014,
- Strategy of railway, road, inland waterway, air, and intermodal transport development from 2008 until 2015, adopted by the Government of the Republic of Serbia in 2007,
- General Transport Master Plan for the Republic of Serbia, prepared in 2009 within the European Union Agenda for the Balkans,

- Spatial Plan of the Republic of Serbia from 2010 to 2020 ("Official Gazette of RS", No. 88/2010).

2.4.2 Project justification

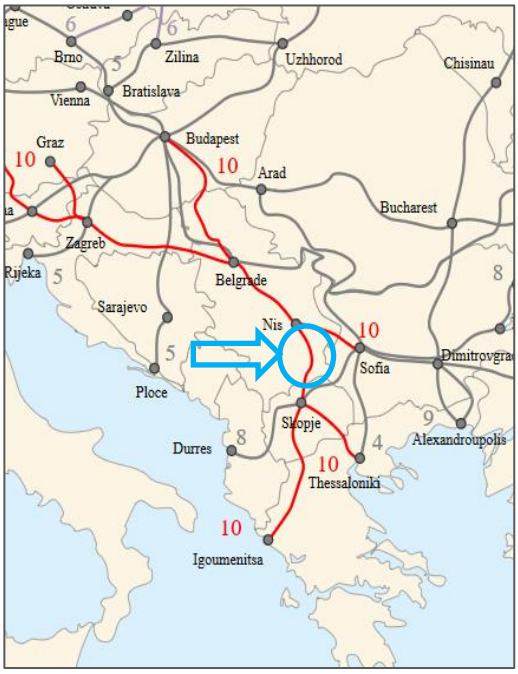
The current condition of the railway infrastructure is not satisfactory due to the lack of permanent maintenance in the previous period, while electrical equipment is technologically outdated. The speeds in the timetable are lower than designed, with numerous reductions, i.e. "light driving" has been introduced on some sections. The operating speed of passenger trains is on average around 50 km/h. The main goal of the modernization of the railway infrastructure on Corridor X through Serbia is the reconstruction of the existing lines and the extension of the second track on the sections where single-track lines were built. This task is one of the state priorities in the construction of traffic infrastructure on the territory of the Republic of Serbia.

The modernized railway line should meet the requirements defined by international agreements (AGC, AGTC, and SEECP). The reconstructed and modernized railway for mixed passenger and freight traffic should be equipped with modern ERTMS devices (ETCS-L2, GSM-R) and other characteristics in accordance with the requirements of interoperability (TSI). The reconstruction and modernization of the line are defined as a priority in the future development of the Serbian railway network, due to the high importance of the railway line, as well as low technical characteristics which affect regular passenger and freight transport.

2.4.3 Project history

The single-track railway line Niš-Preševo-state border railway line is approximately 157 km long.

This section forms part of Pan-European Corridor X that passes through Austria, Slovenia, Croatia, Serbia, North Macedonia, and Greece.



Generally, the line passes along flat topography, apart from a central section of 32 km between Grdelica and Suva Morava. Here the topography is mountainous, and the line shares a corridor within a river canyon with other major road infrastructure, including the Corridor 10 motorway.

The railway section included in the scope of this sub-project can be divided into three subsections considering distinct terrain conditions, as follows:

Subsection A: Brestovac – Grdelica

The length of Subsection A is about 34 km.

The minimum radius of the horizontal curves is 400 m, before the Grdelica station, where the maximum speed (Vmax) is reduced to 90 km/h. On the rest of the section parameters of horizontal geometry allow speed of 120km/h.

Subsection B: Grdelica – Vladicin Han

The length of Subsection B is about 32 km. The minimum radius of the horizontal curves is 300 m, where the possible speed is Vmax = 80km/h.

Subsection C: Vladicin Han - State border with North Macedonia (Tabanovce)

The length of Subsection C is about 67 km. The minimum radius of the horizontal curves is 300 m, where the possible speed is Vmax = 80 km/h. However, the majority of curves have radii of over 700 m (60% of the total number of horizontal curves), which corresponds to Vmax of 120 km/h.

Throughout the section, the permissible axle load is 225 KN, and permissible load per linear metre 80 KN/m. The key structures along the line are three tunnels (less than 500 m long) and 14 bridges with spans larger than 30 m.

The stations are not well equipped for passenger operations and do not offer sufficient comfort and safety to the passengers.

Originally constructed to a design speed of 120km/h the line has deteriorated to such an extent that operating speeds have been severely reduced in certain sections.

The following sections of the line were rehabilitated during 2017, with the funding of a Russian loan:

- Vinarce–Djordjevo, in Subsection 1 (13.8 km)
- Vranjska Banja–Ristovac, in Subsection 3 (17.7 km), and
- Bujanovac–Bukarevac (12.9 km), also in Subsection 3.

These works included some minimum technical improvements to restore the design speeds, but the operating speeds in these subsections still do not exceed 90-100 km/h. No civil structures (bridges, culverts, or tunnels) were included in those works.

2.5 The Project's Environmental and Social Impact Assessment (ESIA) Process

The Consultant's overall approach to ESIA follows Serbian regulations and in line with the requirements of the European EIA Directive, applicable international standards and the EIB standards. The specific objectives of the ESIA areas are listed as follows:

- Present the main characteristics of the baseline regarding environmental and social parameters;
- Ensure that key potential significant positive and adverse environmental and social impacts are identified;
- Capitalize on positive aspects and benefits;
- Mitigate negative impacts and avoid serious and irreversible damage to the environment and people;
- Prepare environmental and social management and monitoring plant to help ensure the stated above;
- Ensure that environmental and social factors are considered in the decision- making process of construction of the railway alignment.
- Inform the public about the proposed Project and ensure stakeholder participation and involvement

A description of the ESIA process steps is provided in the following table, while as indicated, the project stage is currently at the alternatives assessment and scoping.

Table 4 ESIA process steps

Alternatives Assessment	Assessment of alternatives with the aim to identify the advantages and disadvantages of all Project alternatives
Scoping	Scoping identifies the key issues to be addressed in the ESIA. Scoping, as presented in this report, will ensure that the process is focused on the potentially significant environmental and social impacts which may arise from the Project. It will consider the results of consultations undertaken to date on the Project. Ultimately scoping defines the scope of work of the ESIA, including stakeholder engagement.
Baseline studies	For the key issues identified in scoping, available information on the existing environmental and social conditions (also referred to as baseline conditions) will be gathered
Impact assessment and mitigation measures	This stage focuses on predicting environmental and social changes from the baseline as a result of the Project's activities (considering the entire lifecycle of the Project). Each impact will then be evaluated to determine its significance for the environment and society. Where necessary measures will be proposed to mitigate significant impacts.
Environmental and social management plans	The various mitigation measures will be presented in an Environmental and Social Management Plan (ESMP), describing how measures will be implemented throughout the different Project phases. The ESMP will provide general details (considering the project stage) for the responsibilities for implementation, the timing and monitoring and

	audit plans to ensure all the mitigation commitments are met. It will also identify any requirements for training and other capacity building
Stakeholder Engagement and Consultation	During the ESIA stage the team will seek the views of interested parties so that these can be considered in the assessment and reflected in the proposals for mitigation

2.6 Approach to Scoping

In line with the requirements set out in the ToR, the Consultant will undertake the Environmental and Social Scoping Study (ESSS) at this phase. This document will aim at:

- Providing an overview description of the Project,
- Describing the existing environmental and socioeconomic baseline,
- Identifying potential environmental and socioeconomic issues at a preliminary level associated with the proposed Project,
- Obtaining early input from key stakeholders in the identification of potential impacts and mitigation measures, and
- Identifying key data gaps and defining a proposed Terms of Reference (ToR) for a ESIA study including program for consultation with stakeholders.

The Scoping Report has been prepared in accordance with international requirements as defined by the potential lender to the Project –the EIB (European Investment Bank). The level of depth of this scoping report is aligned with the design stage (preliminary).

2.7 Scoping report structure

The remainder of this report is structured as follows:

Table 5 Structure of the Scoping report

Chapter 3 – Legal Framework	Regulations and Guidelines provides a brief overview of the relevant and International ESIA regulatory framework and international best practice with regards to scoping;
Chapter 4 – Project Description:	Describes the main components of the Project and the main construction and operation activities
Chapter 5 – Environmental and Social Baseline	Baseline Conditions: provides an overview of the baseline environmental, socioeconomic and cultural heritage characteristics of the Study Area
Chapter 6 – Project Alternatives	Description of Selected Options: summarizes the alternatives railway alignments and proposes the "base case" route;
Chapter 7 – Potential Impacts and Mitigation Measures:	Summarizes potential significant environmental, socioeconomic and cultural heritage impacts and provides an indication of potential mitigation and management measures;
Chapter 8 Stakeholder Engagement	Presents the proposals for consultation with identified external stakeholders i.e. individuals or groups who are affected or likely to be affected (directly or indirectly) by the Project ("affected parties") or

	may have an interest in the Project ("other interested parties") during scoping. The section also summarizes the consultation activities undertaken earlier in the ESIA process
Chapter 9– Management and Monitoring arrangements	Preliminary guidelines and arrangements on management and monitoring
Chapter 10 - Terms of Reference of the ESIA:	presents the proposed terms of reference, the structure of the detailed ESIA and a tentative schedule of the ESIA activities

3 Legal framework

The environmental regulations applicable to this project are numerous and diverse. Therefore, only the key requirements associated with the project have been chosen to be presented in this section. However, a full and detailed list of legislation associated with the project will be developed as part of the project management systems for construction and operation.

The Environmental Impact Assessment (EIA) procedure in the Republic of Serbia as governed by the Law on Environmental Impact Assessment, which is harmonized with European EIA Directive (85/337/EEC, 97/11/EC, 2003/35/EC and COM 2009/378 as codified by the Directive 2011/92/EU and as amended by the Directive 2014/52/EU).

3.1 Overview of the main relevant national legislation

The legal, legislative and institutional framework for environment and society i.e. social considerations in Serbia is founded on the Constitution of Serbia, which stipulates the right to a healthy environment and the duty of all, in line with the law, to protect and enhance the environment. Health and environment are also supported by many governmental strategies, international agreements and the Millennium Development Goals. Environmental legislation in Serbia has over 100 laws and regulations. Currently, the majority of these are harmonized with EU directives and other legislation.

The Constitution of Republic of Serbia was proclaimed on November 8th, 2006. According to Article 74 of the Constitution:

- Everyone shall have the right to live in healthy environment and the right to timely and full information about the state of environment.
- Everyone, especially the Republic of Serbia and autonomous provinces, shall be accountable for the protection of environment.
- Everyone shall be obliged to preserve and improve the environment

Article 58 of the Constitution guarantees of peaceful tenure of a person's own property and other property rights acquired by law. The Article indicates that right of property may be revoked or restricted only in public interest established by law and with compensation which cannot be less than market value.

Article 16 of the Constitution states that the foreign policy of the Republic of Serbia shall be based on generally accepted principles and rules of international law. Generally accepted rules of international law and ratified international treaties shall be applied directly if they are dully signed and ratified by the Government of Serbia.

The following key national laws and regulations are applicable to the scope of this project:

- Law on Environmental Protection (Official Gazette of the Republic of Serbia No. 135/04, 36/09, 72/09, 43/11, 14/16, 76/18 and 95/18);

- Law on Environmental Impact Assessment (Official Gazette of the Republic of Serbia No. 135/04 and 36/09);
- Law on Strategic Environmental Assessment (Official Gazette of the Republic of Serbia No. 135/04 and 88/10);
- Law on Air Protection (Official Gazette of the Republic of Serbia No. 36/09, 10/13 and 26/21);
- Law on Nature Conservation (Official Gazette of the Republic of Serbia No. 36/09, 88/10, 91/10, 14/16, 95/18 and 71/21);
- Law on Waste Management (Official Gazette of the Republic of Serbia No. 36/09, 88/10, 14/16, 95/18 – other law and 35/23);
- Law on Chemicals (Official Gazette of the Republic of Serbia No. 36/09, 88/10, 92/11, 93/12 and 25/15);
- Law on Water (Official Gazette of the Republic of Serbia No. 30/10, 93/12, 101/16, 95/18 and 95/18 – other law)
- Law on Environmental Noise Protection (Official Gazette of the Republic of Serbia No. 96/21)
- Law on safe transport of hazardous goods (Official Gazette of the Republic of Serbia No. 104/16, 83/18, 95/18 and 10/19)
- Law on mining and geologic al explorations (Official Gazette of the Republic of Serbia No. 101/15, 95/18 and 40/21)
- Law on Railway (Official Gazette of the Republic of Serbia No. 41/18 and 62/23)
- Law on Planning and construction law (Official Gazette of the Republic of Serbia No. 72/09, 81/09 (Corrigendum), 64/10 (CC), 24/11, 121/12, 42/13 (CC), 50/13 (CC), 98/13 (CC), 132/14, 145/14, 83/18, 31/19, 37/19 (CC), 9/20, 52/21 and 62/23)
- Law on Expropriation (Official Gazette of the Republic of Serbia No. 53/95, 23/01, Official Gazette of the Socialistic Republic of Yugoslavia No. 16/01-CC ruling, and Official Gazette of Republic of Serbia No.20/09, 55/13-CC ruling and 106/16 – authentic interpretation)
- Law on Special Procedures for the Implementation of the Project of Construction and Reconstruction of line Infrastructure Structures of Particular Importance to The Republic of Serbia (Official Gazette of the Republic of Serbia No. 9/20)
- Law on General Administrative procedures (Official Gazette of the Republic of Serbia No. 18/16, 95/18 and 2/23)
- Law on State Survey and Cadastre (Official Gazette of the Republic of Serbia No. 72/09, 18/10, 65/13, 15/15, 47/17, 113/17, 27/18, 41/18-other law, 9/20 – other law and 92/23)
- Labour Law (Official Gazette of the Republic of Serbia No. 24/05, 61/05, 64/09, 32/13, 75/14, 13/17- CC ruling, 113/17 and 95/18 – authentic interpretation)
- Law on Occupational Safety and Health (Official Gazette of the Republic of Serbia No. 35/23)

- Law on Cultural property (Official Gazette of the Republic of Serbia No. 71/94, 52/11 – other law, 99/11 – other law , 6/20 – other law, 35/21- other law and 129/21 – other law)
- Law on Land Protection (Official Gazette of the Republic of Serbia, No. 112/2015).

3.2 National EIA procedure

Environmental impact assessment is a preventive measure of environmental protection based on processing demands, preparation of assessments and consultations with the participation of the public and analysis of alternative measures, aiming to collect data and predict harmful effects of certain projects on the environment and human health, flora and fauna, land, water, air, climate and landscape, material and cultural heritage and the interaction of these factors, as well as determine and propose measures for adverse effects to be prevented, reduced or eliminated, bearing in mind the feasibility of these projects.

Law on Environmental Impact Assessment (EIA) ("Official Gazette of the RS ", No. 135/04 and 36/09) regulates EIA process, EIA content, Interested Authorities and organizations participation and public participation, international notification for projects that can have important impacts on other environment and inception and other important issues for EIA.

The impact assessment includes projects in the field of: industry, mining, energy, transport, tourism, forestry, agriculture, water management, waste management, utilities and projects planned in a protected natural asset or special purpose area defined by the Decree on making the list of projects which require environmental impact assessment and list of projects which may require environmental impact assessment ("Official Gazette of the RS", No. 114/08).

The process of environmental impact assessment of the modernization project of the existing railway is initiated by the owner of the project, which is "Serbian Railway Infrastructure" AD, with the competent authority for environmental protection. For facilities for which the construction permit is issued by the republic authority the impact assessment procedure is carried out by the Ministry of Environmental Protection. The Ministry of Environmental Protection is also responsible for all projects that may have a trans-boundary impact.

The Law on Environmental Impact Assessment ("Official Gazette of RS", No. 135/04 and 36/09) regulates the environmental impact assessment procedure, the content of the environmental impact assessment study, the participation of interested bodies and organizations and the public, cross-border notification for projects that may have significant environmental impacts, supervision and other environmental impact assessments.

The Decree on Determining the List of Projects for which an Impact Assessment is mandatory and the list of projects for which an Environmental Impact Assessment may be Required ("Official Gazette of the RS", No. 114/08) determines the List I Projects (for which an Environmental Impact Assessment is mandatory) and List II Projects (for which an environmental impact assessment may be required). According to its characteristics, the project in question is

classified in List I, under item 7. Construction of: 1) Main railway lines including ancillary facilities (bridges, tunnels and stations).

The process of environmental impact assessment for railway infrastructure projects consists of the following phases:

- Phase I - Deciding on the need for impact assessment – not relevant for this project being on the list of projects for which the impact assessment is mandatory - List I Regulations,
- Phase II - Determining the scope and content of the impact assessment.
- Phase III - Procedure for obtaining approval of the Environmental Impact Assessment Study

The scope and content of the Request for deciding on the need to assess the impact of the project on the environment and the Request for determining the scope and content of the project impact assessment on the environment are defined by the Law on Impact Assessment and the Ordinance on the content of and the content of the study on environmental impact assessment ("Official Gazette of RS", No. 69/05).

The Rulebook on the content of the Environmental Impact Assessment Study defines the content of the study, including a qualitative and quantitative presentation of possible changes in the environment during the project, regular work, in case of an accident and assessment of whether the changes are temporary or permanent. The decision on defining the scope and content of the study made by the competent authority in charge of environmental issues specifies in detail the content of the study on environmental impact assessment.

The Environmental Impact Assessment Study is an integral part of the technical documentation required to obtain the approval of the design. At the request of the project holder, the competent authority shall issue a decision on granting approval to the EIA Study or on rejecting the request for granting approval to the EIA Study, based on the conducted procedure and the report of the Technical Commission.

Public participation has to be ensured at all stages of the environmental impact assessment process: the decision-making process on the need for impact assessment, the procedure for determining the scope and content of the EIA Study and the procedure for giving approval to the Environmental Impact Assessment Study. The competent authority is obliged to inform the interested authorities and organizations and the public about the submitted request, provide insight in submitting the request and documentation that is attached to the request and provide public insight, organize the presentation and conduct a public discussion on the Environmental Impact Assessment Study.

3.3 Overview of the Main Relevant International Regulatory Framework

3.3.1 The EU EIA Directive

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

- Directive 97/11/EC brought the EIA Directive in line with the UN ECE Espoo Convention on EIAs in a Transboundary Context. The 1997 Directive widened the scope of the EIA Directive by increasing the types of projects covered and the number of projects requiring mandatory environmental impact assessment (Annex I). It also provided for new screening arrangements, including new screening criteria (included in Annex III) for Annex II projects, and established minimum information requirements;
- Directive 2003/35/EC sought to align EIA Directive provisions with the Aarhus Convention on public participation in decision-making and access to justice in environmental matters; and
- Directive 2009/31/EC amended Annexes I and II of the EIA Directive, by adding projects related to the transport, capture and storage of carbon dioxide (CO_2).

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

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

According to the Directive 2011/92 EC, the proposed Project falls into Annex I, Category 7 (a) "Construction of lines for long-distance railway traffic and of airports with a basic runway length of 2100 m or more".

3.3.2 Other Most Relevant EU Directives

Other relevant EU Directives that will be taken into account are the following:

- Water Framework Directive establishing a framework for Community action in the field of water policy (2000/60/EC)
- Directive on the assessment and management of flood risks (2007/60/EC) - Floods Directive

- Directive 2008/105/EC on environmental quality standards in the field of water policy (amending and subsequently repealing Council Directives 82/176/EEC, 83/513/EEC, 84/156/EEC, 84/491/EEC, 86/280/EEC and amending Directive 2000/60/EC)
- Directive 2006/11/EC on Dangerous Substances lays down rules for protection against, and prevention of, pollution resulting from the discharge of certain substances into the aquatic environment of the Community.
- Groundwater Directive 2006/118/EC established a regime which sets groundwater quality standards and introduces measures to prevent or limit inputs of pollutants into groundwater.
- Directive 2012/18/EU on the control of major-accident hazards involving dangerous substances (amending and subsequently repealing Council Directive 96/82/EC), obliges Member States to ensure that operators have a policy in place to prevent major accidents.
- Environmental Noise Directive 2002/49/EC defines a common approach intended to avoid, prevent or reduce on a prioritized basis the harmful effects, including annoyance, due to exposure to environmental noise, including, among other, assessment methods for the noise indicators.
- Directive 2000/14/EC on the approximation of laws of the Member States relating to noise applies to equipment for use outdoors listed in Articles 12 and 13 and defined in Annex I of this Directive.
- Directive 2008/50/EC 16 on ambient air quality and cleaner air for Europe;
- Directive 2008/98/EC 18 on waste (Waste Framework Directive)
- Habitats Directive 92/43/EEC aims to contribute towards ensuring biodiversity through the conservation of natural habitats and of wild fauna and flora in the territory of the Member States.
- Birds Directive 2009/147/EC relates to the conservation of all species of naturally occurring birds in the wild state in the territory of the Member States.
- Directive 89/391/EEC – Occupational Health and Safety
- Regulation (EU) 2018/1999 of the European Parliament and of the Council on the Governance of the Energy Union and Climate Action ('European Climate Law').

3.3.3 Relevant International Multilateral Agreements

Most of the International Conventions with regard to the Environment, Public Participation and Labour issues have been transposed in the Serbian national legislation such as:

- Bern Convention for the Protection of flora, wild fauna and nature environment of Europe, signed in 1995 and ratified by the GoA in 1999, ratified by the law 8294/1998.
- CITES Convention on International Trade in Endangered Species of Wild Fauna and Flora, ratified by the GoA in 2003.

- Convention of Biological Diversity (CBD) Rio de Janeiro, signed in 1996 and ratified by the GoA in 2004.
- Convention on Access to Information, Public Participation in Decision-Making and Access to Justice in Environmental Matters (Aarhus, 1998), ratified by the law no.8672/2000.
- United Nations Convention to Combat Desertification (UNCCD) was ratified in 1999.
- Convention on the Conservation of Migratory Species of Wild Animals (CMS or the Bonn Convention) ratified by the GoA in 2002.
- ESPOO Convention (Finland) "On Environmental Impact Assessment in a Trans-boundary Context", ratified by the law no 9478/2006.
- United Nations Framework Convention on Climate Change (UNFCCC) ratified by the law no. 2/97.
- Kyoto protocol to the United Nations Framework Convention on climate change 1998 ratified by Serbian government 2007.
- Paris Agreement, United Nations 2015, ratified by the law no. 4/17.
- Protocol on Strategic Environmental Assessment ratified by Serbian government at the end of 2004,
- The European Landscape Convention, Florence, 2000, ratified 2011.
- International Convention on the Elimination of all forms of Racial Discrimination, New York, 7.03.1966
- Convention on Elimination of all forms of Discriminations Against Women, New York, 03.09.1981, ratified by Republic of Serbia in 2001.
- Council of Europe Convention on Preventing and Combating Violence Against Women and Domestic Violence, Istanbul, 11.05.2011, in force in Republic of Serbia from 01.08.2014.
- National Convention on Economic, Social and Cultural Rights New York, 16.12. 1966, ratified by Republic of Serbia in 1990.
- International Labour Organization Convention No. 155: Occupational Safety and Health, 1981, ratified 1992.
- UNESCO Convention for the Safeguarding of the Intangible Cultural Heritage, 2003, ratified in May 2010.
- EUROPEAN Convention "For the Protection of Archaeological Heritage", ratified in 2009.

The social standards are within this project will be guided by provisions of several fundamental treaties and conventions: The International Bill of Human Rights, International Labour Organization (ILO) Conventions, the European Convention on Human Rights, UNESCO World Heritage Convention etc.

In addition to the above, Serbia has adopted or embedded in its regulations the principles of many international treaties[1] and standards that provide base for EIB Policy SIA regulation.

3.3.4 Serbia's progress in the transposition and implementation of the relevant EU Acquis

As per the most recent EC Progress Report[2], latest recorded progress of the country in the process of transposition and implementation of the EU environmental acquis is as follows:

Serbia has achieved some level of preparation in the area of environment and climate change. Overall, Serbia made limited progress during the reporting period including on last year's recommendations, in particular by continuing to increase environmental funding and investments, improving trans-boundary cooperation and developing its national energy and climate plan. The adoption of important legislation and strategic documents is pending.

Last year's recommendations remain largely valid. Serbia should considerably step up ambitions towards a green transition and focus on:

- *adopting and start implementing an ambitious national energy and climate plan through transparent consultative procedures, consistent with the European Green Deal's zero emission target for 2050 and the Green Agenda for the Western Balkans;*
- *intensifying implementation and enforcement work, such as ensuring strict adherence to rules on environmental impact assessment, closing non-compliant landfills, increasing investing in waste reduction, separation and recycling, improving air and water quality including through phasing out coal, further intensifying trans-boundary cooperation, improving law enforcement by inspectorates and judiciary, adopting Serbia's river basin management plan 2021-2027 and continue preparing for Natura 2000;*
- *enhancing administrative and financial capacity of central and local authorities, in particular in the Serbian Environmental Protection Agency and environmental inspectorates, by further improving inter-institutional coordination, further raising staff levels, continuing to raise environmental investments as well as further improving strategic investment planning and management including transparency of procedures. A coordinated, institutional structure is required to deliver the size and quality of the investments that Serbia needs.*

[1] Convention on the Elimination of all Forms of Discrimination Against Women (CEDAW); World Health Organisation (WHO) standards and guidelines; International Labor Organization Convention on Construction Safety and Health No. 167; EC Directive 98/59/EC of 20 July 1998 on the approximation of the laws of the Member States relating to collective redundancies and collective dismissals; EEC Directive 89/391/EEC the Safety and Health at Work Directive; EC Directive 2008/96/EC On Road Infrastructure Safety Management; EU Directive 2012/18/EU on the control of major- accident hazards.

[2] https://neighbourhood-enlargement.ec.europa.eu/system/files/2022-10/Serbia%20Report%202022.pdf

3.4 EIB Environmental and Social Policy

The new EIB Group Environmental and Social Policy[3] as of February 2022 lays out the Group's vision to 2030, namely, to actively contribute to sustainable development and inclusive growth. This is reflected in its environmental and social safeguards, through the EIB Statement on Environmental and Social Standards from February 2022. Such procedures, principles and standards are translated into the routine practices of the EIB in the Environmental and Social Practices Handbook. EIBs environmental and social standards are listed below:

Standard 1 – Environmental and Social Impacts and Risks

Standard 2 – Stakeholder Engagement

Standard 3 – Resource Efficiency and Pollution Prevention

Standard 4 – Biodiversity and Ecosystems

Standard 5 – Climate Change

Standard 6 – Involuntary Resettlement

Standard 7 – Vulnerable Groups, Indigenous Peoples and Gender Standard

Standard 8 – Labour Rights

Standard 9 – Health, Safety and Security

Standard 10 – Cultural Heritage

Standard 11 – Intermediated Finance

The Project is included in the category 'High' for which an ESIA is mandatory to be prepared.

3.5 Gap analysis

The international and national processes are aligned regarding the requirements for assessment of environmental impact. However, the international ESIA is a more integrated process and needs to encompass the requirements associated with regulatory mechanisms such as those which are part of the local "planning process" and are outside the formal environmental impact assessment process. For example, issues associated with local grievances arising from land purchase for the project are managed locally by local regulatory authorities. In the ESIA process, these local issues must also be encompassed in the integrated impact assessment. The table below summarises the similarities and differences between the ESIA and the national EIA process.

[3] https://www.eib.org/en/publications/eib-group-environmental-and-social-policy

Table 6 Gap assessment

Activity	ESIA	EIA	Comments
Screening Study	√	√	Since the project falls within Category High /List I, a formal screening study was not produced. The procedure started from the scoping study.
Categorisation	√	√	Formal categorisation in accordance with banking standards and national legislation indicates that the proposed project is a Category High / List I project and requires a full impact assessment
Stakeholder Engagement Plan	√		A formal stakeholder engagement plan is not required under national legislation. However, stakeholder consultation is part of the EIA process.
Scoping Study	√	√	Both, international and national scoping procedure will be prepared in line the project scope.
Consideration of alternatives	√	√	The alternatives were considered and analysed during previous stage of the project. The results of the analysis are recorded in the 1st LoA report.
Environmental Impact Assessment	√	√	The EIA requirements are generally aligned. The standards adopted in the environmental assessment undertaken for the ESIA should be in line with European and other international best practice. The requirements under the national EIA regulatory process need to ensure compliance with national legislation and not the regulatory requirements outside of the country.
Environmental impacts assessment in cases of accidents	√	√	Both studies require quite detailed analysis of environmental impacts in case of accidents which includes specification of hazardous substances used, emergency preparedness and response, remediation measures, etc.
Socio-Economic Impact Assessment	√	Limited	EIB standards impose an integrated approach including full deliberation of the socio-economic effects. The national regulatory requirements for impact assessment are primarily focused on environmental requirements with other requirements encompassed in other regulatory (e.g. 'planning') mechanisms. A formal socio-economic impact assessment is not required under national legislation. However, the local national legislation does require assessment of effects where impacts are associated with impacts to human health.
Resettlement Action Plan	√		EIB E&S Standard 6 (Involuntary Resettlement) applies to the displacement of persons without formal, traditional or recognisable usage rights, who are occupying or utilising land prior to the cut-off-date. The Serbian Law on expropriation still does not recognize illegally built facilities.
Environmental and Social Management Plan (ESMP)	√		ESMP is not typically included as a requirement according to local legislation. ESMP describes the roles, the responsibilities, the key commitments and general measures which should be implemented.
Non-Technical Summary (NTS)	√	√	NTS is required for investment requirements for use as a disclosure document. It is recognised as good practice to produce an NTS to provide readily accessible summary of the project key features, an

Activity	ESIA	EIA	Comments
			assessment of its effects, the proposed mitigation measures and a summary of the residual impacts.
Public Consultation & Disclosure	√	√	The public consultation process for both investment and national regulatory purposes is required. The project is categorised in Category "High", requiring the full ESIA disclosure package to be publicly disclosed for a minimum of 120 days.
Management of Grievances and Objections	√		A Grievance Mechanism is not a formal requirement under the national regulatory requirements. However, grievances are reported under the consultation process and are encompassed under other regulatory mechanisms (e.g. the local 'planning' process).

4 Project Description

4.1 Overview of the existing situation of the subject railway line

4.1.1 General overview

The railway line Nis – Presevo is one of the oldest railway lines in Serbia and a part of Corridor X route through Serbia. According to European AGC Agreement, and European Agreement on Important International Combined Transport Lines and Related Installations (AGTC) the railway line Nis – Presevo combines the railway line C-E 85 and has the largest volume of transport operation on the railway lines of JSC "Serbian Railways Infrastructure". The section Nis – Presevo is a 151 km long section of European Corridor X and on the extended Core TEN-T network. The line is electrified using the single-phase 25 kV, 50 Hz system over the whole of its length. The track was constructed with the parameters for the permissible speed of up to 120 km/h; however, owing to a poor condition of the track, the speed has been restricted along certain parts. Permissible axle load is 225 KN, and permissible load per linear metre 80 KN/m. The key structures along the line are three tunnels (less than 500 m long) and 14 bridges with spans larger than 30 m. Along this part of the railway line stations are not well equipped for passenger operations and do not offer sufficient comfort and safety to the passengers. The local area map (**Error! Reference source not found.**) shows he relationship of the railway, marked in red, to the road, rivers and the topography of the corridor.

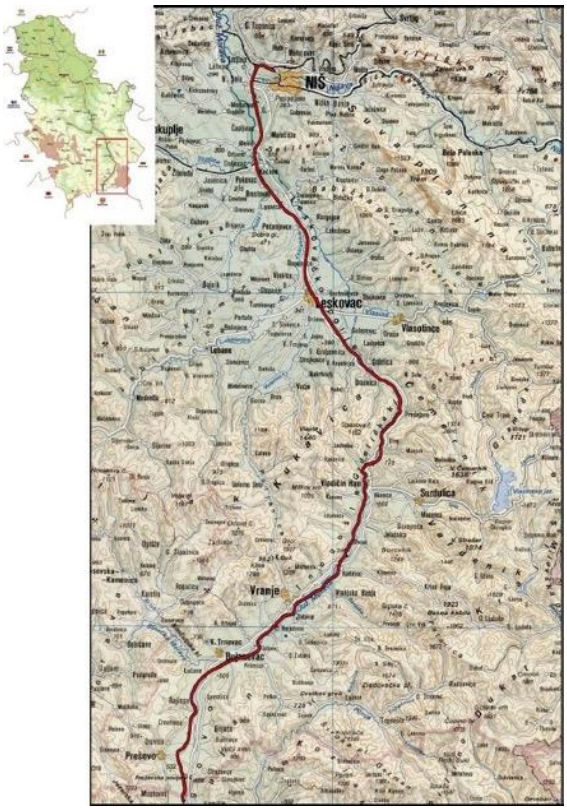


Figure 3 Existing Nis - Presevo railway line

The main line from Belgrade to the border enters the Nis area at Trupale and by-passes the City on the west side, as shown in **Error! Reference source not ound.**.

Between Trupale and Medjurovo, where the through line joins the line from Nis, there is a large marshalling yard, complete with intermodal freight transhipment facilities.

The line from Trupale via the marshalling yard and Medjurovo to the State border is 157.8 km long, single track for the whole route, and it passes through three distinct topographical areas, as shown below.

Figure 4 Railway line sub-sections

There are 8 manned crossing stations between Trupale and Presevo, 7 other stations and 13 halts.

4.1.2 Main technical characteristics of the existing geometry

Some of the sections within existing longitudinal profile it has the value of the straight section below 20 m, the vertical gradients are higher than 12.5 ‰ (km 393 + 840 - km 394 + 160 - i = 13.29 ‰, km 397 + 430 - km 399 + 630 - i = 13 ‰), and usable length of the relief track in station are less than 750 m.

The width of subgrade (substructure) of the existing railway is less than 6.60 m.

Existing transition curves are cubic parabolas, which were designed and constructed by standards applied 100 years ago. Current standards define

transition curves as clothoid. By applying a clothoid, it is not possible that alignment remain exactly on the same position.

The existing alignment geometry is not fully compliant with the national standards in force, with the following minimum values of parameters:

- The minimum length of the straight section is 0.4 x Vmax or min. 20 m;
- The maximum gradient i = 12.5 ‰;
- The usable length of the relief track in station is 750 m;
- Width of subgrade must be min. 6.60 m.

The main technical characteristics of the existing railway line are provided below.

The total length is 132.524 km. The lengths of subsections are as follows:

- Brestovac - Grdelica – 33.9217 km
- Grdelica - Suva Morava – 32.2028 km
- Suva Morava - State border with North Macedonia (Tabanovce) – 66.3995 km.

The Nis-Brestovac railway section is 22.83 km long.

The minimum radius of the horizontal curve is 400 m. Predicted speeds per subsection are:

- from km 244 + 600 (exit Niš) to km 248 + 300 (entrance Međurovo) Vmax = 90km/h;
- from km 248 + 300 (entrance Međurovo) to km 267 + 430 (entrance Brestovac) Vmax = 120km/h;

Further details of the main technical elements of the existing railway line include:

- alignment length: 132.54 km,
- air distance of start/end point of the alignment: 103.03 km,
- number of horizontal curves: 158,
- minimum radius of horizontal curves (Rmin) = 300m (32 of the 158 curves),
- total curve length: 46,127.71 m or 34.81%,
- total straight length: 86,396.29 m or 65.19%,
- maximum inclination: 13.39‰ along 340.00 m,
- average radius of horizontal curves: 532.33 m,
- curvature coefficient of alignment: 37.53°/km,
- curvature factor: 132.54/103.03 = 1.29.

Section 1: Brestovac – Grdelica

The length of Section 1 is about 33.9 km.

The minimum radius of the horizontal curves is 400 m, before the Grdelica station, where the maximum speed (Vmax) is reduced to 90 km/h. On the rest of the section, Rmin is 1404 m, and the maximum speed 130km/h.

Section 2: Grdelica – Suva Morava

The length of Section 2 is about 32.2 km.

The minimum radius of the horizontal curves is 300 m, where the possible speed is Vmax = 80km/h.

Section 3: Suva Morava - State border with North Macedonia (Tabanovce)

The length of Section 3 is about 32.2 km. The minimum radius of the horizontal curves is 300 m, where the possible speed is Vmax = 80 km/h. However, the majority of curves have radii of over 700 m (60% of the total number of horizontal curves), which corresponds to Vmax of 120 km/h.

The original design speed on each of the sections was partially dictated by the topography and the track alignment. The absolute maximum speeds are now however severely restricted, as shown on **Error! Reference source not found.** ue to poor track conditions.

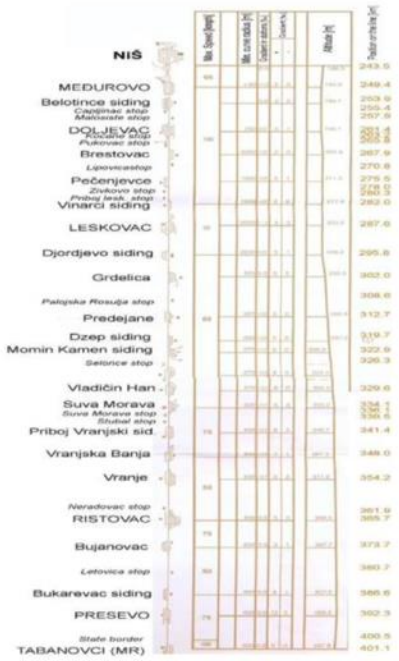


Figure 5 Line summary diagram

The last capital overhaul of certain parts of the railway line was performed more than 20 years ago, whereas it was performed more than 30 years ago concerning the major part of the railway line. A great number of level crossings along the railway line Nis – Presevo endanger the safety of rail and road traffic.

4.1.3 Overview of existing railway stations

The overview of the existing railway stations is provided in the table and figure below. The technological schemes of all existing stations and diagrams with data on the objects in the stations, the useful lengths of the tracks, the types of rails and switches, etc are presented in the 1st Level Option Analysis Report.

Table 7 Overview of existing buildings and station facilities

No.	Station/Intersection	Location	Station Building and Facilities	Tracks
01	Brestovac Station	km 267+939,19	Station Building, Warehouses, Field Toilets and S&T Facility	3
02	Pecenjevce Station	km 275+564	Station Building, Warehouse, Field Toilets and S&T Facility	3
03	Vinarce Intersection	km 281+974,80	Station Building	2
04	Leskovac Station	km 287+573,90	Station Building and S&T Facility	5
05	Djordjevo Intersection	km 295+779	Station Building and S&T Facility	3
06	Grdelica Station	km 301+863,70	Station Building, Residential Building, Field Toilet, Warehouse and S&T Facility	4
07	Predejane Station	km 312+725	Station Building, Field Toilets, Warehouse and S&T Facility	4
08	Dzep Station	km 319+671	Station Building ETS Facility, Field Toilet, Residential Building and S&T Facility	4
09	Momin Kamen Intersection	km 322+838,23	Station Building, Residential Building with small Warehouse and S&T Facility	3
10	Vladicin Han Station	km 329+591	Station Building, Warehouse and S&T Facility	5
11	Suva Morava Station	km 334+066,50	Station Building, Field Toilet and S&T Facility	4
12	Priboj Vranjski Station	km 341+437	Station Building and S&T Facility	4
13	Vranjska Banja Station	km 348+015,50	Station Building, S&T Facility, ETS Facility, Warehouse, Residential Buildings and Field Toilet not in use	3
14	Vranje Station	km 354+205,70	Station Building, Field Toilet, Small building, S&T Facility, Coffee Peron and Warehouses	5
15	Ristovac Station	km 365+725,30	Station Building, Office Building and S&T Facility	6
16	Bujanovac Station	km 373+692,50	Station Building, Field Toilet, Container, Warehouse and S&T Facility	5
17	Bukarevac Intersection	km 386+549,60	Station Building, S&T Facility, Field Toilet and ETS Facility	3
18	Presevo Station	km 392+309	Station Building, S&T Facility, Field Toilets, Police Station, Customs Facility and Warehouse	7

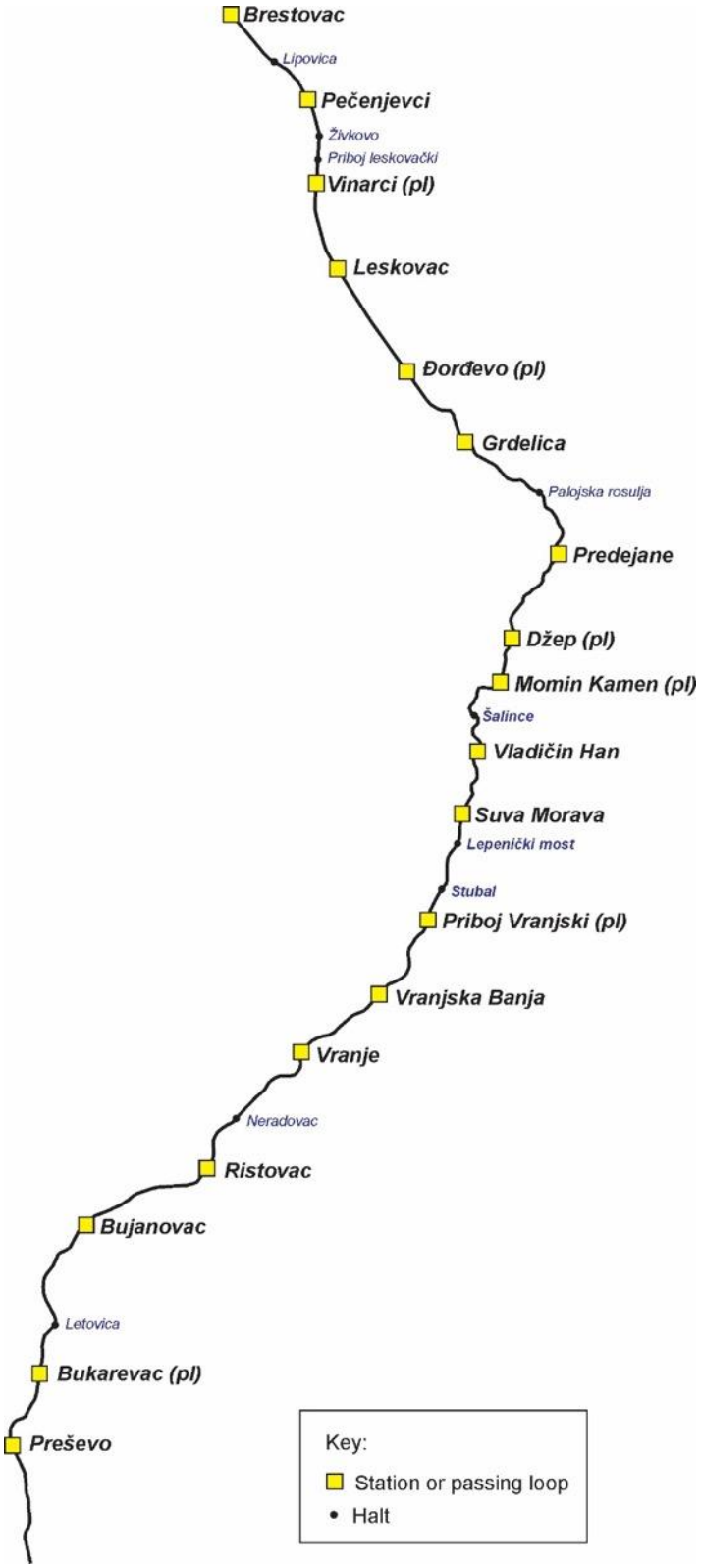


Figure 6 Overview of existing station facilities

4.1.4 Overview of existing bridges

There are 11 bridges on the railway line Brestovac – Presevo - State border, mostly steel bridges:

1. Steel bridge across River Jablanica, km 274 + 097, L=31,52 m
2. Steel bridge across River Veternica, km 285 + 068, L=31,52 m
3. Steel bridge across River Južna Morava, km 300 + 327, L=55,60 m
4. Steel bridge across River Južna Morava, km 302 + 598, L=55,60 m
5. Steel bridge across River Južna Morava, km 305 + 072, L=2x44,10 m
6. Steel bridge across River Južna Morava, km 309 + 335, L=41,80 + 21,28 m
7. Steel bridge across River Južna Morava, km 311+821, L=2x44 m
8. Steel bridge across River Južna Morava, km 326 + 230, L=2x34,10 m
9. Steel bridge across River Južna Morava, km 343 + 334, L=41,80 m
10. Steel bridge across River Južna Morava, km 353 + 109, L=64,30 m
11. Steel bridge across River Južna Morava, km 364+516, L=55,90 m

Two bridges, at km 274+097 and km 275+068 have been identified with open topics which will require urgent maintenance. The bridge at km 285 + 068 is with the longitudinal girders cracked in several places. These girders require urgent remediation.

The general impression is that the bridges are in satisfactory condition. However, it has been noted that the bridges are not maintained, but there are no damages that would affect the traffic safety, except for the two objects mentioned. It can be concluded that maximum speeds at the bridges are below 70km/h.

4.1.5 Overview of existing tunnels

1. Tunnel no. 1 "Grdelica" from km 307 + 508 to km 307 + 678, with a length of ~ L = 170m.

The tunnel was built in 1885, according to the old type no. 11 of the Serbian railways. Tunnel is partly in the direction and in the left curve radius R=300 m. Vertical gradient is +5.6 ‰.

During the electrification of the railway Nis-Presevo-Border with North Macedonia in 1974, in order to achieve the dimensions of the gauge for electric traction, the elevation of track was lowered, by reducing the height of the ballast, which is now with a variable thickness of 0-5 cm. In 2010, works were carried out on cleaning the drainage channel in the tunnel and replacing the ballast, so that now the tunnel is in general good condition.

2. Tunnel no. 2 "Letovica" from km. 324 + 291 to km. 324 + 775, with a length of L ~ 483 m.

The tunnel was built in 1885, according to the old type of Serbian railways, in a complex left curve R = 350, 500 and 360 m, with a gradient of +1.94 ‰. The drainage channel in tunnel is in the good condition. Very little penetration at the exit part of the tunnel. The track is in good condition. Due to the destabilized retaining wall in front, and the lining wall behind the tunnel, driving is limited to 30 km/h.

3. Tunnel no. 3 "Hanski" from km. 328 + 292 to km. 328 + 694, with a length L ~ 402m.

The tunnel was built in 1885, according to the old type of Serbian railways. Tunnel is in the direction and in the right curve R=550 m. Vertical gradient are + 4.82 ‰ and +5.45 ‰.

There was a deformation of the support on the right side, in the length of 25 m, which led to a reduction of the gauge, so the repair of this support also needs to be done as soon as possible.

At the entrance part of the tunnel "Hanski" on the right side, due to the activation of the landslide, there was an increased pressure of the mountain mass, which led to cracks in the tunnel wall, as well as permanent landslides in the drainage channel. Due to the erosion of the material and the filling of the drainage channel, drainage from the tunnel is difficult, which is reflected in the condition of the track curtain in the tunnel, and thus in the stability of the track.

At the beginning of 2018, the tunnel was temporarily repaired, within in the portal camp were installed centres.

In order to preserve the safety of railway traffic on that part of the line, the speed is limited to Vmax = 10 km/h. Reinforced security service was introduced to prevent possible further deterioration of the situation.

4.1.6 Overhead contact line (OCL) - current situation

The line is single-track along its entire length and is electrified by a single-phase system of 25 kV, 50 Hz. It was built in the early 1970s. The catenary network on this line is of standard construction, without Y-rope at the suspension points of the overhead contact line, allowing a maximum train speed of 120 km/h.

During operation, the components of the catenary are exposed to the effects of weather and operating conditions that significantly affect their service life. Since the existing catenary is almost 50 years old, all the considered scenarios require a general reconstruction, i.e. the construction of a new OCL in accordance with the proposed scenarios.

4.1.7 Overview of existing level crossings

There are 78 identified level crossings. Their position, way of protection and type of road is presented in the following table.

Table 8 Existing level crossings

No.	Chainage	Intersection with state road	Protection level
1	267+141	No	Road vertical signalization
2	268+318	Yes	Barriers with traffic lights
3	269+410	No	Road vertical signalization
4	270+846	No	Road vertical signalization
5	273+221	Yes	Barriers with traffic lights
6	277+182	No	Road vertical signalization
7	281+699	No	Road vertical signalization
8	283+386	No	Road vertical signalization

No.	Chainage	Intersection with state road	Protection level
9	284+841	No	Road vertical signalization
10	286+071	No	Barriers with traffic lights
11	287+137	No	Barriers with traffic lights
12	287+994	No	Barriers with traffic lights
13	288+608	Yes	Barriers with traffic lights
14	290+488	No	Barriers with traffic lights
15	292+198	No	Road vertical signalization
16	293+192	No	Road vertical signalization
17	295+077	No	Road vertical signalization
18	296+562	No	Barriers with traffic lights
19	298+424	No	Road vertical signalization
20	298+992	No	Road vertical signalization
21	300+375	No	Road vertical signalization
22	302+530	No	Road vertical signalization
23	304+277	No	Road vertical signalization
24	305+527	No	Road vertical signalization
25	307+405	No	Road vertical signalization
26	308+607	No	Road vertical signalization
27	311+727	No	Road vertical signalization
28	312+001	No	Barriers with traffic lights
29	313+856	No	Road vertical signalization
30	315+973	No	Road vertical signalization
31	318+503	No	Road vertical signalization
32	320+178	No	Road vertical signalization
33	321+347	Yes	Barriers with traffic lights
34	321+987	No	Road vertical signalization
35	322+943	No	Road vertical signalization
36	328+979	No	Road vertical signalization
37	329+977	No	Road vertical signalization
38	331+305	No	Road vertical signalization
39	333+585	No	Barriers with traffic lights
40	335+404	No	Barriers with traffic lights
41	335+818	Yes	Road vertical signalization
42	337+986	No	Road vertical signalization
43	338+992	No	Road vertical signalization
44	340+141	No	Road vertical signalization
45	341+749	No	Road vertical signalization
46	342+800	No	Road vertical signalization

No.	Chainage	Intersection with state road	Protection level
47	344+230	No	Barriers with traffic lights
48	346+505	No	Road vertical signalization
49	347+121	No	Road vertical signalization
50	347+598	No	Road vertical signalization
51	348+691	Yes	Barriers with traffic lights
52	349+531	No	Road vertical signalization
53	352+085	No	Road vertical signalization
54	353+834	No	Barriers and traffic signs
55	355+081	No	Road vertical signalization
56	361+872	No	Barriers with traffic lights
57	362+949	No	Road vertical signalization
58	365+272	Yes	Barriers with traffic lights
59	366+788	No	Barriers with traffic lights
60	367+478	No	Road vertical signalization
61	369+243	No	Road vertical signalization
62	372+160	No	Road vertical signalization
63	373+435	No	Barriers and traffic signs
64	374+310	Yes	Barriers with traffic lights
65	376+491	No	Road vertical signalization
66	379+102	No	Road vertical signalization
67	380+702	No	Road vertical signalization
68	382+789	No	Barriers with traffic lights
69	384+745	No	Road vertical signalization
70	386+253	No	Road vertical signalization
71	387+953	No	Road vertical signalization
72	390+284	No	Road vertical signalization
73	391+135	No	Road vertical signalization
74	391+712	No	Barriers with traffic lights
75	392+567	Yes	Barriers and traffic signs
76	394+786	No	Road vertical signalization
77	396+179	No	Road vertical signalization
78	399+377	No	Road vertical signalization

4.1.8 Telecommunication and signalling systems

Railway line from Nis to Presevo is equipped with outdated signalling and telecommunications equipment which is 35 years old. Signalisation is out-dated and without a realistic solution to incorporate it into a modern system. Existing signalisation is entirely incompatible with the modern facilities for station interlocking, open track interlocking and level crossing interlocking. The installed

technology is obsolete to the level that it is not compatible with the similar facilities used in the European Union countries. Ultimately, the long term negligence has brought these facilities in the condition that it requires a total replacement and renewal with modern signal-safety equipment. The overall situation of safety-signalling facilities on this railway section requires a comprehensive rehabilitation and bringing to the full compatibility with actual Technical Conditions for Signalling.

Level crossings' signalling shall also be taken in consideration. The basic signalling installation shall be designed to present a contemporary, standardised, reliable and cost-efficient solution, meeting the safety requirements and standards.

Taking into account that the Presevo railway station is a border station with the neighbouring country North Macedonia, interoperability of the European high-speed rail system and Directive 2001/16/EC on the interoperability of the European conventional rail system must be met through modernisation of TK and SS systems.

4.2 Status of technical documentation development

4.2.1 Inception report

The Inception Report was prepared and submitted to the Beneficiary and lead IFI for review on 26 August 2020.

The IR analysed the Key Issues identified and proposed ways for their resolution. It also included in detail a proposal for methodology timeframe and output for the subsequent stages after the Inception Period, including resources and the budget required for the next stages on the assumption of following the speed options as referred to in the ToR for the 3 subsections of the railway line: namely 120km/h-80km/h-120km/h.

Two new activities were added to the workplan: 1st Level Options Analysis and preparation of the Spatial Plan which were accordingly budgeted. The IR also presented in detail the budgeting of topographic and geotechnical surveys.

Alternatives for the Option Analysis were discussed:

1. Speed options and type of railway track on subsections Brestovac-Grdelica Gorge/Grdelica Gorge/Grdelica Gorge-North Macedonia:
   - 120km/h-80-120 single track
   - 120-120-120 single track
   - 160-120-160 single track
   - 160-160-160 double track
2. Subsection Nis-Brestovac to be included in the 1st Level Options Analysis with respect to Speed Option "160-160-160 double track" only.
3. 160-160-160 single track.

Following several series of comments, Version 3 (V3) of the IR together with the comments/response matrix was submitted on 5 November 2020.

4.3 1st Level Option Analysis

On 3 December 2020, a meeting was held with the aim to discuss 1st Level Options Analysis (LOA) and issues outstanding from the Inception Phase.

1st LOA started on 8 March 2021 when IPF8 Team organised an Initial workshop where workplan was prepared and discussed.

The Consultant has delivered the 1st LOA Report which summarized the intermediate outputs of the project on 16 December 2021. Intermediate reports were delivered in stages during this phase as part of the 1st LOA and included:

- MCA Methodology Report,
- Traffic Study Report,
- Railway Stations Report,
- Outline Design Report,
- Details of cost estimates,
- CBA Report,
- MCA Report and evaluation of the options.

The Final 1st LOA Report, which took into consideration the above comments, was submitted on 20 May 2022.

Taking into consideration the intermediate reports of the IPF8 Study, JASPERS issued Guidance Note N°2 on 23 November 2021, independent of the conclusions of the intermediate reports. In this Note JASPERS identified several issues with the criteria and process adopted for the MCA. Making a further micro-evaluation of time savings versus cost per subsection (which was not part of the IR approved methodology) and particularly for the Grdelica Gorge (2nd subsection of the line), JASPERS introduced a new option and recommending to move on to the next stage (Feasibility Study and Preliminary Design including 2nd Level Option Analysis) on the following basis:

- *Sections 1 and 3 to be assessed on the basis of the 160 km/h target (i.e. up to 160 km/h), which should include optimising and refining the alignment as to achieve the maximal positive ratio between the benefits and costs.*
- *Section 2 alignment, once necessary surveys for obtaining reliable geo-reference data have been completed, on the basis of the target of the 80 km/h, to be analysed in more detail zooming in the assessment in view of refining the alignment as to minimise the cost and the negative E&S impacts. Where higher speed may be achieved without any significant cost increase and if justified from the operational point of view, it should be considered in the design. This can be done only after the appropriately detailed information about the area and existing alignment is available, i.e. during the next project stage.*
- *Hereinafter, the above-recommended option (160-80-160 km/h – single line) is called "Optimised Option".*

and the following conclusion:

- *"In summary, we recommend closing the 1st Level Option Analysis with the conclusions above."*

Confirmation to proceed with the "Optimised Option" was received by email from EIB on 23 March 2022, having themselves being informed by Serbian Railways Infrastructure (SRI) to proceed with this option. In this message, EIB instructed the Consultant:

- *to prepare proposal and methodology for preparing the Feasibility Study, Environmental and Social Impact Assessment, Preliminary Design and Tender Documents for this option.*
- *While civil works, track superstructure and electrification should cover the Brestovac - Presevo (State border) section, the ERTMS Level 2 and telecoms should cover the entire Nis - Presevo (State border) line.*

In the direction of preparing the proposal, a preparatory meeting to confirm the scope and strategy was held on 31 March 2022 between the Ministry, the Beneficiary (SRI represented by its CEO) and IPF8. The conclusions were the following:

- Telecom and signalization design will be a component in itself.
- Serbian railways prioritises this section with the objective of finalising the designs in 2-3 years, with construction starting thereafter. Particular priority will be given to the section covered by this project and Nis - Belgrade section, after the construction of the link to Hungary through Subotica is completed.
- Spatial Plan has to be done for the entire railway corridor.
- In order to ensure efficiency and avoidance of overlaps, SRI is organising common meetings that take place regularly for all project teams working on railway sections on Corridor 10.

4.4 Schematic and Preliminary Design

It was concluded after the First Level Options Analysis Report (May 2022), that the preferred option for consideration was a combination of Options 1 and 4 in that report, i.e. 160 km/h for Subsections A and C, and 80 km/h for Subsection B. Subsection B passes through the Grdelica gorge and would be very expensive to reconstruct for 160 km/h.

Based on the analysis of the existing situation, and conducted option analysis carried out, a conceptual solution for the reconstruction, modernization and construction of a single-track railway line for passenger and freight traffic with 160-80-160 km/h was prepared. This will be followed by the preparation of Schematic and Preliminary Designs.

Solutions are defined for the following:

- the route of the single-track railway and stations,
- objects on the railway: bridges, underpasses, overpasses, culverts
- hydrotechnical facilities
- architectural structures

› de-levelled crossings with roads.

4.4.1 Railway alignment

Optimised option starts in Brestovac station at Km 267 + 942, and ends at the border with North Macedonia (Tabanovce) at Km 396 + 325.

Technical elements:

› alignment length: 130.87 km,
› air distance of start/end point of the alignment: 103.03 km,
› number of horizontal curves: 113,
› minimum radius of horizontal curves (Rmin) = 300m,
› total curve length: 50,641.34 m or 38.69 %,
› total straight length: 85,233.62 m or 61.31%,
› maximum gradient: 11.58‰ along 5,957.66 m,
› average radius of horizontal curves: 760.85 m,
› curvature coefficient of alignment: 24.37°/km,
› curvature factor: 130.87/103.03 = 1.27,
› total length of bridges: 2.42 km (1.85% of total alignment length), longest bridge is 120 m,
› total length of tunnels: 1.69 km (1.29% of total alignment length), longest tunnel 591 m (on subsection 3, new tunnel),
› the number of tunnels on subsection 2 will remain as now and Letovica tunnel will be on a new alignment:
- Tunnel Grdelica – 170.27 m,
- Tunnel Letovica – 526.77 m,
- Tunnel Hanski - 402.4 m.
- Construction of a new tunnel on subsection 3: - 591 m.
› the total length of open alignment: 126.76 km (96,86% of the total alignment length),
› all stations and passing points that still exist today, will be retained in operational condition, except Vinarci passing points (leaving 9 stations and 8 passing points).
› Subsection 1 – km 267+942 – 299+228
› Subsection 2 – km 299+228 - 334+098
› Subsection 3 – km 334+098 – 398+816

Table 9 Summary of alignment interventions - Optimised option

SUBSECTIONS	REHABILITATION AND MODERNIZATION[4]	%	RECONSTRUCION[5]	%	TOTAL LENGTH
Subsection 1	27729	89%	3557	11%	31286
Subsection 2	17775	51%	17095	49%	34870
Subsection 3	16636	26%	48082	74%	64718
TOTAL	62140	47%	68734	53%	130874

4.4.2 Railway facilities - Stations and official posts

The following table shows all official places on the Niš – Presevo railway line optimised option, their chainage, station building and facilities and their role

Table 10 Proposed facility composition in Optimised option

No.	Station/Intersection	Location	Station Building and Facilities
1	Brestovac Station	km 267+942.00	Station Building, Warehouses, Field Toilets and S&T Facility
2	Pecenjevce Intersection	km 275+564.00	Station Building, Warehouse, Field Toilets and S&T Facility
3	Leskovac Station	km 287+568.00	Station Building and S&T Facility
4	Djordjevo Intersection	km 295+779.00	Station Building and S&T Facility
5	Grdelica Station	km 301+514.60	Station Building, Residential Building, Field Toilet, Warehouse and S&T Facility
6	Predejane Station	km 310+973.35	Station Building, Field Toilets, Warehouse and S&T Facility
7	Momin Kamen Intersection	km 321+520.08	Station Building, Residential Building with small Warehouse and S&T Facility
8	Vladicin Han Station	km 326+959.39	Station Building, Warehouse and S&T Facility
9	Priboj Vranjski Intersection	km 338+541.58	Station Building and S&T Facility
10	Vranjska Banja Station	km 344+904.62	Station Building, S&T Facility, ETS Facility, Warehouse, Residential Buildings and Field Toilet not in use
11	Vranje Station	km 351+007.62	Station Building, Field Toilet, Small building, S&T Facility, Coffee Peron and Warehouses
12	Ristovac Station	km 362+354.69	Station Building, Office Building and S&T Facility
13	Bujanovac Station	km 370+264.41	Station Building, Field Toilet, Container, Warehouse and S&T Facility
14	Bukarevac Intersection	km 382+650.77	Station Building, S&T Facility, Field Toilet and ETS Facility
15	Presevo Station	km 388+262.01	Station Building, S&T Facility, Field Toilets, Police Station, Customs Facility and Warehouse

[4] intervention within existing railway corridor

[5] intervention outside existing railway corridor

4.4.3 Formation

Width of formation of the open single-track railway line, which ensures the safety space, working paths and accommodation of electrical engineering and other equipment, is 6.6 m. Formation's cross fall is one-way with inclination of 5%.

On parts of the railway line where protection against noise is needed, design envisages mounting of noise protection barriers whose height is to be determined during the design process which will be installed on the formation edge.

Topsoil shall be stripped in 30-50 cm layer, and exact thickness of the topsoil shall be determined on site. After topsoil stripping, the foundation soil shall be compacted.

On the part of the terrain with lower bearing capacity, placing of geocomposite is envisaged. Slopes are envisaged to be topsoiled and grassed on the entire section.

4.4.4 Drainage

The railway line drainage addresses the drainage and protection of the designed railway line against rainwater from the track bed and from hillside waters from the sections of the railway line which are in cut. The design also includes the drainage of water from the designed structures along the railway line. These are road deviations, overpasses and underpasses and bridges.

The design addresses the drainage and protection of the designed railway line from stormwater, the protection against hillside waters on sections of the railway line which are in cut and parts of the railway line which on the embankment when the terrain falls towards the railway line. Channels are envisaged on one or both sides, depending on the railway line finished level and the configuration of the surrounding terrain. On the sections of the railway where the embankment is higher and where, in the transverse sense, the terrain "falls" from the railway line, no channels are envisaged.

Dimensions, layout and levelling solution of the drainage channel will be defined during design process being conditioned by the existing structures on the alignment, longitudinal and cross falls, relevant rains and catchment areas. The location of the channel is part of the railway line civil engineering design. The same applies to railway station drainage.

For drainage of track bed in railway stations, drainages are designed and fit into the railway line drainage system.

The collected water is discharged to the nearest recipient by the shortest route. During the design process it will be defined if open infiltration ponds will be envisaged, representing green artificial depressions in the soil, with layers of broken rock and gravel at the bottom, which are occasionally filled up during heavy rains and completely emptied in dry weather. An alternative would be absorbing wells and/or drainage fields.

The principle in locating the infiltration facility was to keep it at a minimum distance of 5 m from the edge of the slope of the railway embankment.

The drainage principle for the railway line in the zones of sanitary protection of water source areas is, like in the remaining part of the railway line, by channels, with the following additional elements:

- lineside channels are concrete on the entire height, with dimensions larger than the ones required for drainage of the track bed, so that it can retain the incident amount of fluid which could possible spilled from the tank wagons.
- the entire surface under the superstructure is separated by foil to the channel, so that the possibly spilt pollutant could safely end up in the channels.
- in front of the outflow into irrigation canals or absorbing well, separators with settling basins are envisaged, and space is reserved for installation of tertiary treatment, should the need for it arise in the future.
- floodgates will be envisaged at entry to the separator for the purpose of control in case of incidents.

4.4.5 Permanent way

The characteristics of permanent way elements are:

- width of subgrade 8.00 m;
- type of rail 60E1;
- concrete sleepers 2.60 m;
- elastic rail fastenings.

At stations and passing points, depending on the option and design speed, the planned types of switches on the main through track and relief tracks will be:

- 60E1-300-60 (Vdirection=140 km/h; Vturn=50 km/h)
- 60E1-500-1:12 (Vdirection=160 km/h; Vturn=60 km/h).

In the stations (V=160 km/h), double-sided platforms are planned, 400 m long and 55 cm high.
In the passing points (V=80 km/h), double-sided platforms are planned, 110 m long and 55 cm high.

For the purposes of protection against harmful effects of train derailment, design envisages guard rails type 60E1 with elastic rail fastenings, which are to be placed on bridge structures and at 10.4m in front of and behind the bridge. Concrete sleepers with even top surface are envisaged, onto which running, and guard rails shall be mounted via double steel base plates.

This design includes the design of superstructure on bridge structures and on 10.4m length in front of and behind the bridge structures (from the beginning to the end of guard rail).

After laying the new rails, preventive grinding is necessary to remove the initial roughness on the upper surface of the rail head and the layer with uneven carbon content, as well as irregularities resulting from the superposition of the tolerance during the laying of tracks (including lining and levelling).

In the course of operation of the railway line, flat and smooth-running surface of rails should be provided. When repairing the rails, it is necessary to remove all bulges and dents at the welding points. Maintenance plans should anticipate and implement regular grinding of the rails.

4.4.6 Structures

4.4.6.1 Subsection A, Brestovac–Grdelica

This subsection of 34.0 km has been constructed with a design speed of 120 km/h, though the present maximum allowable speeds limit the actual average speed to 83 km/h. The proposal is to upgrade this subsection to 160 km/h standard, which could reduce the time taken for a non-stop journey at maximum speed from 25 to 13 minutes.

The structures along this subsection are shown in Table 11. Underpasses and bridges of 15 m or less are not included in the table, but if retained they will all need renewal also.

Table 11 Structures in subsection A

Location (km from Belgrade)	**Type of Structure**	**Name**	**Remarks**
274.1	Bridge	R. Jablanica	31.5 m. Requires urgent maintenance
285.1	Bridge	R. Veternica	31.5 m. Requires urgent maintenance
300.3	Bridge	R. South Morava	55.6 m Requires maintenance

There are no tunnels on this subsection. The three main bridges are of steel and more than 100 years old and need to be replaced.

The superstructure of the 13.8 km long subsection between Vinarci and Djordjevo was rehabilitated in 2017 through a Russian loan. Bridges and culverts were not included then, however, and need to be considered in the present proposals. There are 20 road-rail level crossings on this subsection.

4.4.6.2 Subsection B, Grdelica–Suva Morava

This subsection of 32.2 km was constructed with a design speed of 70 km/h. This would be raised to 80 km/h under the proposals. The currently allowable speeds only enable an average of 49 km/h to be reached. The 80 km/h standard could reduce the time taken on a non-stop journey at maximum speed from the present 36 minutes to 24 minutes.

The structures along this stretch of line are shown in Table 12. Underpasses and bridges of 30 m or less are not included in the table, but if retained they will all need renewal also.

Table 12 Structures in subsection B

Location (km from Belgrade)	**Type of Structure**	**Name**	**Remarks**
302.6	Bridge	R. South Morava	55.6 m

305.1	Bridge	R. South Morava	44.1 m + 44.1 m
307.5	Tunnel	Grdelica Tunnel	170 m
309.3	Bridge	R. South Morava	41.8 m + 21.3 m
311.8	Bridge	R. South Morava	44.0 m + 44.0 m
324.3	Tunnel	Letovica Tunnel	483 m
326.2	Bridge	R. South Morava	34.1 m + 34.1 m
328.3	Tunnel	Hanski Tunnel	402 m. Loading gauge reduced

The bridges are of steel and more than 100 years old and need to be replaced.

There are 18 road-rail level crossings on Subsection B. The subsection has many curves and simply to reach the 80 km/h design requirement requires 16.7 km of new alignment that include the adaptation of existing approaches to curves. 48% of the existing alignment would be retained. All the existing bridges need replacement and major works are needed to reconstruct the tunnels. The non-stop journey time at maximum speed would reduce from 36 minutes today to 24 minutes.

4.4.6.3 Subsection C, Suva Morava–Border

This subsection of 66.4 km was mostly constructed with a design speed of 110 km/h. In its present condition the maximum allowable speeds limit the average speed to 73 km/h. This would be increased to 160 km/h under the proposals.

Such an increase could reduce the time taken on a non-stop journey at maximum speed from the present 54 minutes to 24 minutes, a saving of 30 minutes.

The structures along this stretch of line are shown in Table 13. Underpasses and bridges of 30 m or less are not included in the table, but where retained they will all need renewal also.

The superstructure of two smaller subsections was rehabilitated in 2017 by Russian loan. Bridges and culverts were not included then, however, so need to be included in the present proposals. Parts of these rehabilitated sections would become redundant due to realignment.

Table 13 Structures in subsection C

Location (km from Belgrade)	**Type of Structure**	**Name**	**Remarks**
343.2	Bridge	R. South Morava	90 m
347.2	Bridge		35 m
352.9	Bridge	R. South Morava	120 m
364.0	Bridge	R. South Morava	120 m
373.7	Bridge		35 m

The bridges are of steel and more than 100 years old and need to be replaced. Three of the stations appear to have light traffic, but the others almost none. The halts would be closed, though the potential of Stubal should be checked, as it may be worth keeping. The stations on this part of the line have not traditionally been served by the international trains, other than the border station at Preševo.

There are 38 road-rail level crossings on Subsection C.

To reach 160 km/h on Subsection C requires a new alignment over a total length of about 48 km. Only about 27% of the existing alignment would be retained. Suva Mora passing loop would be omitted. The total length would be reduced from 65.4 km to 64.7 km. The number of major (steel) bridges would rise from 5 to 8. The few other remaining installations and structures would be renewed.

4.4.7 Electrification

4.4.7.1 Overhead Contact System

The reconstructed and modernized railway line is envisaged to be electrified with single-phase system, 25kV, 50Hz.

4.4.7.2 Electric Traction Substations and Sectioning Posts

Within the scope of reconstruction, modernization and construction of single-track railway line Nis – Presevo it is necessary to perform the reconstruction and modernization of the existing power supply substations and sectioning posts located on this section.

4.4.7.3 Transformer Substations 25/0.23 kV from the Overhead Contact System

For back-up supply of signalling and interlocking devices, devices for control of motor-driven disconnectors and switch point heating, on the section Nis – Presevo transformer substations (TS) supplied from the overhead contact system are envisaged, whereof ratio is 25/0.23 kV, power: 5kVA, 50kVA and 100kVA.

4.4.7.4 Remote Control of the Fixed Electric Traction Installations

Preliminary design will contain the design of the temporary remote-control centre located in the premises of the existing centre (CDU Nis) and local and remote control of motor-driven disconnectors. The design envisages equipment (and software) of temporary remote-control centre for fixed electric traction installations.

4.4.8 Signalisation and telecommunication

The designed solution envisages the equipping of all stations on the subject section of the railway line with electronic interlocking devices in all unequipped stations, with centralized setting of switches (via electronic devices) and automatic routing, setting, locking, control and release of train routes through the station area. The design will also include modernisation (new interlocking devices) of level crossings where applicable.

Design solution for telecommunication facilities will include design of telecommunication systems in new stations and stops (common structural network, master clock, Passenger Announcement (PA) system (video and sound), video surveillance system, automatic fire alarm system), design of railway

telecommunication systems along the new alignment (fibre optical lineside cables, dispatcher and trackside telephone devices, radio-dispatching system; GSM-R system, transport system, station telecommunication systems). This will also include design of premises for accommodation of all mentioned telecommunication facilities with corresponding access roads.

5 Environmental and Social baseline

This section describes the main components of the physical and natural baseline environment in the area affected by the implementation of the proposed Project. The characterization of the existing environment and identification of sensitivities along the proposed railway alignment have involved a comprehensive desk review of a wide range of existing data sources.

5.1 Environmental baseline

The area of influence for the environmental parameters has been determined as an area of 500 m left and right from the railway axis with possibility, if needed, to extend the area up to 5 km to cover biodiversity and other specific social impact that will be determined in detail in the next stage of E&S assessment. Due to lack of primary data (i.e. air, noise, surface water measurements, potentially contaminated locations), the fact that no field surveys were carried out and the preliminary stage of the study, information was provided for all environmental parameters to the possible extent. Efforts have been done so that the information provided herein is adequate for meeting the environmental performance requirements of international lenders and will satisfy public disclosure and consultation requirements, focused the impact assessment and informed management measures and mitigation commensurate to this stage of the Project.

All areas of influence for each parameter are presented in the impacts section, since each parameter has different sensitivity, i.e.at each side of the railway for biodiversity 500 m, landscape 1km, floods 1km, surface waters 0,5 km, groundwater 0,5 km, air and noise 0,2 km, vibration 0,1 km) and they will be taken into account at the baseline description for the ESIA per section.

5.1.1 Climate

The climate in the project area is continental to moderate-continental, and the amount of precipitation is usually up to 500-650 mm/year, while the air humidity is moderate. It is characterized by relatively colder winters, warmer autumns than spring and moderately warm summers. More specifically, low annual precipitation dominates, while the summer precipitation is characterized by strong evaporation due to high temperatures, with frequent occurrence of summer storms and showers. Winds are a very important factor causing differences in temperature, bringing precipitation or drought. Although the wind frequency is high especially in this area, its speed is low.

According to the map of climatic areas of Serbia (Ducić, V. et Radovanović, M., 2005), two main climate areas can be defined, A and B.

Climate area A includes Vojvodina and the Peripanonian rim, Pomoravlje and eastern Serbia, up to Nisava River. This climate area has the characteristics of a continental climate. Five sub-areas have been singled out within it: A-1-a, A-1- b, A-2-a, A-2-b and A-2-c. Having in mind the route of the railway, sub-area A-1-a

is only crossed by the railway. Sub-area A-1-a - encompasses the plains of Vojvodina and the Peripanonian rim, as well as the Leskovac valley. Absolute extreme air temperatures in this subregion range from -32.60C to 42.30C. The annual temperature amplitude is above 220C. The average winter temperature is above 100C, and in summer it is above 200C. Spring temperatures are slightly different from autumn temperatures. The average annual amount of precipitation in the lower regions is about 520 mm, and in some places over 650 mm. There is the least precipitation in winter, while spring precipitation is slightly higher than in autumn.

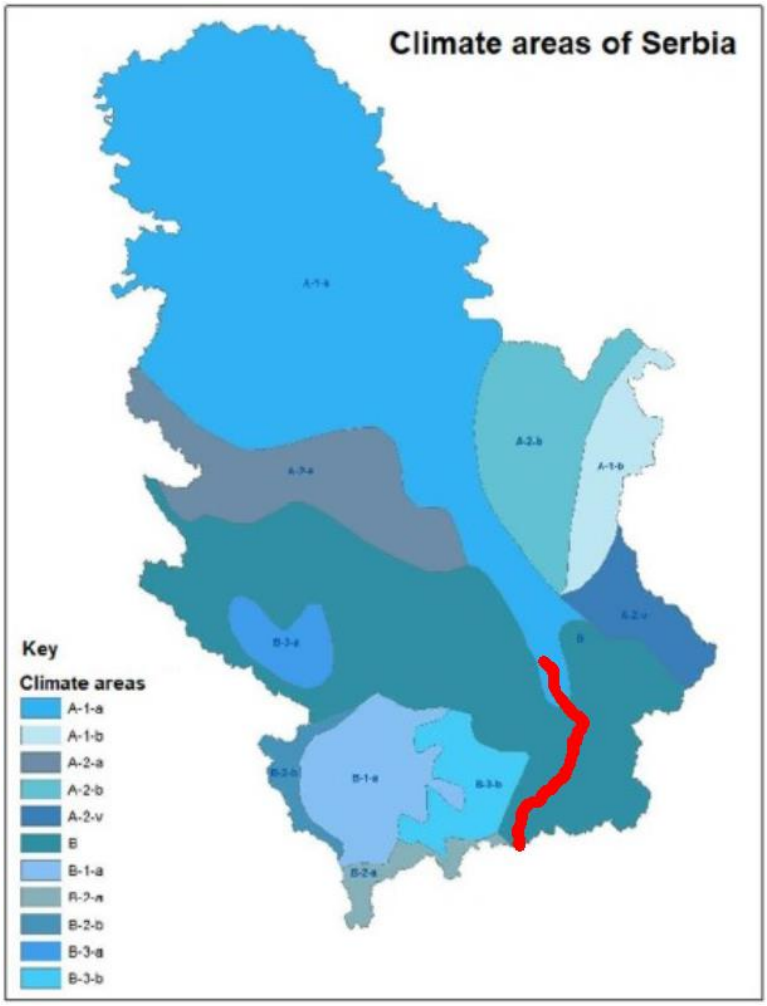


Figure 7 Climate areas in Serbia and railway route (red)

Climate area B covers the area from the border with North Macedonia and Bulgaria in the east and southeast to the border with Bosnia and Herzegovina and Montenegro in the west. It is bounded in the north by the valley of Zapadna Morava and Nišava, and in the southwest with the climate area V. The mountain massifs, most often covered with dense forest, are divided by numerous river valleys and basins, so that different types of climate change relatively often. Observed from the northeast to the southwest, the isobars are more densely grouped next to each other, that is, towards the Adriatic, the pressure drops more markedly. The average annual air temperature in Vranje is 10.8°C, Ivanjica 9.3°C, Bosilegrad 8.6°C, Zlatibor 7.1°C, Kukavica 6.5°C, Vlasina 5.7°C, Kopaonik 2.7°C

etc. These stations, with the exception of Vranje and Ivanjica, registered negative average monthly temperatures in February as well, and at Kopaonik in March. It is interesting that out of 78 studied stations in Serbia, average negative December temperatures occur only in this area (including both sub-areas). Outside of area B, negative December temperatures were recorded only on Crni vrh.

The analyzed data indicate that spring is colder than autumn, that is, that the difference becomes greater with the increase in altitude. Going from southeast to northwest, the share of spring precipitation decreases at the expense of autumn precipitation. For example, Vlasina receives 27.6% of precipitation in spring and 21.6% in autumn, while Zlatibor receives 24.8% in spring and 24.4% in autumn. Krnjača (1,225 m above sea level) near the border with Montenegro, with 1,344 mm of average annual precipitation, is one of the rainiest places in Serbia. Rain shadows and depressions are a relatively common phenomenon, which could be seen in the examples of Kopaonik and Golija, as well as the river courses at their foot. Rakićević (1980) states that Tara belongs to the climatic region with the highest air humidity in Serbia (83%) and the highest cloud cover (6.0-6.5 in the Lim basin).

Data on climate characteristics were analysed for the period 2000-2020 for the meteorological station Niš, for the meteorological station Leskovac and for the meteorological station Vranje. Information on the meteorological stations is given in the following table, while the figure that follows presents them in relation with the railway line.

Table 14 Meteorological stations data

Location	Coordinates		Altitude (m above sea level)	Established (year)
Niš	21°54E	43°20N	202	1889
Leskovac	21°57E	42°59N	230	1895
Vranje	21°55E	42°33N	432	1894

Station Nis

The lowest average annual air temperature for the observed period 2000-2020 year is 6.3 ^{0}C (2005) and the highest average annual for the same period is 20.2 ^{0}C (2019). The absolute maximum temperatures in this area reached the value of 44.2 ^{0}C, and the absolute minimum temperatures reached the value - 19.0 ^{0}C. The average annual amount of precipitation for the observed period from 2000-2020 ranged from the lowest 385.6 mm of water column, maximum 950.2 mm of water column.

The average annual humidity is about 69%. The average number of days with snow is 39.5, or 45 with snow cover. The largest number of days with fog is in the period from October to February, with the appearance of 13.7 days with fog during the year. The highest number of frosty days during the year occurs in the period from October to April, with the average number of frosty days occurring during the year being 79.7 days.

Figure 8 Meteorological stations near the railway line

The wind frequencies in directions, silences average and wind speeds in m/s for the period 1981-2010 are given in the following table and figure.

Table 15 Relative wind fractions in Niš by direction and silences and average wind speed in m/s, 1981-2010

	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	C
relative wind fractions (‰)	24	20	32	117	67	33	15	16	23	19	17	24	27	50	105	98	313
average wind speed (m/s)	1,4	1,8	2,1	2,1	2	1,7	1,6	2,2	2,6	2,1	1,9	1,3	1,4	1,9	2,8	2,3	

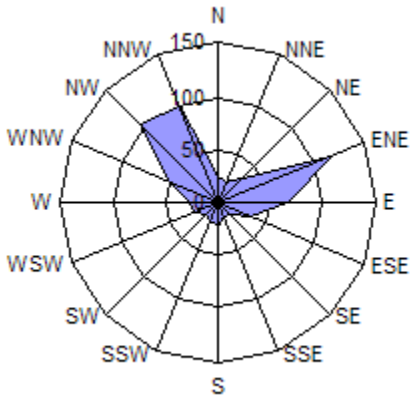


Figure 9 Wind data for the station of Nis

The dominant wind is from north – west, which is constant throughout the year. In the summer months, winds from the east and north are frequent.

Station: Leskovac

The climate is moderate – continental. According to the data of the Republic Hydrometeorological Institute, the average annual air temperature for the period from 1987-2006. year is 11.0°C.

Table 16 Average monthly air temperature in Leskovac for the period from 1987-2006

Month	Jan	Feb	Mar	April	May	June	July	Aug	Sept	Oct	Nov	Dec
^{0}C	-0.2	1.9	6.2	11.2	16.1	19.7	21.9	21.3	16.3	11.4	5.6	1.0

Average annual amount of precipitation – 622.5 mm of water sediment per m^2. The hottest months of the year are July with an average maximum air temperature of 29.4 ^{0}C and August with 29.5 °C. The coldest months are January with an average minimum temperature of -3.7 ^{0}C and February with -2.7°C. The average relative humidity is 72.9%.

Leskovac has an average of 75 clear and 111 gloomy days per year, while 48 days are under snow. North-west and south winds prevail in all seasons, with the highest speed during January, March and December.

Station: Vranje

The climate of this region is moderate-continental with a sub-variant of the parish climate in the Vranjska basin, to sub-mountainous and mountainous in the high-mountainous part of the city (Besna Kobila, Kukavica). Vranje is located in the southern part of the temperate climate zone of the northern temperate heat belt, so the southern climate influences are more pronounced compared to the northern ones.

The relief of the urban area of Vranje is the main climatic factor that determines the microclimatic properties. Thus, spring in the lower - southern, southeastern and eastern parts starts earlier than in the higher peripheral parts. In the mountainous hinterland, spring almost never occurs, because winter turns into summer. The basic climate indicators change with the change of the relief - with

the increase in altitude, the temperature decreases, humidity, cloudiness, precipitation increase, the pressure is lower, and in general the conditions become worse for people's lives. Next table shows climate indicators for the reference period 1981-2010 year for Vranje.

Table 17 Climate indicators for the reference period 1981-2010 for Vranje

Month	Jan	Feb	Mar	Apr	May	Jun	July	Aug	Sept	Oct	Nov	Dec	Year
average monthly temperature	-0.1	1.8	6.4	11.2	16.0	19.5	21.6	21.6	16.9	11.8	5.7	1.2	11,1
relative humidity (%)	81	75	67	64	65	65	61	60	67	73	79	83	70
duration of insolation	73,8	100,7	151,3	176,2	230,5	274,3	316,1	294,8	209,8	153,4	87,5	55,5	2123,9
mean monthly rainfall	35,4	38,3	38,2	52,0	56,3	63,2	44,7	43,2	46,7	52,4	57,4	50,5	578,3

Table 18 Relative wind fractions in Vranje by direction and silences and average wind speed in m/s, 1981-2010

	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	C
relative wind fractions (‰)	51	65	149	138	39	11	13	14	38	39	50	52	31	10	9	11	279
average wind speed (m/s)	4,3	3,5	4	4,2	3,6	2,2	2,2	2,4	3,3	3,4	4	4,3	4	3,5	3,3	3,6	

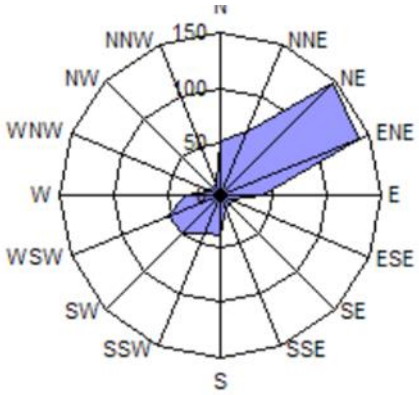


Figure 10 Wind data for the station of Vranje

5.1.2 Landscape

Landscape characteristics of topographical units that include the analysed corridor are an important element for understanding the overall relationship between the planned object and the environment. The analysis of the terrain established that the sections are provided through areas with different landscape and visual characteristics, which make up:

- The valley of the Južna Morava and the hills on the left bank of the Južna Morava; Grdelica gorge; the Južna Morava valley;

- Contact of hills and plain terrain which is mainly anthropogenically altered arable land;
- Constructed parts of the route where it passes through populated areas (Brestovac, Lipovica, Pečenjevce, Leskovac, Vladičin Han, Vranjska Banja, Vranje, Bujanovac, Preševo) including the E-75 (A1) highway corridor; and other infrastructure facilities.

Figure 11 Typical landscape in the South Morava valley through which the railway passes

The terrain in the corridor of the existing railway route from Niš to Preševo is slightly undulating, from the valley to the hilly terrain. The exception is Grdelica Gorge, through which a part of the railway passes in the part from Grdelica to Vladičin Han. In the wider part of the existing corridor, the mountains starting from north are the Suva Planina, Kukavica, Čemernik and Besna Kobila.

In respect to landscape, the most dominant element along the road corridor is open flat or undulating land covered with vegetation. A part of the corridor is characterized by scattered rural structures and individual buildings visually connected with the railway. Mountainous sections of the railway corridor have the most significant landscape value, especially in the area of the Grdelica gorge.

Structure and composition of ecosystems in the study area are defined by presence of river watercourses and surrounding relief. In the natural condition, the valleys were overgrown by hydrophilic (water-loving) plants, while surrounding hilly slopes were covered by Hungarian Oak (*Quercetum frainettocerris*) and Turkey Oak (*Quercus laevis*), as well as their transitional forms. However, under anthropogenic influences these ecosystems suffered significant changes. Existing line does not pass through the Nature Protected Areas (including Natura 2000). In respect to biodiversity, Grdelica gorge is the area of the highest sensitivity along the corridor. Although it is not formally protected, the Grdelica area is a refugium for tertiary flora, rare and endangered herbal species and mixed relic vegetation (some in The Red Data Book of Flora of Serbia). Some endangered and protected birds of prey, such as The Golden Eagle (*Aquila chrysaetos*) and The Peregrine Falcon (*Falco peregrinus*) are also present in the Grdelica gorge. These two species were identified by the Institute for Nature Protection as highly sensitive, and it will be necessary to protect them from

excessive the north. From the desktop research at this stage, no protected landscapes or high value landscapes have been identified in a distance of sensitivity of 1km.

Regarding landscape and ESIA per Section, there will be defined the topographical and morphological characteristics along the section, while the main landscape remarks will be identified, including land use, habitat and cultural heritage elements.

5.1.3 Geology

Taking into account existing data availability and the processing of data on geological conditions and characteristics along the corridor where the subject railway line is intended to be reconstructed, the following geological compositions can be expected:

Alluvium of different facies

t1-t3 river terraces

There are three levels of terraces. The oldest level (t3) has a relative height of 50-80 m, the middle level (t2) is 30-50 m high, and the youngest (t1) is only about 10 m. Alluvial sediments have a large distribution in the valleys of all strong and constant water flows (J. Morava, Nisava, Pusta reka, Jablanica, etc.). They are characterized by a very regular arrangement of geological components in the vertical sense. If we take as an example any vertical profile of the alluvial plain of any of the mentioned streams, we can almost always notice that in its base lie typical fluvial "colourful" gravels of the trough facies (in the sense of EV Shanzer, 1951), which sometimes cover sands of the same facies. Across the riverbed facies lie various dusty rocks of the floodplain facies (loam, sandstones, loess-like clays, etc.). In the Morava valley, in the area of Grdelička gorge, alluvial material is bound mainly to the riverbed and its immediate banks. The intense incision of the Morava did not allow the expansion of the valley. In places where the lake Neogene islands were wider, the sudden incision of the Morava created trapped meanders. This geological structure is conditioned by a certain dynamic development of each flow, depending on the degree of balancing of its longitudinal profile. Considering that the dead facies are found only sporadically in our part of the terrain and that they are still in formation today, we can conclude that the mature part of the prestratal phase has been reached on most of the alluvial plains of Nisava and J. Morava with certain modifications that characterize the early phase of the constitutive stage. In all other currents of a permanent character (Pusta reka, Veternica, Jablanica, etc.), the creation of the flood facies is in progress and it can be said that they pass through the early period of the prestratic phase.

d-diluvium

By diluvium we mean deposits that have become denudation processes on hilly slopes whose slopes range from 5-25°. Diluvium is well represented on all valley sides where asymmetry is present. Diluvial and mixed diluvial-proluvial deposits are well developed also on parts of crystalline shales that were covered with water during the Pliocene epoch. The lithological and petrographic composition of

diluvium differs from place to place. Within the diluvium in the Neogene areas, the main lithological components are loams and sandstones, while on crystalline shales deposits are formed with more fine detritus that tends to coarse-grained sands and even gravels. Roughly speaking, all diluvial formations in Neogene areas have a fine-grained composition, while those on crystalline shales are regularly coarser-grained.

p-proluvium

An important difference between proluvial and alluvial deposits is that the former do not show any regularity in the vertical profiles. Like alluvial sediments, they have the same lithological components - sandy loam, loam, lesoid clays, sands and gravels. All these components change irregularly either horizontally or vertically. In addition, while alluvial sediments form wide alluvial plains, proluvium is usually found in very narrow valleys (all streams within the crystalline shales and andesites of Radan), and, more characteristically, builds quite extensive alluvial cones (Kutinska reka, Grabovačka reka, Kamenica river, etc.). All alluvial cones are characterized by total non-layered material with chaotic and cross-stratification within different lithological components. At the root of each cone, there is usually coarse-grained material, while on its periphery, sandstones and loams with smaller lenses of gravel are observed. This is the so-called gradational stratification which can be explained by the weakening of the transmissive power of the flow that builds the cone. The proluvial terrace forms of the Pusta reka represent a transitional type between alluvial and proluvial formations. While morphologically they represent typical terraces, their geological structure is characteristic of proluvial deposits. The reason for the creation of significant amounts of proluvial material lies in the intensive surface decomposition of rocks and large amounts of water from occasional flows. The inconsistency of the longitudinal profiles of the tributaries with the incision of the southern Morava, especially in the area of the Grdelica gorge, significantly helped the creation of characteristic alluvial fans of proluvial material.

Pl - pliocene, gravels and sands, rarely sand clays

Pliocene sediments lie transgressively either over older Neogene sediments or over crystalline shales. Based on the transverse profile, it could be concluded that there is an angular discrepancy between them and the Mio-Pliocene deposits, but these relationships are not so clear in other parts of the terrain. The series is built mostly of gravel and sand, but in many places, in addition to the multiple alternation of basic lithological components, lenses or thin layers of sandy clays, clayey sands, and even real clays are observed. By analysing the vertical profiles of different localities, we come to the conclusion that the share of the clastic component always grows in the vertical direction. However, due to the lateral and vertical shifts of the lithological components, this relationship is usually not clear enough. This type of sedimentation is usually characterized by sediments deposited by constant and occasional water flows. The rollers in the gravel are usually unrounded or slightly rounded, which is also evidence of short transport of the material. Sandy members, in addition to the uneven granulometric composition, are characterized by a large presence of iron hydroxide, the average thickness of sediments being about 80 m. In the gravelly-sandy series, small amounts of groundwater are regularly accumulated, most likely due to the high

filtration coefficient. Larger amounts of groundwater, as a rule, are always in deeper parts in contact with clays, sands or crystalline shales. In cases where the mentioned contacts are located at the level or immediately above the surface drainage, there are very large movements, and within larger arms, there are also the appearance of broken springs.

E3- pyroclastics, volcanic breccias and tuffs

ψαq - tuffs, tuffites and volcanic breccias

The pyroclastite horizon occurs at the base of the Eocene series, and only on the north-eastern edge of the Pričnj basin. Pyroclastics have a variable thickness (10-750 m). Near Lepčinac, red pyroclastics are 10–80 m thick, while thicknesses up to 750 m are observed near Katalenac. In this locality, pyroclastics are dirty-white to grey in colour. In both localities, they have in common that in their upper horizons they gradually pass into the tuffogenic-sedimentary member of the series. In the locality of Katalenac, the pyroclastic component begins with agglomerates through which sparse and thin basins of andesite, tuff (about 50 m thick) and other agglomerates are layered. Tuffs are built of very tiny fragments of plagioclase, biotite, amphibole, and metallic minerals. In addition, fragments of andesite are observed. Cement is built of ash. The agglomerates differ from the tuffs in the size of the fragments, which reach the size of the fist in them. Cement is also here. In Lepčinac, only crystalloblastic and lithoclastic tuffs appear, which alternate with each other. They are constructed of fine-grained ash, feldspar and quartz crystals, and fragments of effusives.

M, Pl- sandstones and conglomerates, tuffs and tuffites

Clasts are represented by conglomerates, microconglomerates, arenites, siltstones and tuff limestones. The detritus of these rocks consists mainly of fragments of crystalline shale, quartz and much mica, while the pyroclastic material is subordinate. In coarse-grained arena, jets and lenses of conglomerates with transitional or erosion boundaries appear, and there are also blocks and smaller olistolites. The stratification is weakly expressed - it is characterized by rapid lateral shifts and irregularly lenticular body shapes. All these properties show that the sedimentation was very fast and strong, and that it took place in a very shallow environment. Tuffogenic rocks are represented by purple tuff micro-conglomerates, tuffites and tuff sandstones. Detritus in these rocks is most often of volcanic origin (large grains of zonal feldspars, fragments of volcanics and their basic masses, volcanic glass), while quartz has less. Fragments of crystalline shales are rare. The binder consists of matrix, volcanic ash and clay.

M2, Pl- gravel and sand, sandy limestone

After the tuff series, loose, poorly bound sediments are deposited, sometimes with layers of limestone of small horizontal distribution. This series is represented by loosely bound gravel sands, sands, sandy clays and sandy limestones. Sandy-gravel layers wedge laterally and vertically, turning into gravelly sands or sandy clays. Pebbles in loosely bound gravels are made of shales (lower and upper complex of the Serbian-Macedonian mass) and effusive rocks. The size of the pebbles ranges from 1 to 10 cm. In this series, sand fractions are the most represented. Sandy limestones appear very sporadically in the form of smaller layers in gravelly sand. In the upper part of this series, in the area of SW of

Vladičin Han (in Suva Morava), characteristic fragments of volcanic rocks are observed. This part of the series was also developed in the neighbouring Poljanica and would represent the connection between the Poljanica and Vranje basins. Hemispherical grains ("breads") in Suva Morava can be explained by the still falling plastic pieces of volcanic rocks during eruptions on the surface of the earth or in water. Fish teeth and vertebrae were found in the sandy clays around the village of Kruševica (Vlasotince 51). Based on the distribution of fish teeth of this shape in the Pliocene sediments of other localities, it is possible to assume only the Pliocene age of these sediments. The greatest similarities (in terms of mineral composition) in the Leskovac and Vranje basins are the youngest weakly bound gravelly-sandy sediments, which were most likely formed at the same time and connected after the tuff series. South-west of Modra Stena (Vlasotince 52) there is a small mass of tertiary loosely bound sands and gravels. This part represents the south-east continuation of the Zaplanje Tertiary for which the Lower Pliocene age was determined (M. Čičulić, 1961).

K32-Marl, clay and marl

Upper Cretaceous of Grdelica

It is developed on the left bank of Grdelica gorge, and to a lesser extent on the right, of the South Morava. Cretaceous sediments lie discordantly over crystalline shales and form a mass about 20 km long and about 2 km wide on average, which extends from the villages of Jastrebac through Mrtvica, Repište and Deja to Grahovo. On the right side of the South Morava, Cretaceous formations were developed in the area of the village of Sejaice. According to M. Jevremović (1962/63), four superposition packages with different facial development can be distinguished within the Cretaceous formations, as follows: a) coastal facies (conglomerates, sandstones with interlayers of coal and bituminous substances; b) shallow water facies (sandy-clay limestones, calcareous sandstones and marly sandstones); c) moderately deep-water facies (Pelagian sediments); d) final shallow water facies (limestones, breccias and conglomerates). Sedimentation was accompanied by a constant deepening of the deposition area with vertical oscillations that are common in the initial stages of deposition, at the time of formation of conglomerates and sandstones, which led to shallowing and formation of coal and bituminous sediments.

a) Facia of coastal shallow sediments

Conglomerates lie transgressively over crystalline shales and form the base of Cretaceous sediments; they build rockeries especially around Mrtvica and Repište. They are made of quartzite, chlorite, sericite and mica shales, 5-15 cm in size. The binder is clay and limonite cement; pore type predominates. Conglomerates of higher horizons are more homogeneous and mostly fine-grained. In these parts, the occurrence of coal and bituminous interlayers of small thickness and small horizontal distribution is frequent. Sandstones occur in the lower parts, mostly in the form of lenses. They are most often associated with conglomerates. Detritus consists of quartz, muscovite, rarely biotite, and quartzite fragments. Cement is usually clayey or clayey-limonite, more abundant than in conglomerates.

b) Shallow water sediment facies

As the depth of the sedimentation area increases and the mobility of the aquatic environment decreases, increasingly fine-grained sediments are gradually deposited. Sandy-clayey limestones, calcareous sandstones and marly sandstones are deposited in the lower parts of the package and contain limonite matter. Sandy-clay limestones are characterized by a continuous bank about 2 m thick, which is a lumachella from gastropods and other organisms. According to K. Petković (1931, 1951), its fauna is exclusively Santonian and represents the border between Santoni and Campana; this author includes all lower sediments in Santonian.

c) Faction of moderately deep-water sediments

Clays, marls and marly limestones are present in these facies. Clays and marls appear in the field in beautifully developed slabs 3 to 5 cm thick in alternation with marly limestones and lie above calcareous and marly sandstones. Marl limestones with Pelagian fauna vary in composition between calcareous marls and very marly limestones. They contain a very rich Pelasgian fauna, in some parts predominantly Globotruncana, which according to K. Petković (1931) corresponds to the middle campaign.

d) Faction of final shallow-water sediments

Above the moderately deep-water sediments are (on Deji - Crvena Njiva) shallow-water sediments: crystalline limestones with algae, ore-bearing limestones and conglomerates. Bright crystalline limestones with algae consist of light crystalline calcite and contain beautifully preserved lithotamnium, quartz grains and green fresh glauconite. Whitish crystalline limestones with ores are built of ore fragments filled with large calcite crystals. It is characteristic of these limestones that they contain chalcedony in cavities and cracks. They contain 91.4% calcium carbonate. According to K. Petković (1931), they belong to the upper campaign or the Lower Maastricht. The conglomerates are composed of weakly rounded fragments of quartzite, mica shales, chlorite-sericite shales, Cretaceous limestones, and fragments of flora. The size of the fragments ranges from 2 mm to several cm. The cement is carbonate, sandy, and in some parts contains more limonite material, which gives the rock a red colour.

αq -Dacites and andesites

The freshwater Upper Oligocene volcanogenic-sedimentary series ends with andesitic volcanism, which may partly pass into the Lower Miocene, and certainly ceases before the Helveto-Torton sediments in the Kriva Reka basin. Volcanic rocks are localized in the area between Busovata, Businac and Populanac. Andesitic volcanism is characterized by strong eruptions that gave very thick deposits of pyroclastic material in the form of agglomerates, tuffs (more subordinate) and breccias, whose total thickness exceeds 250 metres. The avalanche basins near Katalenac are up to several metres thick and are built by andesites with variations that move towards dacites. However, chemical analyses indicate that these variations are a consequence of physical conditions and not chemical differences because the percentage of silicon varies equally in both andesites and Dacian rocks. The structure of the lava is hypocrystalline porphyry with cryptocrystalline, less often hyalopylite and glassy base mass, in which the orientation of the microliths is observed as a consequence of the flow in the lava.

In addition to such andesitic lavas, hyaloandesites with a vitrophyre structure are also observed.

Andesites are composed of andesine, amphibole, biotite, and rarely quartz (phenocyte types). By-products are apatite, metallic minerals and, less commonly, sphene. In addition, monoclinic pyroxenes are observed in some samples. Andesitic rocks in Busovata and Bušinci build lion's covers, up to 59 m thick. Individual basins have a smaller thickness, up to several metres. In Populans, andesite occurs in the form of a breakthrough through the sediments of the final horizons of the Oligocene, during which it is slightly hydrothermally altered, localizing lead-zinc mineralization at the contact with the sediments or in the sediments themselves. Andesites belong to the amphibole-pyroxene type with a hypocrystalline porphyry structure and a microcrystalline base mass. Their mineral composition is sweetening: phenocrystals and microliths, plagioclase (about 40% An), hornblende (C: Ng = 12-17; 2V = 79° to —85°) which occurs with 15-25% among phenocrystals, and diopside (C: Ng = 40; 2V = + 45°), sparse and very small. By-ingredients are very rare; these are apatite and metallic minerals.

Dacit (αq)

Occurrences of tertiary effusive rocks in the examined area are very common. They build smaller masses, entanglements and swarms of wires and, rarely, spills. The largest occurrences of these rocks are located along the northern rim of the Surdulica granodiorite massif, then around Mačkatica, Predejan, Džep, Ruplje, Brod, Borino Do, Crtovo, east of Kalna, in the wider vicinity of Crna Trava and finally, as individual wires in several places in Surdulica granodiorite massif, west of Predejane and elsewhere. Isolation of certain groups of effusive rocks on the geological map was rather difficult, since all these rocks are more or less identical in appearance, as well as in their basic petrological character. The main differences between the individual representatives are in the crystallinity of the basic mass (microcrystalline, cryptocrystalline or hypocrystalline), the appearance of quartz, rarely sanidine among phenocrystals, or their withdrawal into the basic mass (according to which dacites, andesites and rare quartzlatites are isolated), hornblende (biotite-amphibole dacites, biotite dacites and amphibole-biotite andesites) and by the degree of freshness, i.e. intensity and character of alteration (propylitisation, sericitization, silicification, zeolitization, calcitation and surface alteration). However, petrologically, all these rocks are basically of Dacian character. Finally, it should be noted that it is very difficult to distinguish dacites with a coarse-grained microcrystalline base mass from granodiorite porphyrites (especially in the vicinity of the Surdulica granodiorite massif), since these rocks are very similar. The structure of these rocks is holocrystalline to very rarely hypocrystalline porphyry. The basic mass in holocrystalline varieties is cryptocrystalline to microcrystalline, sometimes granophilic.

G-granite

The Bujanovac pluton covers the central parts of the terrain, and has a general NW-SW location. The massif consists of a central granite body with a peripheral zone in which the forces of granite, ectinites and migmatites alternate. The central granitoid body also contains a large number of crystalline shale lenses, which are

more or less altered and granitized. Very rare are larger parts of the massif built exclusively of granite. During the intrusion, they migmatized and recrystallized the previously metamorphosed shales of the Serbian-Macedonian mass and (only partially) the metamorphites of the Veles series.

During the indentation of granite magma in the main intrusive phase, granodiorites, granites, plagiogranites and quartz diorites were formed by differentiation and assimilation. Microscopic examinations have determined that granodiorites and granites are the most abundant in quantity. The granitoids of this phase are mostly leucocratic rocks of the middle grain. Varieties with well-oriented ingredients and pronounced primary foliation are very common, but quite granular types are also common. The mineral composition of granitoids of this phase varies widely. The basic ingredients are quartz, plagioclase (oligoclase and rarely andesine), K-feldspar (microcline), biotite, muscovite and hornblende.

Scom-Scose-Smco - Albit-chlorite-sericite shales

The Vlasina complex is a sedimentary-volcanogenic formation metamorphosed under the conditions of a medium-pressure green shale facies and albite to a greater or lesser extent. Such conditions of rock formation of the Vlasina complex have conditioned the following general characteristics: rock variability in both vertical and horizontal sense, due to the alternation of the original clay, sandy, marly and other sediments and basic igneous rocks, their tuffs and genetically related desmositic-spilositic rocks, intensive development of minerals stable under the conditions of green shale facies chlorite, muscovite, sericite, epidote, then actinolite and stilpnomelane, constant, greater or lesser presence of albite, which partly originates from primary rocks (clastic fraction, spilite rock albite, desmosite-spylositic rock albite, or sodium absorbently bound to minerals clay). The intensive development of albite is post-kinematic, and part of the sodium is probably captured.

Among the rocks of the Vlasina complex, the following groups can be distinguished:

- Liscune-chlorite rocks (with more or less chlorite),
- Chlorite rocks poor in mica or without mica (chlorite and chlorite-epidotic rocks),
- Amphibole rocks and metabasites,
- Quartzites,
- Calcschists and
- Meta-quartz porphyries.

These groups include a number of varieties, selected primarily according to the intensity of occurrence of individual minerals: albite, chlorite, muscovite, sericite, stilpnomelane, epidote, actinolite and quartz. In these cases, the separation of individual varieties on the map was only approximate, especially for rocks with contents of individual components close to critical contents. In the case of packages with frequent change of individual varieties, the inclusion was performed statistically, i.e. to the group that predominates.

Mica-chlorite walls. Mica-chlorite rocks are rocks formed by metamorphosis of pelitic and pelitic-psammitic sediments. Among these rocks, depending on the content of individual minerals, can be distinguished: albite-chlorite-muscovite shales (Sabkom) (albite content between 15% and 25% of rock mass), which are the most widespread, then with a decrease in the amount of albite (below 15%) chlorite-muscovite shales (Scom), then with a decrease in chlorite content muscovite-chlorite shales and finally quartz-sericite (Sqse) and sericite shales. Chlorite-sericite shales (Scose) occur locally. Finally, in places with increasing crystallinity, these shales turn into leptinolite-mikashiste with chlorite (Sm). With the appearance of epidotes, albite-chlorite-muscovite shales turn into albite-chlorite-epidote-muscovite shales. Rocks with albite content over 25% were singled out as albite gneisses (Gco) (chlorite-albite gneisses, chlorite-muscovite-albite gneisses, muscovite-biotite-albite gneisses, etc.). Rocks in which the albite content is very high (over 50 to 60%) were isolated as albite.

Scoab-Chlorite-epidote shales

These are chlorite and chlorite-epidotic rocks. The rocks of the previous group are connected to the group of mica-free shales via chlorite-muscovite shales. In this group, we can distinguish: chlorite-albite shales (Scoab) (with 15 to 25% of albite), then chlorite shales (Sso) (in which the content of albite decreases) and chlorite-epidote shales (Ssoer). Of these rocks, chlorite-albite shales are more widespread in the eastern parts of the terrain. Chlorite and chlorite-epidote shales form small concordant lenses in various other shales. Actinolithic shales, chlorite-actinolytic and chlorite-epidote-actinolithic shales are more strongly metamorphosed representatives, and metadiabases and metagabbros are representatives in which the primary composition and mineral composition of the rock have been better preserved. These rocks occur in the entire area of the Vlasina complex; the largest number of occurrences was found north of Predejane (metagabbros).

Gab - Amphiphole gneisses

By the combined action of dynamo metamorphic influences and contact metamorphism of the Vlajna granite, the shales of the Vlasina complex were progressively metamorphosed under the conditions of the amphibolite facies, staurolite stone sub-facies (Turner and Verhoogen 1961), with occasionally pronounced potassium metasomatosis. They are building a larger lens west of Vladicin Han, as well as smaller concordant bodies in leptinolites and gneisses. According to the mineral composition of this rock, they are epidote-amphibolite and epidote-amphibolite shales with transitions into epidote-amphibole-biotite gneisses. The origin of these rocks is, at least for massive varieties with more leucoxene and without biotite and quartz, than basic migmatites. However, varieties with biotite and quartz probably originated from tuff or spilosite-desmosite rocks.

5.1.4 Seismicity

In order to determine the seismicity of the terrain, maps of the Republic Seismological Institute of Serbia were used, based on probability, which corresponds to the return period of seismic action of 475 years. The observed area

is in the zone of seventh-eighth degree and eighth degrees of seismic scale MSC. The first part of the route of the existing line is in the zone of seven-eight degrees of seismic scale, and while rest of the route from Vranje to Preševo is in the zone eighth of seismic scale. The figure below shows the seismic activity for the route of the Nis – Presevo railway.

According to the archives of the US Geological Survey (USGS), the strongest earthquake in Serbia was recorded in Lazarevac in 1922. This earthquake had a magnitude of 6.0 on the Richter scale, while in Rudnik in 1927 an earthquake of 5.9 of the Richter scale occurred and in Kopaonik, in Brus, an earthquake of 5.7 on the Richter scale occurred in 1978. According to the USGS, earthquakes were recorded in 1980 (5.8 on the Richter scale), 1983 (5.1), 1984 (4.7) and 1998 near Ljig. The last earthquake above 5 degrees happened in 2010 near Kraljevo, on November 3, its intensity was 5.5 degrees.

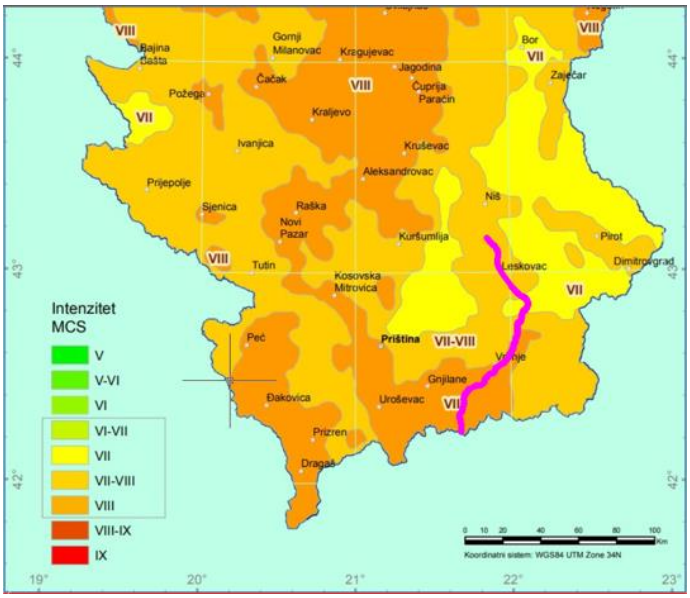


Figure 12 Map of seismic activity of the Republic of Serbia in the project area

5.1.5 Soils

5.1.5.1 Types of Soil in the Project Area

In the area through which the railway passes, classes of fluvial and fluviogleic soils are characteristic, with a zonal soil types standing out, differently developed and differently fertile. The main soil types are alluvium, alluvium in cultivation and alluvial meadow land.

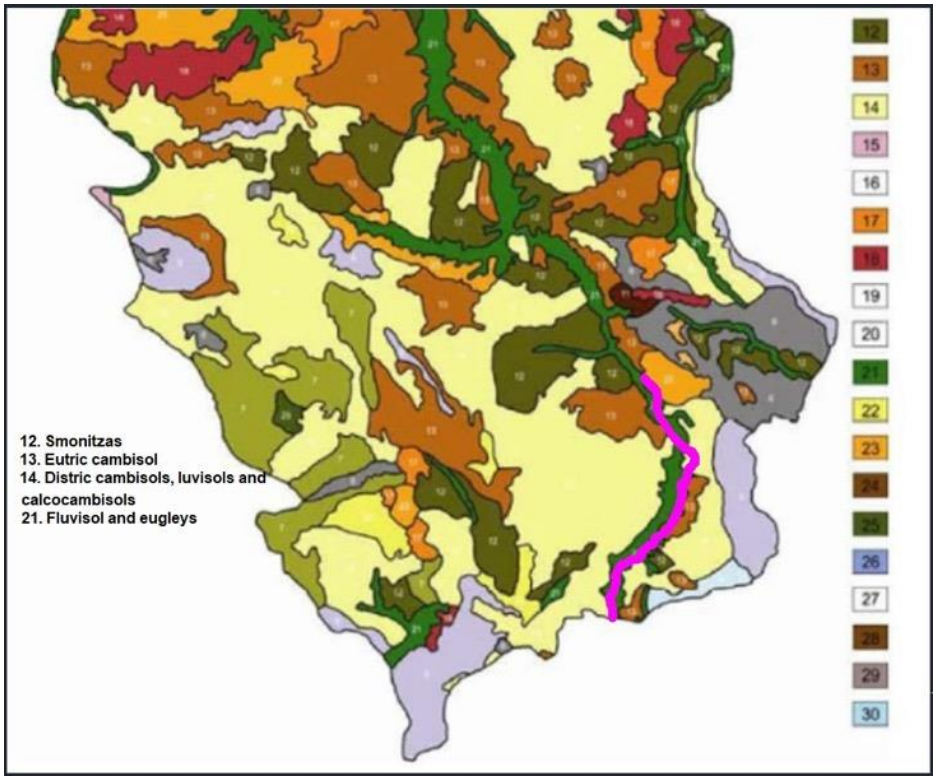


Figure 13 Soil map of Serbia (project area - magenta line)

Also, typical soils found in the Project area are cambisol and smonitza. Cambisol is a land of oak forests (Irish Oak, Hungarian oak and Turkey oak). Cambisol has significant amounts of humus, so it is very suitable for arable farming, fruit growing and viticulture. It is widespread in the South Morava valley. Smonitza is a type of soil that is formed on a clay substrate and in climatic conditions that assume alternating wet and dry periods. They are often very deep, from 60 to 150 m, and sometimes reach up to 250 m deep. They are sticky in the wetter part of the year. In summer, they dry out and often crack. Smonitza is typical for the South Morava valley. The crops that thrive on this land are industrial plants, mainly sunflower and sugar beet.

5.1.5.2 Landfills

Based on the Landfill Map from the Public Utility Company and the Environmental Protection Agency, there are a certain number of illegal landfills along the railway. The following table displays basic information about them as well as their distance from the existing and planned railway. Only landfills located within 100 meters from the railway were considered.

Table 19 Landfills managed by the PUC and illegal and old landfills near the railway

Landfill name	Municipality	Volume (m^3)	Distance (m)		Note
			from the existing railway	from the proposed railway	
Lipovica	Leskovac	103,24	~110	~110	
Živkovo	Leskovac	145,99	~50	~50	
Pečenjevce	Leskovac	1503,07	~50	~50	PUC

Landfill name	Municipality	Volume (m^3)	Distance (m)		Note
			from the existing railway	from the proposed railway	
Leskovac	Leskovac	18,63	~90	~90	
Leskovac	Leskovac	55,56	~8	~8	level crossing
Karađorđevo	Leskovac	249,22	1	1	level crossing
Leskovac	Leskovac	420,31	~60	~60	waste near the railway
Predejane	Leskovac	49,68	~65	~75	
Džep	Vladičin Han	91,09	~63	~63	PUC
Vladičin Han	Vladičin Han	263,85	~50	~50	Nectar factory
Vladičin Han	Vladičin Han	2847,66	~50	~50	
Vladičin Han	Vladičin Han	105,94	~50	~50	
Stubal	Vladičin Han	55,69	~15	~30	level crossing on the existing railway
Stubal	Vladičin Han	109.22	~60	~200	near the level crossing
Priboj	Vladičin Han	462,98	~10	~10	near the railway station
Bujkovac	Vranje	210,67	~55	~140	unofficial level crossing
Neradovac	Vranje	44,22	~30	~30	near the railway
Pavlovac	Vranje	618,66	~25	~20	near the overpass
Ristovac	Vranje	171,94	~63	~63	level crossing

5.1.5.3 Soil Contamination

Based on the data from the Ministry of Environmental Protection (publication "Towards Soil Decontamination", 2018), the following figure shows a map of potentially contaminated sites in the Republic of Serbia, along with the route of the subject railway. Further elaboration in the Environmental Impact Assessment Study will provide a more detailed assessment of the locations along the railway.

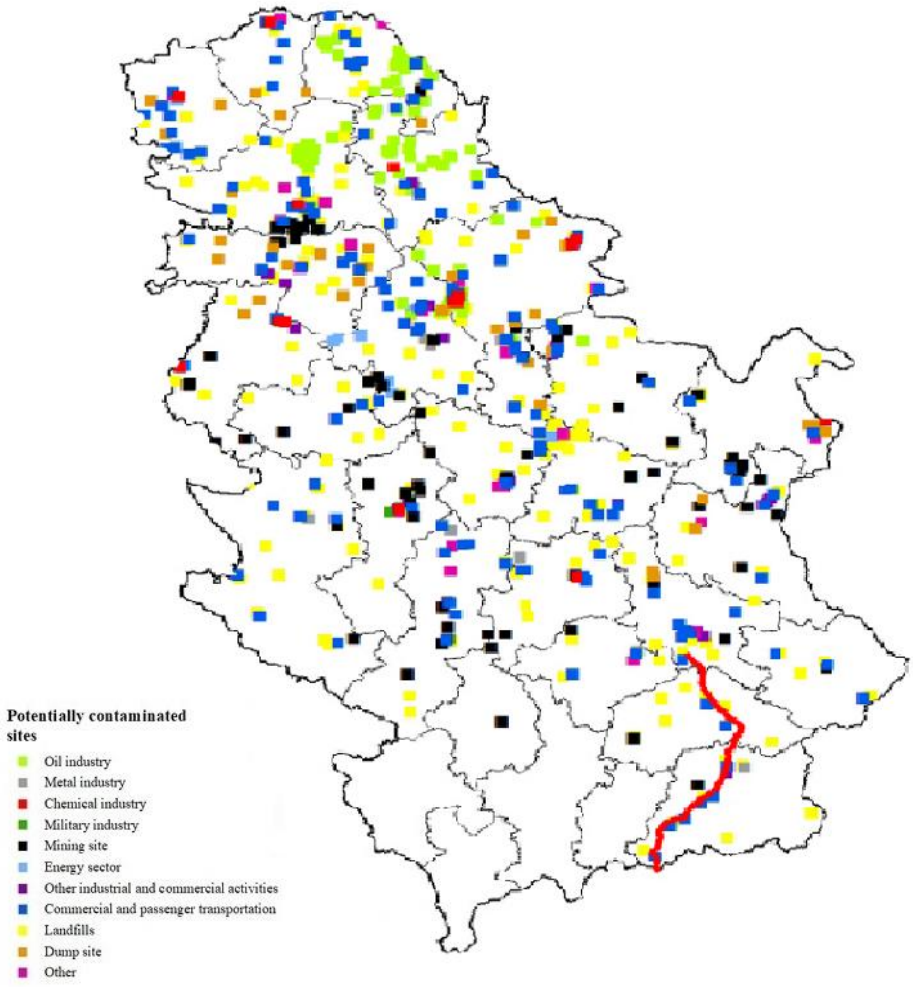


Figure 14 Map of Potentially Contaminated Locations in the Republic of Serbia in relation to the railway route

5.1.6 Air

Monitoring of air quality indicators in the Republic of Serbia is performed by the Environmental Protection Agency. Obligations and tasks of the Environmental Protection Agency in air quality management are defined in more detail by the Law on Air Protection ("Official Gazette of RS" No. 36/09 and 10/13). The annual report on the state of air quality in the Republic of Serbia derives from the obligation of the Agency based on Article 67 of the Law on Air Protection.

The following table shows the CAQI (Common Air Quality Index) of the basic parameters being measured, as well as their maximum allowable concentrations.

Table 20 Air quality index CAQI

Averaging period	Pollutant	Limit µg/m 3	Excellent	Good	Acceptable	Polluted	Very polluted
1h	SO_2	350	0 – 50	50.1-100	100.01-350	350.01-500	> 500.01

Averaging period	Pollutant	Limit µg/m 3	Excellent	Good	Acceptable	Polluted	Very polluted
1h	NO_2	150	0 – 50	50.01-100	100.01-150	150.01-400	>400.01
1h	PM_{10}	90	0 - 25	25.01-50	50-.01-90	90.01-180.0	>180.01
1h	$PM_{2.5}$	55	0-15	15.01-30	30.01-55	55.01-110	>110.01
1h	CO	25	0 - 5	5.00001-10	10.00001-25	25.0001-50	>50.0001
1h	O_3	180	0 - 60	60.1-120	120.1-180	180-240	>240.1

The colour display is usually used so that citizens can easily find out which of several categories the air quality is currently in: whether it is excellent, good, acceptable, polluted or very polluted/dangerous. The concentration of multiple pollutants is measured and they have specific thresholds and ranges for the colors that determine the category of contamination. As part of air quality monitoring and in accordance with the criteria prescribed by the Law on Air Protection, SEPA performs AQ assessment in zones and agglomerations. This is an official assessment of air quality in Serbia that applies the standards present in practice in the EU due to the fact that the EU Air Quality Directive has been transposed and integrated into national legislation.

Table 21 Air quality standards for health protection, as presented in the Air Quality Directives and applied by SEPA in the assessment of AQ in the RS

Pollutant	Averaging period	Legal nature and concentration	Comments
SO_2	1h	Limit 350 µg/m^3	Not more than 24 hours per year
		Alarm threshold 500 µg/m^3	It is measured for three consecutive hours in an area of 100 km^2 or in theentire zone
	1 day	Limit 125 µg/m^3	Not more than 3 days per year
NO_2	1 h	Limit 200 µg/m^3	Not more than 18 hours per year
		Alarm threshold 400 µg/m^3	It is measured for three consecutive hours in an area of 100 km^2 or in theentire zone
PM_{10}	1 day	Limit 50 µg/m^3	Not more than 35 days per year
	Calendar year	Limit 40 µg/m^3	
$PM_{2.5}$	Calendar year	Limit 25 µg/m^3	
CO	Max. daily 8-hour average value	Limit 10 µg/m^3	
O_3	Max. daily 8-hour average value	Target value 120 µg/m^3	No more than 25 days a year arranged for three years
		Information threshold 180 µg/m^3	
	1 h	Information threshold 240 µg/m^3	

In accordance with Article 21 of the Law on Air Protection, and according to the level of pollution, starting from the prescribed limit and tolerance values, based

on the measurement results, the following categories of air quality are determined:

1. Category 1 – pure or slightly polluted air where the limit values of none of the pollutants are exceeded;
2. Category 2 – moderately polluted air where limit values of one or more pollutants are exceeded, but tolerant values of none of the pollutants are not exceeded;
3. Category 3 – too polluted air where tolerant values for one or more pollutants are exceeded.

In event of a pollutant not having a prescribed tolerance limit, its limit value shall be taken as the tolerant one.

Air quality categories are established once a year for the previous calendar year. The list of air quality categories by zones and agglomerations at the Republic of Serbia territory is formed by the Government and published in "The Official Gazette of the Republic of Serbia", electronic media, as well as the web sites of the Government and the Ministry.

As of January 1, 2021, the tolerance limit for nitrogen dioxide is 0, and thus the tolerance value has equalled the limit value.

The network of stations for automatic air quality monitoring, AMSKV, is, in accordance with the Law on Air Protection, recognized as a state network for air quality monitoring at the level of the Republic of Serbia.

The Nis - Presevo railway is electrified, so it has a minimal effect on air quality. As a source of air pollution in the investigated corridor, there are some industrial plants that represent the source of emissions of harmful pollutants into the atmosphere, as well as individual pollution caused by the combustion of solid and liquid fuels and other substances.

The following pictures show the locations of the air quality monitoring stations and the parameters that are measured. Taking into account the route of the Nis-Presevo railway, the relevant stations for automatic monitoring of air quality are located in Nis and Vranje. The assessment of air quality for the year 2021, in the Annual report of EPA for 2021, was made on the basis of the results of measuring polluting substances obtained by air quality monitoring of state and local networks.

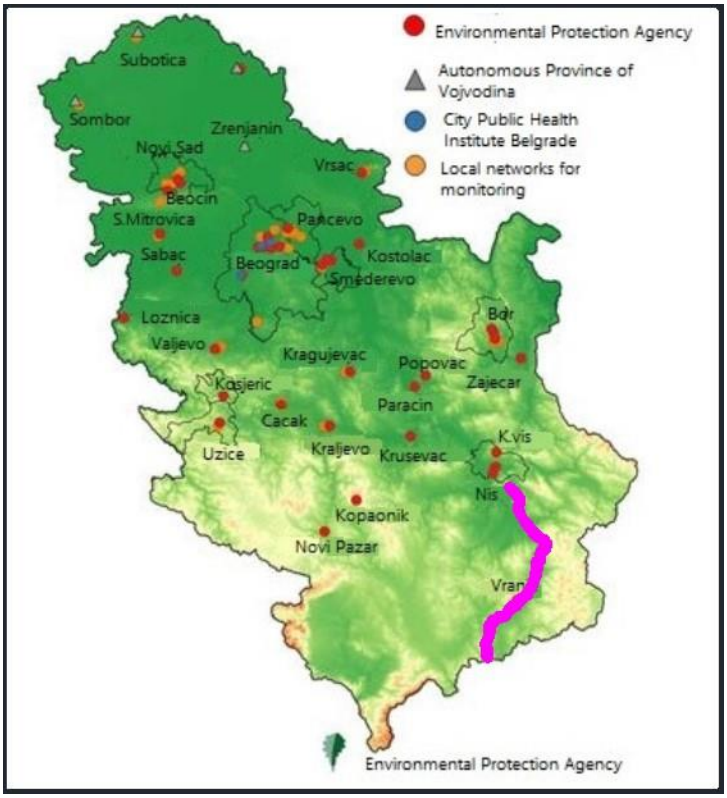


Figure 15 Network of stations for air quality monitoring and railway route

The assessment of air quality by stations, for the year 2021, is shown in the following figure. In Nis, air was assessed as third class, and in Vranje as first class.

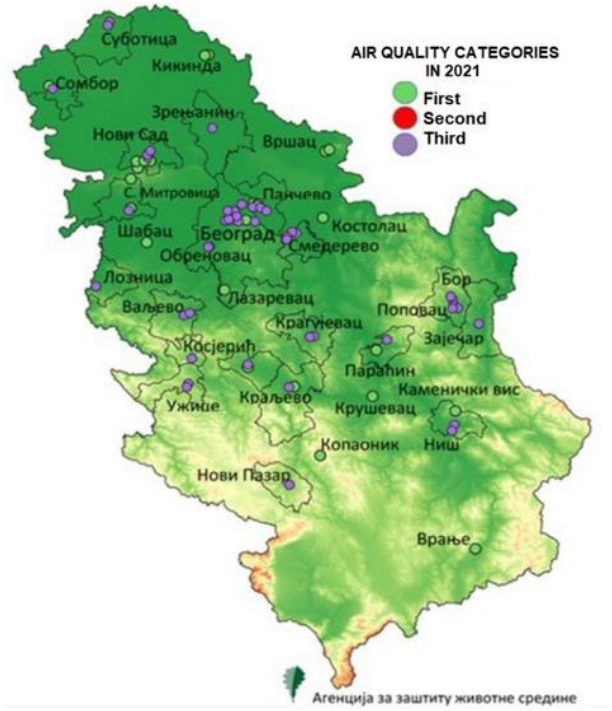


Figure 16 Assessment of air quality by stations in 2021

5.1.7 Climate change

5.1.7.1 General

Positive trend of number of catastrophic and unfavourable natural events especially reflects with the events depending on the meteorological conditions. A map of natural disaster risk is shown in the following figure (Natural Hazard Assessment for Land-use Planning in Serbia, Dragicevic et al., 2011).

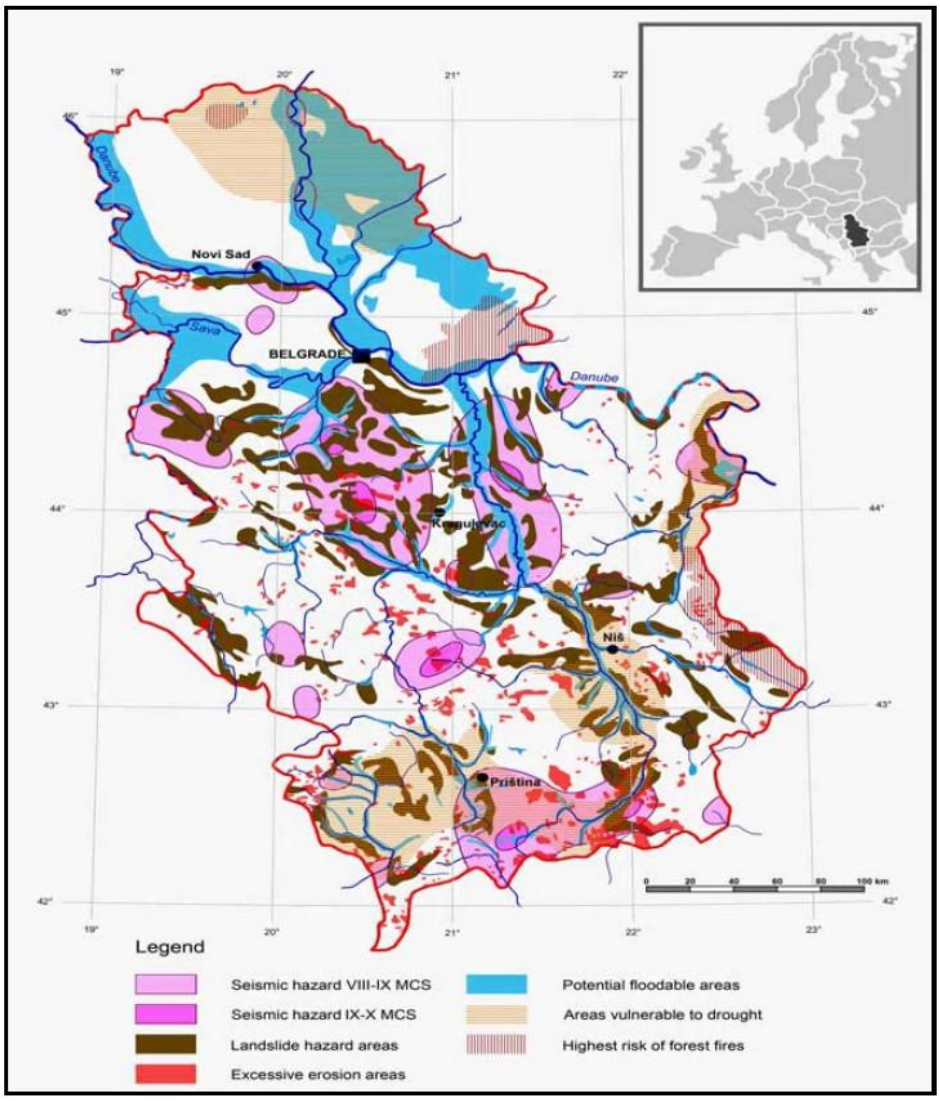


Figure 17 Integral vulnerability map of the natural hazards on the territory of Serbia

5.1.7.2 Expected changes in temperatures and precipitation

The analyses of future climate change are aligned with the latest, Fifth Assessment Report of the Intergovernmental Panel on Climate Change. The results presented here represent the most likely value from the set (ensemble) of solutions obtained using daily values of temperatures and precipitation from nine regional climate models that can be downloaded from the EURO-CORDEX database. The reference period with respect to which the change in future climatic conditions is analysed is 1986-2005 and the analysed future periods are: 2016-2035 (near future),

2046- 2065 (mid-century) and 2081-2100 (end of century). The analyses were performed according to two selected greenhouse gas emission scenarios: RCP4.5 (stabilization scenario, which anticipates the stabilisation of emissions from 2040) and RCP8.5 (constant growth scenario), which are assumed to cover the likely range of possible future outcomes.

Future temperature changes

Over the future periods, an increase in temperature is expected in both scenarios compared to the 1986 -2005 reference period. A more intense increase in temperature is anticipated according to RCP8.5, which is expected due to the more intense emissions of greenhouse gases and their impact on the energy balance in the climate system. In this scenario, the mean annual temperature, on average for the territory of Serbia, will increase by 1°C in the near future compared to the reference period, in the period attributed to the mid-21st century, it will rise to 2°C, and, by the end of the century, the average annual temperature will be higher by as much as 4.3°C compared to the reference period. The stabilisation scenario, RCP4.5, shows a slightly less increase in mean annual temperature by about 0.5°C compared to RCP8.5 during the first two analysed periods.

In this scenario, by the end of the 21st century, the increase in the average annual temperature in the territory of Serbia will reach a much lower value than the value obtained under the RCP8.5 scenario, which is 2°C higher than the value of the reference period. Seasonal analyses and changes in mean maximum and minimum temperatures have shown that in the future climate the temperature increase during the colder part of the year may be slightly less than the temperature increase during the warmer part of the year, but during the second half of the century according to the RCP8.5 the warming of the colder part of the year becomes more intense and catches up with the warming up of the warmer part. The increase in maximum temperatures are slightly higher than the increase in minimum temperatures. The largest increase will be in the RCP8.5 scenario of the mean maximum temperature during the June-August period for the period at the end of the 21st century, with an average value of as much as 4.7°C higher than the 1986-2005 reference period. A spatial analysis of changes in temperatures over future periods indicates an increase in warming from north to south. The selected results obtained from the analysis of future temperature changes are shown in Figure 18.

The number of frost and ice days will progressively decrease in the future due to the temperature increase. Their trend of change is more pronounced at higher altitudes. In the near future, there will be almost 10 days less frosty days on average annually in the territory of Serbia compared to the values of the 1986-2005 reference period. During the mid-21st century climatic period, according to the RCP8.5, there will be almost one month less frosty days and according to the RCP4.5 there will be about half a month less of them. Although the climate will begin to stabilise according to RCP4.5, by the end of the 21st century there will be on average one month less frosty days, while according to RCP8.5 the average decrease in the territory of Serbia is expected to be almost two months, in which case frost days will become a rare event in Serbia. Ice days in the case of the RCP8.5 scenario will only be possible in the highest mountain areas.

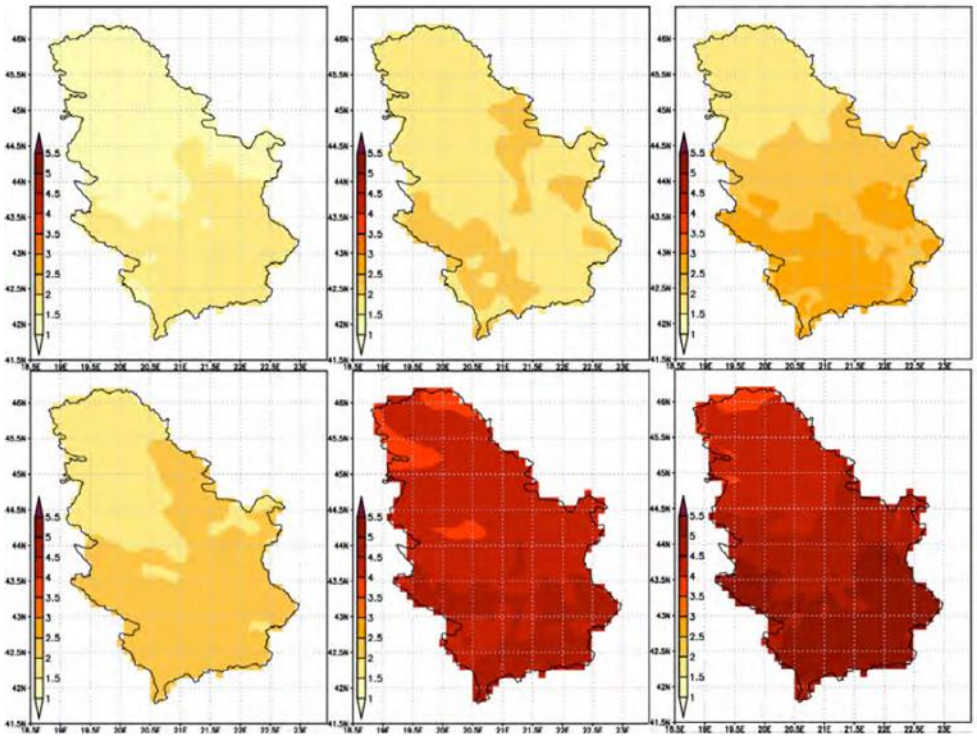


Figure 18 Anomaly of the mean annual temperatures(°C)[6]

The number of hot and tropical days will continue to increase in the future climate conditions. In the climate of the near future, relative to the reference period, changes indicate an extension of summer season conditions by almost half a month, and in the second half of the 21st century, an extension of almost a month may occur, after which the change will stabilise according to the RCP4.5 scenario, while according to RCP8.5, by the end of the century, summer conditions will be on average nearly two months longer than during 1986-2005 period. By the end of the 21st century, the expected increase in the average annual number of tropical days will be in the range between 20, according to RCP4.5, up to almost 50 days in the RCP8.5 scenario. The analysis of the spatial distribution of the results has shown that tropical days will become a relatively regular event in mountainous areas as well.

Heat waves will become more intense and more frequent during future climate periods. Extreme heat waves in the future climate will occur on average at least 2-3 times a year, while during the 1986-2005 reference period these were very rare events. According to the RCP8.5 scenario, by the end of the 21st century, their average occurrence in the territory of Serbia will be as high as 7 occurrences

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6 Anomaly of the mean annual temperatures(°C) for the 2046-2065 period (left panel) and for the 2081-2100 period (central panel) relative to the values for the 1986-2005 reference period; anomaly of the mean maximum temperature (°C) obtained for the June-August 2081-2100 period compared to the mean maximum temperature values of this period for 1986-2005 (right panel); the results obtained according to the RCP4.5 scenario are shown in the top panels and the results obtained according to the RCP8.5 are shown in the bottom panels.

Source: Climate changes observed in Serbia and future climate projections based on different scenarios of future emissions, October 2018

during the year, and in some areas even more than 10. The analysis has shown that in this case, for over two months annually the thermal conditions on the territory of Serbia will be like during the rare occurrences of extreme heat waves in the current climate, but with record high temperatures that have not yet been observed in these regions.

Future precipitation changes

The future changes in mean annual accumulated precipitation, averaged for the territory of Serbia, will not have a pronounced trend in the future periods, as is the case with temperature. However, in the second half of the 21st century, according to the RCP8.5 scenario, the average annual precipitation will start to decrease and in the period at the end of the 21st century, central and especially southern Serbia will experience the largest precipitation decrease, even exceeding 10% with respect to the 1986-2005 reference period. The spatial distribution of change in precipitation shows declining trend towards the south. Precipitation decrease during the June-August period has already been observed and it will continue during future periods according to both scenarios. In the period at the end of the 21st century, according to RCP8.5, the average precipitation decrease in the territory of Serbia will be 20.5%, with a much larger decrease in the southern regions, of as much as 40%. The selected results obtained from the analysis of future precipitation changes are shown in Figure 19.

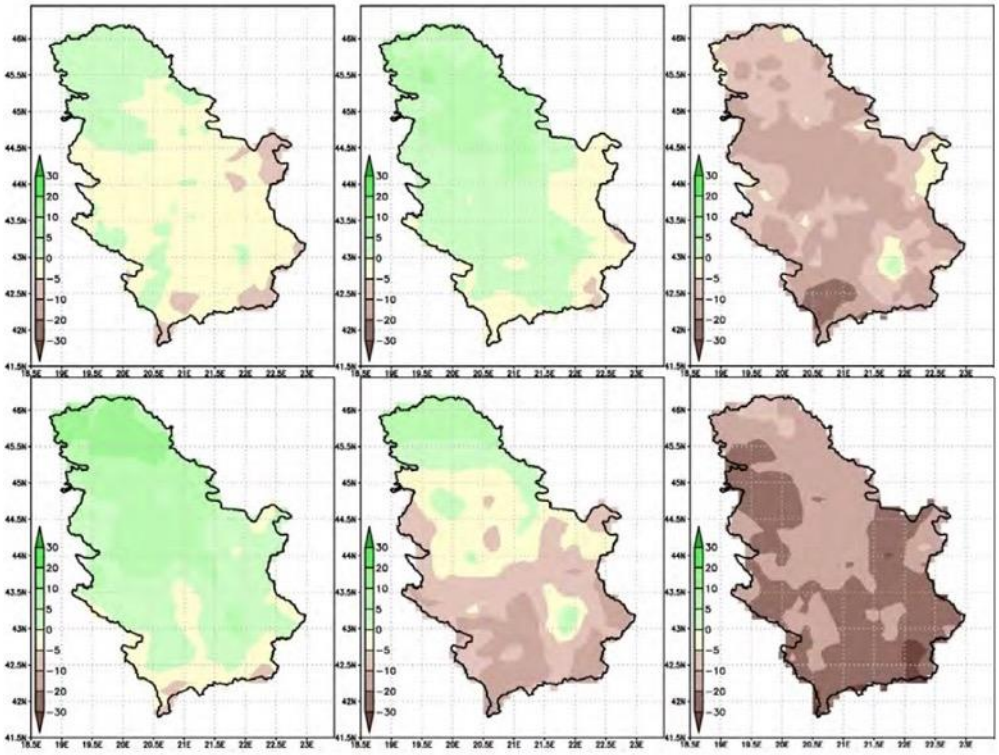

Figure 19 The anomaly of the mean annual precipitation sum (%)[7]

[7] *The anomaly of the mean annual precipitation sum (%)*[7] *for the 2046-2065 period (left panel) and for the 2081-2100 period (central panel) relative to the values for the 1986-2005*

The changes in precipitation indices indicate a further intensification of the already observed changes in the precipitation distribution intensity towards more frequent heavy precipitation events and higher precipitation accumulations during intense precipitation events. An interesting result was obtained in the analysis of the change in the percentage share of precipitation falling during heavy precipitation days: the change in the amount of precipitation during extreme precipitation events in future climatological periods will progressively increase as a result of more frequent extreme precipitation events but also more intense precipitation.

By the end of the 21st century, according to RCP4.5, as much as 40% more precipitation, accumulated during year, will occur during the days when precipitation is extremely high compared to the precipitation events of the 1986-2005 reference period. According to RCP8.5, these accumulations will increase by 60%. Additional focus on the project area will be placed in the ESIA phase.

5.1.7.3 Floods

In Serbia, 12.4% of its territory (10,968 km2) is potentially endangered by flooding. According to Gavrilovic (1981), among the largest flood areas are in the basins of river Velika Morava (2,240 km2) and Danube (2,070 km2). The main problems in the Velika Morava River basin are flash floods. According to Dragicevic et al. (2013), the potentially flooded area in Serbia with a 100-year return period is 15,198.07 km2 (17.2% of total area). The locations of the most destructive torrential flood events in Serbia in the period 1915-2013 are presented in the following map.

The most important flood events in the wider region are presented below:

- Floods in 1948 - The flood in the Juzna Morava basin was in 1948. It was caused by rains while flash floods brought a lot of sediment in river basin. As a result of flood, the Juzna Morava River destroyed all bridges.
- Floods in 1999 - In the river basins of major tributaries of the Velika Morava great flash floods occurred in July 1999. As result of floods 8 people lost their lives, dozens of thousands of houses and hundreds of commerce buildings were damaged and 30 bridges in basins of the Velika Morava, the Jasenica, the Kubršnica and the Lepenica were destroyed (Milanovic and Milijasevic, 2008).
- Floods in 2010 - In 2010, the floods occurred in several municipalities. Jagodina and Paraćin were threatened by the Velika Morava whereas nearly 300 ha of arable land were flooded.

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reference period; anomaly of mean precipitation sum (%) for the June-August season for the 2081-2100 period compared to the mean seasonal value for the 1986-2005 period (right panel); the results obtained according to the RCP4.5 scenario are shown in the top panels, while the results obtained according to the RCP8.5 are shown in the bottom panels.

Source: Climate changes observed in Serbia and future climate projections based on different scenarios of future emissions, October 2018

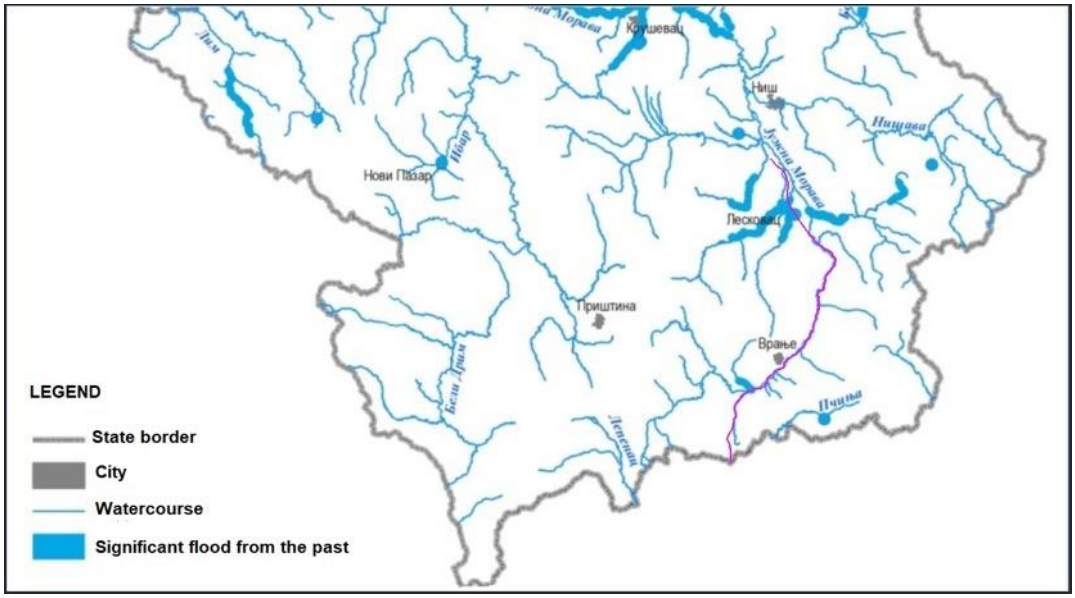


Figure 20 Map of significant floods from the past on the territory of RS in the period 1965-2011.

Source: Preliminary flood risk assessment, Ministry of Agriculture, Forestry and Water Management, 2012.

- Floods in 2014 catastrophic floods registered in Serbia in May 2014 caused enormous damages (figure below). During the third week of May 2014 Serbia was affected by heavy rains and the rains were caused by the field of low air pressure ("Yvette") formed above the Adriatic Sea. Record amount of rainfall was registered then: more than 200mm of rain fell in Western Serbia during only one week which equals the amount of rainfall for a three-month-period under standard conditions. Due to the heavy floods affecting several districts, on 15 May 2014 the Republic Headquarters for Emergencies held an extraordinary session when they passed a decision to recommend to the Government to declare a state of emergency on the entire territory of the Republic of Serbia in order to utilize the resources from the entire territory and direct them into the affected areas. In accordance with the Report on the natural disaster - flood which struck the Republic of Serbia and the measures taken to rescue people and defend the endangered places, among the most affected towns were Paraćin, Svilajnac, Jagodina and Smederevska Palanka.

Following the 2014 floods, the Serbian Government approved a National Disaster Risk Management Program (financed by EU IPA II funds) to develop a long-term risk management system, including the generation of flood risk information. In this context, the Project prepared flood hazard and risk maps for 75 Areas of Potentially Significant Flood Risk (APSFR) previously identified in the river Morava (Juzna, Velika and Zapadna Morava). The project was funded by the EU and managed by the World Bank/GFDRR, who provided valuable support and insight.

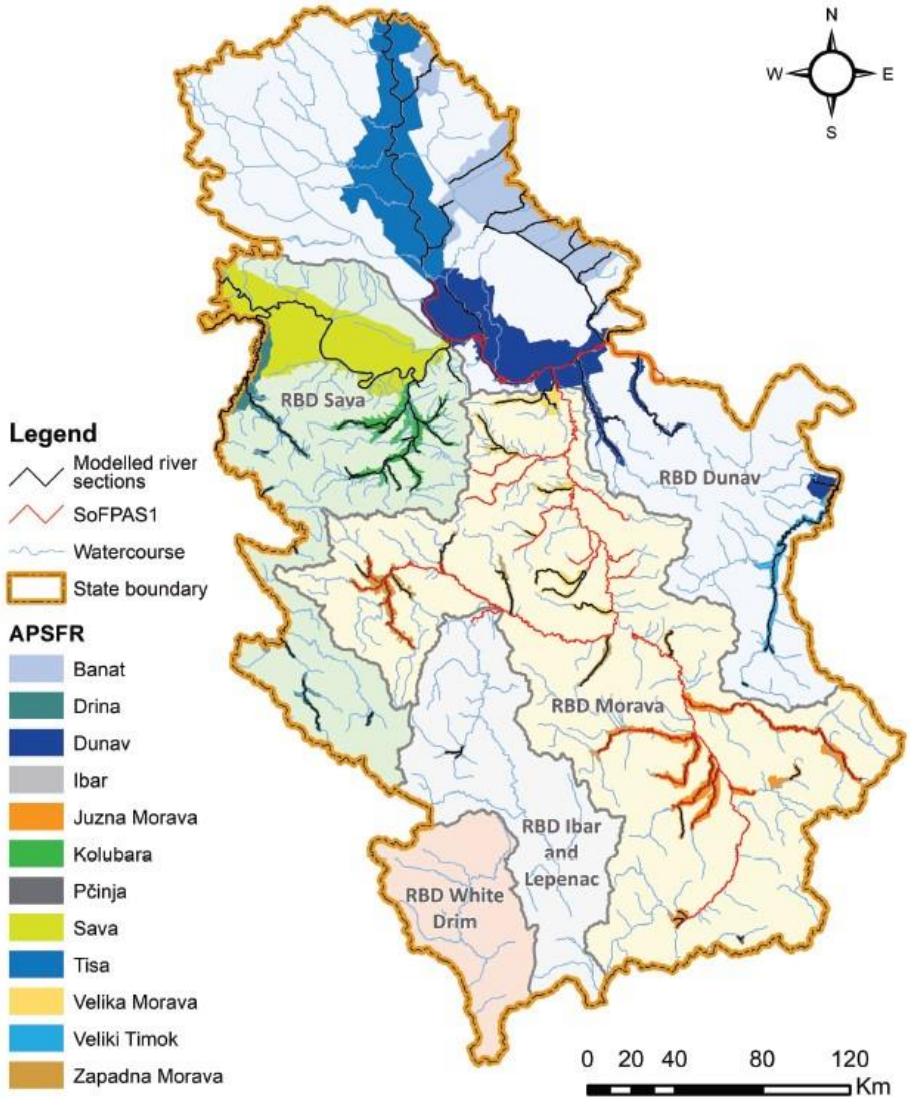


Figure 21 Areas covered by flood hazard and risk maps

In Juzna Morava and its tributaries, the protection system consists of defense lines (embankments and regulated riverbeds) which are continuously formed on both sides only in the zone of larger settlements on Nisava through Nis and on Moravica through Aleksinac. On numerous tributaries of torrential character, protective systems consist of one-sided embankments and regulated riverbeds. The level of protection is adjusted to the importance of protected values in the protected area - in the zone of 100-year-old waters, outside the settlements of 50-year-old waters, while the regulated Nisava riverbed through Nis achieved a degree of protection of 500-year high waters. Flood events and recorded flooding of settlements, especially in 2010 and 2014, indicated the need to upgrade and reconstruct existing protection systems. In the Juzna Morava basin, the largest number of active flood defenses are included, mostly multipurpose reservoirs, of which a smaller number has a reserved - inviolable space for receiving the flood wave. Only some reservoirs are primarily for flood protection.

Based on data of the Second National Communication of the Republic of Serbia under the United Nations Framework Convention on Climate Change, in order to assess the impact of climate change on water resources, the changes of river flow trends have been examined (data at 18 selected river monitoring stations in central Serbia). A negative trend was already observed, particularly from the period 1950-1960. The results indicate that the long-term average yearly hydrological trend is approximately -30%/100 years, but its spatial distribution varies.

Scenario results indicate that future discharge will decrease, especially for the period 2071-2100. The decreasing trend of average groundwater availability is generally expected to be lower than for surface water, especially for deep aquifers. It should be noted that there is a lack of long-term data sets for a detailed analysis on the climate change impacts and the availability of groundwater resources.

Analysis based on climate scenarios (scenario A1B the addressed future periods 2021-2050 and 2071-2100) applied on test areas (four locations) showed that a considerable decrease in the capacity of groundwater resources is to be expected. The data indicates the likelihood for considerable pressure on Serbia's water supply in the future. Besides the big cities, the most vulnerable areas are expected to be in the southeastern, eastern, central and northern part of the country. A deviation from average annual temperature by +1°C has an inversely proportional effect on average annual precipitation levels (about 7%), and on the average annual river discharge (about 20%). This means that in the near future, years with an average annual temperature 2°C higher than the average in the last 60 years, can be expected to result in 40-50% less water in Serbia's rivers, on average. The figure below shows the significant possible future floods in the territory of Serbia.

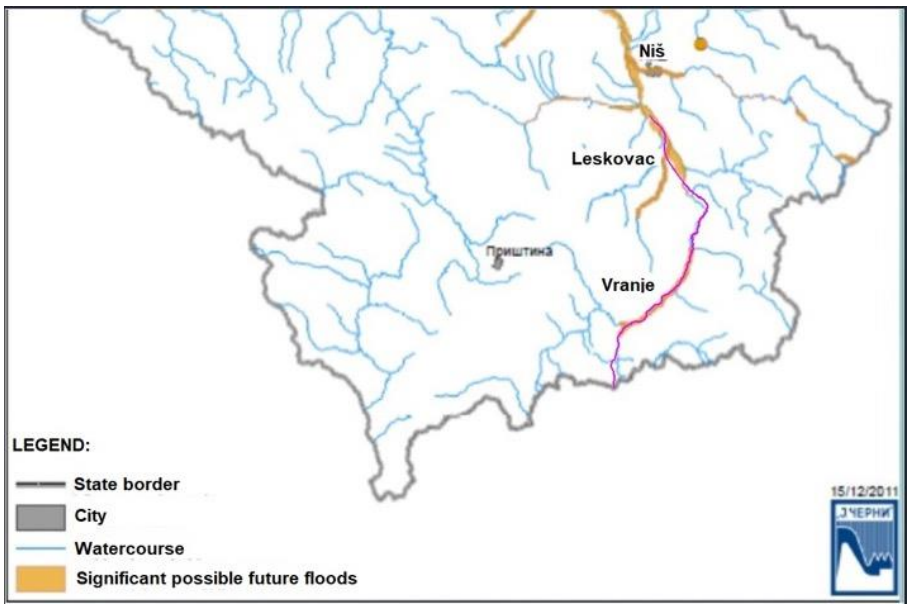


Figure 22 Map of significant possible future floods in the territory of RS

5.1.7.4 Landslides and escarpments on the slopes and inclinations

The area of Serbia is seriously exposed to risks from landslide. Estimates show that the highest number of landslides in Europe is located on the territory of

Serbia. About 25% of Serbia is potentially at risk for landslides and rock falls (Lazic and Bozovic, 1995). Furthermore, one of the largest landslides on the continent, Duboko, is in Serbia. About 70% of landslides in Serbia are known and researched.

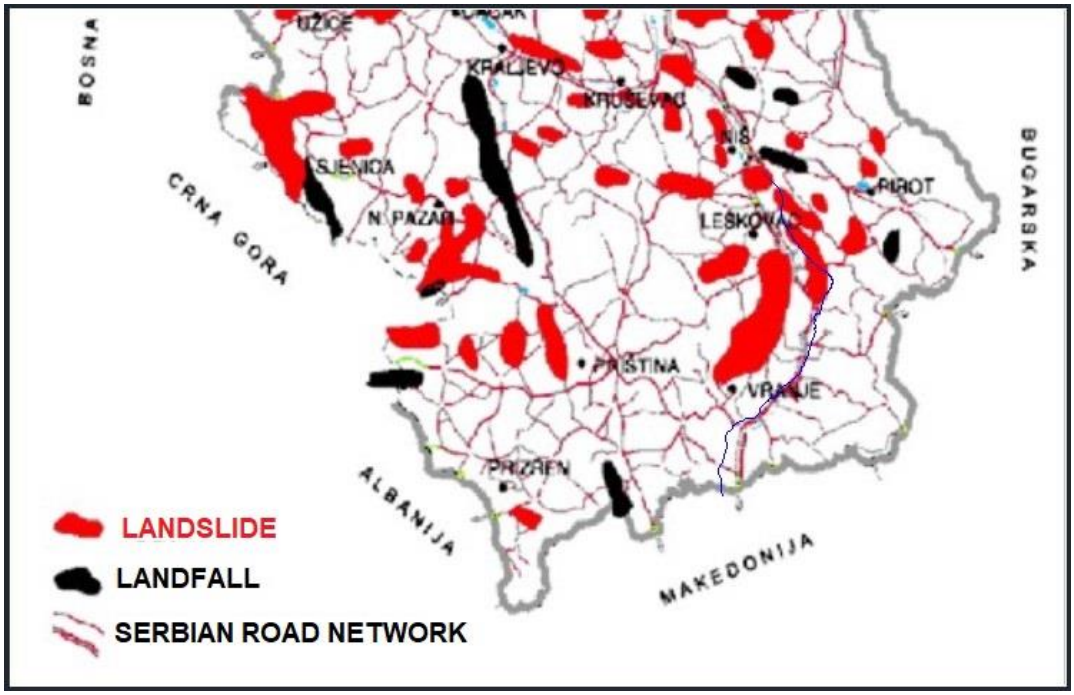


Figure 23 Map of landfall and landslides in area of the railway

There are around 3,000 active and potentially active landslides in Serbia. Most of them cause the damage on local roads and highways and a few of them cause the damage on residential buildings. As far as Serbia is concerned, there are landslides in south-eastern part of Pannonian plain and in central parts. Landslides derived after floods in 2014 caused enormous losses to citizens and economy. Heavy rains in our country in May 2014 and afterwards left a large amount of water that eroded and destroyed ground, moving huge amount of eroded material. Torrential streams destroyed fields, roads, railways, houses and other objects. Broad landslides occurred after the floods.

Landslides that are located in the immediate vicinity of the route of the Nis-Presevo railway are in the zones of municipalities Grdelica and Vladicin Han. In the mentioned municipalities, ie for certain local communities, which are located on the route or in the immediate vicinity of the observed route of the Nis-Presevo railway, there are danger zones for this natural disaster, while there is no official landslide cadastre for this territory.

5.1.7.5 Hail

Hailstorms occur almost every summer in July or August in the municipalities of Vranje, Niš, less often Leskovac. To Leskovac and its surroundings, and then to Nis, there was a downpour with thunder and hail. In Leskovac and its surroundings, it rained and hailed the size of walnuts 29.04.2018. shortly after 6 p.m.

5.1.7.6 Drought

Territory of the Republic of Serbia is located in a region of the world considered vulnerable to climate change. (IPCC, 2007). Gocic and Trajkovic identified three distinct drought sub–regions: R1, R2 and R3. Region R1 (red colour in the following map) includes the north and the northeast part of Serbia, region R2 (blue colour in the following map) includes the western part of Central Serbia and southwestern part of Serbia and region R3 (yellow colour in the following map) includes central, east, south and southeast part of Serbia. The R1 is characterized by the lowest amount of precipitations in the country and most intensive agriculture. The R2 is mostly forested with the average annual precipitations to 1000 mm, while the R3 is characterized by a moderate–precipitation regime with the average annual precipitations to 650 mm. The R2 had the monthly precipitations values above average, while R1 and R3 had the precipitations values under average in Serbia.

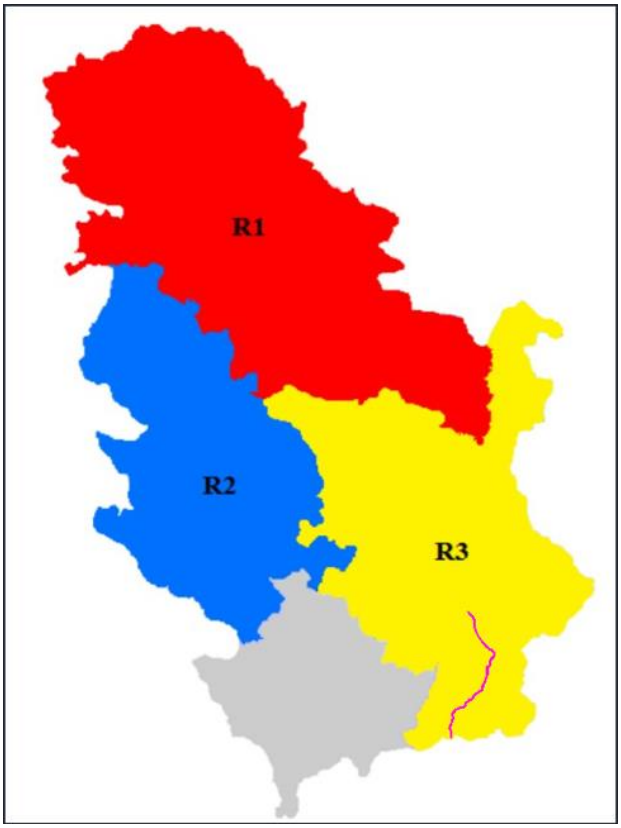


Figure 24 Drought–based regionalization in Serbia

Source: Report on natural disasters in the Western Balkans

5.1.7.7 Fires

Climate change, specifically alternating periods of droughts and heavy rains, increasingly highlight the issue of forest fires and damages caused by natural disasters in forests. Moreover, direct losses in terms of lost timber volume are becoming less significant compared to the loss of forests' multiple beneficial functions after fires (such as hydrological, protective, climatic, hygiene and health, tourism, and recreational functions).

According to the Environmental Status Report for the year 2022, in the territory of the Republic of Serbia, 6,267 cubic meters of timber volume were burned in 2022, which is approximately 40% less than in 2021. In comparison to 2021, when forest fires affected an area of about 572 hectares, the area affected by fire in 2022 was 423 hectares, approximately 25% smaller than the previous year.

A map showing the probability of forest fire occurrence in Serbia (Source: Report - forecasting fire hazards and early detection of fires in the Republic of Serbia, Ministry of Agriculture, Forestry, and Water Management, Forestry Administration) along with the depiction of the subject railway route is presented below. Currently, official data on fires at illegal landfills are not available.

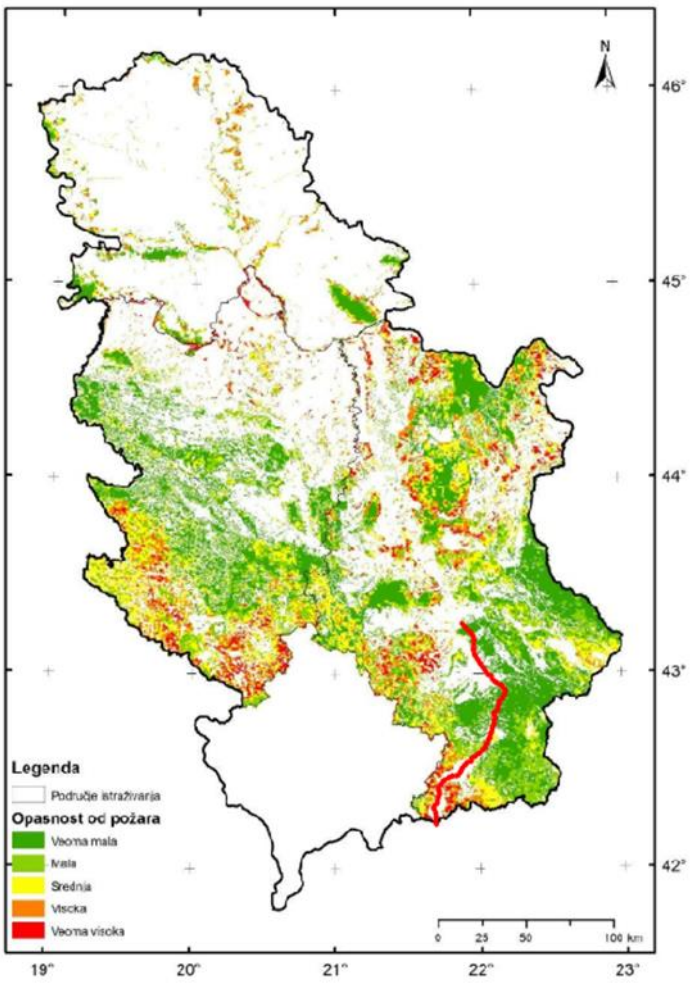


Figure 25 Map of forest fire probability

Source: Forecasting fire hazards and early detection of fires in the Republic of Serbia (Belgrade, 2020.)

5.1.8 Noise and vibration

The Rulebook on Permissible Noise Levels in the Environment (Official Gazette of RS No. 54/92) defines the highest permissible levels of external noise, as shown in the table.

Table 22 Maximum allowed noise levels

Purpose of space	Maximum permissible level of external noise dB(A)	
	day	night
Areas for rest and recreation, hospital zones and convalescent homes, cultural and historical sites, large parks	50	40
Tourist areas, small and rural settlements, camps and school zones	50	45
Purely residential areas	55	45
Business-residential areas, commercial-residential areas, children's playgrounds	60	50
City center, craft, trade, administrative zone with apartments, zones along motorways and highways	65	55
Industrial, storage and service areas and transport terminals without housing	At the border of the noise zone, the levels in the zone with which it borders must not be exceeded	

The regulations in the field of noise protection of the Republic of Serbia during the previous few years have been harmonized with the relevant EU directives. Accordingly, maps of the noise of the settlement or the existing railway line that relates to the section Niš - Preševo have not yet been made. According to available data, local self-government units along the railway have not yet conducted acoustic zoning, designated quiet zones, or developed a plan for prohibitions and restrictions on their territory. Acoustic zoning has only been conducted by the city of Niš.

The nearest areas in which noise is measured are the center of Niš, run by local Public Health Institute, which are not considered relevant for the section in question. There are noise monitoring stations in Leskovac, measuring noise level in urban areas of the city under the responsibility of the Department of Environmental Protection. Having in mind the route of the railway through Leskovac as well as the distance from the measuring stations, the data obtained from them cannot be considered as relevant for the preparation of this document.

More detailed data do not exist since measurements of noise levels in the communal environment have not been carried out so far. For that reason, the basic noise level in the observed area can be estimated only on the basis of field insights.

The dominant source of traffic noise in the observed corridor are sections of highways, highways and regional roads that intersect the observed corridor. Industrial plants are also emerging as a source of noise pollution. The amount of noise that will be emitted into the environment depends on the type of production process, as well as the machines that participate in it. According to existing experience, noise caused by the operation of the railway usually occurs at the point of contact between the rail and the wheel, during the discharge of exhaust gases from the diesel locomotive and at the ventilation openings above the tunnel.

As superstructure on the Nis – Presevo line is in a very bad condition, the contact of the rail and the wheel during driving produces additional noise of significant intensity (shocks, creaks, etc.).

Under the ESIA and more precisely in its scoping phase, it will be necessary to determine potential endangered zones and noise receptors in the vicinity of the designed railway, and based on that, noise measurements will be performed by an accredited laboratory. Currently there are no existing noise barriers along the railway that could possibly minimize the noise impacts. Under this phase, certain locations can be proposed for noise measurements which include populated areas where the existing line passes that will be upgraded and populated areas close to which new parts of the railway will pass. Therefore, starting from Nis to Presevo, the following locations or wider areas can be indicated: Lipovica, Leskovac (Podrum), Predejane, Vranjska Banja and Donji Neradovac. As mentioned above, these locations will be more defined under the ESIA report. Indicatively the locations are placed in the following map.

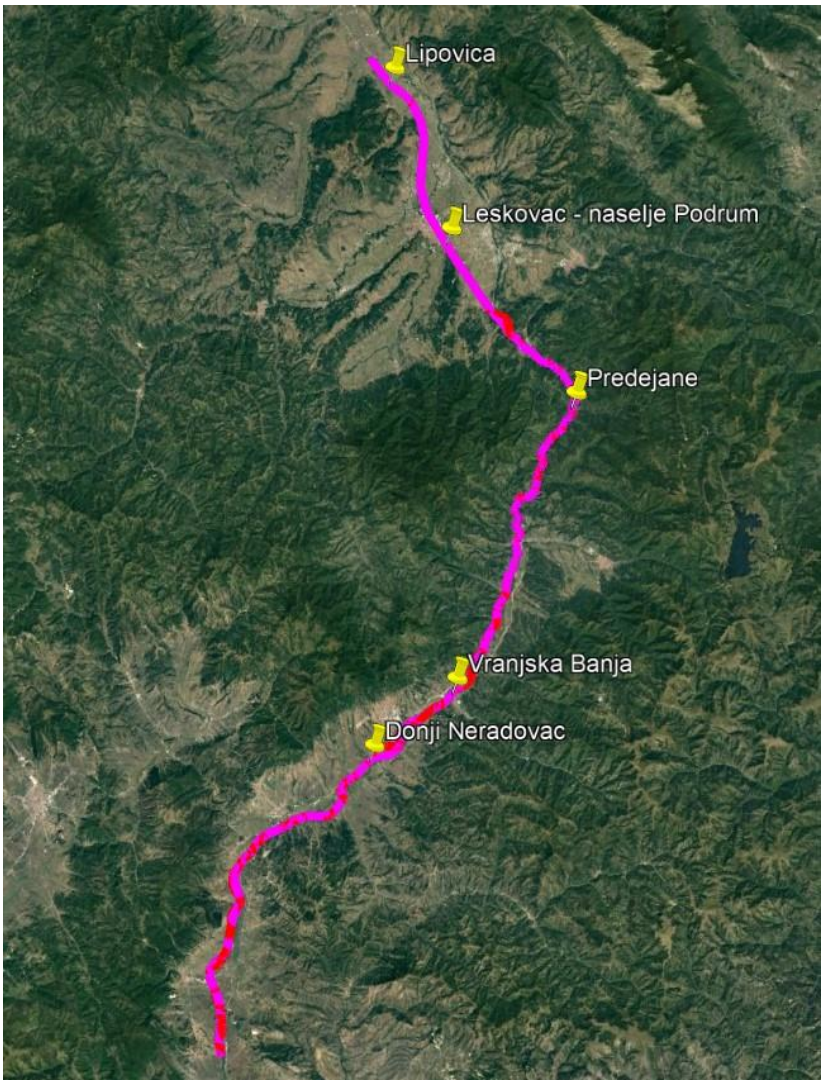


Figure 26 Indicative locations for noise measurements

5.1.9 Vibrations

The analysis of the observed corridor determined that in the current state, the source of vibrations can be railway traffic. Also in the existing state, the source of vibrations can be road traffic (from the existing roads in the corridor).

Criteria for the impact of structural vibrations and noise on the environment, according to US DOT, FTA methodology, are based on maximum levels for certain types of buildings or human activities and are divided into three categories of land occupation:

Category 1. - High sensitivity facilities or activities. This category includes buildings where it is necessary to provide a low level of vibration for operations performed in the building and which can be much lower than the levels that cause disturbance to people. This group includes vibration-sensitive research and production, hospitals with vibration-sensitive equipment, and university research

Category 2. - Residential areas. This category covers land occupied by residential buildings and other buildings where people sleep (hotels and hospitals). No differentiation has been made between different types of residential areas, because structural vibrations and noise are felt from within, and tenants have virtually no way to reduce exposure to these phenomena.

Category 3. - Business areas. This category includes schools, churches and other institutions and quiet business premises where there are no vibration-sensitive appliances. This group also includes office buildings, but not industrial facilities with office space because they are primarily intended for industry.

Table 23 Permitted vibration levels according to land occupation categories

Land occupation category	Frequency vibration phenoena[1]		Rare occurrences of vibration [2]	
	VdB[3]	mm/s[4]	VdB[3]	mm/s
Category 1. - High sensitivity facilities or activities	65	0.09	65	0.09
Category 2. - Residential areas	72	0.20	80	0.50
Category 3. - Business areas	75	0.28	83	0.71

Frequency vibration phenomena are defined as more than 70 vibration phenomena.
2. Rare vibration occurrences are defined as less than 70 vibration occurrences.
3. Vibration level in VdB is: LV = 20 · log10 [V/Vref] Vref = 5 x 10-5 mm/s,
4. Calculated from the values given in VdB.

Since no data exist for vibration, at the next stage, vibration measurements have to be carried out for the sensitive receptors identified per section.

Under the ESIA and more precisely in its scoping phase, it will be necessary to determine vibration receptors in the vicinity of the designed railway, and based on that, vibration measurements will be performed by an accredited laboratory. Under this phase, certain locations can be proposed for vibration measurements. Therefore starting from Nis to Presevo, the following locations or wider areas can be indicated: Lipovica, Leskovac (Podrum), Predejane, Vranjska Banja and Donji Neradovac. The abovementioned locations are also indicatively presented in the maps above in the noise section. As mentioned above, these locations will be more defined under the ESIA report of each per Section.

5.1.10 Surface waters

5.1.10.1 Water courses

The hydrographic network of the project area is moderately dense and developed, with relatively high average discharge. The average annual flow of the South Morava River, measured at characteristic profiles, is between 11 and 19 m3/s. The whole catchment area is relatively rich in natural springs, especially in the higher, mountainous zone. There are also many small mountain creeks with torrent flow.

The largest tributaries of the South Morava in the zone of the subject corridor are the Jablanica, Slatinska, Veternica, Džepska, Predejanska, Kalimanka, and Kopašnička rivers. Other tributaries are smaller watercourses, most of which dry up during dry periods. The existing line has about 34 surface water crossings which generally present the sensitive points in respect to potential pollution. All rivers belong to the Juzna Morava river basin (green area in the Figure 27).

Table 24 List of watercourses intersected by the railway route and their chainage

N°	Title of the watercourse	Chainage	Area
		(km)	(km2)
1	Šavarište-Šaranica kanal	1+001.65	18.52
2	Jablanica	6+158.11	922.04
3	Veternica	17+144.11	483.88
4	Bučan	21+626.42	19.09
5	Golema reka - Tulovska reka	27+237.2	21.82
6	Muratovacki potok- Slatinska reka - Kopašnička reka	31+666.74	43.6
7	Gorunjski potok - Predejanska reka	44+491.16	20.09
8	Džepska reka	52+985.58	91.46
9	Danjina reka - Dikavska reka - Koznička reka	55+053.02	21.24
10	Karađinska reka	59+608.81	19.19
11	Gornjojabukovska reka - Kalimanka	61+619.31	15.96
12	Deja dol - Kukavička reka - Lepenica	67+531.24	62.87
13	Jezerina -Oblička reka - Jovačka reka	706+16.28	34.49
14	Korbevačka reka	76+197.77	76.63
15	akumulacija Prvonek - Banjska reka	78+667.04	114.43
16	Neradovačka reka	91+438.86	15.48
17	Dubnička reka - Pavlovačka reka	93+286.47	23.42
18	Bela voda- Golema reka - Bogranovačka reka	101+592.57	18.38
19	Krševačka reka	100+176.70	39.64
20	Ljiljanska reka	100+990.58	19.62
21	Berčevska reka - Rajinska reka	113+142.58	23.44
22	Oraovička reka	119+523.8	26.6
23	Preševska reka	121+953.64	22.22
24	Trnavska reka	125+038.58	18.28

Under the project all the bridges will be renewed. The number of bridges over the South Morava River will be 11.

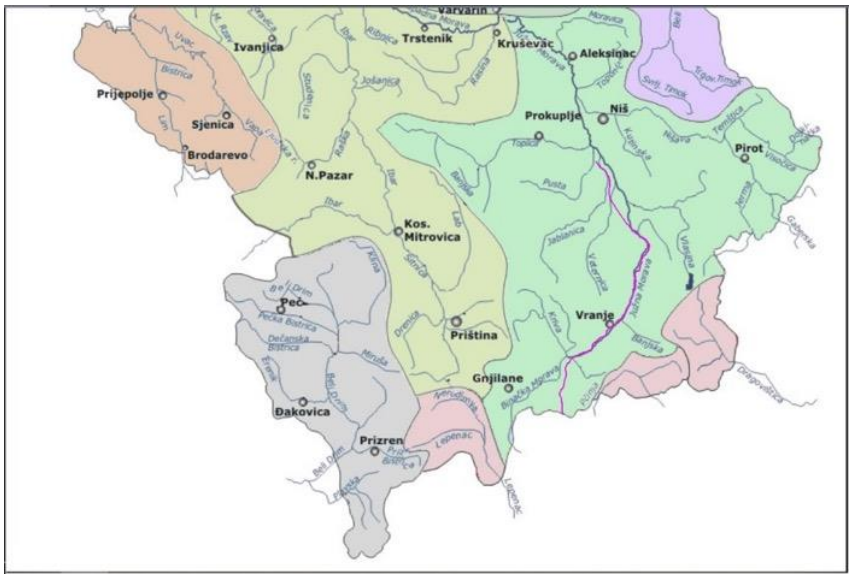


Figure 27 Main river network in the Project zone

5.1.10.2 Water quality

The following figure shows the stations relevant to the railway route where surface water quality testing was carried out during 2020.

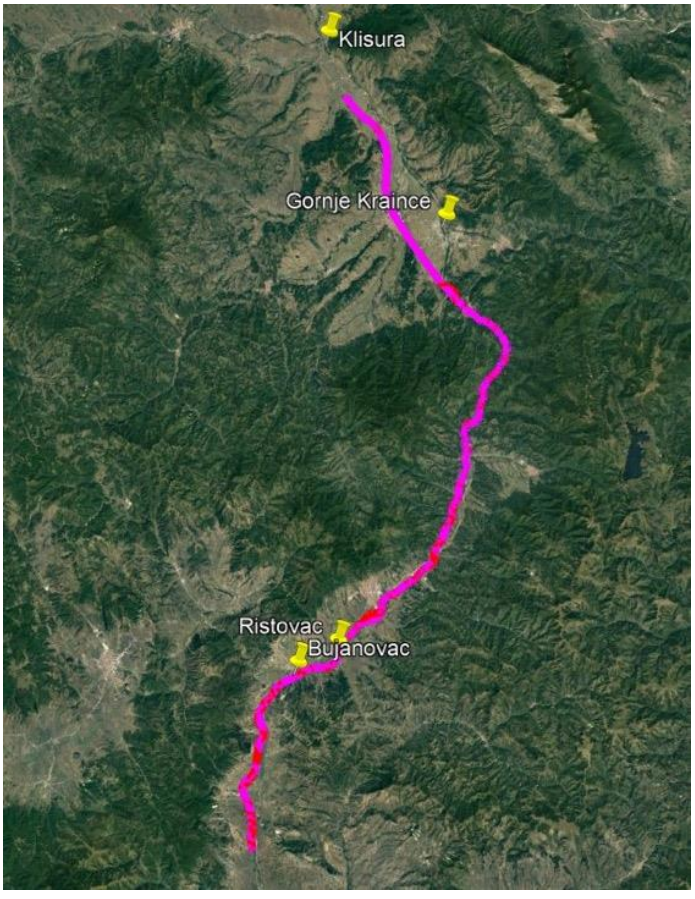


Figure 28 Stations where surface water quality was tested in 2020

Based on the Decree on the categorization of watercourses (Official Gazette of the SRS, No. 5/68), the river Juzna Morava belongs to IIa and IIb subclasses of watercourses.

The II class includes waters suitable for bathing, recreation and water sports, for the breeding of less noble species of fish (cyprinids), as well as waters which, in addition to normal treatment methods (coagulation, filtration and disinfection), can be used to supply water to beverages and in the food industry. Class II waters are divided into subclasses:

- Subclass IIa — includes waters that, in addition to normal treatment methods (coagulation, filtration and disinfection), can be used to supply settlements with drinking water, for bathing and in the food industry.
- Subclass IIb — includes waters that can be exploited or used for water sports, recreation, for breeding less noble species of fish (cyprinids) and for watering livestock.

Having in mind the watercourses on the route of the railway from Nis to Presevo and the cities through which the railway passes, the measuring stations close to the route have been identified, while results of the basic surface water quality parameters for 2020 are presented in the tables below.

Table 25 Results of measurement of parameters on the Juzna Morava watercourse, Klisura station

Station / Parameter / Month	Klisura					
	Water temperature ^0C	**Suspended matter mg/l**	**Dissolved oxygen (O_2) mg/l**	**pH**	**Dissolved CO_2 mg/l**	**Total alkalinity ($CaCO_3$) mg/l**
I	4.7	29	11.47	8.00	1.3	128
II	5.6	15	11.57	8.10	1.3	111
V	12.0	15	10.16	8.10	1.3	98
V	13.6	<4	8.88	8.00	1.3	116
VI	17.4	89	7.61	7.90	1.3	116
VII	23.6	8	10.06	8.30	0.0	161
VIII	21.4	114	6.80	8.00	1.8	94
IX	17.6	<4	8.92	8.30	0.0	190
X	12.4	5	9.80	8.10	0.9	158
XI	8.8	9	10.94	8.30	0.0	192
XII	6.2	5	11.03	8.10	0.9	113

Table 26 Results of measurement of parameters on the Juzna Morava watercourse, Ristovac station

Station / Parameter / Month	**Ristovac**					
	Water temperature ^0C	**Suspended matter mg/l**	**Dissolved oxygen (O_2) mg/l**	**pH**	**Dissolved CO_2 mg/l**	Total alkalinity ($CaCO_3$) mg/l
I	4.3	10	10.50	8.00	2.2	314
II	6.4	8	10.36	7.90	1.8	200
V	13.1	7	8.88	8.00	1.8	210
V	15.0		7.61	7.80	2.2	240
VI	16.7	122	6.66	7.80	2.2	119
VII	21.6	17	6.48	7.80	2.2	244
VIII	20.2	92	7.34	7.90	2.2	157
IX	16.8		6.60	7.90	1.8	275
X	11.9	16	8.64	7.90	1.8	244
XI	8.4	9	8.88	7.80	1.8	285
XII	6.6	5	8.98	7.90	1.8	305

Table 27 Results of measurement of parameters on the Binacka Morava watercourse, Bujanovac station

Station	Bujanovac					
Parameter / Month	**Water temperature ^0C**	**Suspended matter mg/l**	**Dissolved oxygen (O_2) mg/l**	**pH**	**Dissolved CO_2 mg/l**	Total alkalinity ($CaCO_3$) mg/l
I	4.6	13	10.50	9.73	2.6	333
II	6.0	<4	10.36	10.18	1.8	197
V	12.8	30	8.88	8.57	1.8	212
V	14.8		7.61	7.38	2.2	254
VI	16.3	66	6.66	6.48	2.2	101
VII	21.2	24	6.48	6.24	1.8	212
VIII	20.5	70	7.34	7.06	1.8	174
IX	16.5	19	6.60	6.22	1.8	271
X	11.1		8.64	8.15	1.8	227
XI	8.2	13	8.88	7.40	1.8	302
XII	6.4	16	8.98	7.80	1.8	277

In order to analyse the existing water quality of the river Juzna Morava, the data of the Ministry for the Environmental Protection, their Report on the state of the environment of the Republic of Serbia in 2021, chapter Water Quality were used.

Nitrate analysis was done at 43 measuring points where, in the period 2011-2020 year, there is continuity in sampling. An increasing (unfavorable) trend of median nitrate was determined in the Morava basin. An unfavorable (increasing) trend of nitrates was determined at 28% (twelve) measuring points, including Ristovac (South Morava). It is good that the mean nitrate values at these measuring points are low and within the limits of excellent ecological status.

The quality of river water in the Republic of Serbia, in terms of orthophosphate, does not belong to a good ecological status at eight (19%) measuring points. The worst situation is at the measuring points in AP Vojvodina. According to the orthophosphate indicator, water quality is the best in 2020 compared to the period 2011-2020.

The analysis of BOD-5 was carried out at 36 measuring points where, in the period 2011-2020., there is continuity in sampling. An insignificant trend in the median BOD-5 was determined in all catchment areas. In 2020, according to the BOD-5 indicator, water quality slightly worsened compared to 2019.

Ammonium analysis was done at 43 measuring points where, in the period 2011-2020., there is continuity in sampling. An insignificant trend in the same period is in the Morava and Danube basins as well as in the entire territory of the Republic of Serbia. According to the indicator that monitors the ammonium content, the water quality in the watercourses of the Republic of Serbia improved in 2020 compared to 2019.

The Serbian Water Quality Index (SWQI) monitors nine physical-chemical quality parameters (water temperature, pH value, electrical conductivity, oxygen saturation percentage, BOD5, suspended matter, total oxidized nitrogen (nitrates + nitrites), orthophosphates and ammonium) and one microbiological quality parameter of water (the most probable number of coliform germs) and provides a measure of the state of surface water in terms of the general quality of surface water without taking into account priority and hazardous substances.

The SWQI analysis was performed at 45 measuring points where, in the period 2011-2020 year, there is continuity in sampling. An insignificant trend was determined in the Sava basin, while an increasing (positive) trend was determined in the Danube and Morava basins, as well as in the entire territory of the Republic of Serbia.

Bad quality according to the SWQI parameter was determined at five (11%) measuring points, including Ristovac (South Morava). An insignificant trend was determined at this location.

5.1.11 Groundwaters

5.1.11.1 General

In the Republic of Serbia, groundwater accounts for about 80% of water used for public water supply (VOS, 2002). According to Stevanović (2011), the most significant deposits of fresh underground water in Serbia are in the Sava valley up to the confluence with the Danube, the Danube coast up to Golupac, in the area of Mačva, Kučajsko-Beljaničko massif, Suva planina, Tara, the valley of the great Morava, Metohija kotilina. At the same time, underground water is the only source of water supply in Vojvodina.

The largest part of groundwater reserves is located in the areas of alluvial springs, primarily in the valley of the Velika Morava. The filtration characteristics of the sand-gravel layer along the entire length of the alluvium are favourable, and the water supply sources are mainly formed in the area of lower Pomoravlje. The use of groundwater is organized mainly through wells for the needs of individual households, while larger quantities for water supply are provided from the sandy sediments of the Neogene. The catchment area of Velika Morava is rich in the occurrence of mineral and thermal waters, which is conditioned by the diverse lithostratigraphic composition and complex structural relations and the Great Moravian Neogene basin abounds in significant hydrogeothermal potentials.

Based on the hydrogeological properties of individual lithological formations as well as on the structural types of porosity, the following types can be distinguished in this area: phreatic (compacted) type issued, artesian, fissure, karst, fissure-karst, and in some parts of the terrain complex type issued, as well as arid terrains. In some parts of the terrain, it is difficult to draw sharp boundaries between these issues. Also, there is the appearance of mineral waters on these terrains.

5.1.11.2 Groundwater quality monitoring

Since the Environmental Protection Agency does not conduct testing of hydromorphological quality elements, namely it does not monitor the hydrological regime of water, the data of the Republic Hydrometeorological Institute (RHMZ) published in the annual reports of the Hydrological Yearbook are used in the analysis of water quality data. Groundwater levels and temperatures are measured at stations (piezometers) and groundwater samples are taken for quality testing.

The following figure is a map of measuring stations on the route Nis - Presevo, which determine the quality of groundwater.

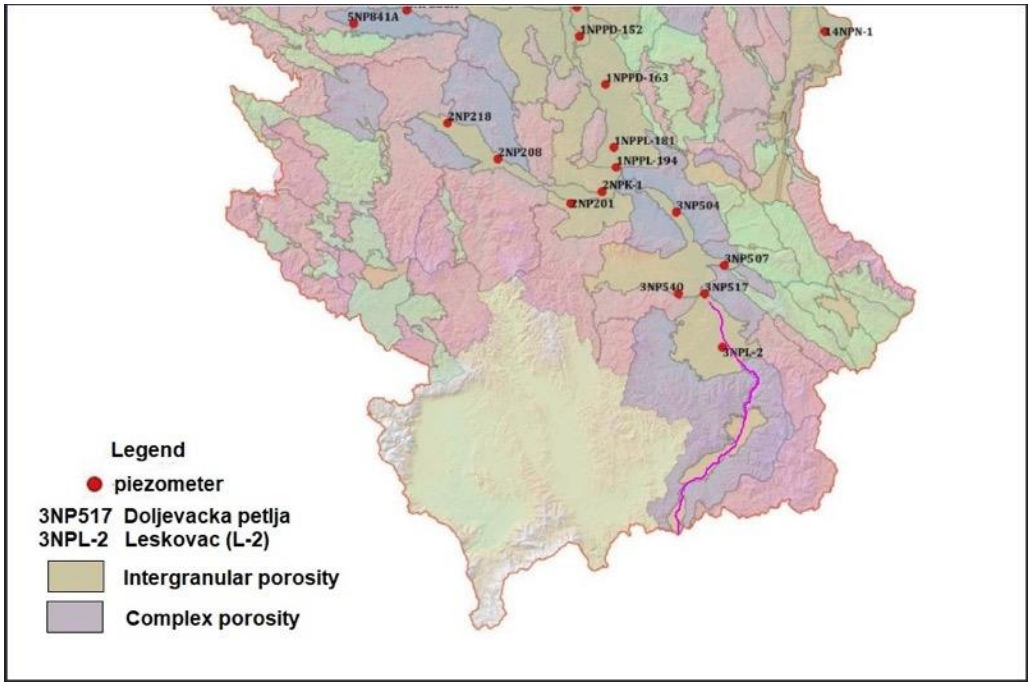


Figure 29 Network of groundwater quality stations on the route Nis - Presevo

Having in mind which river basins intersect the line from Nis to Presevo and through which cities the railway line passes, certain measuring stations have been chosen and presented in the following table. The network of groundwater monitoring stations is presented, accompanied by the following data: ordinal number, name of the hydrological station where sampling is performed water, hydrological station code, name of groundwater body, water area and coordinates.

Table 28 List of stations for monitoring groundwater quality on the railway route

No.	Name of the hydrological station where the sampling is performed	Hydrological station code	Name of groundwater body	Water basin	Coordinates	
1.	Leskovac (L-2)	3NPL-2	Leskovac - neogen	Morava	4759875	7577962
2.	Doljevačka petlja	3NP517	Leskovac - neogen	Morava	4783615	7570030

More analytical data will be presented in the relevant ESIA.

5.1.11.3 Groundwater sources in the vicinity of the railway

The most important groundwater aquifer is within the South Morava valley, where there are sands and gravels, river terrace gravels and proluvial deposits. Sensitive areas in respect to risk of groundwater pollution are Vranje, Leskovac and Bujanovac, whose protection zones are near or intersected by the railway, and several other lower public sources in the wider vicinity. The following picture shows the protection zones of water sources in Leskovac, Vranje and Bujanovac, as well as smaller springs near the railway line. Data about water sources near the route are from the Spatial plan of the special purpose area of the infrastructure corridor Nis-border of Bulgaria.

Figure 30 Water source protection zones and railway route

5.1.12 Biodiversity

5.1.12.1 Habitats

The structure and composition of the habitats in the study area are defined by the presence of river watercourses and the surrounding relief. In the natural condition, the valleys were overgrown by hydrophilic (water-loving) plants, while surrounding hilly slopes were covered by Hungarian Oak (*Quercetum frainetto-cerris*) and Turkey Oak (*Quercus laevis*) as well as their transitional forms. However, under human influence these habitats have been affected by significant changes.

5.1.12.2 Flora and Fauna

On the mountains around the South Morava valley, Rhodope mountain mixed forests are covered. Their structure consists of mixed deciduous forests: beech, oak, hornbeam and birch in lower areas and mixed coniferous forests: fir (*Abies*), spruce (*Picea*) and black pine (*Pinus thunbergii*) at higher altitudes. Fox (*Vulpes vulpes*), wolf (*Canis lupus*), wild boar (*Sus scrofa*), European hare (*Lepus europaeus*), hedgehog (*Erinaceus europaeus*), skunk (*Mustela putorius*) and fire salamander (*Salamandra salamandra*) live in them, and from birds there are crows, falcons, hawks, pheasants, owls, woodpeckers and others. Beside the rivers poplar (*Populus alba*), willow (*Salix*), alder (*Alnus glutinosa*), and pedunculate oak (*Quercus robur*) grow.

Due to the unpolluted nature of most of the region, a large number of medicinal and edible plants can be found here. Entire fields of mint, St. John's wort, thyme, etc. Some of them are included in the Red Book of the Flora of Serbia. The special specificity of the region is represented by two endemic and relict plant species: sundews (Drosera) and cherry laurel (Prunus laurocerasus). Sundews is a carnivorous plant, because it feeds on insects. It catches them with its sticky

leaves. It is characteristic of the terrains of Vlasina. It used to cover entire fields, but today, in the face of the onslaught of pesticides and various chemicals, its areas are getting smaller and rarer. The Tertiary relic, which managed to survive major climatic cataclysms, was first described by Josif Pančić in 1886.

In respect to biodiversity, the Grdelica gorge is the area of the highest sensitivity along the corridor. Although it is not formally protected, the Grdelica area is a refugium for tertiary flora, rare and endangered herbal species and mixed relic vegetation (some in The Red Data Book of Flora of Serbia). Some endangered and protected birds of prey, such as the golden eagle (*Aquila chrysaetos*) and the peregrine falcon (*Falco peregrinus*) are also present in the Grdelica gorge. These two species were identified by the Institute for Nature Protection as highly sensitive, and it will be necessary to protect them from excessive anthropogenic impacts during construction and operation of the whole traffic corridor. Aside from the important species which reside there, the Grdelica gorge also represents a migratory route for some fauna species, from the south to the north.

Fauna can be grouped in two categories: animals living in the water or associated with water and the animals of terrestrial ecosystems. Representatives of the ichtyo-fauna (fish) living in the South Morava River are: ukraine brook lamprey (*Eudontomyzon mariae*), Crucian carp (*Carassius carassius*), common barbel (*Barbus barbus*), wels catfish (*Silurus glanis*), Common nase (*Chondrostoma nasus*), Common carp (*Cyprinus carpio*), grass carp (*Ctenopharyngodon idella*), European chub (*Squalius cephalus*) and gudgeon. The valley of the South Morava River is populated by more than 150 bird species.

5.1.12.3 Protected areas

There are no protected areas on the railway route. Some of the protected areas in the wider area, as well as their distance from the railway, are presented in the following figure.

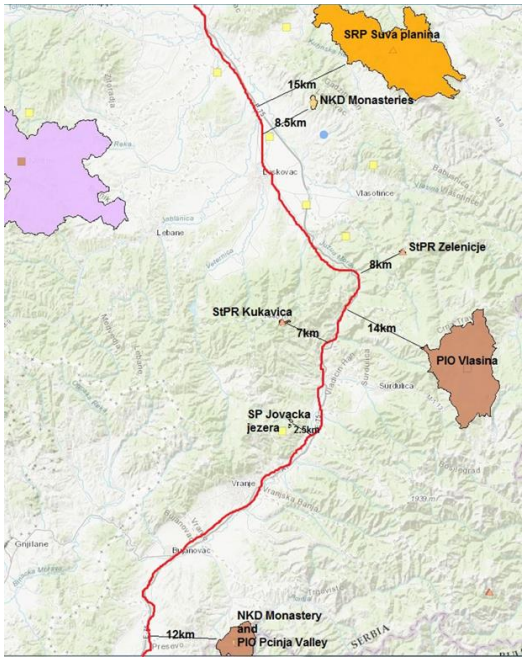


Figure 31 Protected areas and railway line

5.2 Social baseline

Elements of the baseline have been chosen to depict the Project area's sensitivity in terms of potential adverse social impacts and the possibility that the intervention would create, reinforce or deepen inequity and/or social conflict, or that the attitudes and actions of key stakeholders may subvert the achievement of the development objective, or that the development objective, or means to achieve it, lack ownership among key stakeholders.

The description of social baseline conditions has considered a wide range of data and information gathered from various sources, including:

- Desk-based studies and literature reviews.
- Data obtained from stakeholders.

Field surveys and site investigations were not conducted at this stage.

The adverse impacts of the project are contained within a moderate range of risks revolving around the following:

- Personal and property rights,
- Social and human rights issues
- Economic Impacts
- Health impacts
- Community impacts
- Impacts on the infrastructure
- Community Health and Safety
- Labor and working conditions.

5.2.1 Methodology applied for all receptors

The spatial scope of the Social Area of Influence (AoI) includes the following areas:

The Primary AoI: The primary area of influence encompasses a corridor of 8 m in rural areas and 6m in urban, measured from the centreline of the outer rail, and 14 m of air rights above as land required for the standard gauge (on each side). This corridor is potentially expected to experience the land acquisition impacts in addition to other environmental and social impacts. This applies only to land acquisition and resettlement impacts.

The Secondary AoI: Area of potential socioeconomic impacts directly associated with the Project activities encompasses a corridor of 2 km left and right. The impacts to cultural heritage features observed encompasses a corridor of 600 m left and right to as a buffer to account for refinement in the design and impacts beyond the railway right of way.

Area of Indirect Impacts: Area of potential socioeconomic impacts indirectly induced by the Project activities.

5.2.2 Limitations and assumptions

Gaps in contemporary data have been identified. However given the Secondary area of Influence and the fact that consistency within a certain municipality is known (areas of great disparity within a Municipality are not impacted by the Project), it is asserted that the information provided herein is adequate for meeting the environmental and social performance requirements of international lenders and will satisfy public disclosure and consultation requirements, focused the impact assessment and informed management measures and mitigation commensurate to this stage of the Project. It is asserted that the information provided herein is adequate for meeting the environmental and social performance requirements of international lenders and will satisfy public disclosure and consultation requirements, focused the impact assessment and informed management measures and mitigation commensurate to this stage of the Project.

5.2.3 Administrative Structure

Based on the Nomenclature of Statistical Territorial Units ("Official Gazette of the RS, No 109/09 and 46/10), and in accordance with the Law on territorial organization ("Official Gazette of the RS, No 129/07) key and basic units of local-governments are 147 municipalities, while there are 29 administrative districts and two autonomous provinces[8]. Serbia constitutes of administrative districts which are not units of local self-governments but are established for purpose of state administration outside the headquarters of the state administration. Administrative districts are established by the RS Government decree, which also included the areas and seats of administrative districts. Currently, there are five cities in Serbia with city municipalities: Belgrade, Niš, Kragujevac, Požarevac and Vranje comprise several city municipalities each, divided into "urban" and "suburban". The Project is routed through Jablanicki and Pcinjski District marked in the figure below.

[8] Source: "Law on the Territorial Organization of RS"

Figure 32 Jablanicki and Pcinjski Districts

For the purpose of outreach and stakeholder engagement, local municipal offices play a pivotal role to serve as main focal communication point as identified in the SEP. Each of the affected municipalities have registered community offices (mesne zajednice i kancelarije) which are often focal points of contact for the community, but also perform administrative responsibilities (e.g. birth, marriage and death certificates, census etc).

Municipalities: Leskovac, Vlasotince, Vladicin Han, Vranjska Banja, Vranje, Bujanovac, Presevo can be considered as core municipalities included in the study area while the elaborated areas are all other regions and countries relying on the major corridor, Corridor X, passing through this area.

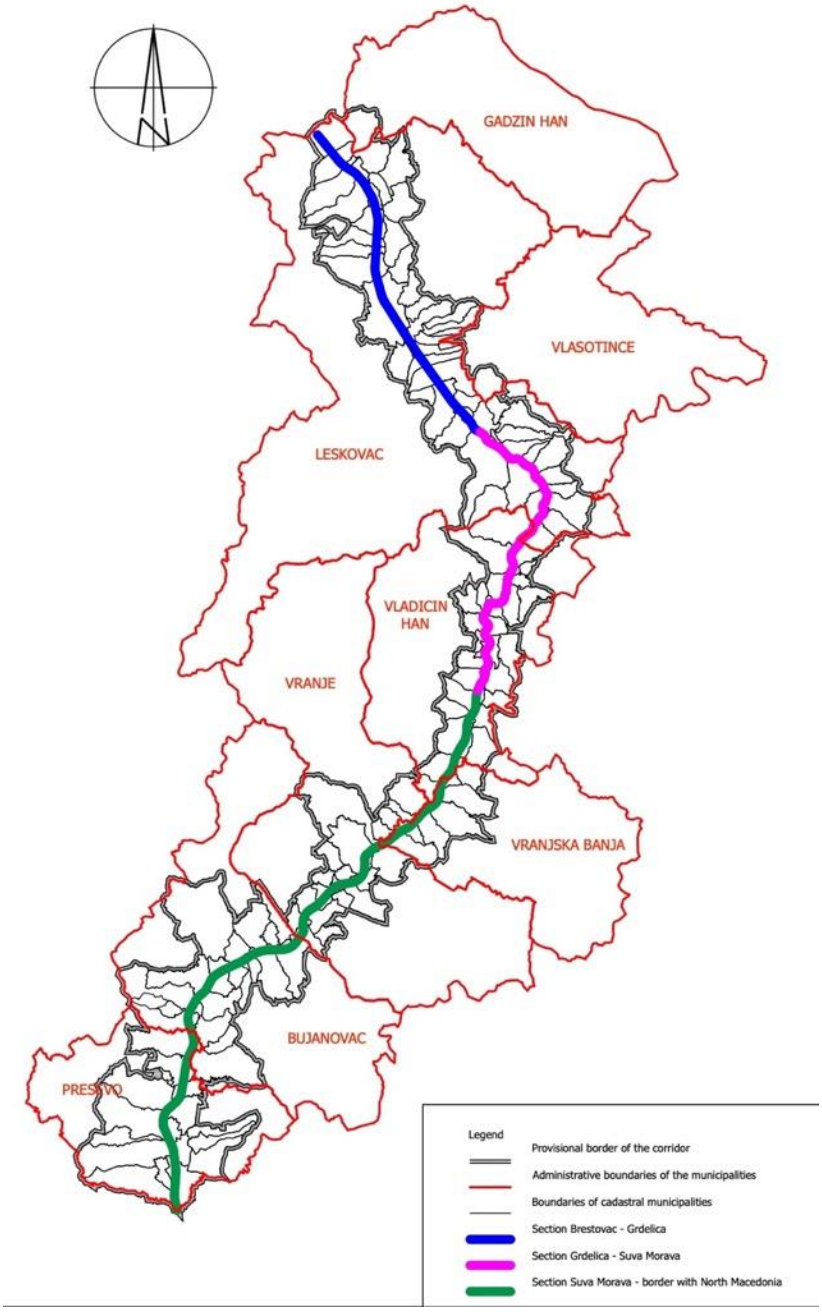


Figure 33 Railway corridor - municipalities

5.2.4 Population

Population censuses are the main source of statistical data on the total number, territorial distribution and major characteristics of individuals and households in the Republic of Serbia. Inter-census data rely on statistical estimate methodologies.

The number of populations is estimated in the inter-censual period for every year, including the census year. The estimated number of inhabitants in the Republic of Serbia in 2021 is 6,834,326 (estimates are based on the results of statistics on natural movements and internal migrations of the population). Observed by gender, 51.3% are women (3,507,325), and 48.7% are men (3,327,001). The

trend of depopulation continued, which means that the population growth rate, compared to the previous year, is negative and amounts to -9.4‰.

Table 29 Municipalities crossed by the Project and their demographics[9]

Municipalities	Area (km²)	Estimation of population in August 2021	Population density Number of inhabitants /km²	Internal migration balance (2021)
R. of Serbia	88,499	6,834,326	77	
Leskovac	1,025	132,764	130	-310
Vlasotince	308	27,101	48	-46
Vladicin Han	366	18,472	50	-60
Vranjska Banja	258	8,608	33	-60
Vranje	602	70,460	117	-193
Bujanovac	461	37,615	82	-135
Presevo	264	30,172	114	-47

According to the data in the table above, all municipalities through which the Nis - Presevo railway corridor passes record negative migration balance, with expected continuation of trend of the decline in population in the future.

Settlements that cross the Project route are listed in the Table 25, including information on the number of inhabitants and whether the given settlements currently have railway stations.

Table 30 Settlements crossed by the subject railway corridor

No.	District (Crossed by alignment)	City/Municipality (Crossed by alignment)	Settlement (Crossed by alignment)	Population (No)[10]		Station (Yes/No)
				2002	2011	
1	Jablanički	Leskovac	Brestovac	2,086	2,027	Yes
2	Jablanički	Leskovac	Lipovica	1,287	1,165	No
3	Jablanički	Leskovac	Čekmin	915	820	No
4	Jablanički	Leskovac	Pečenjevce	1,776	1,500	Yes
5	Jablanički	Leskovac	Brejanovce	364	303	No
6	Jablanički	Leskovac	Živkovo	669	620	No
7	Jablanički	Leskovac	Priboj	642	548	No
8	Jablanički	Leskovac	Zalužnje	482	422	No
9	Jablanički	Leskovac	Vinarce	3,090	2,730	No
10	Jablanički	Leskovac	Leskovac	770	779	Yes
11	Jablanički	Leskovac	Mrštane	1.431	1,332	No
12	Jablanički	Leskovac	Donji Bunibrod	644	553	No
13	Jablanički	Leskovac	Gornji Bunibrod	762	710	No
14	Jablanički	Leskovac	Guberevac	1,875	1,766	No
15	Jablanički	Leskovac	Dobrotin	321	320	No

[9] Source: Statistical Institute of the Republic of Serbia

[10] Source: Statistical Institute of Serbia

No.	District (Crossed by alignment)	City/Municipality (Crossed by alignment)	Settlement (Crossed by alignment)	Population (No)[10]		Station (Yes/No)
				2002	2011	
16	Jablanički	Leskovac	Mala Kopašnica	255	213	No
17	Jablanički	Leskovac	Grdelica (willage)	1,172	1058	Yes
18	Jablanički	Leskovac	Bojišina	245	185	No
19	Jablanički	Leskovac	Boćevica	151	118	No
20	Jablanički	Leskovac	Palojce	484	453	No
21	Jablanički	Leskovac	Graovo	277	215	No
22	Jablanički	Leskovac	Koraćevac	192	172	No
23	Jablanički	Leskovac	Ličin Dol	139	97	No
24	Jablanički	Leskovac	Predejane (varoš)	1,222	1,088	Yes
25	Jablanički	Leskovac	Predejane (selo)	491	405	No
26	Jablanički	Leskovac	Bričevlje	241	196	No
26	Jablanički	Leskovac	Suševlje	228	136	No
27	Jablanicki	Vlasotince	Ladovica	904	806	No
28	Pčinjski	Vladičin Han	Garinje	554	483	No
29	Pčinjski	Vladičin Han	Džep	194	182	No
30	Pčinjski	Vladičin Han	Manajle	60	34	No
31	Pčinjski	Vladičin Han	Balinovce	154	121	No
32	Pčinjski	Vladičin Han	Kržince	257	236	No
33	Pčinjski	Vladičin Han	Vladičin Han	8,338	8,030	Yes
34	Pčinjski	Vladičin Han	Suva Morava	859	821	No
35	Pčinjski	Vladičin Han	Lepenica	734	675	No
36	Pčinjski	Vladičin Han	Stubal	1,113	1,072	No
37	Pčinjski	Vladičin Han	Priboj	392	296	No
38	Pčinjski	Vranjska Banja	Prevalac	153	167	No
39	Pčinjski	Vranjska Banja	Korbevac	711	663	No
40	Pčinjski	Vranjska Banja	Bujkovac	796	784	No
41	Pčinjski	Vranjska Banja	Vranjska Banja	5,882	5,347	Yes
42	Pčinjski	Vranjska Banja	Kumarevo	283	243	No
43	Pčinjski	Vranjska Banja	Toplac	519	436	No
44	Pčinjski	Vranje	Vranje I	55,052	55,138	Yes
45	Pčinjski	Vranje	Vranje II	21,187	18,806	No
46	Pčinjski	Vranje	Ribnice	471	472	No
47	Pčinjski	Vranje	Donji Neradovac	633	930	No
48	Pčinjski	Vranje	Pavlovac	878	603	No
49	Pčinjski	Vranje	Davidovac	461	426	No
50	Pčinjski	Vranje	Ristovac	342	347	Yes
51	Pčinjski	Bujanovac	Žbevac	830	804	No
52	Pčinjski	Bujanovac	Ljiljance	552	535	No
53	Pčinjski	Bujanovac	Bujanovac	17,050	12,011	Yes
54	Pčinjski	Bujanovac	Božinjevac	322	376	No

No.	District (Crossed by alignment)	City/Municipality (Crossed by alignment)	Settlement (Crossed by alignment)	Population (No)[10]		Station (Yes/No)
				2002	2011	
55	Pčinjski	Bujanovac	Žuželjica	159	166	No
56	Pčinjski	Bujanovac	Levosoje	764	840	No
57	Pčinjski	Bujanovac	Oslare	898	904	No
58	Pčinjski	Bujanovac	Letovica	902	1,126	No
58	Pčinjski	Preševo	Rajince	2,110	1,954	No
59	Pčinjski	Preševo	Crnotince	1,730	1,454	No
60	Pčinjski	Preševo	Bukarevac	630	905	Yes
61	Pčinjski	Preševo	Žujince	1,405	1,248	No
62	Pčinjski	Preševo	Preševo	15,107	13,426	Yes
63	Pčinjski	Preševo	Čukarka	526	512	No
64	Pčinjski	Preševo	Trnava	463	378	No
65	Pčinjski	Preševo	Miratovac	3,072	2,774	No

Table 31 Population by age group

No.	Settlement (Crossed by alignment)	Total	Population (No)[11]			Male	Female
			0-14	15-64	65 and over		
1	R. of Serbia	6,834,326	977,124	4,402,974	1,454,228	3,327,001	3,507,325
2	Leskovac	130,940	17,425	85,215	28,300	65,126	65,814
3	Vlasotince	26,723	3,284	17,652	5,787	13,424	13,299
4	Vladičin Han	18,174	2,369	11,681	4,124	9,098	9,076
5	Vranjska Banja	8,440	1,019	5,621	1,800	4,286	4,154
6	Vranje	69,654	10,274	46,039	13,341	34,925	34,729
7	Bujanovac	37,394	6,042	27,721	3631	19,177	18,217
8	Preševo	30,194	5,492	22,814	1,888	15,285	14,909

5.2.5 Employment and economy

Less than a half of the population of the Republic of Serbia is economically active (41.3%), whereby the share of male labor force (57.2%) prevails over the female (42.8%). The share of persons who perform an occupation in the total population aged 15 and over, i.e., the employment rate is 37.4%, being higher in men (44.9%) than in women 30.5%). The highest percentage was recorded in Belgrade region (41.6%), and the lowest in Southern and Eastern Serbia (34.0%). In the Republic of Serbia, the unemployment rate, i.e., the share of unemployed persons in total economically active population is 22.4%. The unemployment rate in women (23.6%) is somewhat higher than in men (21.6%). The lowest unemployment rate has been recorded in Belgrade region (17.9%), and the highest in the Southern and Eastern Region of Srbije (27.3%). The rate of not economically active, representing the share of the not economically active population (aged 15 and over) in total population aged 15 and over, is 51.8% for the Republic of Serbia. Observed by sex, that rate is lower in men (42.8%) than

[11] Source: Statistical Institute of Serbia

in women 60.1%). The lowest unemployment rate has been recorded in Belgrade region (49.4%), and the highest in Region Southern and Eastern Serbia (53.3%).

The unemployment rate is higher than the national average in all municipalities through which the railway corridor passes.

Table 32 Employment and Salaries in impacted municipalities

Municipalities	Registered employees	Average net salary (RSD)	Unemployed*	Unemployement rate (%)
R. of Serbia	2215475	75275	491347	18
Leskovac	24351	57616	22658	43
Vlasotince	5563	52234	6216	49
Vladičin Han	3116	59286	3927	53
Vranjska Banja	1505	54408	859	36
Vranje	20149	59214	9193	30
Bujanovac	5100	52451	4544	37
Preševo	2918	50663	5153	46

5.2.6 Public services

The 2011 Serbia census identified 164,884 or 2.68 % of illiterate residents in Serbia. The number was halved compared to the 2002 census. A total of 850,000 residents, or 14 percent of the population, have no formal education or only few elementary school grades. Incomplete elementary school education has 677,000 residents of Serbia, or 11 percent. In the Republic of Serbia, 51% of persons aged 15 and over are computer illiterate, that is, 34.2% of persons are computer literate, while 14.8% are partially computer literate (May 2019). 2011 research show that 18.5% of rural women did not complete high school education because pressures by the family to stay and work in the household or on the farm, 26% because of the attitude of the family that women do not need to attain higher education levels, 18% because of a lack of financial resources, and 10% because of early marriage and family care. Differences in educational attainments are much more prominent when adult population of urban and rural areas are compared. Data from population census indicate less favorable education structure of population in rural areas with higher share of persons without any school particularly among women (these are mainly older women). On the other hand, share of persons with higher and university education is much lower among rural than urban population.

To assess and present the baseline for Public Services two most prominent indicators have been selected, i.e. access to education and health.

Table 33 Accessibility of education services

Municipalities	Children (preschool)	Elementary education	High school education
R. of Serbia	216570	519382	248846
Leskovac	2710	9675	5384
Vlasotince	525	1871	931
Vladičin Han	309	1414	688
Vranjska Banja	150	586	-
Vranje	1914	5594	3467
Bujanovac	653	2950	1238
Preševo	495	2693	1434

In terms of access to health, the Leskovac have the highest number of doctors, but Vranje has lowest number of inhabitants per one doctor available. We assume that there is a daily migration of users of health services in other municipal centers and that some users undoubtedly use rail transport to obtain health services. Access to health care becomes even more important in the years burdened by the unprecedented impact of the global pandemic caused by the novel SARS-COV 19 virus.

Table 34 Access to Health services

Municipalities	Number of Medical Doctors	Number of inhabitants per 1 doctor
R. of Serbia	20186	339
Leskovac	402	326
Vlasotince	44	607
Vladičin Han	28	649
Vranjska Banja	-	-
Vranje	281	278
Bujanovac	53	706
Preševo	43	702

5.2.7 Cultural heritage

Based on data from the Information System of Immovable Cultural Property, the Institute for the Protection of Cultural Monuments – Leskovac and Institute for the Protection of Cultural Monuments – Nis there has been carried out an identification of monuments of culture located in the study area (1000 m left and right from the line route). The most important ones and at a relative close distance to the railway are mentioned below per each of the municipalities included in the project scope.

Table 35 Cultural property near the railway line

Municipalities	Cultural property within 1000 m from the railway line	Distance from the railway line (km)
Leskovac	Church of the Holy Virgin (Crkva Svete Bogorodice)	0,6
Leskovac	Cathedral Church of the Holy Trinity (Saborna Crkva Svete Trojice)	0,6
Leskovac	Monument to the fallen warriors of Leskovac (Spomenik palim ratnicima Leskovca)	0,4
Vladičin Han	Church of the Holy Virgin in Mrtvica Crkva Svete Bogorodice u Mrtvici	0,4
Vladičin Han	Church of the Holy Transfiguration, Stubal (Crkva Svetog Preobrazenja, Stubal)	0,4
Vladičin Han	Church of Holly Paraskeva in Lepenica (Crkva Svete Petke u Lepenici)	0,7

5.2.8 Gender and gender equality

The Constitution of Serbia, adopted in 2006, endorses equality for women and men, mandates equal opportunities policies, and prohibits direct and indirect discrimination, including discrimination based on sex, gender identity, sexual orientation, marital and family status.

In 2021, Serbia adopted a new Law on Gender Equality, the umbrella law in the field of protection of women's rights; the Law on Amendments to the Law on Prohibition of Discrimination; the Strategy for Preventing and Combating Gender-Based Violence and Domestic Violence for 2021 - 2025; and a new national Strategy for Gender Equality.

Out of the total population of Serbia, 51.3% are female and 48.7% are male inhabitants. The Constitution of the Serbia proclaims principles of gender equality. Although the Constitution fails to mention gender pay equality, articles of The Labor Law treat rights of men and women equally, including right of equal pay. Additionally, according to provisions of this Law, a working woman has the right of absence from work due to pregnancy and childbirth, maternity leave, and absence from work for child care, for a total of 365 days. This length of maternity leave is usually used in full, making it one of the lengthiest in the world. The right of employment is also proclaimed equal, but because of maternity leave provisions young women in certain cases will be discriminated in employment possibility, although it is illegal to ask questions about maternity plans during job interviews. This particularly applies to employment in small and moderate private enterprises.

Despite principles however, many women in Serbia face challenges combining paid work and child care responsibilities. This could be an additional cause for Serbia's low fertility rate, which is one of the lowest in European countries, and average in the region at 1.46 percent in 2014. The employment rate of women in Serbia (38.3%) is significantly lower than the EU-27 average (58.5%). Of all the employed in the transport sector in Serbia, 20 percent are female and 80 percent are male.

The most prominent inequalities are in the domains of money, time and power, indicating lower economic standard of women, carrying out disproportionately unpaid household work and care for family, and insufficient participation in decision making in positions of political, economic and social power.

The labor market participation is much lower for women than for men, as indicated by activity, employment, unemployment and inactivity rates. There is also prominent gender segregation on the labor market, with women concentrating more in the sectors related to social services and men in the sectors of manufacturing, construction, and ICT. Transport sector is one of the sectors with strong gender segregation.19

Serbia is characterized by high number of trips made by women and men, on weekdays and weekends as well. Serbia, the average number of trips is 3.8 per day, with 3.6 trips for men and 3.9 trips for women (in the context of this statistic trips are defined as one non-stop travel within one transportation mean). Both, men and women, make much more trips during the week than on weekends. Although the difference is not high, Serbian women still make more trips on weekdays and on weekends than men. Women are more prone to intermodal mobility behavior that is, combining two or more transport modalities in one trip. More than fifth of women and men in the sample (23% of women and 22% of men) combine different transport means during single trip every day, and 20% of women and 14% of men do that 4-5 times a week. Combining different transport means in a single trip could pose stress20.

As in countries across the region, women and men also have different specializations in university, which contributes to the segregation seen in the labor market and the differences in labor market outcomes. Women constitute 89 percent of graduates in education, 75 percent in health, and 74 percent in humanities and the arts. However, they make up only 35 percent of graduates in engineering, manufacturing, and construction.

As the Project addresses passenger rail services in a border sense, there would be scope for improved mobility for people in rural areas, people with disabilities, and/or the elderly to gain better access to public services, markets and jobs. It will be important to analyze the gender implications of the Project, as women's experiences with transport systems differ from those of men, particularly as related to decision-making, facilities planning, safety, reliability, affordability, and accessibility. With the World Bank's technical advice, the GoS has recently finalized country-wide Gender in Transport study. This study analyzes gendered mobility patterns of transport users, with a view to enhance transport service provision for men and women alike, and to create better access to employment opportunities for females and improve their workplace advancement. The Project could operationalize the study's recommendations insofar as scope of this Project is concerned is concerned.

The above study also focuses on the establishment of robust human resources (HR) systems and an HR strategy within all rail companies including SRI. Of all the employed in the transport sector in Serbia, 20 percent are female and 80 percent are male. The statistics are similar in individual railway companies for which data was obtained. For example, in 2021, SRI employed 19% of women in

its workforce. Addressing gender gaps during overhauling of HR practices is an opportunity to enhance and diversify the supply of needed talent. The project in hand with ongoing activities and other projects supported by other IFIs and donors will operationalize the actions specific to human capital that will stem from the earlier-mentioned gender-sensitive Transport Strategy, related to the Jobs and strategic staffing under the strategy. The main recommendations the design can consider are related to adequate lightning in and around the station buildings, including access areas to main streets.

SRI has adopted the Code of Equality by decision number 4 / 2018-1159-275 of 12.12.2018, with the aim of preventing discrimination and promoting gender equality in the business environment. The Code of Equality was adopted with the participation of representative unions and in accordance with the National Strategy for Gender Equality for the period 2016-2020. and the Joint Recommendations of the Community of European Railways and Infrastructure Companies and the European Federation of Transport Workers. The Code of Equality also defined the Plan of Measures for Ensuring Gender Equality. in May 2018 the Joint Recommendations of CER and the European Federation of Transport Workers (ETF) have been disclosed for better representation and integration of women in the railway sector https://infrazs.rs/2018/05/zajednicke-preporuke-organizacija-cer-i-etf-za-bolju-zastupljenost-i-integraciju-zena-u-zeleznickom-sektoru/. In November 2018, at the meeting in Brussels, the SRI signed the "Declaration on Gender Equality in the Transport Sector" of the European Railways (CER).

No data on women use of the railway and GBVH on this section is found. The Customer satisfaction survey is regularly implemented but the results of this survey are not disaggregated by gender.

World Bank is funding the assignment that is yet to be initiated that aims at: preparation of the Study on passenger rail market potentials and development of a strategy for attracting more users with special emphasis on integration with existing and future urban transport. This strategy will assist: (i) the GoS to structure further support to the railway sector, (ii) railway companies to better understand passenger rail transport demand and improve their range of services; and (iii) municipalities to better connect their urban fabric to rail stations. The specific tasks and activities include:

- Assessment of perspectives for passenger rail transport through analysis of the railway passenger market and potential for the next 10 years in Serbia; gap analysis to enable passenger rail demand and development of Impact Analysis on Passenger Services Obligations
- Development of strategy to attract more railway users and identification of priority activities and investments with technical specification for pilot interventions on the basis of international best practices, analysis of the existing and planned development and development of Strategy framework and Action plan

The coordination with this project will be ensured to discuss and learn how the gender issues will be addressed in the strategy, taking into account the following issues:

- The changes in the last 20–30 years, especially in mass motorisation and the development of the motorway network, mean that many people in Serbia have not used the railway for many years – for younger generations, perhaps not in their lifetime. To attract, and retain, such potential railway users, it is necessary to aim firmly at the younger generations. Trains and stations need wi-fi connections. This will enable the young and other smartphone users to be fully catered for and they can enjoy their on-line activities while travelling.
- As an extension to this, to attract the next generation, the railway needs to target children. If a child enjoys a railway journey, it can become a potential railway user for life. In re-inventing itself, the Serbian railway needs to become known as being child-friendly, so that parents are encouraged to take their children on railway journeys.
- The service must be punctual and reliable, and the trains must be clean. Women must feel valued and safe. All the improvements and all the marketing in the world will have no lasting impact if users cannot rely on consistent standards and find a late, dirty or disrupted service. The train service plan, while aiming to offer an attractive service, must not become overambitious. Constraints must be understood, and a programme to overcome them will need to be prepared.
- Finally, the railway must be safe. There remain many unprotected, or inadequately protected, road-rail level crossings in Serbia. Any accident is a serious setback to public confidence, as well as a heavy cost. The Consultant notes that there are plans to eliminate the worst of these crossings. These plans should continue and be accelerated. The railway is a whole, each part dependent on the other, and with a holistic approach progress will be assured.

5.2.9 Vulnerable and disadvantaged groups

The initial screening against drivers of vulnerability, identified the potential vulnerable groups: retired, elderly and people with disabilities and chronical disease; single parent headed households, male and female; people with low literacy and ICT knowledge; economically marginalized and disadvantaged groups; persons living below the poverty line; women.

Roma are one of the most vulnerable groups in Western Balkans, including the Republic of Serbia and are usually exposed to several risks and adverse impacts at once. It is known that they are more sensitive to those risks and impacts, having been subject to pre-existing discrimination, financial, socio-economic, cultural and/or gender inequalities, of their geographical location, their dependence on the environment and/or limited or no access to justice and decision-making; and have a weaker adaptive capacity for coping with those risks and recovering from those impacts, due to limited access to necessary assets and/or resources. As a result, they risk being disproportionately affected by project-related risks and adverse impacts. The 2011 Census, has identified less than 150,000 Roma living in Serbia. Estimates of the actual number of Roma range between 300,000 and 600,000.

Of this number, 42.4 thousand live in the territory of Vojvodina, 27.3 thousand in Belgrade and 77.9 thousand in Central Serbia without Belgrade. They have the largest share in Vojvodina (2.19%), followed by Central Serbia (2.17%), and the smallest in Belgrade (1.65%). Compared to the 2002 census, the share in the total population increased in all three separated areas, and in all areas of Serbia. The highest percentage growth was experienced by the Roma in the Pčinjski region, but this is a consequence of the boycott of the Albanians to register. When we exclude this area, the largest share growth was in the Pirot area, by 1.49% (from 3.17 to 4.66%). Among the districts, the largest share is in Pčinjska (8.7%) and the smallest in Zlatibor Oblate (0.27%).

Observed by municipality, the largest number of Roma live in Leskovac (7,700), followed by Zemun with Surčin and Palilula, Vranje and Bujanovac. There are more than 1,000 Roma in 47 municipalities, including Belgrade, but not in Nis, Novi Sad, Kostolac and Vranjska Banja. There are between 1,000 and 100 Roma in 83 municipalities, and less than 100 in 27 municipalities, while not a single Roma is registered in Knić and Crno Trava. Crna Trava did not have a single Roma in the 2002 census, while Knić had one. In the 2002 census, there were no Roma either in Kosjerić (now there is one), Čajetina (1), Bajina Bašta (1), Nova Varoš (3), Trgovište (29), Priboj (32), and Bosilevgrad (now there are 162).

The number of Roma decreased in 11 municipalities, the most in Stari Grad (by 189), Smederevska Palanka (52) and Preševo (51). The number of Roma increased in 143 municipalities, the most in Zemun (2,062), Palilula (1,710), Subotica (1,505), Požarevac (1,265) and Čukarica (by 1,170).

The percentage of Roma in the total population is the highest in Bojnik (14.85%), Surdulica (12.95%), Bela Palanka (11.69%), Nova Crnja (9.89%) and Beocin (9.04%). Roma have more than 1% of the total population in 99 municipalities, and less in 59 municipalities.

During future field visits that will be conducted during preparation of the ESIA and subsequent RAPs, Roma communities will be registered in order to activate support programs for these citizens in cooperation with municipal centers for social work and non-governmental organizations. These programs should be aimed in particular at pre-school and school-age children (use of mobile kindergartens, organized translation to school, learning assistance, etc.), high school youth and women. The assumption is that Roma women use rail transport as the cheapest form of transport to neighbouring settlements in search of most often daily employment such as housework, cleaning services in companies, work in agriculture, etc. There are no data on the housing ownership. Serbia's government was supported in developing a Geographic Information System (GIS) on substandard Roma settlements. Through the IPA 2014 funded" Technical assistance for improvement of socio-economic living conditions of Roma population" that started in March 2019, the GIS database is to be updated. Official information is provided on 08.02.2017 from the last conducted census, according to which there are 594 substandard Roma settlements, with 20.477 dwellings and with 48.223 persons living in those dwellings. According to the responsible officials, census is not providing data on legal aspects of ownership, but their estimation is that "most probably most of the objects are illegal". For the purpose of planning the Roadmap for Serbia, according to the available data, the baseline

may be set to 51% of stated numbers: 10.443 illegal dwellings at 303 substandard settlements, with 24.594 persons. GIS data are not available in open format, as they contain personal data and protection by the data privacy act is established, while it is under the administration of a number of ministries which will provide access to details during the ESIA phase. The information on potential Roma dwellings in the Project area have been obtained through stakeholder engagement with key informants in the local communities. However, a more detailed baseline shall be developed during the ESIA phase.

The presence of Roma settlements and substandard dwellings are likely expected in the Municipality of Leskovac, Vranje and Bujanovac.

Regarding equity of access to services, twenty-two percent of Roma settlements do not have access to water. According to a UNDP 2011 survey, 22% of the Roma population do not have access to an improved water source (compared to 1% of the total population), and 39% do not have access to improved sanitation (compared to 5% of the total population) (UNDP 2012). In 2009, a strategy for the improvement of the Roma's position in Serbia was adopted. It is built around four priority areas for action: education, housing, employment, and health. Some results have been achieved in the areas of education and health, but no real improvement has been achieved in employment and housing (MHMR 2010).

5.2.10 Land use

Rough assessment of the planned railway corridor on the basis of CORINE Land cover resulted with the following land use division:

Table 36 Corridor land use

No	Type of area	Area (m2)	Area %
1	Discontinuous urban fabric	19072937,43	7%
2	Mineral extraction sites	2045081,25	1%
3	Non-irrigated arable land	81243771,35	31%
4	Pastures	108008630,2	42%
5	Broad-leaved forests	49080824,22	19%
6	Inland marshes	355146,48	0,14%
7	Other	311340,708	0,12%
		260117731,6	

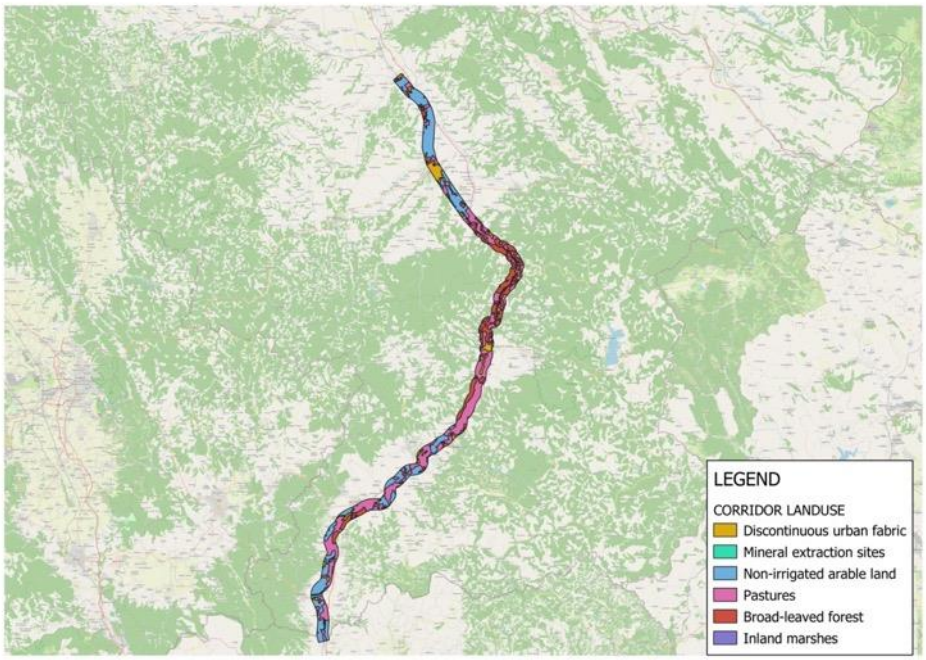


Figure 34 Corridor land use

During ESIA development a more detailed assessment of the land use within corridor area will be conducted using the cadastral data that are yet to be obtained. Taking into account that for most of the route the railway will remain within the existing alignment, it is expected that the existing corridors will be kept with spatial entities and contents already formed, with the minimum necessary occupation of new land.

The modernization and reconstruction of the railway will not affect the permanent degradation of the land, considering that the railway and the railway land are already present in the occupation of the space. The railway also passes by populated areas, passing by work zones and residential buildings.

Dependency of livelihood and to cultivated land from the social aspect is considered significant and impacts from economic displacement, severance of land plots and diversifications of income and livelihood will be considered through the next stage of the ESIA. State owned agricultural areas are sporadically present along the route.

5.2.11 Transport and infrastructure

In the Infrastructure Corridor, the Spatial Plan of the Republic of Serbia established the following main infrastructure systems in the direction of Niš - Preševo:

1) highway E-75 (M-1);

2) railway line E-85, which modernizes the existing line;

3) main optical cable, which replaces the existing coaxial cable;

4) main gas pipeline;

5) existing 220 kV transmission lines and the planned 400 kV transmission line,

6) water protection facilities - defence embankments;

5.2.12 Labor and informal employment

The incidence of informal employment is the highest among the youngest age group (15-19 years), 76% of whom are employed informally. Incidence of informal employment tends to decrease with age. This can be accounted to the low level of professional experience of the youngest age group. Informal employment rates tend to rise again for older workers, with 50% of employees over 55 being informally employed. Broken down by age group, young men and older women are over-represented in informal employment.

The Labor Inspectorate reports that 52.375 informal employment cases have been confirmed during the inspections conducted between 2017 and 2019 following which a total of 45.207 was transformed to formal employment. The labor market has recovered from post-crisis job losses. From 2014 to 2018, Serbia created around 240,000 net new jobs. The unemployment rate declined from close to 20 percent in 2014 to below 11 percent in 2019 (among people aged 15-64), and the employment rate now surpasses pre-crisis levels. Many of the new jobs have been fulltime wage jobs in the formal private sector. Recent labor market improvements have also benefited women, older workers, and the youth. Job creation was the strongest in services and industry. Earnings increased alongside the number of jobs, as real wages in the private sector grew by more than 6 percent in 2014–17 and by more than 4 percent in 2018. Despite recent labor market improvements, many people in Serbia are not working or searching for a job. Among people aged 15-64, Serbia's activity rate (67.8 percent) and employment rate (58.8 percent) remain far below those of neighboring EU countries. Inactivity and unemployment are even worse among poor households: only 22.4 percent of the working-age poor are employed, compared to 53.0 percent of working-age non-poor. As a result of inactivity and unemployment, the average male and female worker in Serbia loses about 20 years and 25 years, respectively, of his and her potential productive lifetime (ages 15–64). Many job seekers are long-term unemployed: 75 percent of unemployed workers wait more than one year to find a job. Serbia is underutilizing its full potential workforce while firms demand more workers with the right skills. With a declining working-age population due to aging and outmigration, it is important that Serbia uses its available workforce effectively.

When broken down by region, the largest number of informally employed workers is located in Vojvodina, and the smallest number in Belgrade. The highest share of informally employed workers of the total number of workers is in West Serbia and Sumadija (33.7%), followed by South and East Serbia (27.7%), Vojvodina (21.2%), and Belgrade (11.9%). These differences can, to large extent, be explained by the higher share of agricultural workers in these regions, and their higher propensity to work in the informal sectors.

Of those informally employed the vast majority can be found in the agricultural sector (59.5% of all informally employed), followed by construction (7.1%). In other sectors, the share of informal work is less than 20%. The construction

industry has a 34.9% share of informal employment in total sector employment and a 7.1% share of sectorial informal employment in total informal employment.

The poverty rate, measured as income per capita below the standardized upper-middle-income country poverty line of US$5.5/day in 2011 purchasing power parity (PPP), fell from 26.7 percent in 2013 to 20.8 percent in 2017. An increase of 1 percent in GDP was associated with about a 4 percent reduction in the poverty headcount rate, higher than the elasticities in neighboring Western Balkan countries. Consistent with the labor market recovery, increased labor income contributed the most to the observed reduction in poverty, followed by pensions. Household income increased and the poverty rate fell because of overall economic growth and its strong impact on households in the bottom of the income distribution.

Desktop data were not available in more details for the Project area. Gaps shall be closed during the ESIA stage through field studies as indicated in the section Assumptions and limitations. The employment shall be one of the criteria factored in during the ESIA stage in identifying more drivers of vulnerability. The employment status will also be elaborated during the Socio-economic survey.

6 Project alternatives

This chapter presents the variants identified and analysed during 1st LoA stage.

6.1 Assessment methodology

Based on the characteristics of the project under analysis (multi-stakeholder, concept design phase, both quantitative and qualitative criteria) it was proposed to use a MCA (Multi criteria analysis) with weighting and allowing both quantitative and qualitative criteria.

MCA is an approach and a set of techniques, aiming at providing an overall ordering of options, from the most preferred to the least preferred one.

In summary, the steps of the MCA approach are six:

7. Establish the decision context and the aims.
8. Identify the options to be considered and compared.
9. Identify the investment objectives and constraints.
10. Identify the criteria that reflect the value associated with the outcome of each option and "weigh" their relative importance in the scope of the project.
11. Assess the impacts:
    - describe the expected performance of each option against the criteria and "score" the ability of each option for delivered impacts;
    - combine the weights and scores to derive an overall value for each option (total weighted scores) and rank them accordingly.
12. Conduct sensitivity analysis to assess the robustness of MCA results to changes in weights and scores.

The main objective of the project is to modernize the existing railway line in compliance with TEN-T standards, making it a reliable and competitive mode of transport and increasing passenger and freight traffic demand. Furthermore, the objective shall be achieved in a cost effective and sustainable way in compliance with strategic plans at national, regional and local level. It should comply with internationally agreed Technical Specifications for Interoperability and with the technical requirements for the core TEN-T.

In line with the above-stated objectives, the following main criteria are proposed:

9. Strategic relevance
10. Environmental aspects
11. Social aspects
12. Safety
13. Accessibility/Competitiveness
14. Technical aspects
15. Climate Change
16. Financial aspects

These groups of criteria correspond to the project objectives and reflect the nature of the project. The specific sub-criteria under each group were selected in anticipation of the results of the design elaboration of options after having been discussed with the stakeholders. The goal was to present any significant differential impacts between the options, so the initial number of defined sub-criteria was reduced by eliminating those criteria in which no significant difference

between options was observed or assumed. The summary of all criteria and sub-criteria is shown in the following table.

Table 37 MCA criteria, sub-criteria and weights applied

Parameter / Criterion Group	Sub-criterion	Relative weights of criteria and sub-criteria within groups		Overall weights (%)
Strategic Relevance	TEN-T Policy	**4%**	100%	**4%**
Environment	Flora – Fauna	**13%**	25%	**3%**
	Landscape		25%	**3%**
	Groundwater		25%	**3%**
	Emissions		25%	**3%**
Social	Expropriations and resettlements	**13%**	33%	**4%**
	Cultural heritage		33%	**4%**
	Disturbance of residential areas		33%	**4%**
Safety	Level crossings	**11%**	50%	**6%**
	Modal shift		50%	**6%**
Accessibility/ competitiveness	Rail competitiveness	**12%**	40%	**5%**
	Rail stations accessibility		30%	**4%**
	Road network		30%	**4%**
Technical Aspects	Technical difficulties	**10%**	33%	**3%**
	Operation during construction		33%	**3%**
	Departure from standards		33%	**3%**
Climate Change	CC Resilience	**7%**	50%	**4%**
	Climate Change Gas emissions		50%	**4%**
Financial Cost	National contribution (%)	**20%**	50%	**10%**
	Investment cost in total		50%	**10%**
Net Financial Impact	Net Revenues	**10%**	100%	**10%**

The performance of the options against the criteria has been measured using proper indicators. These indicators can be qualitative or quantitative (monetized or other types of quantities). The performance indicators applied during MCA are provided below.

Table 38 The performance indicators

Parameter / Criterion Group	Sub-criterion	Indicators of Performance of each Option
Strategic Relevance	Spatial Planning/Policy	Qualitative evaluation of accordance (or not) with strategy for speed and length of tracks in stations
Environment	Flora - Fauna	There aren't any protected zones along the line. Quantitative: km in open track (potential severance), km in green/brown fields, Occupation of forest or wild vegetation land (Ha).
	Landscape	Quantitative: Length and areas affected by the rail track construction (Km of high cuts/embankments). Number and length of river training.
	Groundwater	Quantitative: Number of sources. Distance from sources, if closer than 300 m.
	Emissions	Quantitative: vehicle*kms shifted from road to rail (modal shift)
Social	Expropriations and resettlements	Quantitative: Expropriation of agricultural land (Ha). Number of buildings (small buildings, apartment blocks, industrial buildings) to be demolished.
	Cultural heritage	Quantitative: Number of sites, distance from such sites (less than 300m). Qualitative: significance of sites if available.
	Disturbance of residential areas	Quantitative: Length of rail track in close distance from houses (less than 300m), cases of separated villages.
Safety	Level crossings	Qualitative: evaluation based on the number of level crossings and the operation of the existing and new line
	Modal shift	Quantitative: vehicle*kms shifted from road to rail (modal shift)
Accessibility/ competitiveness	Rail competitiveness	Quantitative: reduction of travel time between 3-4 main O-D pairs (pas. and freight)
	Rail Stations accessibility	Quantitative: Traffic volumes in stations/stops to be abolished. Distance in case of relocation.
	Road network	Qualitative: evaluation based on potential overall impact on local road network
Technical Aspects	Technical difficulties	Qualitative: taking into account the number of difficult structures and the level of risk.
	Operation during construction	Qualitative: taking into account ways and difficulties to keep the line open. In case of closure, consider the hours/periods of stoppage. Actual impacts on traffic.
	Departure from standards	Qualitative
Climate Change	Resilience	Quantitative: Km within flood or erosion area based on past experience and cases.

Parameter / Criterion Group	Sub-criterion	Indicators of Performance of each Option
	Climate Change Gas emissions	Quantitative: vehicle*kms shifted from road to rail (modal shift)
Financial Cost	National contribution (%)	% of national contribution on the investment cost
	Investment cost	Monetized: CAPEX in Euros
Net Financial impact	Net Revenues	Monetized: Euros/year

6.2 Description of the options

The Nis (Trupale) – Presevo line is divided into three subsections considering distinct terrain conditions, as follows:

- **Subsection A**: Trupale–Grdelica (59.3 km);
- **Subsection B**: Grdelica–Suva Morava (32.1 km);
- **Subsection C**: Suva Morava–Presevo/North Macedonian border (66.4 km).

The following options, were considered and evaluated with respect to the design speed per sub-section and single/double rail tracks, as it was decided among the stakeholders and documented in the Inception Report:

- **Option 1:** 120km/h-80km/h-120km/h single track
- **Option 2:** 120 km/h -120 km/h -120 km/h single track
- **Option 3:** 160 km/h -120 km/h -160 km/h single track
- **Option 4:** 160 km/h -160 km/h -160 km/h single track
- **Option 5:** 160 km/h -160 km/h -160 km/h double track

It was concluded after the First Level Options Analysis Report (May 2022), that the preferred option for consideration was a combination of Options 1 and 4 in that report, i.e. 160 km/h for Subsections A and C, and 80 km/h for Subsection B. Subsection B passes through the Grdelica gorge and would be very expensive to reconstruct for 160 km/h. This option 6 is described in more details under the heading 6.4. below.

6.2.1 Spatial limitations

All Options are in accordance with the tasks of National Programme of Public Railway Infrastructure on Corridor X through the Republic of Serbia. It should be noted though, that deviations from the existing line, necessitate the preparation of a new Spatial Plan adjusted to each Option.

In particular, deviations from the existing line, per Option are as follows:

Option 1

Sub-section A will remain in the existing corridor, while in sub-section B realignment will be needed for 16.7 km. Subsection C will require a new alignment over a total length of about 32 km.

Option 2

Sub-section A will remain in the existing corridor, but in sub-section B about 26.9 km will be in new alignment. Sub-section C will be realigned for a length of about 32 km.

Option 3

Sub-section A will be realigned for a length of about 6.5km while in sub-section B about 26.9 km will be in new alignment. Sub-section C will require a new alignment for a total length of about 48 km.

Option 4

Sub-section A will be realigned for a length of about 6.5km and sub-section B for a length of about 28.6 km. Sub-section C will require a new alignment for a total length of about 48 km.

Option 5

Sub-section A will be realigned for a length of about 9km and sub-section B for about 28.1 km. In sub-section C about 28.1 km would need to be realigned. In this Option, the doubling of the track requires the bridges to be widened and the station layouts to be changed.

6.2.2 Technical issues

The increase of the design speed obtained by each Option, imposes the construction of additional main structures (bridges and tunnels).

In Option 1 the total length of bridges is 1,680 m, and the 6 bridges are of length over 100 m. The total length of tunnels is 1,099 m, and the one tunnel (Letovica) is long (526.77 m.). The total length of open alignment is 128,808 m, i.e. 97.88% of the total length of the line.

In Option 2 the total length of bridges is 2,565 m, and the longest bridge is 120 m. 11 bridges are of length over 100 m. The total length of tunnels is 7,253 m, and the longest tunnel is 2,925 m. In this Option there are 7 new tunnels 5 of them being long and one very long. The total length of open alignment is 119,338.94 m, i.e. 92.40% of the total length of the line.

In Option 3 the total length of bridges is 2,740 m, and 12 bridges are of length over 100 m. The total length of tunnels is 7,842 m, and the longest tunnel is 2,925 m. In this Option there are 8 new tunnels 5 of them being long and one very long. The total length of open alignment is 117,802 m. i.e. 91.76% of the total length of the line.

In Option 4 the total length of bridges is 2,575 m, and 9 bridges are of length over 100 m. The total length of tunnels is 15,194 m, and the longest tunnel is 2,913 m. In this Option there are 11 new tunnels 3 of them being long and 7 very long. The total length of open alignment is 110,314 m, i.e. 86.13% of the total length of the line.

The design of option 5 was based on option 4. The subsections have similar characteristic with option 4, while realignments were due to an increase of the width of the subgrade and the number of tracks. In Option 5 the total length of bridges is 2,310 m, and 7 bridges are of length over 100 m. The total length of tunnels is 15,522 m, and the longest tunnel is 2,950 m. In this Option there are 10 new tunnels 2 of them being long and 7 very long. The total length of open alignment is 110,206 m, i.e. 86.07% of the total length of the line.

6.2.3 Vulnerability to climate change

The line passes through some identified sensitive to erosion and/or flood areas. The table below presents these areas by Option.

Table 39 Flood/erosion areas

Flood/ Erosion	Option 1 (from km to km)	Option 2 (from km to km)	Option 3 (from km to km)	Option 4 (from km to km)	Option 5 (from km to km)
section 1					
F	300-302	300-302	300-302	300-302	300-302
section 2					
F	304-305	304-305	304-305		
F/E		306-308 (1.7km)	306-308 (1.5km)		
F/E		310-311	310-311		
F/E		311-312	311-312		311-312
section 3					
F/E		313.5-318 (3.85km)	313.5-318 (3.85km)		
E		318-321 (2.25km)	318-321 (2.25km)		
F		321-323 (1.7km)	321-323 (1.7km)	321-323 (1.4km)	321-323 (1.4km)
F		327-328	327-328	327-328	327-328
F					328.5-329.5
F/E		346-349	346-349	346-349	346-349
F	372-374	372-374	372-374 (1.7km)	372-374	372-374
F	377-378	377-378	377-378	377-378	377-378
Flood (km)	6	15.7	15.4	9.4	10.9
Erosion (km)		5.8	5.6	1	1.5
TOTAL F/E	**6km**	**21.5km**	**21km**	**10.4km**	**12.4km**

6.2.4 Environmental conditions in the alternative alignment areas

The rail line follows the South Morava River flowing generally from the South to North direction and crosses the river in several locations. River regulations will be necessary locally in the positions of bridges but also a long river regulation of more than 2 km is necessary in Options 1 and 2. Also, along the line there are several water sources and the line passes through the protection zone of the city water source for about 16 – 17 km, depending on the Option.

With respect to the effects of the Options on environment, it should be noted that none of the Options affects protected areas.

The Options present small differences with respect to the length of crossing green fields, from 21.33km in Option 5 to 28.06 km in Option 2. The potential effect on forest and/or wild vegetation areas also varies from Option 5 presenting less effect, mainly due to tunnels, to Option 2 which presents the max effect due to realignments in open tracks. This effect represents an estimate of the area of the belt of natural greenery (forests, hedges) that the railway line will cut i.e. it corresponds to potential severance.

Landscape and optical intrusion (due to high cuts or embankments) presents greater variations between Options, with Options 4 and 5 being more intrusive and Options 1 and 2 less intrusive.

6.2.5 Social aspects

Realignments will have different effect on the villages along the line. This effect could be beneficial in cases where the rail line is separating or very close to a village, while the realignment bypasses the urban area. The number of villages separated by rail or very close to the rail line, declines from 19 in Option 1 to 16 in Option 2 and to 15 in Options 3, 4 and 5.

6.2.5.1 Expropriations

In order to estimate the effect of the options, a corridor of 30 m width for the single track options and of 35m width for the two-track option has been reserved in accordance with the Spatial Plan of the infrastructure corridor Nis - Presevo.

The following table shows the areas to be expropriated of agricultural land under each option

Table 40 Estimated areas for expropriation

Option	Urban (m^2)	Other (m^2)	Total (m^2)
Option 1	490,000	1,025,000	1,515,000
Option 2	580,000	1,020,000	1,600,000
Option 3	595,000	1,285,000	1,880,000
Option 4	575,000	1,195,000	1,770,000

Option	Urban (m^2)	Other (m^2)	Total (m^2)
Option 5	740,000	1,580,000	2,320,000

6.2.5.2 Resettlement

The impact of alternative options on displacement was estimated based on the categorization of buildings in residential buildings and industrial buildings.

For the estimation of the buildings to be demolished the following assumptions were done.

- For Options 1 to 4, where there is little or no deviation from the existing alignment, a belt for demolition of buildings of 15 m was adopted. For Option 5, this was raised to 19 m.
- For all options, on sections where the route deviates from the existing alignment, the belt in which the structures are demolished varies according to the height of the embankment or depth of the cut, as follows:
  - cut/embankment up to 3m - belt width 17m (for option 5 belt width 21m)
  - cut/embankment up to 6m - belt width 26m (for option 5 belt width 30m).

There will be no demolition on the sections where tunnels are planned.

Table 41 Estimated number of residential buildings demolition

Option	Subsection 1 Brestovac-Grdelica	Subsection 2 Grdelica-Suva Morava	Subsection 3 Suva Morava-Granica sa SM	Total
Option 1	10	27	8	45
Option 2	11	36	21	68
Option 3	11	36	13	60
Option 4	6	36	13	53
Option 5	14	38	24	76

Table 42 Estimated number of industrial buildings demolition

Option	Subsection 1 Brestovac-Grdelica	Subsection 2 Grdelica-Suva Morava	Subsection 3 Suva Morava-Granica sa SM	Total
Option 1	-	-	1	1
Option 2	-	2	1	3
Option 3	-	2	1	3
Option 4	-	2	1	3
Option 5	1	1	1	3

6.2.5.3 Cultural heritage

Thirteen sites of cultural heritage have been identified along the corridor, but at this stage of the project no information about their names, characteristics or significance, is available.

One site is on Subsection A, near Grdelica, where Options 4 and 5 may pass under the site, in a tunnel. Two of the sites are further away from Options 3, 4 and 5 than they are from Options 1 and 2. Nine sites are along Subsection C, with little difference in the alignments on this subsection. Therefore, little difference between the options can be identified.

Besides these objects, one graveyard has to be relocated in Subsection B of Option 5.

6.3 Scoring of the MCA

Scoring of performances is expressed by a number in a 1 to 5 scale for all criteria.

Each option is evaluated for each criterion, according to the above mentioned indicators, and got a performance score in a 1 to 5 scale (higher score for the best option).

Apart from the above 5 levels of scoring, a 6th level corresponding to the unlikely event that extremely severe negative effects derive from an option, was foreseen to be used. The categorization of an option in this level – for any of the criteria - would be a "red flag" which leads to the rejection of this option without further evaluation. At the end, such a score was not used, so all Options remain eligible.

The overall score of each Option is calculated by the formula:

$$Vi = \sum_{j=1}^{n} (w_j * p_{ij})$$

where:

i= the options

j=the criteria

Vi=the total evaluation score of option i

wj = the weight of each criterion j

pij=the value of performance of each option (i) for each criterion (j)

The most advantageous option is the one presenting the higher V value.

The evaluation of the Options was performed by a team of Senior Experts covering technical, environmental, social, traffic and transport planning expertise. In total Option 4 got the higher score. The overall results of the scoring are summarized in the table below.

Table 43Scoring results

Parameter / Criterion Group	Option 1	Option 2	Option 3	Option 4	Option 5
Strategic Relevance	**2.0**	**2.0**	**2.0**	**2.0**	**2.4**
Environment	2.8	2.4	2.9	3.2	**3.4**
Social	2.6	3.0	**3.2**	2.9	2.5
Safety	1.4	2.2	3.4	**4.6**	**4.6**
Accessibility/ competitiveness	2.9	3.1	3.0	**3.4**	3.0
Technical Aspects	2.4	2.0	2.6	2.3	**3.0**
Climate Change	2.8	2.0	2.5	**3.9**	**3.9**
Financial cost[12]	**2.4**	1.9	1.6	1.1	0.5
Net Financial impact	**4.4**	3.6	3.3	2.6	1.6
Weighted total	263	247	269	**277**	256

According to the evaluation performed by the Consultant's experts, Option 1 presents higher performances in the financial criteria i.e. due to low construction and maintenance cost only. Option 2 is the least advantageous Option, presenting no top scoring in not one of the criteria. Option 3 presents higher scores in the social criteria, while Option 4 in safety, accessibility/competitiveness and climate change. Option 5 presents higher performances in environment, safety, technical aspects, strategic relevance and climate change, but lower scores in the financial criteria.

In overall, Option 4 got the higher weighted score, Option 3 getting the second highest score. Option 1 follows in scoring.

6.3.1 MCA Sensitivity Analysis

The Sensitivity Analysis provides the result of the MCA assuming different weights were attributed to the criteria. This helps to measure how robust the MCA result is and will show if another option could be considered as optimal.

As already mentioned, the weights to be used in this MCA derived from the expressed opinions of the stakeholders during the process of selecting the criteria and their sub-criteria and their weighing.

In Sensitivity scenario 1 the criterion "Strategic relevance" and sub-criterion "national contribution" are not taken into account. All sub-criteria weights remain unchanged.

Sensitivity scenario 2, was produced by the Consultant, and considers all criteria as having equal weight.

In Sensitivity scenario 3, sub-criteria with unclear performance were omitted (cultural heritage, national contribution), in order to check the impact on the final

[12] The sub-criterion "National contribution" is practically not used since – up to the evaluation time - it is not clear if there will be a flat percentage for all options, or not.

result. In this last sensitivity scenario, the weight of financial criterion remains at 20%, and the weight of Social criterion remains at 13%.

The results of these sensitivity scenario on the scoring and ranking of the options is shown in Table 44.

Table 44 MCA Sensitivity scenario results

Scenario	Best Option	Score of best Option	Rank of the Main scenario best Option	Second best option
Main	Option 4	277	1	Option 3
Sens 1	Option 4	313	1	Option 3
Sens 2	Option 4	295	1	Option 5
Sens 3	Option 1	306	2	Option 4

Therefore, in most cases Option 4 remains the optimum one. In the only case (sensitivity scenario 3) that Option 4 is not the best one, it is ranked second to Option 1.

It should be noted, also, that according to the sensitivity results, the second best option varies between Option 3 and Option 5.

6.4 The Selected Option (Option 6)

It was concluded after the First Level Options Analysis Report (May 2022), that the preferred option for consideration was a combination of Options 1 and 4 in that report, i.e. 160 km/h for Subsections A and C, and 80 km/h for Subsection B. Subsection B passes through the Grdelica gorge and would be very expensive to reconstruct for 160 km/h.The selected option is to raise the maximum line speed for passenger trains to 160 km/h on Subsections A and C, and 80 km/h on Section B. The lower design speed for Subsection B is a result of the high cost to realign for 160 km/h in this section which passes through the Grdelica Gorge. Extensive new tunnelling would be involved. Proposals for speed increase to 160 km/h on this central section need to be considered for future projects if the EU aim for 2040 is to be achieved.

Under the selected option the line will remain single-track, with passing stations. This reduces the line capacity and the potential average speeds, compared with double-track options, since not every train can be non-stop through the entire 132-km section. Trains will need to stop to allow trains in the opposite direction to pass.

The characteristics are as follows. The theoretically possible journey times shown in the table are calculated for a passenger train that would run at the maximum sectional design speed without any stop or delay. It shows that the time taken for a through journey could potentially be halved, but this is only a notional figure that indicates the upper limit of the possibilities for time reduction.

Table 45 Improvement Options under Consideration

Subsection	Km	Present Design Speed	Present Allowable Speed	Proposed Design Speed
A. Brestovac–Grdelica	34.0	120	70–100	160
B. Grdelica–Suva Morava	32.2	70	50–65	80
C. Suva Morava–Preševo/ North Macedonian border	66.4	110	50–95	160
Average for whole section	132.6	103	70	140
Theoretically possible journey times (minutes)		*77′*	*114′*	*57′*

6.5 The no project scenario

In the "do nothing" alternative, the situation will remain the same. This would mean the following:

- The current condition of the railway infrastructure on the Niš – Preševo railway line will remain unsatisfactory,
- The technologically obsolete electrical equipment will not be replaced.
- The technologically obsolete signalling and telecommunication systems will not be replaced.
- Keeping a large number of level crossings on the line, which poses danger to road users, as well as for the safety of both rail and road traffic.
- No modal shift from road to rail, and more traffic on the road would result in more pollutant emissions, GHG emissions, congestion and accidents.

The goal of the railway infrastructure modernization on Corridor X through Serbia is the reconstruction of the existing lines and the extension of the second track on the sections where single-track lines were built. This task is one of the state priorities in the construction of traffic infrastructure on the territory of the Republic of Serbia. The modernized railway should meet the requirements defined by international agreements (AGC, AGTC, SEECP). The reconstructed and modernized railway for mixed passenger and freight traffic should be equipped with modern ERTMS devices (ETCS-L 2, GSM-R) and should have other characteristics in accordance with the requirements of interoperability (TSI).

Furthermore, the "do nothing" alternative would ignore the obligations of the Republic of Serbia as a candidate for EU membership, which address the need for a sound, high quality, and integrated transportation network to effectively connect the European market. For all the above reasons, it was considered that the choice of this alternative was not prudent and not considered further within the selection of the alignment.

7 Potential impacts and mitigation measures

7.1 Introduction

7.1.1 Generic Methodology

For the current Project, the methodology that was chosen for the evaluation of environmental impacts took into consideration rated qualitative criteria.

The following sections describe some of the general principles that underpin the assessment approach, while physical, biological, socio economic and cultural environment will be assessed related with the project development.

The methodology that will be used to predict and assess potential environmental impacts includes:

- Collection of baseline environmental and social data by research and survey
- Review of existing literature, documents and reports from various organizations (governmental agencies, universities, institutes) and other similar projects
- Interviews with individuals and representatives of interest groups
- Consultation meetings with relevant Project stakeholders to identify key concerns and to obtain further data where necessary
- Review of relevant statistical and cartographic databases and various census data
- Area of Influence to be defined for each of the potential impacts
- Site visits and field investigations along the railway corridor
- Identification of receptors
- Characterization of the potential impacts and evaluation of their significance

7.1.2 Characterization of Impacts

The parameters that were taken into consideration for the evaluation of environmental impacts include (i) landscape and morphology, (ii) geology (iii) soils, (iv) seismicity, (v) climate change, (vi) air, (vii) noise, (viii) surface waters, (ix) groundwaters and (x) biodiversity and protected areas, while the parameters for the evaluation of social impacts include (i) labor standards and terms of employment (ii) community impacts such as public health, safety, security, gender equality, impacts on indigenous peoples and cultural heritage, land acquisition or potential reduction in people's livelihoods as a result of project activities (iii) occupational Health and Safety. It also includes disproportionate impacts on vulnerable groups/gender, involuntary resettlement, and affordability of basic services.

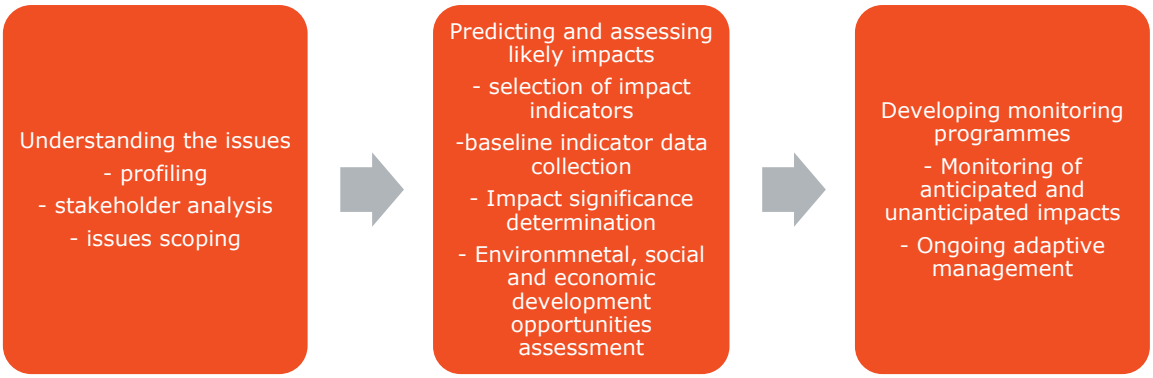
In determining the type of environmental and social impact, the ESIA report will be guided by the following indicators:

- The nature of impact. Identification what changes the impact brings, are they an improvement or degradation to the benchmark conditions. In this respect they are classified as: Positive or Negative.
- Vulnerability of receptors assess the recipient of impact itself, its rarity, vulnerability and adaptability to impact and change. In this respect, they can be low, moderate and high.
- The spatial dimension and geographic 'reach' of the impact. This considers the proportion of communities potentially affected by the change. By this virtue impacts are categorized as local, regional, national and trans-boundary.
- Time dimension. This is the timeframe over which an impact will be experienced; this may include temporary, short-term, long-term and permanent impacts.
- Reversibility (long term reversible, short term reversible or irreversible);
- Magnitude. This is the degree of change at a household or community level to livelihoods and quality of life i.e. extent of impact. In this respect they can be major, moderate, minor, negligible and none.

During the planning phase, all potential impacts should be assessed by its probability. In the respect of the likelihood of occurrence, potential impacts should be determined as: very unlikely (the impact is very unlikely to occur under normal operating conditions but may occur in exceptional circumstances), unlikely (the impact in unlikely but may occur at some time under normal operating conditions), likely (likely to occur under normal operating conditions), very likely (the impact will almost certainly occur) and certain (impact will occur).

The significance of environmental and social impacts is evaluated taking into account the magnitude of the impact and the vulnerability of affected receptors as well as all other above-mentioned dimensions. In order to assess the significance of the impacts, the impact is reflected within the local setting as articulated in the view of the local population and the environment. Socioeconomic and environmental impacts, significance of the impact is evaluated by the consideration of the impact magnitude and the importance placed on the impact by stakeholders.

Diagram below depicts the assessment process.



The table below should show how the significance of impacts should be designated and determined according to mentioned characterization indicators of impacts.

Table 46 Significance of impacts

NATURE OF IMPACT NEGATIVE /POSITIVE					
			Vulnerability of Receptors		
			Low: Minimal areas of vulnerabilities; consequently, with a high ability to adapt to changes brought by the project.	Moderate: Few areas of vulnerability; but still retaining an ability to at least in part adapt to change brought by the project.	High: Profound or multiple levels of vulnerability that undermine the ability to adapt to changes brought by the project
Magnitude of Impact	Negligible	Change remains within the range commonly experienced within the households or	Negligible	Negligible	Negligible
	Minor	Perceptible difference from baseline conditions. Tendency is that impact is local, rare and affects a small proportion of receptors and is of a short duration.	Negligible	Minor	Moderate
	Moderate	Clearly evident difference from baseline conditions. Tendency is that impact affects a substantial area or number of people and/or is of Moderate duration. Frequency may be occasional, and impact may be regional in scale	Minor	Moderate	Major

	Major	Change dominates over baseline conditions. Affects the majority of the area or population in the area of influence and/or persists over many years. The impact may be experienced often and national in scale.	Moderate	Major	Major

7.1.3 Cumulative and Transboundary Impacts

Cumulative impacts are those that result from the incremental impact of a project when added to other existing, planned, and/or reasonably predictable future projects and developments". Cumulative impacts are limited to those impacts generally recognized as important on the basis of scientific concerns and/or concerns from Affected Communities and Stakeholders. Cumulative impacts are those that result from the successive, incremental, and/or combined effects of an action, projects, or activity when added to other existing, planned, and/or reasonably anticipated projects and activities. Areas and communities can be potentially impacted by cumulative impacts from further planned development of the project or other sources of similar impacts in the geographical area, any existing project or condition, and other project-related developments that can realistically be expected. However, the assessment does not include potential impacts that would occur without the Project or independently of the Project.

The assessment of cumulative impacts considers the combination of multiple impacts that may result when the Project is considered alongside other existing or proposed projects in the same geographic area or similar development timetable. However, considering the nature and magnitude of the Project, the extend of the impacts it will have on both social and environmental component and the necessary mitigation measures it will include, it is likely that all possible cumulative impacts will be merged, examined and assessed in the ESIA process. Cumulative effects due to noise superimposition can be expected in areas in the immediate vicinity of the highway and the high-speed railway, primarily in the area of the city center of Vladičin Han and 27 smaller settlements and villages.

That being said, cumulative impacts will be assessed as appropriate in the proper stages of ESIA report.

Potential transboundary environmental impacts are more likely to occur at the area of the railway alignment near the North Macedonian border, and these could include impacts to surface water, groundwater, fauna and protected and designated areas.

Potential transboundary social impacts are expected to occur along the railway alignment not only near the North Macedonian border but wider.

The most important transboundary impacts potentially will be the impact on economy and Communities Quality of life.

7.1.4 Residual Impacts

Residual impacts are impacts that remain in the case where proposed mitigation measures are implemented. It should be noted that effectiveness of mitigation measures could vary for different impact subjects and receptors. Negative residual impacts overall assessed as being either of minor or negligible significance will be considered to be environmentally and/or socially acceptable. For negative residual impacts assessed as being either major or moderate significance measures will be planned and implemented that compensate/offset for residual risks and impacts (these measures do not eliminate the identified adverse risks and impacts, but they seek to offset it with an-at least- comparable positive one). Evaluation of the significance of residual impacts will be done based on expert judgment and separately for each type of impact.

7.1.5 Uncertainties

Any uncertainties related with impact prediction or the sensitivity of receptors due to the absence and inconclusiveness of data or due to other limitations are explicitly stated. Where applicable, the ESIA report will make recommendations concerning measures that should be put in place with monitoring or environmental or social management plans to deal with the uncertainty so that they may be addressed.

7.2 Impacts and mitigation measures during construction

7.2.1 Environmental Aspects

The potential environmental impacts and indicative mitigation measures for the construction phase that can be identified at this stage of assessment are summarized in the tables below. More localized analysis will be carried out under the ESIA at the next stage.

Table 47 Environmental aspects during construction phase

Impact area	Potential impacts	Indicative mitigation measures
	Construction phase	
Landscape	• Visual impacts from the establishment of construction areas along the alignment, the presence of buildings, machinery, construction yards, new buildings, fences and structures, noise barrier. • Loss of existing vegetation to facilitate the construction of both the online and offline section of the project • Demolition of properties along the project • Temporary visual awareness of construction activities associated with tunnel construction, bridges, underpasses, overpasses etc.	• Upon completion, areas used as construction compounds will be returned to their original use and state • Specific attention will have to be given to Sections where the infrastructure will be dismantled. • Replacement tree planting/woodland planting will be carried out within those areas noted as being subject tosignificant loss • All planting will be of local provenance and in keeping with the local character; and • Where topsoil is to be stripped and stored on site temporarily for reuse, the stockpile mounds will be stored at a maximum height of 2m, in order to preserve the structural integrity of the soil. • Mitigation screen vegetation planting, subject to land take, and availability of suitable land area. • Implementation of a 5-year Landscape Management Plan • Restricted hours of working will be proposed within built up areas
Resources and waste	• Water consumption. • Impacts on ecosystems • Visual impacts from demolition waste, excavated material, decommissioning of the existing railway line and construction work site waste. • Occupying space (land)	• Ensure that the specification of recycled and secondary content in imported materials (such as earth work, stone and aggregate, cement and asphalt), is set out during detailed design. • Maximise the use of off-site construction and pre-fabrication methods to encourage a process of assembly rather than construction. • Capture and communicate actions already undertaken (or planned) within the design for deconstruction and disassembly, to encourage reuse and recycling at assets' end of life. Items that can be readily reused includethe following: ballast (can be washed and sold for construction), sleepers, rails, track accessories, and switches (can be revitalized and used for lower-grade tracks, in accordance with the Waste Management Plan for IŽS). • The Contractor will be required to develop and implement a Waste Management Plan, to drive performance in the highest tiers of Waste Hierarchy, thereby maximise reuse and recycling • Where on-site reuse (or other forms of revitalisation) cannot be achieved, the arising should be submitted to companies licensed for the disposal of hazardous and non-hazardous waste. • A Decommissioning Waste Management Plan (DWMP) for the existing railway line will be prepared and maintained by the lead contractors. • Waste generated from the decommissioning of the existing railway line will be, where appropriate, treated and safely disposed in accordance with the Serbian regulatory requirements; • Hazardous waste (e.g., impregnated sleepers, transformer oils, PCB oils, transformers) should be identified and managed in accordance with the Waste Management Act.

Impact area	Potential impacts	Indicative mitigation measures
	Construction phase	
Geology and soils	• Potential Impacts on Topsoil from Leaks/Spills from HGVs, Machinery and Hazardous Material Storage • Soil erosion from construction activities • Loss of fertile topsoil • Soil stability and risk of landslides • Soil contamination	• Careful construction and thorough quality control processes • Provision of spill kits to contain leaks/spills; • Program to ensure good driver behaviour/maintenance of vehicles • An Emergency Response Plan will be produced prior to construction (including a Spill Management Plan), • Slope stabilisation – including mulching (straw mulching), brushwood mulching, erosion control blankets, soil binders (e.g. polyacrylamide) and gravelling; • Retaining walls – to retain loose materials on slopes w here it would not naturally be held, for example on near vertical or vertical slopes; • Sediment traps and basins – which will intercept and retain sediment-laden runoff; • Drainage channels – which will divert run-off water; • Treatment systems – to remove material contained within the run-off water; • Limited temporary land take of agricultural land is proposed during construction • Land where the existing infrastructure has been dismantled may need to be decontaminated.
Climate change	• Release of greenhouse gas emissions (through the transportation using construction machinery, producing materials, etc.) • The construction activities may affect the climate through increase of CO2 concentration by diminution of vegetation from earthworks for construction purposes (work camps, any eventual access road, vegetation clearing alongside the working strip both sides of the railway line) • Drying out and cracking of ground and access road surfaces leading to slower vehicle movements and repair work, resulting in construction delays. • Deformation and melting of materials. • Overheating of machinery leading to delay. • Rail tracks buckling or deforming under extreme heat. • Fires	• Design optimisation to reflect the carbon reduction hierarchy • Reduce the requirement for construction materials and excavation; • Specify materials and products with reduced embodied GHG emissions including through material substitution, recycled or secondary content and from renewable sources; • Designing, specifying and constructing the Project with a view to maximising the potential for reuse and recycling of materials/elements at the end-of-life stage; and • Specifying high efficiency mechanical and electrical equipment. • Planting specifications and maintenance regimes for the public realm will be important in reducing the impact of long periods of drought and water logging on ground conditions. • All long-term topsoil material stockpiles will be located outside the active construction site and away from drainage ditches. • River crossings, beds and banks will be restored to their original state, and banks and adjacent upland areas will be stabilised immediately after final grading; the watercourse crossings will be designed to avoid affecting the stability and long-term performance of riverbanks and flood defences. • Not carry out landscaping or excavation work near watercourses during high water periods or during heavy rains. • Drainage from higher areas will be diverted around stockpile areas to prevent erosion. As required, sediment controls will be installed downstream of stockpile areas to collect any run-off. • Restore ditches damaged by machinery (damage to the gradient, shoulder construction of the

Impact area	Potential impacts	Indicative mitigation measures
	Construction phase	
		embankments, etc.). • The Contractor will ensure all dirt and debris are cleaned on sites without delay (approved by the Construction Supervision Officer) • Adherence to energy efficiency measures
Air pollution	• Impacts from generate dust and particulate matter from the construction works • Change in human exposure to dust generated by rail and brake wear as a result of railway alignment	• A Dust Management Plan (DMP), including measures to control other emissions, in addition to the dust and PM10 mitigation measures given in this report, will be developed • A Construction Traffic Management Plan will be produced to manage the sustainable delivery of goods and materials. • Construction compounds are required to be located away from sensitive receptors • Where practicable, erect solid screens or barriers around dusty activities or the site boundary that are at leastas high as any stockpiles on site. • Remove materials that have a potential to produce dust from site as soon as possible, unless being reusedon site. If they are being reused on-site cover appropriately. • Ensure all vehicle operators switch off engines when stationary - no idling vehicles. • Avoid the use of diesel-or petrol-powered generators and use mains electricity or battery powered equipmentwhere practicable. • Ensure an adequate water supply on the site for enabling effective dust or particulate matter suppression • Avoid explosive blasting, using appropriate manual or mechanical alternatives. • Re-vegetate earthworks and exposed areas/soil stockpiles to stabilise surfaces as soon as practicable
Noise pollution	• Impacts from noise and vibration from blasting, tunneling, earthworks or pilling	• Preparation of Noise Management Plan by the Contractor; • Measurement and monitoring of environmental noise • Avoid necessary revving engines and switch off equipment when it is not required; • Keep haul/access roads in close proximity to the Project well maintained; • Use rubber linings for dumpers to reduce noise impact; • Minimise drop height of materials; • Start-up plant and vehicles sequentially rather than all together; • Use of reversing alarms that do not have a tonal component (i.e. broadband), if applicable. • Sources of significant noise should be enclosed, as far as reasonably possible; • Ensure regular and effective maintenance for the plant and any sound-reducing equipment; and • Install temporary local noise barriers for noisy equipment. • The selection of low or non-vibratory piling equipment such as rotary or bored piling. • Reducing the requirement for vibratory compaction and using static force compaction, such as

Impact area	Potential impacts	Indicative mitigation measures
	Construction phase	
		smooth-wheeled or sheep foot rollers. • No start up or shut-down of vibratory plant within 50m of receptors. • Communication with residents to highlight potential periods of disruption in order to minimise the number of complaints.
Surface waters	• Increased pollution risks to surface water bodies from increased sedimentation and disposal or spillage of fuels or other harmful substances that may be discharged, spilled directly or migrate to local surface water receptors. • Increased risks to surface waters from discharge of foul effluent from construction compounds/construction workers accommodation and increased water demand associated with construction compounds / construction workers accommodation. • Increased flood risk associated with temporary works within areas of fluvial flood risk and within watercourses and increased flood risk associated with surface water discharges during construction • Impacts to watercourse flow and connectivity • Earthworks required for installation of abutments and piers may initiate the bank erosion resulting in significant sediment run-off and deterioration of the surface water quality and even affect the streambed hydromorphology.	• Provide sediment barriers between earthworks and the watercourse to prevent sediment from washing into the river. • Use of silt fences, silt traps, filter bunds, settlement basins and/or proprietary units such as a 'siltbuster' to treat sediment laden water generated on site before discharge should also be implemented. • Additional measures and pre-treatment required prior to discharging potentially polluted water from tunnel dewatering to include use of non eco toxic additives and oil separator. • Fuels and potentially hazardous construction materials should be stored in bounded areas with external cut-off drainage and fuel • Fueling and maintenance of construction vehicles and plant (including wash down) should be done on hard standing or on haul roads, with appropriate cut-off drainage and located away from watercourses. • No surface water runoff from construction working areas or sites that may contain fuels or other harmful substances should be discharged to surface water receptors unless first subject to robust pre-treatment. • Limit the clearance of vegetation on the channel banks. • Until the beginning of the in-water works, preserve at least 20m depth of bankside vegetation from the channel bank to protect bank stability. • Avoid works to watercourses during high flow events and during heavy rainfall to reduce the risk of fine sediment release, watercourse erosion and increased flood risk. • Hydraulic connectivity must be maintained • If watercourse diversion is required, maintain a temporary channel to maintain flow and connectivity whilst the permanent channel is prepared. • Avoid undertaking works within or adjacent to the watercourses as far as practicable. • Minimise the required construction zone adjacent to and within watercourses to reduce the impacts of flow construction and loss of fluvial floodplain storage and conveyance. • Implement a construction-stage drainage strategy for construction compounds, construction workers accommodation and other large areas of impermeable surface to capture and attenuate runoff prior to discharge.

Impact area	Potential impacts	Indicative mitigation measures
	Construction phase	
Ground waters	• Potential Impacts on Groundwater Quality from Leaks / Spills from HGVs, Machinery and Hazardous Material Storage • Impacts on flow and recharge • Dewatering and changing the groundwater regime	• Long term and seasonal groundwater monitoring should ideally be undertaken prior to construction to allow for baseline conditions to be understood and monitor changes (such as those to turbidity and groundwater levels) • Action would be needed to address the degradation of groundwater quality during construction such as adjustments to drilling duration or speed. • Construction Plans and Method Statements Tunnel Construction, Tunnel Handover Plan and Blasting Management Plan to prevent impact to groundwater resources during construction activities.
Biodiversity, protected areas and habitats	• Habitat loss (construction) • Habitat degradation (construction and rehabilitation) • Habitat fragmentation (construction) • Severance of ecological bio-corridors (construction and rehabilitation) • Loss of flora • Use of pesticides • Direct mortality • Species disturbance including noise / vibrationand visual disturbance;	• Pre-construction surveys for Nesting bird habitat/features, presence of specific sensitive receptors, bat roosts, suitable reptile/amphibian hibernacula and invasive plants. • Avoiding certain types of works in the reproductive seasons • Avoiding of all works that cause noise during reproductive season of birds. • Close cooperation with environmental authorities to identify locations and seasons to be avoided by any construction activities in order to not have harmful impact on nesting, breading or mating of specific species along the corridor. • Delimitation of areas to be cleared before the beginning of the construction activities • Construction/rehabilitation of facilities to be sited on unused land of no particular ecological value • Maximum use of existing access roads in order to avoid construction of new temporary access roads for bringing material and vehicles, which will minimize loss and fragmentation of vegetation and natural semi- natural habitats • Restoration of sites after completion of construction rehabilitation (retaining as much of the original vegetation as possible for reinstatement) • Minimized or avoided clearing in riparian areas • The construction of drainage pipes and bridges in water courses will be carried out during the dry season • The extension of the construction area next to water courses will be only that strictly necessary to adequately • Gradual vegetation clearance to retain passage for species as long as possible • Avoid dawn-dusk and night-time works, during the activity of nocturnal animals such as carnivore species and bats • Vegetation clearance works should start if possible before the breeding season (spring) • Construction fauna crossing points (i.e. culverts) along the railway. • Improvements on the existing line for underpasses which may not be present and can be installed in therehabilitation works • Offset planting • Develop and implement a Biodiversity Management Plan (BMP), if necessary to protect ecological values of high biodiversity importance areas (which will be further elaborated after the detailed investigation) –

Impact area	Potential impacts	Indicative mitigation measures
	Construction phase	
		prior to any construction operations • The clearance of vegetation will be limited to the strip of land needed for the occupation of the permanent way and the right of way of the future railway corridor and the adjacent working width for buildings • Avoid the cutting of trees: if cutting will be necessary, it will only be done with the required permits in compliance with the regulations • Preparation of integrated vegetation control and management program, regarding use and application of pesticides, or use of the alternative control measures and methods to avoid use of chemicals • In forested areas, and especially those where the value of vegetation is high or very high, each tree lying in the border of the construction site will be protected by covering its trunk with wooden planks avoiding any damage to the tree • Railways will be designed and maintained to discourage plant growth in the track area • The workers camps will be constructed in areas of vegetation with negligible sensitivity vegetation, or low sensitivity • Construction materials should be stored and maintained away from watercourses. • Surface water runoff from the construction sites into the watercourses should be avoided and a system of cut-off ditches, silt fencing and/or bunds should be installed if required. • Noise and vibration should be controlled and kept to the minimum necessary to prevent potential negative effects on fish. • Lighting used for construction should be switched-off when not in use and, where possible, positioned so as not to spill on to watercourses.

7.2.2 Social Aspects

The Proposed Scheme has the potential to affect land use through loss of land, severance of land and severance of access. There is also the potential for a wide range of socioeconomic impacts including effects on economic investment and access to employment. The assessment of population and human health will be undertaken to understand the potential effects on local communities and human populations of the Project. Consistent with the socioeconomics and land use, health effects associated with the Project are described according to the administrative boundaries of the impacted municipalities as outlined below.

Table 48 Social impacts during construction

Impact area	Potential impacts	Indicative Mitigation measures
Impact to Archaeological sites and cultural resources (Chance find) outside of known sites	• Impacts to cultural heritage by chance finds during earthworks	• Cultural Heritage Management Plan • Chance finds procedures in place and embedded into contracts for construction works • Archaeological supervision in place • Reconnaissance of terrain prior to earthworks
Labour and working condition risks	• Non-compliance with the HR requirements of the Project • Shadowed and unpaid work • Child Labour • Inadequate workforceaccommodation • Gender Based Discrimination • SEA/SH risks	• Implement HR policies • Require Contractor to sign statements of adherence to National Labour laws as supplemented to meet the requirements of ESS8 • Adopt Project general HR Procedure • Adopt Labour relation management Plan • Establish a workers grievance mechanism • Adopt equitable and gender observant recruitment policy including • SRI to adopt overarching HR policy • Adopt Camp management Plan and apply camp operation procedures in line with EBRD and EIB requirements
OHS risk	• Risk from working at heights • Risk from working with electrical circuits • Emergencies and Epidemic Diseases due to increased workforce and COVID-19 pandemic • Risk from operation of machinery and equipment • Inadequate	• Implement OHS management Plan • Regular unannounced site inspections • Implement Prevention plan • Planning and segregating construction and operation traffic either through the use of one-way traffic routes, establishment of speed limits , and on-site trained flag-people • Alternatively plan for rail line

Impact area	Potential impacts	Indicative Mitigation measures
	resources, equipment, procedures, training • Communicable diseases • Risks from operation of the existing line while the new line is constructed (whether this will be the case is not yet know but risk have ben scoped in)	closure during certain period of construction should be adopted
Community health and safety risks	• Risk during creation of access routes • Disruption of traffic and pedestrian routes • Noise and vibration fromequipment • Spills/Releases • Direct mortality – e.g. as a resultof increased collision risk with the railway and electrocution power lines • Disruption of mobility • Railway traffic disruption on theexisting line • Temporary influx of workers • Social tension	• Notification to local residents and businesses of works • Noise controls detailed within the ESMP beadhered to • Setup of site boundary/installation of securityand lighting • Implement Traffic Management Plan • Notification to municipalities and local residents w here interface/access is impacted • Proper maintenance of equipment. Inspection prior to operation. • Apply appropriate spill control measures as per Fuel Supply, Handling and Distribution procedure and Chemical and Hazardous Materials procedure • Implement Stakeholder Engagements Plan and Grievance mechanism • Apply appropriate spill control measures per • Spill Prevention and Response procedure • To maintain safety, works will primarily take place on the period when no traffic is scheduled, • A detailed program of work should be developed and implemented in line SRI operating procedures.
Private and public property	• Physical and economic displacement and land restrictions • Damages to property and assets • Loss of private and public lands • Loss of business lands • Temporary land allocation • Damage to land and property impacts	• Implement The Project resettlement policyFramework • Develop site specific resettlement instrumentRAP/LARP) • Implement RAP /LARP • Monitoring and evaluation
Fragmentation of agricultural land plots	• Loss of livelihood	• Implement RAP and surrender of orphan land procedures

7.3 Impacts and mitigation measures during operation and maintenance

7.3.1 Environmental Aspects

The potential environmental impacts and indicative mitigation measures for the operation and maintenance phase that can be identified at this stage of assessment are summarized in the tables below. More localized analysis will be carried out under the ESIA at the next stage.

Table 49 Environmental aspects during operation phase

Impact area	Potential impacts	Indicative Mitigation measures
Resources and waste	• Waste that will be generated during the railway operation will be primarily food, paper and packaging waste, coming from passengers • Track maintenance waste and ancillary infrastructure waste can be expected along the route and their quantities will depend on the maintenance activity.	• Implementation by the SRI of the waste management hierarchy • Public waste bins in passenger trains and inside the stations' facilities will be provided; • Waste containers for use by the track maintenance personnel and railway station tenants will be provided and waste will be segregated; • Hazardous waste from the track maintenance will be segregated and temporarily stored inside a properly equipped space.
Geology and Soils	• Impact on topsoil quality and soilerosion • Soil stability and risk of landslides • Seismic activity • Soil contamination	• Maintain sediment traps and basins, drainage channels and treatment systems; • Maintain slope (cuttings and embankment). • An Emergency Response Plan will be produced prior to operation. • Revegetation and/or maintenance of vegetation to increase the stability of potentially loose materials and surfaces which may develop during the operational phase of the Project • Maintenance and thorough quality control processes including inspections for maintenance depots; • Leak/ spill management
Air pollution	• Modal shift of passenger and freight movements from road-based travel (car or bus movements for passenger and freight respectively) to rail-based travel.	

Impact area	Potential impacts	Indicative Mitigation measures
Noise and vibration pollution	• Annoyance and complaints from noise and vibration	• Cuttings: The Project benefits from cuttings at some sensitive locations. • Tunnel portals will be designed to avoid any significant airborne noise and vibration effects caused by the trains entering the tunnel; • Between source and receptor: o Measurement and monitoring of environmental noise o Installing noise barriers (protective walls) o Insulation of house windows and facade. • Using maintenance strategies for track. Considering the use of track support systems such as Resilient track fasteners, Ballast mats, resiliently supported ties, Floating slabs, construction of trenches. • Vibration barriers are generally an introduction of material or geometry without material as in the case open trench in the soil between the source and the receiver that thanks to its characteristics such as density, stiffness, weight, etc., are able to deviate/damp the waves. Different barriers are available with different shapes and materials. • Application of different soft and stiff wave vibration barriers.
Climate change	• Flooding of underpasses and tunnels. • Scour of structures, weakening and degrading materials. • Drainage infrastructure overwhelmed leading to surface water flooding. • Flooding of railway tracks resulting in disruption to service. • Waterlogging and erosion leading to destabilisation. • Increase in expansion of materials leading to structural damage. • Drying out and cracking of substrate leading to damage to foundations and destabilisation of structure • Fires	• Implement energy efficient lighting throughout the Project; • Use energy meters to monitor energy requirements; • Implement efficient water fittings. • Rail tracks will be designed, and materials will be selected to withstand temperature increases • Technical buildings will have air conditioning systems to eliminate the effect of condensation due to temperature differences or very cold/hot air. • Permanent and temporary loads that will be taken into account for designing the bored tunnels and cross passages will also include temperature and shrinkage. • Consideration of design foundation and ground movements in regard to their resilience to flooding or heavy rainfall events. • Drainage ditches will be the best quality without any casting defects and beads and showing no cracks or other faults and be in firm and homogenous condition • Drainage infrastructure will include an allowance for climate change. • The design of drainage will minimise

Impact area	Potential impacts	Indicative Mitigation measures
		the need for drain cleaning, the possibility of clogging and the consequentflooding of the track work subgrade. • Drainage infrastructure will be inspected regularly to identify any deterioration, and additional inspections following extreme weather events and/or persistent high temperatures. • Necessary training will be given regarding correct usage of the equipment.
Surface water	• Polluted surface water runoff that may be discharged to surface water bodies. • Increased wastewater discharge and increased water demand associated with railway stations. • Increased flood risk associated with proposed drainage systems. • Increased flood risk caused by displacement of flood water storage or crossing of watercourses that may impact flood flow conveyance. • Impacts to hydrology, hydro morphology and flow dynamics associated with any crossing or realignment of watercourses.	• Provision of a new drainage system that will drain the track corridor (embedded in Project design). • Maintain existing drainage and treatment at high-risk areas • Collect waste products such as oil from maintenance stations and dispose of site in agreement with the necessary requirements • Regular inspection and maintenance of drainage systems to remove blockages (embedded in Project operation). • Consider climate change effects on capacity of drainage system. • Detailed assessment and, if required, provision of attenuation to reduce rate and volume of increased runoff from impermeable surfaces. • Design of watercourse crossings to have sufficient capacity • Consider climate change effects. • Further consideration to potential impacts to fluvial floodplain storage and conveyance in high risk areas, and provision of appropriate mitigation such as flood relief culverts beneath embankments or re-profiling of low-vulnerability land to provide compensation, • Further consideration of the potential effects of climate change to flood flow s and the extent/depth of the

Impact area	Potential impacts	Indicative Mitigation measures
		floodplain. • Maintain the stability, profile, hydraulic connectivity and hydraulic capacity of all watercourses crossed by the Project and in particular those with bridge piers within the watercourse. • Provision of erosion control upstream and downstream of all watercourse crossings to prevent scour and impact to watercourse hydro morphology and geomorphology (e.g. rock armour and concrete scour mattress). • Set back bridge piers from within watercourse to remove any impacts on flow conveyance • Provision of low flow channels through proposed culverts to maintain constant base flow.
Ground waters	• Potential effects on groundwater quality, flow and recharge	• Operational Maintenance Plan will be produced and will include maintenance and repair plans. • The implementation of the mitigation measures defined above for soils and surface water will serve to protect groundwater during the operational phase.
Habitats and biodiversity	• Habitat degradation • Habitat fragmentation	• Restore pre-construction conditions as far as possible (e.g. re-vegetation of working strip) and maintain vegetation - Vegetation/Landscape Restoration Plan. • Preparation of Vegetation Restoration Plan in order to achieve pre-construction conditions as much as possible (e.g. re-vegetation of working strip) • Develop and implementation Monitoring Plan for flora and fauna in order to timely recognise negative impacts and trends related to the railway operation and define additional mitigation measures. • Maintenance clearing in riparian areas will be avoided or minimized • The implementation of the mitigation measures identified for flora, fauna and habitats, will serve to ensure the integrity and conservation objectives of all the ecologically important and designated areas in the railway corridor area.

Impact area	Potential impacts	Indicative Mitigation measures
	• Direct mortality – e.g. as a result of increased collision risk with the railway and electrocution on power lines, Bird collision with high speed trains to be noted, particularly in proximity to IBA or migration routes if identified • Species disturbance - disturbance –including noise/vibration and visual disturbance. • "Barrier effect" • Invasion alien species	• Control of vegetation along the track; use of an integrated vegetation control and management program, regarding pesticides/herbicide uses • Alien and invasive species are not used for the maintenance of corridor; native species will be planted and invasive plant species removed • Development of a natural vegetation along the railway corridor which assist the screening of the Railway • Maintain the multifunctional passages for small and large animals clear of vegetation and debris, in a functional status • Registration where animals are killed; propose appropriate measures (e.g. fencing) • Regular removal of food and organic waste from the railway • Fenced areas to be vegetated with native plant species that attract local fauna and with plantation patterns designed to lead the animals towards the wildlife crossings. • Regular maintenance activities including protective fence maintenance, removal of food, waste, animal carcasses etc. around the railway, in order to reduce the attraction of scavengers.
	• Ecologically important habitats	• Monitoring of the status of these areas, including activities with stakeholders; Monitoring Plan will definefurther status and condition of these habitats, with proposal of specific measures for the preservation of these areas
Landscape and visual	• Permanent change to the nature of the landscape directly within the footprint of the project • Permanent modifications to existing land form (cuttings and embankments) • Addition of a number of permanent built structures within the landscape including bridges, overpasses and underpasses, tunnel portals fencing, noise barriers • Increased visual awareness of disturbance from passenger and freight train movements within the view	• Regular maintenance of vegetation. • The appropriate design and colours for the fencing. • Using as much as possible low and/or transparent noisebarriers

7.3.2 Social Aspects

The social aspects for the operation phase are summarised below.

Table 50 Social aspects during operation phase

Impact area	Potential impacts	Indicative mitigation measures
General Operational Safety	Safety issue potentially affecting both crew and passengers is the threat of serious injury or the potential loss of life due to train collisions with other trains or with road vehicles, as w ell as the possibility of derailment due to these or other operational causes	• Implementation of rail operational safety procedures aimed at reducing the likelihood of train collisions such as a positive train control (PTC) system • Rail design and application of TSI and EU CSM process
Derailments	The risk form derailment remains reasonably common although those leading to significant injury or loss of life are increasingly rare	• Implementation of rail operational safety procedures aimed at reducing the likelihood
Railway staff risks	Despite the high level of safety achieved for rail users, railways have traditionally been a relatively high-risk industry for staff both in terms of injuries and fatalities. Track workers are especially vulnerable due to their exposure to moving trains and high voltage electricity, the use of heavy plant and equipment, exposure to poor environmental conditions and frequent need for working anti-social hours.	• Implement OHS Standards
Transport of dangerous goods	Dangerous goods are frequently transported in bulk or packaged form by rail, representing a potential risk of release to the environment in the event of accidents on a number of other causes.	• Implementation of a system for the proper screening, acceptance, and transport of dangerous good and Use of tank cars and other rolling stock that meet national and international standards (e.g. thermal protection and puncture resistance) appropriate for the cargo being carried. • Preparation of spill prevention and control, and emergency preparedness and response plans, • Routing and timing of hazardous materials transport to minimize risk to the community • Limiting train speed in developed areas • Dissemination of emergency preparedness and response information to the potentially affected communities
Level Crossing safety	RLC and trespass. As the safety of passengers on trains increases, the greatest harm inflicted by the railways often arises at its external interfaces; boundaries, level crossings. This in particular may be exacerbated by traditional habits of crossing railways with the perceived small risks from slow speed trains.	• The erection of safety barriers/nets should be explored in details as mitigation actions • RLC in line with National, Safety and EU Standards including signalling • Use of bridges or tunnels in place of level crossings (this is to be explored during the design phase) • Installation of automatic gates at all level crossings, and regular inspection/maintenance to ensure proper operation

Impact area	Potential impacts	Indicative mitigation measures
Pedestrian Safety	Trespassers on rail lines and facilities may incur risks from moving trains, electrical lines and equipment, and hazardous substances, among other issues (accidents related to electric circuits have been reported and identified by SRI) [13]	• SRI to continue the activity ongoing for the past couple of years targeting elementary schools raising awareness to risks from rail and the electrical power line since education is seen as one of the most constituting mitigation measures • Posting of clear and prominent warning signage at potential points of entry to track areas (e.g., stations and level crossings); • Installation of fencing or other barriers at station ends and other locations to prevent access to tracks by unauthorized persons; • Local education, especially to young people, regarding the dangers of trespassing; • Designing stations to ensure the authorized route is safe, clearly indicated, and easy to use; • Use of closed-circuit television to monitor rail stations and other areas where trespassing occurs frequently, with a voice alarm system to detect trespassers
Stations	Personnel should be trained in herbicide application, including applicable certification or equivalent training where such certifications are not required;	• Regular inspection and maintenance of the rail lines and facilities to ensure track stability and integrity in accordance with national and international track safety standards;· Implementation of an overall safety management program that is equivalent to internationally recognized railway safety programs • Build awareness and Safety culture as the interaction between the requirements of the Safety management system and how people make sense of them, based on their attitudes, values and beliefs,and what they actually do, as seen in decisions and behaviours. • Introduce good reporting practices for safety occurrence notification, recommendation and remedy including consultation and publication of the reports and finding as a capacity enhancement measure to the community on health and safety
Right-of-Way Maintenance	Regular maintenance of vegetation within railroad rights-of-way is necessary to avoid interference with train operations and track maintenance Personnel should be trained in herbicide application, including applicable certification or equivalent training w here such certifications are not required; Maintenance of Rolling	

[13] The latest incident had occurred in October 2021, while a total of 6 have occurred since the beginning of the year

Impact area	Potential impacts	Indicative mitigation measures
	Stock Occupational hazards typically associated with locomotive and railcar maintenance activities may include physical, chemical, and biological hazards as w ell as confined space entry hazards	
Station /Halt Closure	Under the project all halts (except maybe one) would be closed. The other stations with very few passengers – often less than 10 per day – should on the face of it be closed for economic reasons. Local bus and taxi services would be more economic. Some hardship could be caused to isolated families, but the railway parallels the main highway so this will not be a critical issue.	• Municipalities to explore alternative mobility options should stations for local and regional lines need to be closed • Alternative transport through buses shall be explored for remote villages • Stakeholder consultation and engagement on all aspects

8 Stakeholder engagement

8.1 Introduction

Consultation and engagement with stakeholders an integral part of the Environmental and Social Impact Assessment (ESIA) process. To support the realization of the Project, the Project Promoter will develop and implement a Stakeholder Engagement Strategy, the overall aim of which is to ensure that a consistent, comprehensive, coordinated and culturally appropriate approach is taken for stakeholder consultation and disclosure. This approach is in full compliance with national and local legal provisions and IFIs Performance Requirements.

The Project Promoter will undertake a practice of stakeholder engagement throughout the project planning, construction and operation phases. The plan for this engagement, including identification of stakeholders (i.e. people and organizations who have a role in the Project or could be affected by the Project activities or who are interested in the Project) and disclosure of information, consultation, and handling of suggestions, comments and concerns, is to be documented in the Stakeholder Engagement Plan (SEP). This plan will be updated as required as the Project progresses. The purpose of the Stakeholders" Engagement Plan (SEP) is to provide a basis for a constructive relationship, between the Project Promoter and the affected stakeholders over time, by ensuring relevant and understandable information and by providing, to all the Project Affected Persons opportunities to express their views and receive responses. The nature of and frequency of engagement is defined by the risks and impacts that the Project will have. The SEP also stipulates for stakeholders how their concerns are to be considered in compliance with a grievance procedure. According to IFIs Environmental and Social Policy, the Project is classified in Category "High" project that is likely to have adverse environmental or social impacts.

8.2 Stakeholder engagement phases

To accomplish the objectives of stakeholder engagement, the Project Promoter will develop a plan for engagement with stakeholders throughout the Project life-cycle (Stakeholders Engagement Plan - SEP), that will focus on short- and long-term goals of stakeholder engagement, determine logistics and procedures for the stakeholder engagement. The main objectives of stakeholder engagements are to:

- Ensure that adequate and timely information is provided to persons affected or likely to be affected by the Projector that may have an interest in the Project or that have influence over the Project. Provide to these groups such forums and opportunities to voice their concerns and opinions
- Ensure that comments and concerns are received in a timely manner so that they can be considered during the decision making process
- Establish effective communication and cooperation facilitating community support in general, and

› Establish an effective grievance and mediation mechanisms with the main goal to intervene in a dispute in order to resolve and close out and minimize the number of cases referred to judicial authorities.

The SEP will describe the approach in engaging with stakeholders, to be maintained throughout the Project cycle i.e. for, pre-construction including land acquisition, construction/rehabilitation activities and operation. These stages are described in the following table.

Table 51 Stakeholders involvement stages

Phase	Objectives	Status
Alternative's assessment	To introduce the Project and identify environmental, social and cultural heritage sensitivities that should be taken into account in selecting the preferred route.	*Completed*
Scoping disclosure and consultation	To provide further detail on the Project and an opportunity for stakeholders to provide feedback on the scope, approach and key issues that will be addressed during the ESIA as well as the plans for future engagement activities. An ESIA Scoping Report (planned for mid-April 2023) will be prepared in English and salient features shall be translated to Serbian and will be circulated for comment to key stakeholders during May/June 2023. Consultees consist of the Municipalities and Cities (including Settlements) through which the alignment is planned to pass; relevant government agencies (including relevant line Ministries). The ESIA Scoping Report will be posted on the SRI website in line with disclosure principles of the SEP in both English and salient features in Serbian. Relevant Stakeholders identified will be informed that the Scoping report has been disclosed and how it can be accessed and that comments, questions and queries can be submitted to SRI within 30 days following the disclosure of the ESIA Scoping Report. Following the disclosure period, the ESIA Scoping report shall be subject to public consultations. Depending on the COVID- 19 constraints the consultation shall take the form of one or several online or face to face meetings. Stakeholder feedback shall be taken into account as relevant	*Ongoing*
SEP and RAP disclosure and consultation	To provide details on the Project and an opportunity for stakeholders to provide feedback on the approach and key issues that will be addressed during the land acquisition process	*Planned*
ESIA disclosure	To present the draft ESIA report and invite stakeholders to comment on the document. Information on the project impacts will be presented along with the mitigation measures designed to minimize or enhance positive ones. This will allow the project to maintain the relationships developed during the previous stages; and ensure all stakeholder issues have been identified and taken on board by the Project	*Planned*

Phase	Objectives	Status
Ongoing Project stakeholder engagement	During Project phases (construction, operation and maintenance) to continue engaging with stakeholders throughout the project lifecycle. The methodology for this will be developed and finalised using the information compiled during the ESIA process.	*Planned*

Stakeholder Engagement Plan will be developed to commensurate the stage of the Project. The SEP will be focused on engagement during all Project Phases from Planning, Scoping, Main ESIA, Construction and Operation Phase.

The SEP will identify all key stakeholders Project affected and Other Interested Parties. The SEP will ensure that disadvantaged or vulnerable individuals or groups, relevant to the project, are identified, that their particular sensitivities, concerns and barriers to project information are assessed and that they fully understand project activities and benefits and participate in consultation processes. Vulnerabilities identified in the baseline will help informing the SEP. The vulnerability may stem from person's origin, gender, age, health condition, economic deficiency and financial insecurity, disadvantaged status in the community (e.g. minorities or fringe groups), dependence on other individuals or natural resources, etc. Engagement with the vulnerable groups and individuals often requires the application of specific measures and assistance aimed at the facilitation of their participation in the project-related decision making so that their awareness of and input to the overall process are commensurate to those of the other stakeholders.

8.3 Grievance Mechanism

The implementing agency SRI has an existing centralized grievance system in place within the Media Centre, which is currently dealing with the grievances arising from the on-going projects. Should the Project benefit from a Technical Assistance support it is recommended to inter alia bolster the existing capacity of SRI in Grievance Management.

The existing Grievance Mechanism is expected to be tailored to this Project level grievance mechanism (GM) free of charge. The GM will be expected to consist of a Central Feedback Desk (CFD) to be established and administered by the Media Centre of SRI with Sub-Project specific Local Grievance Admission Desks (LGAD) (collectively referred to as Grievance Mechanism (GM)). The LGAD will comprise representatives from the key three stakeholder groups i.e., SRI Representative, Municipal representative and representative of the PAPs. SRI shall be responsible for overall grievance administration.

The LGAD shall serve mainly as local admission point for uptake of grievances and acknowledgment of grievance receipt through local avenues.

The system and requirements (including staffing) for the grievance redress chain of action – from registration, sorting and processing, and acknowledgement and follow-up, to verification and action, and finally feedback – are embodied in this GM. As a part of the GM outreach campaigns, SRI will make sure that the relevant staff are fully trained and has relevant information and expertise to provide phone consultations and receive feedback. The project will utilize the existing system

(hotline, online, written and phone complaints channels) to ensure all project-related information is disseminated and complaints and responses are disaggregated and reported.

Details on further Grievance admission points in particular LGD and the grievance administration processes, timelines, investigation activities and closure conditions including the 2nd tier resolution instance will be publicized in line with what the SEP will foresee. Stakeholders are encouraged to send all grievances, concerns and queries to the contact points below:

Table 52 CFD contact details

Description	Contact details
Implementing agency:	SRI
Main contact:	During the transitional period the PR Department of SRI shall be the main point pf contact
Address:	Nemanjina 6, 11 000 Belgrade
E-mail:	xxxxx
Telephone:	xxxxx

9 ESIA ToR

9.1 Introduction

A key outcome of the scoping process is the definition of the Terms of Reference (or ToR) of the ESIA study. The findings of the ESIA study will be presented in the ESIA report which will be prepared in compliance with Serbian national laws and regulations and in accordance with IFIs Policy Requirements and Good International Standards. The Consultant has selected the more stringent IFIs standards as the international standards benchmark for the ESIA report.

This chapter provides the proposed Terms of Reference for the ESIA and is structured as follows:

- Next steps required to complete the ESIA process
- Proposed baseline studies
- Proposed structure of the ESIA Report.
- Provisional schedule for the ESIA process.

9.2 ESIA objectives

The Consultant recognizes that comprehensive planning and management of environmental and socio-economic issues are essential to the execution of any successful project and, therefore, intends to fully integrate environmental and socio-economic considerations into the life cycle of the proposed Project.

The purpose of the ESIA is to assess the potential impacts of the Project and Project related activities on the environment (including biophysical and socio-economic resources) and, where applicable, to design mitigation or enhancement measures to avoid, remove or reduce negative impacts to the environment and to enhance positive and mitigate negative environmental and socio-economic impacts.

9.3 ESIA steps

Following on from the scoping phase of the Project, the ESIA will:

- Conduct additional consultation and further refine the scope of the ESIA as necessary;
- Collect additional baseline data through desktop research and field studies to complete a comprehensive description of the environmental, social and cultural heritage conditions;
- Identify and assess environmental, socio-economic and cultural heritage impacts;
- Develop mitigation and enhancement measures and elaborate an Environmental and Management Plan (ESMP) including an approach for monitoring;
- Report findings in a comprehensive ESIA report. A Final draft ESIA Report will be submitted addressing IFI’s and Beneficiary's comments.

9.4 Methodology and key aspects included

9.4.1 Project Description

A Project Description will be provided as early as possible that describes all Project activities that could impact on environmental and social components within the Project area of influence. Ideally the Project Description will be prepared by the Project engineering team in association with the ESIA team. The Project Description will be as detailed as possible to identify the environmental and social aspects resulting from Project's activities.

9.4.2 Analysis of Alternatives

An Analysis of Alternatives to the Project will include consideration of alternatives within Project design. This should also include the 'no-action' or 'no-go' alternative for the Project.

9.4.3 Baseline Conditions

9.4.3.1 Desktop research

Desktop studies will include additional research to identify existing documentation that contains information relevant to key resources present in the Project environment. Potential sources include publicly available literature with relevance to the Project site and general area.

Desktop research will be continued for the description of meteorological, air, noise, waters, soils and biodiversity parameters. Updated data will be provided for meteorological data for the stations encountered along the corridor, analytical data will be presented for air, noise, soil, surface and groundwater results of the national monitoring system while more data will be obtained for a better evaluation of habitats. More detailed description of the other environmental parameters will be provided, while an Annex with species with specific protection status in terms of biodiversity will be prepared.

Project route studies will provide additional information on various individual socio-economic impacts. Further and more detailed desktop studies of impacted settlements, land use and asset inventory of resettled Project Affected Persons will provide necessary information of overall and individual socio-economic impacts of the Project affected area. Additionally, as per this Scoping report outlined guidelines, more detailed baseline information will be acquired on impacts on vulnerable persons and groups, usual daily migration routes of population in the wider area, short and long term potential impacts of the Project on economic and agricultural activity, potential impacts on facilities and services provided to local settlements and tangible and intangible cultural heritage that could be influenced by the Project. The ESIA desktop study will also provide for more detailed gaps between National legislation and IFIs Policy Requirements and ways to bridge the gaps.

9.4.3.2 Field surveys, measurements and assessments

The Project team will carry out stakeholders' meetings to collect environmental and socioeconomic information with the aim to complete the environmental and socioeconomic profile of the Project area. These gathered information and data will also help the project team to assess the situation of physical and biological environments, social infrastructure with regard to specific habitats and landscapes, rivers, settlements and to develop the profiles of natural and semi natural sites, municipalities and settlements. Information on alternative living options due to economic displacement will be investigated. Field visits will focus on areas that have the highest biological, educational/recreational and socio-economic, vulnerability and archaeological potential.

Based on the information gathered, the ESIA team will report the findings in the ESIA Report. This will provide sufficient information to undertake the following tasks.

- Identify the key environmental and socio-economic conditions in areas potentially affected by the Project and highlight those that may be vulnerable to aspects of the Project;
- Describe their characteristics (nature, condition, quality, extent, etc.); and
- Provide sufficient data to inform judgments about the importance, value and sensitivity/ vulnerability of resources and receptors to allow the prediction and evaluation of potential impacts.

The ESIA team will determine the impact assessment and indicative mitigation measures based on the results of data collected.

Environmental

More specifically, during the ESIA stage, the following will be planned:

- Vibration and noise: measurements after defining the sensitive receptors and noise and vibration modelling to predict the impacts in the operation phase
- Climate change: assessment for the project's climate resilience (characteristics for floods, temperature and precipitation changes); effects of the project on reduction of the transport sector's emissions due to the efficiency of passenger and freight rail transportation
- Biodiversity: analytical field inventories (habitats and fauna categories), screening of potential critical habitats and priority biodiversity features, screening for Critical Habitat Assessments (if needed) and Biodiversity Action Plans per Section (if needed) and screening for Appropriate Assessment (if needed).

Social

A social impact assessment will be carried out as part of the Environmental and Social Impact Assessment. The social impact assessment will cover the Socio-cultural environment (include both present and projected where appropriate): Population; land use; planned development activities; settlement and community

structures; employment; distribution of income, goods, and services; recreation; public health; and historical, archaeological and cultural resources.

A detailed Social Survey should have to be undertaken at the ESIA stage, with the aim to provide sufficient information for the physical and/or economical resettlement purposes.

Precise and complete data will be available only after completion of preliminary design and expropriation study. Given the constraints of data available, the fact that the technical options and solutions are still fluid and therefore undiscovered and yet unidentified impacts might differ at later stage. These impacts will be subject to stringent provisions of the social mitigation measures.

More precisely, regarding social issues, the following will also be applied

- Any earlier social assessments in the area and the initial findings and baseline should be used to update any needed social assessment and provide a clear scoping statement of the anticipated impacts arising from the Project. This updated social assessment will describe current social and economic impacts on directly- and indirectly-affected communities. This socio-economic information will provide a baseline for evaluation of impacts and mitigation measures to reduce negative impacts and to enhance positive impacts and opportunities. Data will be obtained from a combination of secondary sources and suitable primary data, such as personal interviews and household or community surveys as relevant. The assessment will verify and update as needed: where likely impacts are identified; social and economic baselines; social and economic impacts; mitigation of adverse impacts and enhancement of positive impacts, and identification of community development opportunities
- Define the Area of Social Influence for the area covered including associated facilities,
- Develop a demographic profile of the study area's communities that may be influenced by the proposed construction works and operation of the Project,
- Map of sufficient detail showing the project site and the area that may be affected by the project's direct, indirect, and cumulative impacts (i.e. area of influence) Socio-economic and environmental characterization, which includes presenting concise information on the main socio-environmental factors that will be affected by the project. This information, whenever possible, should be based on qualitative and quantitative data.
- Identify tangible (social infrastructure) and intangible (human and social capital, community cohesion, community values and connection to place) community assets and provide a general understanding of the local social environment within the study area,

The Consultant shall ensure that any specialized anthropological and sociological experts contributing to the Social Assessment will address issues relevant to the EIB requirements (this effort shall be linked to the RAP s).

- Socio-Economic Conditions: Identify and map nearby human settlements in the proposed railway corridor, paying special attention to communities

or people potentially affected, if any. For such it will be necessary to collect socio-economic data as may be necessary to assess potential impacts on their income, livelihood status etc. Demographic data would include: population (size, gender and age distribution); cultural characteristics (religion, ethnic composition, languages spoken, etc.); population migration over the last few years, livelihood and economic activities; literacy rates and levels of education; community organizations and social networks; public health and safety;

- Infrastructure: For each settlement potentially affected, describe the infrastructure such as level crossings, public health, education infrastructure as appropriate if it is to be used or adversely affected:
- Poverty and Social Risks- For each settlement potentially affected, analyze the level of poverty and vulnerability including social risks such as prevalence of sexual and gender based violence (SGBV), high-risk behaviors among youth, child and forced labor in the construction sector, community cohesiveness etc.;
- Cultural, archaeological, spiritual structures, and historic resources: identify all cultural, archaeological, ceremonial and historic resources in the impact zone/within the area of influence;
- Religious Groups and Ethnic/Other Minorities -Information on marginalized and vulnerable groups living in settlements along the railway, including indigenous communities, ethnic or other minority groups or other traditional cultural groups, if any.
- Vulnerable or disadvantaged groups (if any) and if relevant, social data should be disaggregated accordingly to the extent it is technically and financially feasible. To the extent possible demographic data should report on HHs with members with disabilities legacy issues on land take for the project and associated facilities.
- Legacy issues related to land use, property rights etc.
- Land acquisition and resettlement through development of section specific Resettlement Action Plans and or Livelihood Restoration Plans.

9.4.3.3 Impact Assessment Criteria

The prediction of the scale and significance of environmental impacts will be assessed against the established baseline conditions. The assessment criteria will be based on international requirements and good practice involving a ranking system to classify magnitude and significance of impacts. All activities for the Project will be assessed in terms of the significance of the impact on the receiving environment, for example, air quality, freshwater quality, freshwater ecology, and the significance of the impact of local society, including livelihoods, health, culture and employment. The major characteristics of impacts are:

- Magnitude - the level of change because of the impact.
- Duration and frequency - how long the impact will last - short term (1-5 years), medium term (6-15 years) and long term (more than 15 years).
- Spatial extent - whether the impact is local or wide ranging (regional).

- Quantitative assessments will be undertaken as necessary as part of the ESIA.

9.4.3.4 Mitigation Measures and Recommendations

Mitigation measures are actions taken to avoid or minimise negative environmental or social impacts. The mitigation hierarchy will be followed: avoid, minimise, restore or remedy, offset, compensate. Additional mitigation will be implemented to reduce significant impacts to an acceptable level, this is referred to as the 'residual impact'. The mitigation hierarchy should be followed: avoid, minimise, restore or remedy, offset, compensate. Mitigation measures should be clearly identified and linked to the Environmental and Social Management Plan (ESMP).

9.4.3.5 Monitoring and Follow-Up

Once the ESIA has been completed, monitoring and follow-up actions should be completed to:

- Continue the collection of baseline data throughout construction and operation;
- Evaluate the success of mitigation measures, or compliance with Project standards or requirements;
- Assess whether there are impacts occurring that were not previously predicted; and
- In some cases, it may be appropriate to involve local communities in monitoring efforts through participatory monitoring. In all cases, the collection of monitoring data and the dissemination of monitoring results should be transparent and made available to interested Project stakeholders.

Monitoring recommendations outlined in the ESIA will be carried through to the ESMP.

9.4.3.6 Residual Impacts

Those impacts that remain once mitigation has been put in place will be described as residual impacts.

9.4.3.7 Cumulative Impacts

Cumulative impacts are changes to the environment that are caused by an action in combination with other past, present and future human actions. The assessment of these effects is called a cumulative impact assessment (CIA). Assessment of cumulative impacts assessments will be included in the ESIA and may include considerations of interactions between the associated facilities.

9.4.3.8 Environmental and Social Management Plan (ESMP)

An Environmental and Social Management Plan (ESMP) summarises the mitigation and monitoring measures that should be employed during construction and operation for the Project. The ESMP will summarise the Developer's commitments

to address, mitigate and monitor risks and impacts identified as part of the ESIA, through avoidance, minimisation and compensation/offset.

The ESMP will also ensure that all relevant stages of the project are structured to meet applicable laws and regulatory requirements and the EIB E&S Standards. Where relevant, the ESMP will also cover management of third party and supply chain issues. The ESMP will:

- Include a monitoring plan aimed at tracking actions specified in the ESMP;
- Performance indicators linked to significant environmental and social impacts;
- Any regulatory monitoring and reporting requirements
- Specify the roles and responsibilities for implementation of the actions contained therein as well as for regular update of the ESMP.
- Specify any training or capacity-building required to ensure that personnel tasked with implementing the ESMP have the necessary awareness and skills to execute these functions effectively.

9.5 Proposed Structure of the ESIA Report

The ESIA will include the following:

- Review of relevant local, regional, and national environmental and social laws and regulatory requirements of the jurisdictions in which the Project will operate, including those laws implementing Serbia's obligations under international law. The ESIA will review the Project's compliance to relevant requirements, alongside the status of any material permits or authorisations needed.
- Project description, including alternatives considered and discussed with stakeholders (including potentially affected communities) and information on related operations and activities.
- Analysis of the physical, biological, and socio-economic environment likely to be affected by the Project for both the construction and operational phases. The baseline assessment will consider the interrelationship between relevant factors, as well as the exposure, vulnerability, and resilience of these factors to natural and manmade risks.
- Analysis of the likely impacts of the Project on the physical, biological, and socio-economic environment, which should identify and characterize its potential E&S beneficial and adverse impacts. It will be structured to include all relevant stages of the Project's lifecycle, e.g. pre-construction, construction, operation and maintenance, closure and residual E&S impacts. The level of analysis and reporting will be commensurate with the risk magnitude of the issues identified while mitigation measures will be proposed using the mitigation hierarchy.

The summary headings in the ESIA report are provided in the table below.

Table 53 Proposed ESIA content

Heading	Summary
Non-Technical Summary (NTS)	Concise description of the ESIA process and its findings in a manner prepared to facilitate the reading and understood by the general public.
Legal framework	› Relevant environmental and social legislation › Gap analysis – the difference between the national legislation and EIB standards
Project Description	› The location, site, size, land use › Project design (alignment-permanent way, stations, structures, other design elements) › Estimate of residues, emissions, and quantities and type of waste production
Evaluation of alternatives	› General methodology › Summarized presentation of the MCA › Environmental and social evaluation of options, including the no project alternative.
Baseline conditions	› Air quality, noise and vibrations, surface and ground waters, soil, biodiversity
Social parameters Labour and working conditions, OHS risk, community health and safety risks, private and public property, fragmentation of agricultural land plots, cultural heritage, human rights	› People and communities likely to be affected as well as other relevant stakeholders, paying particular attention to persons and/or groups that are vulnerable, marginalised, discriminated
Assessment of the likely significant environmental and social effects of the proposed project, resulting from:	› the construction and existence of the project; › the use of natural resources, considering as far as possible the sustainable availability of these resources; › the technologies and substances used; › d. the emissions of pollutants, noise, vibration, light, heat and radiation, and the disposal and › recovery of waste; › e. the risks to human health, well-being, persons and/or groups that are vulnerable, › marginalised, discriminated against or excluded on the basis of their socio-economic characteristics, cultural heritage or the environment; › the cumulating of effects with other projects and/or activities. › The description should cover the direct effects and any indirect, secondary, cumulative, transboundary, short-, medium- and long-term, permanent and temporary, positive and negative effects of the project.
Mitigation measures	A description and justification of the measures planned to prevent, reduce and where possible, compensate/remedy any significant environmental, climate and/or social adverse effects as outlined in the environmental and social management plan (ESMP)

Heading	Summary
Environmental and Social Management Plans (ESMP)	Defining effective and responsible implementation and management of environmental and social impacts mitigation and enhancement measures during the construction, operation and closure phases of a proposed project.
Monitoring plan	Arrangements for monitoring and evaluation of the effectiveness of impact management and any positive enhancement action, where applicable, measured as part of the overall environmental and social management plan and system, which should include appropriate qualitative and quantitative indicators and draw on feedback from both internal and external sources, including affected stakeholders.
Stakeholder Engagement Plan (SEP)	Defining guidelines for engagement of relevant stakeholders at certain stages of ESIA process and outlining the target groups and methods of stakeholder engagement and the responsibilities in the implementation of stakeholder engagement activities. Grievance mechanism Defining steps and mechanisms that will be taken to ensure effective access to remedy for affected stakeholders.

9.6 Timeline for the ESIA

1.1.4	**4. ESIA and EIA**			**17.7 mons**	**Thu 12/15/22**	**Tue 5/28/24**	
1.1.4.1	**ESIA for railway Brestovac - Tabanovce**		**IPF8**	**15 mons**	**Thu 12/15/22**	**Fri 3/8/24**	
1.1.4.1.1	Existing conditions and screening		IPF8	2 mons	Thu 12/15/22	Sun 2/12/23	
1.1.4.1.2	Scoping		IPF8	2 mons	Mon 2/13/23	Thu 4/13/23	27
1.1.4.1.3	**Field survey**		**IPF8**	**7.13 mons**	**Thu 3/30/23**	**Sun 10/29/23**	
1.1.4.1.4	Draft ESIA		IPF8	8 mons	Fri 4/14/23	Sat 12/9/23	28
1.1.4.1.5	Final ESIA		IPF8	3 mons	Sun 12/10/23	Fri 3/8/24	33
1.1.4.2	**EIA for railway Brestovac - Tabanovce**		**IPF8**	**6 mons**	**Fri 12/1/23**	**Tue 5/28/24**	
1.1.4.2.1	Request for decision on content of the EIA		IPF8	1 mon	Fri 12/1/23	Sat 12/30/23	
1.1.4.2.2	Decision on content of the EIA		IPF8	1 mon	Sun 12/31/23	Mon 1/29/24	36
1.1.4.2.3	Draft EIA		IPF8	3 mons	Sun 12/31/23	Fri 3/29/24	37SS
1.1.4.2.4	Final EIA		IPF8	2 mons	Sat 3/30/24	Tue 5/28/24	38