

**Main Road Reconstruction
Project, Rehabilitation and
upgrade of the Danilovgrad-
Podgorica road section**

**SUPPLEMENTARY
ENVIRONMENTAL AND
SOCIAL ASSESSMENT
REPORT**

Prepared for: European Bank of
Reconstruction and Development

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TABLE OF CONTENTS

TABLE OF CONTENTS.....	2
List of Acronyms.....	8
List of Figures.....	10
List of Tables.....	12
1. EXECUTIVE SUMMARY	14
2. INTRODUCTION	19
Introduction.....	19
Project Overview.....	19
Need for the Project.....	20
Requirement for a Supplementary ESIA.....	20
Limitations of this Report.....	21
2.5.1 General Project Development Aspects.....	21
2.5.2 Social Aspects.....	22
2.5.3 Water Resources.....	22
2.5.4 Noise and Vibration.....	22
2.5.5 Air.....	23
2.5.6 Soil and Geology.....	23
2.5.7 Traffic and Transport.....	23
2.5.8 Ecology.....	23
Report Structure.....	23
3. PROJECT STANDARDS	24
Montenegro Legal and Policy Framework.....	24
3.1.1. National Assessment and Permitting Requirements.....	24
International Conventions.....	33
EU Directives.....	34
EBRD Requirements.....	35
Applicable Guidance Notes.....	37
4. PROJECT OVERVIEW	39
Project Description.....	39
Road Layout.....	39
Road surface structure.....	39
Objects on the route.....	40
4.4.1 Bridges.....	40
4.4.2 Retaining walls.....	45
4.4.3 RC Culverts.....	46
Key Infrastructure.....	47
4.5.1 Intersections.....	47
4.5.2 Traffic connections and relocation of local road alignment.....	48
4.5.3 Bus stops.....	48

Storm Water Management System	50
Organisation of Construction Site	51
The flow of Traffic During the Execution of Works	52
Earthmoving and Disposal of Excavated Material	52
Alternatives	53
4.10.1 "No Project" Alternative	53
4.10.2 Alternative Solutions for Intersections.....	53
4.10.3 Alternative Solutions for the Route.....	54
4.10.4 Alternative Solutions for Run-Off Management System	54
4.10.5 Alternative Solutions for Intersections and Local Road Connection	54
4.10.6 Alternative Solutions for Reduction of Costs.....	55
4.10.7 Alternative Solutions for Excavated Material	55
Project Timeframe	55
5. SUPPLEMENTARY ESIA APPROACH AND ASSESSMENT METHODOLOGY	56
Overview of the ESIA Process	56
Project Affected Area	56
Associated Facilities	57
Baseline Survey Methodologies	57
5.4.1 Aquatic Invertebrate Survey	57
5.4.2 Bat Survey.....	57
5.4.3 Habitat Mapping.....	57
5.4.4 Traffic Survey	58
5.4.5 Noise Baseline	58
Impact Assessment Methodology	58
5.5.1 General Considerations.....	58
5.5.2 Impact Identification	58
5.5.3 Impact Prediction	59
5.5.4 Impact Significance	60
Mitigation	61
Assessing Residual Impacts	61
Cultural Heritage	61
6. TRAFFIC AND TRANSPORT	62
Introduction	62
Relevant Legislation and Guidance	62
Scoping Assessment	62
Baseline Conditions	63
6.4.1 Data Collection.....	63
6.4.2 Traffic Flows.....	64
6.4.2.2 Historical Data	66
6.4.3 Non-Traffic Flow Issues	67
Impact Assessment	68

6.5.1 Approach and Methodology	68
6.5.2 Construction Phase Impacts	69
6.5.3 Operational Phase Impacts.....	70
Proposed Mitigation	70
6.6.1 Construction Phase	70
6.6.2 Operational Phase.....	71
Residual Impacts	71
Contractor’s Commitments	71
7. AIR QUALITY	73
Relevant Legislation and Guidance Baseline Conditions	73
Baseline Conditions	73
7.2.1 Climate	73
7.2.5 Existing Air Quality	74
Impact Assessment	75
7.3.2 Impacts during the Construction Phase.....	76
7.3.3 Operational Phase Impacts	80
7.3.4 Proposed Construction Mitigation	86
7.3.5 Proposed Operational Phase Mitigation.....	86
7.3.6 Residual Construction Phase Impacts	86
Cumulative Impacts.....	86
Contractors Commitments.....	87
8. NOISE AND VIBRATION	89
Relevant Legislation and Guidance	89
Baseline Conditions	89
8.2.1 Noise - Sensitive Receptors	89
Impact Assessment	93
8.1.1 Impact Criteria	93
8.3.2 Construction Phase Impacts	94
8.3.3 Operational Phase Impacts.....	99
8.3.4 Proposed Construction Phase Mitigation.....	101
8.3.5 Proposed Operational Phase Mitigation	102
8.3.6 Residual Construction Phase Impacts	106
8.3.7 Residual Operational Phase Impacts	106
Contractors Commitments.....	106
9. WATER RESOURCES.....	108
Relevant Legislation and Guidance	108
Baseline Conditions	110
9.2.1 Hydrology	110
9.2.2 Hydrogeology	111
9.2.3 Water Abstractions.....	112
9.2.4 Water Quality.....	114
Impact Assessment	116

9.3.1 Impact Criteria.....	116
9.3.2 Construction Phase Impacts on Surface Water	116
9.3.3 Construction Phase Impacts on Groundwater	118
9.3.4 Operational Phase Impacts on Surface Water	119
9.3.5 Operational Phase Impacts on Ground Water	122
Cumulative Impacts.....	122
Proposed Construction Phase Mitigation	122
Proposed Operational Phase Mitigation	123
Project Commitments.....	123
Residual Construction Phase Impacts.....	124
Residual Operational Phase Impacts	124
10. GEOLOGY AND SOILS.....	125
Relevant Legislation and Guidance	125
Key Issues from Scoping	127
10.3.1 Construction Phase	127
10.3.2 Operation Phase	127
Baseline Conditions	128
10.3.1 Geology	128
10.3.1.4 Soil.....	133
Impact Assessment	139
10.4.1 Impact Criteria.....	139
10.4.2 Construction Phase Impacts	139
10.4.3 Operational Phase Impacts	144
10.5.4 Proposed Construction Phase Mitigation	144
10.5.4.1 Erosion Protection Measures	144
10.5.4.2 Soil Mitigation measures during construction	144
10.5.6 Residual Impacts.....	145
Contractors Commitments.....	145
11. BIODIVERSITY AND NATURE CONSERVATION	147
Relevant legislation and guidance	147
Study Area.....	147
Scoping Assessment.....	148
Baseline Conditions	149
11.4.1 Study Approach and Methodology.....	149
11.4.2 Internationally Designated Sites	151
11.4.3 Nationally Designated Sites	152
11.4.4 Existing Habitats.....	152
11.4.5 Birds	155
11.4.6 Mammals.....	156
11.4.7 Amphibians and Reptiles.....	158
11.4.8 Fish.....	158
11.4.9 Invertebrates	159

Impact Assessment	160
11.5.1 Assessment Criteria	160
11.5.2 General Impacts and Mitigation: Habitats	161
11.5.3 General Impacts and Mitigation: Species.....	164
11.5.4 Impacts on Designated Sites	168
11.5.5 Impacts on Notable Habitats and Flora	169
11.5.6 Impact on Birds.....	172
11.5.7 Impacts on Mammals	173
11.5.8 Impacts on Amphibians and Reptiles.....	180
11.5.9 Impacts on Fish	180
Proposed Project Mitigation.....	181
11.6.1 Protected Areas	181
11.6.3 Birds	183
11.6.5 Amphibians and Reptiles	185
11.6.6 Fish.....	186
Residual and Cumulative Impacts	187
11.7.1 Residual Construction Phase Impacts	187
11.7.2 Residual Operational Phase Impacts	187
11.7.3 Cumulative Impacts.....	187
Summary of Project Commitments.....	187
12. SOCIO – ECONOMIC IMPACTS	190
Introduction.....	190
Relevant Legislation and Guidance	190
Assessment Objective	190
12.3.2 Scope of the Assessment	190
12.3.3 Project Affected Area.....	190
Methodology	193
12.4.1 Overview	193
12.4.2 Impact Assessment Methodology.....	193
12.4.3 Limitations to the Methodology	194
Baseline.....	194
12.5.1 Introduction	194
12.5.2 Project Affected People (PAP): Demographics.....	195
12.5.3. Economy and Livelihoods	201
12.5.4 Infrastructure.....	205
Socioeconomic Impacts	211
12.6.1 Introduction.....	211
12.6.2 Potential Impacts on Land	211
12.6.3 Potential Impacts on the Local Economy and Local Employment	217
12.6.4 Potential Impacts on Local Communities from an Influx of Workers	218
12.6.5 Potential Impacts on Local Communities' Health and Safety from Increased Traffic	220
12.6.6 Potential Impacts on Accessibility and Connectivity	221
12.6.7 Potential Impact Associated with Security Personnel.....	223

12.6.8 Potential Impacts Associated with Occupational Health and Safety of Workers.....	224
Project Commitments	225
Cumulative Impacts.....	227
13. LIST OF ANNEXES.....	228

List of Acronyms

AoI	Area of Influence
ASL	Above Sea Level
AQMA	Air Quality Maintenance Area
A/R CDM	Afforestation/ Reforestation Clean Development Mechanism
BAP	Biodiversity Action Plan
BAT	Best Available Technique
BMP	Biodiversity Management Plan
BS	British Standards
CCNUCC	Convention-Cadre des Nations Unies sur les Changements Climatiques
CESMP	Construction Environmental and Social Management Plan
CH	Chainage
CHA	Critical Habitat Assessment
CM	Cadastre Municipality
CNVMP	Construction Noise and Vibration Management Plan
CTMP	Construction and Traffic Management Plan
DDDMP	Dust, Demolition and Disposal Management Plan
DPM	Diesel Particulate Matter
EBRD	European Bank for Reconstruction and Development
ECoW	Ecological Clerk of Works
EDMP	Emission and Dust Management Plan
EIA	Environmental Impact Assessment
EIB	European Investment Bank
EMS	Environmental Management System
ESAP	Environmental and Social Action Plan
ESIA	Environmental and Social Impact Assessment
ESMP	Environmental and Social Management Plan
EQS	Environmental Quality Standard
EU	European Union
EUNIS	European Nature and Information System
E&S	Environment and Social
GHG	Greenhouse Gases
GIP	Good Industry Practice
GMP	Grievance Management Process
HH	Households
HGV	Heavy Goods Vehicles
H&S	Health and Safety
IBAT	Integrated Biodiversity Assessment Tool
IFC	International Finance Corporation
IPPC	Integrated Pollution Prevention and Control
IUCN	International Union for Conservation of Nature
IUCN (CR)	International Union for Conservation of Nature (Critically Endangered)
IUCN (EN)	International Union for Conservation of Nature (Endangered species)
IUCN (LC)	International Union for Conservation of Nature (Least concern)
IUCN (VU)	International Union for Conservation of Nature (Vulnerable species)

KBA	Key Biodiveristy Area
LARF	Land Acquisition and Resettlement Framework
LARP	Land Acquisition and Resettlement Plan
MAC	Maximum Allowable Concentration
MSDT	Ministry of Sustainable Development and Tourism
MoTMA	Ministry of Transport and Maritime Affairs of Montenegro
MPC	Maximum Permissible Concentration
TA	Transport Administration of Montenegro
MTD	Montenegro Transport Directorate
NEPA	Nature and Environmental Protection Agency
NGO	Non-Governmental Organisation
NTS	Non-Technical Summary
OHS	Occupational Health and Safety
PAH	Poly Aromatic Hydrocarbons
PAP	Project Affected People
PBA	Priority Biodiversity Features
PPE	Personal Protective Equipment
PPV	Peak Particle Velocity
PR	Performance Requirement
RBA	Rapid Biodiversity Assessment
RoW	Right of Way
RTA	Road Traffic Accidents
SEA	Strategic Environmental Assessment
SEP	Stakeholder Engagement Plan
SES	Socio-Economic Survey
S-ESIA	Supplementary Environmental and Social Impact Assessment
SPM	Spatial Plan of Montenegro
SPZ	Sanitary Protection Zone
TA	Transport Administration of Montenegro
UNECE	United Nations Economic Commision for Europe
UNFCCC	United Nations Framwork Convention on Climate Change
US EPA	United States Environmental Protection Agency
WB	World Bank
WHO	World Health Organisation

List of Figures

- *Figure 2.5.4 Traffic and Construction Noise Survey Points*
- *Figure 2.5.4a: Traffic survey point 1 – facing NW*
- *Figure 2.5.4b: Traffic survey point 1 – facing SE*
- *Figure 2.5.4c: Traffic survey point 2 – facing NW*
- *Figure 2.5.4d: Traffic survey point 2 – facing SE*
- *Figure 2.5.4e: Traffic survey point 3- facing NW*
- *Figure 2.5.4f: Traffic survey point 3 – facing SE*
- *Figure 2.5.4g: Traffic survey point 4 – facing NW*
- *Figure 2.5.4h: Traffic survey point 4 – facing SE*
- *Figure 2.5.4i: Traffic survey point 5 – facing NW*
- *Figure 2.5.4j: Traffic survey point 5 – facing SE*
- *Figure 2.5.4k: Traffic survey point 6 – facing NW*
- *Figure 2.5.4l: Traffic survey point 6 – facing SE*
- *Figure 2.5.4m: Traffic survey point 7 – facing NW*
- *Figure 2.5.4n: Traffic survey point 7 – facing SE*
- *Figure 2.5.4o: Construction noise survey point 1 – no street view*
- *Figure 2.5.4p Construction noise survey point 2 – no street view*
- *Figure 2.5.4q: Construction noise survey point 3 – no street view*
- *Figure 4.3: Layers Road Surface Structure*
- *Figure 4.4.1.1 Cross-section of the existing bridge Susica*
- *Figure 4.4.1.1b Cross-section of the new bridge Susica*
- *Figure 4.4.1.2a Cross-section of the existing bridge Matica*
- *Figure 4.4.1.2b Cross-section of the new bridge Matica*
- *Figure 4.4.1.3a Cross-section of the existing bridge Sitnica*
- *Figure 4.4.1.3b Cross-section of the new bridge Sitnica*
- *Figure 4.4.1.4a Cross-section of the existing bridge Mareza*
- *Figure 4.4.1.4b Cross-section of the new bridge Mareza*
- *Figure 4.4.1.5 Cross-section of the underpass*
- *Figure 4.6: Separator for oil and gasses*
- *Figure 4.7: Temporary Construction Site Locations*
- *Figure 5.1 ESHIA Procedures and related activities*
- *Figure 6.4.1: Traffic Data Collection Locations*
- *Figure 7.2.1: Rose of winds in Podgorica*
- *Figure 7.3.3 - Location of the concrete and mortar plant relative to the route of the Main Road M-18 Danilovgrad-Podgorica (approximately at km 116+837)*
- *Figure 8.2.1:- Areas with residential facilities in which negative impact of noise on population is expected to occur after reconstruction of the Main Road M-18 Danilovgrad-Podgorica (from Ch. km 114+527 to km 115+430, right and left from the road)*
- *Figure 8.3.1: Graphical overview of the traffic noise indicators along the reconstructed Main Road M-18 Danilovgrad-Podgorica, which were obtained by doing the calculation for the night period – noise map*
- *Figure 9.3.1: Rivers within Danilovgrad –Podgorica Area*
- *Figure 9.3.3: Location of Groundwater Sources*
- *Figure 9.3.3b: Location of Mareza Spring*
- *Figure 10.2.1a: Geological map of the area of Project*
- *Figure 10.4.1b - Map of seismic regionalization of Montenegro*
- *Figure 10.4.2a: Pedological map of the project area*
- *Figure 10.4.2b: - Percentile distribution of different types of the expropriated land*
- *Figure 10.4.2c: Corine land cover for the project area*
- *Figure 10.4.2d: Erosion – existing condition*
- *Figure 10.5.2: Temporary Camp 1, 2 and 3*
- *Figure 11.4.2: Zeta Stream KBA*
- *Figure 11.4.4: Overview of habitats along the research area according to the vegetation type*

- *Figure 11.5.5.1a: Location of Temporary Construction Sites along the road route*
- *Figure 12.3.3a: Project area of 150m*
- *Figure 12.3.3b: The Broader Perspective of Project Potential Impact*
- *Figure 12.5.2a: Project Location*
- *Figure 12.5.2b: Broader Area of Influence: Local Settlements*
- *Figure 12.5.2c: Houses in the project area*
- *Figure 12.5.3a: Images of Businesses Along the M-18 Road Route*
- *Figure 12.5.3b: Monthly Income of Household Members Surveyed*
- *Figure 12.5.3c: Monthly Income of Households Surveyed*
- *Figure 12.5.4a: Education Facilities Closest to the M-18 Road*
- *Figure 12.5.4b: Universities UDG and the M18*
- *Figure 12.5.4c: Health Care Facilities and the M18*
- *Figure 12.5.4d: Electricity Transmission System, Montenegro*
- *Figure 12.5.4e: Distance of Tennis Court to the M-18 Road*

List of Tables

- Table 3.1: Summary of all relevant strategic, legislative and policy documents for the Project
- Table 4.4.3: Overview table with all RC culverts
- Table 4.5a: Intersections
- Table 4.5b: Roundabouts
- Table 4.5.2: Additional roads
- Table 4.5.3: Bus Stop Positions
- Table 4.10.2: Alternative solutions for intersections in the Preliminary Design
- Table 6.2: Traffic and Transport Legislation
- Table 6.3: Scoping Matrix –Project Construction Phase
- Table 6.4.2.1a: Cumulative total of car/van movements over the 11 hour monitoring period
- Table 6.4.2.1b: Cyclist and horse/cart movements
- Table 6.4.2.2: Estimated traffic intensity at the Danilovgrad-Podgorica road section, 2009-2012
- Table 6.5.1: Significance Criteria for the classification of impacts associated with the Delay and Congestion
- Table 7.3.1: Impact Criteria for Air Quality
- Table 7.3.2.1: Key air emissions pollutants
- Table 7.3.2.2a: Construction machinery/vehicles, type of fuel used and estimated consumption
- Table 7.3.2.2b: Exhaust emission factors (Kg of pollutant / Kg of fuel)
- Table 7.3.2.2c: Daily fuel consumption per vehicle
- Table 7.3.2.2d: Emission factors and emission rate
- Table 7.3.3a: EU/WHO standards relating to main pollutants arising from vehicle exhausts
- Table 7.3.3b: Air pollution estimate from the Podgorica-Danilovgrad road for 2020(AADT=9607 vehicle/24h, direction of the most common wind: NNE; wind speed: 3 m/s. (right and left side)
- Table 7.3.3c: Air pollution estimate from the Podgorica-Danilovgrad road for 2020 (AADT=9607 vehicle/24h, direction of the most common wind: NNE; wind speed: 5 m/s)(right and left side)
- Table 7.3.3d: Air pollution estimate from the Podgorica-Danilovgrad road for 2027 (AADT= 9751 vehicle/24h, direction of the most common wind: NNE; wind speed: 3 m/s) (right and left side)
- Table 7.3.3e: Air pollution estimate from the Podgorica-Danilovgrad road for 2027(AADT=9751 vehicle/24h, direction of the most common wind: NNE; wind speed: 5 m/s) (right and left side)
- Figure 7.3.3: Location of the concrete and mortar plant relative to the route of the Main Road Table 8.1
- Legislation and Guidance for Noise and Vibration
- Table 8.2.1: Areas with residential objects in which negative impact of noise on population is expected after reconstruction of the Main Road M-18 Danilovgrad-Podgorica
- Table 8.2.1a: Measured values of the noise level indicator and the corresponding noise level limit values for a given measuring position.
- Table 8.3.1: Impact Criteria for Noise and Vibration
- Table 8.3.2a: Construction Machinery and Noise Levels
- Table 8.3.2b: Noise levels at various distances from the construction site during ground extraction, transportation and earth work stage
- Table 8.3.2c: Change in Noise Levels and Magnitude of Impacts
- Table 8.3.2d: BS 5228 Guidance on Effects of Vibration Levels
- Table 8.3.2e: BS 6472 Vibration Dose Value
- Table 8.3.2f: BS 7385 Building Damage Criteria
- Table 8.3.3: Traffic noise levels during the operational phase of the reconstructed road M-18 Danilovgrad-Podgorica, in conditions of flat spreading of sound, which were obtained through the abovementioned calculation (forecast PGDS: 9751 vehicles/ 24h, for 2027)
- Table 8.3.4: Construction Noise Limits
- Table 8.3.5: Example Construction Noise and Vibration Risk Based Assessment
- Table 9.3.3: Water Sources for each of Settlement within the immediate Project Area
- Table 9.3.4.1: Water Quality Classification in the River Zeta
- Table 9.4.4.2: Maximum permissible concentrations of contaminants in wastewater being discharged to rivers

- *Table 10.1: Relevant Legislation and Guidance for Geology and Soils*
- *Table 10.3.1: Scoping Matrix - Project Construction Phase*
- *Table 10.3.2: Scoping Matrix - Project Construction Phase*
- *Table 10.4.1a: Detailed description of geotechnical areas in the Project area*
- *Table 10.4.1b: Expected maximum horizontal acceleration and expected maximum earthquake intensity*
- *Table 1.4.2: Overview of cultures by cadastral municipalities of Danilovgrad along the Project zone*
- *Table 10.5.1: Impacts and mitigation for Soil*
- *Table 10.5.2: Higher cuts and embankments of the road*
- *Table 10.4.2: Overview of cultures by cadastral municipalities of Danilovgrad along the Project zone*
- *Table 11.3: Initial Assessment of Potential Sources of Impact*
- *Table 11.4.2: Species of Note within the KBA*
- *Table 11.4.4a: Natura 2000 habitats identified in the Project area*
- *Table 11.4.4b: Habitats of greater ecological value within the area*
- *Table 11.4.4c: Identified species within habitats of greater ecological value within the area*
- *Table 11.4.6a: Notable birds recorded from within the project affected areas*
- *Table 11.4.7a: Notable mammals (other than bats) recorded from the vicinity of the project area (HD – Habitats Directive)*
- *Table 11.4.7a: Notable mammals (other than bats) recorded from the vicinity of the project area (HD – Habitats Directive)*
- *Table 11.4.7b: Bat Species Recorded from Local Area (HD – Habitats Directive)*
- *Table 11.4.8a: Notable Amphibians and Reptiles in the project area*
- *Table 11.4.9a: Fish species caught during the initial survey*
- *Table 11.4.9b: Other fish species that may be present in the local rivers*
- *Table 11.5.1a: Impact Assessment Criteria*
- *Table 11.5.2a: Generic Impacts and Sources*
- *Table 11.5.2b: Generic Habitat Impacts and Mitigation*
- *Table 11.5.3a: Generic Issues that may Affect Notable Species*
- *Table 11.5.3b: Generic Construction Mitigation (GIP) to Minimize Impacts to Notable Species*
- *Table 11.5.5.1a: Areas of natural or modified habitats expected to be lost to the scheme.*
- *Table 11.5.5.3a: Total area under NATURA 2000 habitats and the appertaining permanent loss*
- *Table 11.5.5.4a: Assessment of the Significance of Fragmentation*
- *Table 11.6.2.1a: Specific Measure for Habitats Listed in the Appendix I of the Habitats Directive*
- *Table 11.6.4.1: Mitigation Measures for Mammals during Construction Phase*
- *Table 11.6.5.1a: Mitigation Measures for Amphibians and Reptiles during Construction Phase*
- *Table 11.6.5.1b: Specific Protection Measures for Notable Species*
- *Table 11.6.6.1: Mitigation Measures for Fish during Construction Phase*
- *Table 12.4.2a: Magnitude Definitions*
- *Table 12.4.2b: Vulnerability/Sensitivity Definitions*
- *Table 12.4.2c: Impact Significance Definitions*
- *Table 12.5.2a: Number of People per Household*
- *Table 12.5.2b: Age Profile and Gender Ratios of Households Surveyed*
- *Table 12.5.2c: Ethnic Groups in Podgorica and Danilovgrad*
- *Table 12.5.2d: Ethnic Background of Householders Interviewed*
- *Table 12.5.2e: Education Level of APs in AHs Surveyed*
- *Table 12.5.2f: Primary Livelihoods in Households Surveyed*
- *Table 12.5.3a: Current Occupation of APs in AHs Surveyed*
- *Table 12.5.3b: Current Occupation of APs in AHs Surveyed*
- *Table 12.5.3c: Average Monthly Income from Household Members Surveyed*
- *Table 12.5.4a: Source of heating in Surveyed Households*
- *Table 12.5.4b: Water and Wastewater System of Surveyed Households*
- *Table 12.5.4c: Distance of Closest Sports Facilities to the M-18 Road*
- *Table 12.6.2a – Overview of land area to be expropriated and ownership structure*
- *Table 12.6.2b: Overview of Landuse and Ownership Structure*
- *Table 12.6.2c: Summary of Impacts on Land According to the LARF*

1. Executive Summary

The Project

The European Bank of Reconstruction and Development (EBRD) is considering providing a loan to the Transport Administration of Montenegro (TA) for the rehabilitation, upgrade and works supervision of the 51km 'Montenegro Main Roads Reconstruction Project'. The project is divided into three main sections as follows, of which this report deals with Section 3:

- Section 1: Rehabilitation of the Rozaje-Spiljani road section (approx. 20km);
- Section 2: Rehabilitation and upgrade of the Tivat-Jaz road section (approx. 16km); and
- Section 3: Rehabilitation and upgrade of the Danilovgrad-Podgorica road section (approx. 15km).

The expansion and upgrade of the Danilovgrad-Podgorica section of the existing M-18 road (the Project) is part of a wider programme of rehabilitation of twelve main road sections; a strategic goal of the Government of Montenegro. The Project is aligned with the Spatial Plan of Montenegro (SPM) (2020), which outlines the development of road infrastructure in Montenegro.

S-ESIA

The Project was categorised 'A' by the Bank since the upgrade of this road section involves the widening of the road from 2 to 4 lanes over a more than 10 km continuous length and will require land acquisition, resulting in economic displacement and very limited physical displacement, and this road section is also located within a Key Biodiversity Area. Therefore, the Bank requires it to undergo an Environmental and Social Impact Assessment (ESIA) process with the resulting reports available for a minimum 120 days public disclosure and consultation period.

TA appointed E&S Consultants (E3 & AF) to prepare the E&S disclosure package including the ESIA and the National EIA. A range of draft documents have been shared with EBRD (ESIA, LARP, SEP and NTS), and number of gaps against the requirements of the PRs have been identified. This Supplementary ESIA Report seeks to build on the existing documents to develop an ESIA package that is 'fit for purpose' in terms of disclosure and consultation.

Project Setting

This section of road is approx. 15km in length and runs in a south-northwest direction. The road passes through two municipalities, Danilovgrad and Podgorica, and connects 11 main settlements.

In summary, the works to be undertaken are as follows:

- Widening of the existing 7m wide road to comprise two-lanes in each direction. The expanded road will be 21m wide, plus a 2m safety zone on each side (25m in total);
- Reconstruction of 4 bridges, totalling 215 m in length, and one new underpass, totalling 18m in length;
- Establishment of new pavements/sidewalks along the edge of the road in Danilovgrad (1.5m wide) and Podgorica (2m wide)
- Construction of seven (7) new roundabouts;
- 3 new road junctions;
- 23 new bus stops;
- New lighting along the length of the road
- New pedestrian crossings established at road junctions and near roundabouts;
- Stormwater drainage construction for the treatment of road runoff.

Commencement of works is planned for the end of 2019. According to the schedule provided in the Main Design, the works should be finalized in 24 months.

Key Benefits

The Danilovgrad-Podgorica section of the existing M-18 road is characterised by high volumes of traffic and accidents are commonplace. Flood risk is high at several locations along this section of the M-18, particularly within the Danilovgrad Municipality. The Project is intended to improve traffic flows (thereby reducing journey times) and road safety (for both drivers and pedestrians). Road drainage will be improved to reduce flood risk and run-off rates of contaminated water onto the surrounding land and into adjacent watercourses.

Key E&S findings for each EBRD PR requirement

No significant issues were identified that cannot be addressed in the Project preparation using generally standard provisions including the Environmental and Social Action Plan (ESAP). The key gaps and recommendations from the S-ESIA are summarised below:

PR1

Data deficiencies exist relating mainly to the construction methodology and finalisation of the LARF. A commitments register lists additional plans required of the Contractor to ensure the Project meets EBRD requirements. These will be referenced in the Loan Agreement as Conditions Precedent. An ESMS system will be developed by the TA in line with ISO14001 or other internationally recognised standards in accordance with the ESAP for Tranche 1.

As a contractor has not been appointed at this time, the source of any materials required is yet to be determined, TA must therefore include requirements relating to the Supply Chain within their Tender Documents for the construction contractor.

It is recommended that prior to construction, personnel within the TA are designated with the responsibility of ensuring compliance with relevant national Environmental and Social (E & S) regulatory requirements and the EBRD's PRs as well as ensuring that the contractor is meeting their E & S requirements. The appointed Contractor must produce and implement topic specific Construction Environmental and Social Management Plans (C-ESMPs) which will reflect all Project E&S Commitments as well as any national legislative requirements. During construction it is recommended that an Ecology Clerk of Works (ECoWs) be appointed and present to advise and supervise work activities that may impact biodiversity and habitats.

In addition, a social manager is required to advise and assist the TA and its Contractor in addressing social issues in accordance with PR1, 2, 5, 10. Particular attention needs to be focused on completing the LARP and on the SEP.

PR2

Presently there is no workforce in place. Therefore the Contractor will be required to prepare and implement a Human Resources Policy outlining the Project's commitments to working conditions in line with PR2. TA will develop and implement a robust contractor oversight plan to including managing and monitoring the performance of contractors and subcontractors in relation to PR2.

PR3

There has been limited air quality monitoring historically meaning that dispersion modelling does not provide a strong base for predictive efforts.

An Air Quality Management Plan will be developed which includes the completion of the air emission baseline assessment; modelling of impacts; sensitivity and vulnerability assessments (with reference to Montenegrin or EU standards) and finalisation/refinement of mitigation measures based on these.

However construction phases will happen in intermittent periods along the route, lasting on average 3 weeks (and up to 3 months). Emissions will therefore be short in duration and the effects on air quality along the route are expected to last only for a limited number of days / weeks at each given location, depending on the speed of road construction. Where no settlements exist along the road route, it is considered that there is negligible impact. Most mitigation measures to address impacts on ambient air quality during construction are general mitigation measures that correspond to good practice during construction. These are required to reduce negative impacts on air quality to a minimum. In addition, an air quality monitoring program should be implemented, close to the residential areas along the route. A response plan shall be developed if air quality monitoring shows exceedances of appropriate limits. The contractor will be required to perform baseline monitoring of air quality as per Montenegrin Legislation and GIP prior to and during construction as outlined in the ESMP.

The local municipal water supplies are sourced from groundwater aquifers, and the Project is being constructed in a karstic landscape. There is insufficient data for assessment of potential groundwater impacts and for the formulation of preventative and mitigation measures. Therefore the ESMP includes precautionary measures to prevent possible contamination of the ground water in the project area.

Information on the noise baseline in the project area is limited. The ESMP and supporting Commitments Register contain plans which structure the project to comply with national and PR3 requirements. Noise will be managed to within acceptable limits during the construction phase using sound barriers and judicious timing.

PR4

The contractor will develop an Occupational Health and Safety (OHS) management system in accordance with PR2, which it and other sub-contractors are obliged to implement.

In addition, a series of additional assessments and management plans will be required to achieve full health and safety conformance for the Project. These include inter alia:

- Emergency Preparedness and Response Plan.
- Road safety audits at detailed design and construction phases.
- Construction Traffic management plan,
- Road safety management and implementation of the recommendations from RSA.

PR5

A Land Acquisition and Resettlement Framework has been prepared in accordance with PR5. An audit of progress to date in dealing with resettlement claims will inform the preparation of a land acquisition, in accordance with PR5.

PR6

TA will engage biodiversity specialists to oversee the construction works and the BAP. Contractors will engage an Ecological Clerk Of Works (ECoW) to manage day to day ecological issues on site. The ECoW will perform preconstruction surveys prior to Right of Way (RoW) clearing to confirm the adequacy of proposed mitigation measures identified in the Supplemental ESIA Report, BMP and Biodiversity Action Plan. Where relevant, proposed mitigation measures will be updated, included in site specific method statements/project commitment register and implemented by the Contractor.

TA and its biodiversity specialists will develop, and update as necessary, a Project Biodiversity Action Plan (BAP). This will build on the Framework BAP included as part of the ESIA package and will be used to enable the project to avoid, minimize and/or mitigate impacts to species and habitats of conservation importance. The BAP will include appropriate biodiversity offset mechanisms to address issues that cannot be mitigated to help achieve No Net Loss of Priority Biodiversity Features in line with EBRD requirements.

PR8

There are no known cultural heritage resources with the RoW that may be impacted by the Project. However, the Contractor will need to develop, adapt and make the workforce aware of a Chance Finds Procedure.

PR10

The Project's Stakeholder Engagement Plan (SEP) builds upon limited stakeholder engagement activities undertaken to date. It will be implemented to ensure a continuous and systematic stakeholder engagement programme is in place.

Summary of Key E&S mitigation measurements and ESAP requirements

As construction has not commenced, design work is still in progress and the Contractor has not been appointed, the ESAP focuses mostly upon identifying plans and measures to address the Performance Requirements. These include:

- Biodiversity Action Plan
- Biodiversity Management Plan
- Water Resources and Water Quality Management Plan
- Soil Quality and Erosion Management Plan
- Air Quality Management Plan
- Waste Management Plan
- Hazardous Materials Management and Spill Prevention Plan
- River Crossing Plan
- Construction Traffic Management Plan
- Construction Noise and Vibration Management Plan
- Blasting Plan
- Chance Finds Procedure
- Stakeholder Engagement Plan
- Land Acquisition and Resettlement Plan
- Labour and Working Conditions Management Plan
- Emergency Preparedness and Response Plan

With regards to the project impacts on biodiversity, the project has the potential to affect a number of sensitive habitats (mostly associated with rivers and streams and/or wetland/ wetgrassland areas) and/or notable species. A biodiversity management and monitoring plan will be developed to address general biodiversity management approaches and a specific Biodiversity Action plan (based on the Framework BAP produced for the project) will need to be developed. This plan will specifically identify conservation related activities to be undertaken by the TA and its Contractor to help ensure no net loss (and where required, net gain) of biodiversity.

Resettlement and compensation has been progressing in compliance with Montenegrin Laws. The ESAP identifies actions required to meet the EBRD PR5 requirements:

- Socio-economic baseline to be completed;

- Gap analysis of national and PR5 resettlement and compensation entitlements
- Preparing a LARP on the basis of the gap analysis, in line with PR5

In addition, a Chance Finds Procedure needs to be prepared.

Following commissioning of the road, noise monitoring will be carried out and based on the results of this, further mitigation may be required in terms of sound barriers and insulation.

S-ESIA Conclusions

Taking into account the above, and with the additional requirements set out in the ESAP, SEP and LARF, the project now has commitments, plans and requirements in place to structure compliance with EBRD's Performance Requirements and Mitigation law.

In summary, no significant issues have been identified which cannot be readily addressed using measures in either the design, construction or operation stages.

2. Introduction

Introduction

This Report summarises the results of the Supplementary Environmental and Social Impact Assessment (S-ESIA) for the Main Roads Reconstruction Project, Rehabilitation and upgrade of the Danilovgrad-Podgorica road section. The Report addresses potential Environmental and Social (E&S) impacts associated with both the construction and operation of the expansion of the M-18 Road and is intended to supplement, rather than duplicate, both the regulatory EIA undertaken in April 2019 on behalf of the Transport Administration of Montenegro (TA) as part of the regulatory construction permitting process.

The Report includes an assessment of, and mitigation measures to address, likely significant environmental and social impacts associated with the construction and operation of the Project and any temporary and permanent infrastructure needed to support it.

This document should be read in conjunction with the following Project documents:

- Scoping Report¹
- Regulatory EIA²
- Stakeholder Engagement Plan³
- LARF

Project Overview

The rehabilitation and upgrade of the Danilovgrad-Podgorica section of the existing M-18 road (the Project) will comprise the widening of the existing road from two to four lanes over a distance of approx. 15 km, starting from the exit of the roundabout in Danilovgrad and ending in the suburb of Gornja Gorica in Podgorica. The Project incorporates the territories of two Municipalities located in the central region of Montenegro, namely Podgorica and Danilovgrad and their associated settlements that are located along the M-18 route. The following settlements /cadastre municipalities (CM) will be subject of expropriation: Beri, Baloci, Tolosi, Donja Gorica (Municipality of Podgorica) and Bandici, Curilac, Donji Zagarac, Glavica, Grlic, Jastreb, Novo Selo (Municipality of Danilovgrad).

The existing road has two-lanes (one lane in each direction) and is approximately 7m wide. The Project will expand the road by adding one additional lane in each direction (3.25 m wide each), as well as a central reservation (2 m wide), sidewalks (2 m wide) and a vegetated strip between the carriageway and the sidewalk of approximately 2m in width. The widened road corridor will therefore be approximately 20-21m wide, apart from at road bridges over rivers where it may reduce. The Project will also incorporate the reconstruction of existing road bridges and the construction of parallel new road bridges over the following watercourses: River Susica bridge (75m long), River Sitnica the 'Komanski' bridge (66m long), the River Matica bridge (60m long) and the River Mareza bridge (15m long).

¹ Montenegro Main Roads Reconstruction Project ESIA Scoping Report Tranche 3 – Danilovgrad-Podgorica

² Elaborate Procjene Uticaja Rekonstrukcije Magistralnog Puta M-18 Dionica Podgorica-Danilovgrad Na Životnu Sredinu, 2019

³ Montenegro Main Roads Reconstruction Project Stakeholder Engagement Plan Tranche 3 – Danilovgrad – Podgorica

There will be 23 bus stops constructed on both sides of the upgraded road. A central barrier will be installed to discourage pedestrians from crossing the widened carriageway. Specific pedestrian crossings will mainly be located at roundabouts and intersections.

Roundabouts will be constructed to enable access onto the M-18, except at locations where intersections are required to be built. Connecting or access roads will also be constructed. Retaining walls will be placed at locations where the new lanes need to be cut into existing slopes to ensure slope stability and protect the roadbed.

During the Construction Phase there will be three temporary construction sites in: Plana, at the intersection to Cafa and Baloce and at the Komanski bridge.

Need for the Project

Rehabilitation of the country's main road network is one of the strategic goals of the Government of Montenegro. The expansion and upgrade of the Danilovgrad-Podgorica section of the existing M-18 road (the Project) is part of a wider programme of rehabilitation of twelve main road sections (with a total length of approximately 216.3km) The M-18 upgrade itself is divided into three sections:

- Section 1: Rehabilitation of the Rozaje-Spiljani road section (approx. 20km);
- Section 2: Rehabilitation and upgrade of the Tivat-Jaz road section (approx. 16km); and
- Section 3: Rehabilitation and upgrade of the Danilovgrad-Podgorica road section (approx. 15km).

The Project is aligned with the Spatial Plan of Montenegro (SPM) (2020), which outlines the development of road infrastructure in Montenegro. The Project is part of one of the corridors identified in the SPM as a section of the existing road network that should be improved:

- **South longitudinal direction: Main Road for fast motor traffic: Bozaj – Podgorica – Danilovgrad – Niksic – Pluzine - Scepan Polje with connections to Niksic - Trebinje, Niksic – Bileca and Niksic-Gacko.**

The Danilovgrad-Podgorica section of the existing M-18 road is characterised by high volumes of traffic and accidents are reported to be commonplace. Flood risk is high at several locations along this section of the M-18, particularly within the Danilovgrad Municipality. The Project is intended to improve traffic flows (thereby reducing journey times) and road safety (for both drivers and pedestrians). Road drainage will be improved to reduce flood risk and run-off rates of contaminated water onto the surrounding land and into adjacent watercourses.

Requirement for a Supplementary ESIA

An Environmental Impact Assessment (EIA)⁴ to meet Montenegrin legislation was carried out on behalf of the Transport Administration of Montenegro (TA), and finalised in April 2019. It was issued to the relevant competent authority (the Nature and Environmental Protection Agency- NEPA) in order to obtain a construction permit.

Since the Project is being considered for financing by EBRD, it is also required to demonstrate that it will be constructed and operated in line with the EBRD's Environmental and Social Policy (2014) and associated Performance Requirements (PRs).

Project Standards

⁴ Projects that require an EIA are determined by the "Decree on determining projects for which an environmental impact assessment shall be carried out" - EIA Decree ("Official Gazette of Montenegro" No. 20/07 and 47/13).

The following PRs are considered relevant to the Project:

- PR 1: Assessment and Management of Environmental and Social Impacts and Issues
- PR 2: Labour and Working Conditions
- PR 3: Resource Efficiency and Pollution Prevention and Control
- PR 4: Health and Safety
- PR 5: Land Acquisition, Involuntary Resettlement and Economic Displacement
- PR 6: Biodiversity Conservation and Sustainable Management of Living Natural Resources
- PR 8: Cultural Heritage
- PR 10: Information Disclosure and Stakeholder Engagement

The Project has been assigned Category 'A' by the Bank since the upgrade of this road section involves the widening of the road from 2 to 4 lanes over a more than 10 km continuous length and will require land acquisition, resulting in economic displacement and very limited physical displacement. The road section is also located within a Key Biodiversity Area. Therefore, the Bank requires it to undergo an Environmental and Social Impact Assessment (ESIA) with the resulting reports available for a minimum 120 days public disclosure and consultation.

The disclosure documents (including this report) must include:

1. An accurate description and delineation of the project and the client's associated activities;
2. Social and environmental baseline data at an appropriate level of detail;
3. Details of applicable environmental and social laws and regulatory requirements of the jurisdictions in which the project operates, including laws implementing host country obligations under international law; and
4. Applicable requirements under the PRs, including application of the mitigation hierarchy and Good Industry Practice (GIP).

TA has appointed E&S Consultants (E3 & AF) to prepare the E&S disclosure package including the ESIA and the National EIA, and accordingly baseline data collection, and consultations have already been undertaken. A range of draft documents have been shared with EBRD (ESIA, LARP, SEP and NTS), and number of gaps against the performance requirements (PRs) have been identified. This Supplementary ESIA Report seeks to build on the existing documents to develop an ESIA package that meets EBRD requirements and is 'fit for purpose' in terms of disclosure and consultation.

Limitations of this Report

2.5.1 General Project Development Aspects

This Report has been produced over a limited timeframe of 4 weeks, and builds on the draft ESIA produced by E3 Consulting. Where possible, evidence was sought to independently verify statements made in the draft ESIA but this was not possible in all cases. Further information has been obtained where possible through desk based research, discussions with E3 and the TA and a brief site visit (from 17 – 21 June) to gain an understanding of the E&S context of the Project area, as well as to, undertake a rapid biodiversity assessment. The conclusions drawn have therefore been based on the best information available, and specific recommendations are included in key areas regarding additional work required. Overall, a precautionary approach has been taken to the assessment. We have assumed that the translation of the ESIA from Montenegrin to English was reasonably accurate and that no meaning has been lost.

More specific knowledge gaps include:

- No Construction Methodology information has been provided for the Project, including technical approach, schedule and workforce. This has limited the extent to which impacts during the construction phase can be accurately predicted: hence a more precautionary approach during the assessment. A Construction Methodology is expected later once the design engineer is appointed.
- The detailed design is still evolving. Any material design changes will be subject to an assessment of environmental and social impacts through a Management of Change process.

2.5.2 Social Aspects

The limitations to the social study related to the difficulty in reaching key stakeholders within the project affected areas. The socio-economic survey was undertaken during the day when many workers were out of the house. Survey respondents were therefore typically older members of the household (average age of respondents was 58 years) and therefore not a representative cross-section of the local population. Additionally, a poor understanding of the rationale for the survey led to stakeholders not wishing to answer all questions. The socio-economic survey was also undertaken over a short period of time (between 9-14th March and 13-16th May 2019) limiting the number of questionnaire surveys that could be completed. In total, 88 households were interviewed; which was less than 20% of the total households most directly affected by the Project (i.e. those directly adjacent to the road and affected by land acquisition). A higher proportion of survey participants would have provided a more robust socio-economic baseline for the assessment of impacts.

The socio-economic baseline has used publicly available data, including national census data for Montenegro, which was collected in 2011, and so is outdated. There was limited opportunity to triangulate and verify data presented. The baseline has therefore drawn heavily on the socio-economic survey and direct observation from the field.

Stakeholder engagement has been limited. The TA held several public meetings as part of the regulatory EIA process, but the baseline has not been well-informed by focused discussions with stakeholders - there have been no focus group discussions (for example to gain the views of women) or key-informant interviews (to gain deeper insights into specific issues with those well-informed about certain topics). Roundtable discussions were, however, held with local residents in June 2019 and further engagement is planned during the supplemental survey that will be undertaken as part of the Land Acquisition and Resettlement Plan (LARP) over the coming months.

2.5.3 Water Resources

- The Project description obtained to date in respect of the proposed storm-water drainage system does not clearly define how surface run-off from the road will be treated and discharged. The impacts on surface water quality are therefore assessed assuming that there may be direct point source discharges of untreated run-off into receiving watercourses.
- No baseline data has been obtained to date for water quality, vibration or soil quality. Traffic and noise surveys have been undertaken during the 4 week period and the resulting data has been incorporated into the assessments. A bat and aquatic invertebrate survey were also completed as part of this S_ESIA.

2.5.4 Noise and Vibration

The Noise data used for this assessment dates back to 2012 and represents a fundamental limitation to the assessment. It is also not considered geographically representative of the receptors present along the proposed route and as a result modelling of predicted impact using this data is not considered to be fully representative of the likely current baseline. Additional baseline noise monitoring is recommended (see Annex G for the 2019 Traffic Survey Report). Following this,

further mitigation measures may be required under the management of change/ adaptive management processes.

2.5.5 Air

Baseline air quality monitoring against which impact has been predicted is not sufficient to meet Good International Practice (GIP) and as such requires updating and further dispersion modelling. The absence of this data represents a fundamental limitation to the assessment of impact for receptors present along the route of the road. Supplementary air quality monitoring will be carried out during the operational phase. This may require additional mitigation measures to be implemented as part of the management of change/ adaptive management process.

2.5.6 Soil and Geology

There is limited information on hydrogeological aspects of the project area. Following the precautionary approach, preventative measures will be followed during the construction and operational phases of the road (see Section 10).

2.5.7 Traffic and Transport

Traffic data used in the assessment was collected in 2012 and therefore is not considered representative of the traffic flows likely to be using the road today some limited supplementary data was obtained recently however. The 2012 data has been used in the predictive modelling for air and noise and therefore represents a significant limitation to the interpretation of impact. A traffic survey was conducted in June 2019 which has been used to update the baseline but still remains limited.

2.5.8 Ecology

Ecological assessments have been based on desk studies and "rapid biodiversity assessments" undertaken in spring and summer 2019. Whilst further studies are proposed to provide a more comprehensive baseline, a precautionary approach has been adopted in the meantime and if habitat is deemed suitable for species that are known to be present in the area, it has been assumed that they are present. It is also noted that Montenegro is one of the few countries that, whilst it has adopted EU legislation in general as part of the accession process, has yet to designate any Natura 2000 sites (although it has identified Candidate Emerald Sites). The absence of such sites should therefore not be taken to represent the absence of habitat of notable conservation importance.

Report Structure

The S-ESIA is composed of 12 main chapters and a number of supporting Annexes. The main chapters are divided into the following groups:

- Chapters 1 - 5: Project and Assessment Overview. This includes information on the project description, generic mitigation proposed, S-ESIA approach and legal setting.
- Chapters 6 - 10: Environmental Impact Assessment. This addresses PR3 related impacts on (and mitigation for) the physical environment namely geology, soils, water resources, air quality and noise & vibration, traffic and transport.
- Chapter 11: Ecology and Nature Conservation. This addresses PR6 related elements associated with sensitive ecological receptors.
- Chapter 12: Social Impact Assessment: This includes issues related to PRs 2, 4, 5, & 10.

3. Project Standards

Montenegro Legal and Policy Framework

3.1.1. National Assessment and Permitting Requirements

An EIA was required for this Project in accordance with Montenegrin Law as outlined in the “Decree on determining projects for which an environmental impact assessment shall be carried out” - EIA Decree (“Official Gazette of Montenegro” No. 20/07 and 47/13).

Under the EIA Decree, projects are classified in two groups (Lists):

1. It is compulsory to carry out EIA study for all the projects under List 1.
2. For projects under List 2, the competent state or local authority should decide whether development of an EIA study is required, depending on the potentially significant environmental impacts under all circumstances. The public and other parties need to be consulted too.

This Project “Main Roads Reconstruction Project; Rehabilitation and Upgrade of the Danilovgrad - Podgorica road section” is under List 1 of the EIA Decree. The Project is structured to meet all relevant requirements referenced here.

3.1.2 Legal and Policy Framework Document

Table 3.1 provides a summary of all the relevant strategic, legislative and policy documents for the Project.

Table 3.1: Summary of all relevant strategic, legislative and policy documents for the Project

Title of document	Issue of importance for the Project
Planning documents	
Spatial Plan of Montenegro by 2020	Spatial Plan of Montenegro (SPM) by 2020 outlines development of the road infrastructure in Montenegro. The Project road section is part of one of the corridors identified in the SPM as a section of the road network which should be improved: South longitudinal direction: Main Road for fast motor traffic: Bozaj – Podgorica – Danilovgrad – Niksic – Pluzine - Scepan Polje with connections to Niksic - Trebinje, Niksic –Bileca and Niksic-Gacko.
Spatial Plan of the Capital Podgorica with SEA Report, 2014	Spatial Plan of the Capital of Podgorica with SEA Report stipulates that the main road Podgorica - Danilovgrad - Niksic should be built as a fast road with 4 four traffic lanes. The road will ensure development of a corridor, which will be based on the principle of sustainable development with economic development and housing. The organized corridor will prevent irrational use of space and permanent loss of quality agricultural land.
Spatial Plan of Municipality Danilovgrad with SEA Report, 2014	Spatial Plan of Municipality Danilovgrad with SEA Report stipulates that the main road M 18 (Scepan Polje - Pluzine - Niksic - Podgorica), which passes through the territory of the Municipality of Danilovgrad for about 23 km, should remain on the existing route. It should however be ranked as a main road for fast motor traffic according to the Spatial Plan of Montenegro.
Strategic documents	
Transport Development Strategy for Montenegro (2018-	The Transport Development Strategy identifies the conditions which should be present in all areas of transport. It also establishes the concept of development of infrastructure and transport and defines the long-term and fixed-term goals

2035) with SEA Report	<p>regarding transport development. Guidelines for this have been set for the overall system and they are based on the principles of safety, intramodality, application of modern technologies, complementary use of all modes of transport and rational use of all the available capacities and resources in the country.</p> <p>The SEA Report for Transport Development Strategy provides means for identification of the positive and negative impacts of the implementation of the Strategy in terms of air quality, climate change, protected goods, biodiversity, landscape, land, water, cultural and historical heritage, agriculture, forestry, savage and hunting, tourism and socio - economic characteristics. Analysis of the available documentation does not ensure identification of significant existing environmental problems which could have limiting effect on the activities planned within the Strategy.</p> <p>Transport Strategy defines specific objectives, whereby realisation of these objectives would greatly contribute to preservation of the environment:</p> <ul style="list-style-type: none"> - Planning of new traffic routes out of the most sensitive areas; - Construction of a bypass for transit movements around vulnerable areas; - Construction of third bands for relieving bottlenecks in the tourist season; - Establishment of a special regime for freight assembly in certain periods; - Application of alternative variants of traffic in certain periods, etc. <p>The Report provides a presentation of the assessment of the identified expected impacts on the environmental segments that may arise from the implementation of the Strategy, as well as the criteria / indicators based on which the assessment was carried out. By analysing the available data on all segments of the environment and identifying the potential impacts of the Strategy, measures to prevent, limit, reduce or eliminate any significant identified impact, are defined. Monitoring before and during the construction is planned, as well as during exploitation, so that eventual unforeseen negative impacts could be recognized, and appropriate corrective measures undertaken.</p>
Strategy Road Transport Safety Improvement (2010-2019)	<p>This Strategy defines the guidelines for road transport safety in Montenegro, and it stipulates measures which need to be taken in order to achieve the set goals. The starting points defined in this Strategy should serve as the basis for a reform of road transport safety. Notably, they can be adjusted to the degree which is necessary for making innovations and advancements in terms of the safety system. This Strategy defines development and functioning of the road transport safety system in Montenegro and it reflects its commitment on a regional and global level. Improvement of transport safety through reconstruction of the M-18 Danilovgrad-Podgorica road section is envisaged within the Action Plan, and these works should be funded through the EBRD loan.</p>
National Strategy on Climate Change until 2030	<p>According to the Strategy, recommended climate change measures for the transport sector have been set: High energy savings in traffic and Increasing the use of ICT in energy and traffic use - using smart urban applications. The following target indicators have been established: 20% increase in the use of alternative fuels; established retail biofuels; developed network for powering electric vehicles; 20% increase in the use of appropriate ICT systems in the field of energy and transport.</p>

Transport and traffic legislation	
Law on Roads (Official Gazette of Montenegro No. 42/04, 36/11, 92/17)	<p>This Law governs the legal status, development, maintenance, protection, management and financing of the works performed on the public roads.</p> <p>Article 23 defines scope of work in terms of reconstruction of the road. Article 26 stipulates that the contractor hired for reconstruction of the road (where the traffic closure is not planned) is obliged to perform regular maintenance of the road during execution of works; Articles 34 and 35 define that the investor is obliged to inform the public about commencement of the reconstruction work at least 10 day in advance.</p>
Law on Road Transport Safety (Official Gazette of Montenegro 33/12, 58/14, 14/17)	<p>This Law governs the rules for road transport, obligations of participants in traffic and other actors in transport, traffic restrictions, traffic signalization, markings, signs and commands that all the participants in traffic must adhere to. Additionally, this Law defines requirements that the drivers must meet in terms of handling vehicles, requirements that vehicles must meet, special measures to be taken in traffic and other rules and measures aimed at ensuring road transport safety.</p> <p>Article 130 defines that the Investor is obliged to inform the public about closure or restriction of traffic during reconstruction works, which must be coupled with the setting of appropriate traffic signalization.</p>
Spatial planning and construction legislation	
<p>Law on spatial development and construction (Official Gazette of Montenegro 51/08, 40/10, 34/11, 47/11, 35/13, 39/13, 33/14)</p> <p>Law on spatial planning and construction (Official Gazette of Montenegro No. 064/17, 044/18, 063/18)</p>	<p>The Law governs the system of spatial planning, manner and requirements for construction, as well as other matters of importance such as spatial planning. The new Law envisages application of works with the documentation prescribed by the Law as construction conditions, instead of a construction permit. Instead of the use of a permit, the Law envisages the merger of technical inspection and professional supervision, which relieves the system of double controls.</p> <p>Chapter 3 prescribes requirements for construction of facilities. Additionally, it defines requirements and obligations of the employer (investor), contractor and engineering supervisors, as the main participants in construction.</p> <p>Article 93 prescribes that the employer shall submit the stamped and reviewed final design in electronic and analogue forms to the contractor, prior to commencement of construction. Article 100 prescribes that the employer shall provide an engineering supervisor during the construction. The same Article prescribes that the engineering supervisor shall control the execution of works as per the reviewed final design, the present Law and separate regulations. The supervisor must also control: the compliance of works; quality of materials labour; regular monitoring of progress within contracted limits; undertaking of measures ordered by the contractor to eliminate deficiencies and the compliance of work with environmental protection measures.</p> <p>According to Article 95, the contractor shall execute work in agreement with the reviewed final design, marked boundary and building lines and the elevation points of the structure and terrain alignment. The building site shall be organised in a manner which ensures access with unimpeded traffic. The safety of the structure, occupational health and safety and protection of the environment (adjacent structures and infrastructure), should be monitored by keeping a construction log and a measurement book. Geodetic monitoring of soil shall be conducted, and structural behaviour monitored during the construction phase. Waste created during construction must be treated in compliance with the construction waste</p>

	management plan and regulations. Temporary structures that served during construction must be removed within 30 days of the work finalization date. Article 58 stipulates basic requirements for structures and Articles 76-80 prescribe types of design and other technical documentation. Articles 27, 32, 33 and 34 prescribe the obligation of MSDT for public disclosure and consultation during development and approval of spatial plans.
Environmental legislation	
Law on Environment ("Official Gazette of Montenegro", No. 52/16)	This Law regulates, instruments and measures principles of environmental protection and sustainable development. Article 9 defines that, when performing their activities, national and foreign legal and natural persons shall ensure rational use of natural resources, incorporation of environmental protection costs within investment and production costs, and implementation of regulations, i.e. undertaking of environmental protection measures in accordance with this Law and other regulations.
Law on the Strategic Environmental Impact Assessment (SEA) ("Official Gazette of Montenegro", No. 80/05, "Official Gazette of Montenegro", No. 40/11, 59/11, 52/16)	This Law determines the conditions, methods and procedures to assess the impacts of certain plans and programs on the environment. Environmental protection principles are integrated thoroughly into the procedures for preparation, adoption and implementation of plans and programs that have significant environmental impact, including those in the field of transport.
Law on the Environmental Impact Assessment (EIA) ("Official Gazette of Montenegro", No. 75/18).	This Law prescribes procedures for carrying out EIA studies for projects that may have significant environmental impact. Contents of the EIA study, participation of interested parties, evaluation of EIA studies and issuing approvals, notification of other states on projects with potential transboundary effects, supervision and other relevant issues are also addressed.
Law on Liability for Environmental Damage ("Official Gazette of Montenegro", No. 27/14).	This Law defines responsibility of the legal entity and the entrepreneur (operator) that caused damage or imminent danger to the environment. Environmental damage compensation is based on the polluter pays principle, according to which the legal and physical person who caused damage in the environment or imminent danger of causing damage must compensate by implementing preventive and remediation measures at their own expense. The Law introduces compulsory insurance, according to which the legal and physical person performing activities that pose a risk to human health and / or the environment shall be obliged to ensure liability for environmental damage.
Law on Nature Protection ("Official Gazette of Montenegro", No. 54/16)	This Law prescribes the general measures of protection and conservation of nature; protection of natural goods; sustainable use of natural resources and natural goods and the control of their use; conservation of ecological networks and corridors; implementation of strategies, plans, programs, bases and other documents; mitigating harmful consequences caused by activities in the nature, by exploitation of natural resources or natural hazards; stimulating measures for the protection and conservation of natural resources. Article 76 states that public roads, other roads and other facilities must be built in such a way as to reduce the negative effect on the migratory wildlife pathways and enable the safe passage of wild animals at appropriate distances. These measures shall be provided by the application of specific construction and technical-

	<p>technological solutions (ecological bridges, built passes and passages, tunnels, culverts, channels, safety facilities, facilities for regulating movement direction, fish pass, elevators) on the facilities and in their environment.</p> <p><i>The Rulebook on measures of protection and way to maintain the passes for wildlife ("Official Gazette of Montenegro", No. 80/10) determines the protection measures and the manner of maintaining special technical and technological solutions, which enable the unhindered and safe passage of wild animals. The following articles are relevant for the Project:</i></p> <p><i>Article 4: Amphibian and reptile crossings have the form of tunnels, with direction markers towards the openings at both ends. Openings which are provided at each end of the wildlife crossing, stipulated in Paragraph 1 of this Article, may have circular, rectangular or elliptical shape, whereby their diameter may vary, based on the length of the tunnel. Consequently, minimal diameter may range from 0.4 to 1.2 m, i.e. from 0,4 x 0,4 m to 1,2 x 1,0 m (width times height), in case the wildlife crossing has the length between 10 and 40 m. Direction markers shall be placed vertically along the edge of the tunnel, whereby they should be placed at the minimal height of 50 cm.</i></p> <p><i>Article 5: Crossings for smaller wildlife species (weasel, hedgehog, otter, badger, fox, rabbit, etc.) may only have the form of underground crossings, whereby they may have round or rectangle shape and their dimensions should be adapted to the animal species for which the crossings have been constructed. Protective fencing will be placed at both sides of the crossing defined in Paragraph 1 of this article. This fence will be used for preventing animals from reaching the road, whereby it will have the minimal length of 100 m.</i></p> <p><i>Article 8: Fish ladders are used for re-establishing communication between river watercourses, or between lakes and rivers, in case the natural crossing path is interrupted by construction of the dam. Fish ladder consists of a series of short steps (in the cascade form), whereby the end point of the fish ladder is located on the other side of the dam. Length of the fish ladder depends on the type and height of the dam which is to be bypassed. Fish ladders are equipped with resting areas, i.e. with several deep pools in which fish rest for a certain period of time before continuing migration. Barriers between the cascades must have zigzag openings, which will be used by fish so that it can continue its movement.</i></p>
<p>Law on Air Protection ("Official Gazette of Montenegro", No. 25/10, 40/11, 43/15)</p>	<p>The Law regulates the way of monitoring air quality, protection measures, assessment and improvement of air quality, as well as air quality planning and management. Air, as a natural value of general interest, is part of the environment and has special protection in Montenegro. Protection of air from pollution by radioactive substances, genetically modified organisms, noise and natural disasters is regulated by specific regulations. The Law prescribes that in zones where concentrations of pollutants exceed any established marginal or target value, taking into account the tolerance limits, the Ministry in charge of environmental issues, in cooperation with the NEPA and local government authorities is obliged to pass the Air Quality Plan to reach the values as determined by the <i>Decree on the Determination of Types of Pollutants, Limits and Other Air Quality Standards ("Official Gazette of Montenegro", No. 25/12).</i></p> <p>On the basis of the available data, the territory of Montenegro was divided in three air quality zones in 2011. The network for air quality monitoring was expanded to include seven automatic stations in order to meet minimum requirements set out in Directives 2008/50/EC and 2004/107/EC. All pollutants regulated in the legislation of Montenegro are monitored regularly. Air Quality data are available</p>

	<p>on-line in real time (http://www.epa.org.me/vazduh/) and annually reported to the EU through EIONET.</p> <p>By adopting the <i>Rulebook on the Manner and Conditions for Monitoring of the Air Quality (Official Gazette of Montenegro No. 21/2011 and 32/16)</i>, the methods of measuring/ monitoring and data collection, followed by data quality and its validation were addressed.</p> <p>In the field of Air Quality, the compatibility of national regulations with European legislation has been achieved almost fully by the adoption of regulations in 2012. Primarily the <i>Regulation on Determination of the Types of Pollutants, Threshold Values and other Air Quality Standards ("Official Gazette of Montenegro", No. 45/08, 25/2012)</i> and the <i>Rulebook on the content and method of developing of annual air quality information (" Official Gazette of Montenegro ", No. 27/2012).</i></p> <p>Other:</p> <ul style="list-style-type: none"> - <i>Rulebook on the manner and conditions for monitoring the quality of air ("Official Gazette of Montenegro", No. 21/11 of 21 April 2011, No. 32/2016 dated 20 May 2016);</i> - <i>Rulebook on the emission of pollutants in the air ("Official Gazette of the Republic of Montenegro", No. 25/01);</i> - <i>Rulebook on the methodology of testing, deadlines and manner of notification of the results of monitoring and determination of harmful substances in the air on sources of pollution ("Official Gazette of the Republic of Montenegro", No. 4/82);</i> <p><i>Regulation on Establishing a Network of Measuring Points for Monitoring Air Quality ("Official Gazette of Montenegro", No. 44/10 and 13/11);</i></p>
<p>Law on Protection from Noise in the Environment (Official Gazette of MN, No. 28/11, 28/12 and 01/14)</p>	<p>This Law determines preventative measures on the harmful effects of noise and other important issues for the protection of the environment and human health. The Law deals with noise, particularly in built-up areas, city parks, quiet areas in the countryside and agglomerations, schools, hospitals and other facilities. There is an emphasis on vulnerable groups where noise may have harmful effects on people such as children, the elderly and patients. On the basis of the Law on protection from environmental noise, the Ministry of Sustainable Development and Tourism adopted the <i>Ordinance on limit values of environmental noise, the method of determining the noise indicators and acoustic zones and methods of assessment of adverse effects ("Official Gazette of Montenegro ", No. 60/11).</i></p> <p>Based on the aforementioned legislation, municipalities in Montenegro have adopted the acoustic zoning of their territories, which is a basic requirement for the implementation of this Ordinance. By determining the acoustic zones, the limit values (Lday, Levening, Lnight) are set for the established parts of the municipal territory (silent zone and zone under strong noise), which is important for protection against noise in the environment, and for future planning of the construction of facilities.</p> <p>Other: <i>Rulebook on the methods of calculation and measurement of the environmental noise level ("Official Gazette of Montenegro", No. 27/14, 17/17);</i></p>
<p>Law on Waters ("Official Gazette of Montenegro", No.</p>	<p>The Law regulates the legal status of water related resources and management. According to Article 114, the investor is obliged to prepare technical documentation for the construction/reconstruction of new and existing facilities.</p>

<p>27/2007, 32/2011, 47/2011 48/2015 and 52/2016, 55/16, 02/17).</p>	<p>This involves carrying out hydrogeological research that can permanently, occasionally or temporarily influence the changes in the water regime. According to Article 118, the investor is obliged to obtain a Water consent before the construction or reconstruction of facilities where water related issues are evident. As such, technical documentation for the facilities and works is executed in accordance with the established Water conditions. According to Article 120, the investor is obliged, prior to the use of facilities and installations for which Water consent is required, to obtain a Water Permit that determines that the facilities and installations have been built in accordance with the Water consent.</p> <p>The Law requires wastewater treatment which is to be performed by the polluter. Pollutants must be partially or completely removed before the water is discharged into the public sewage system or another recipient. Additionally, the removal process should be carried out in compliance with the regulations on effluents (<i>emissions</i>).</p> <p>Article 84 of this Law prescribes that companies, other legal entities and persons discharging wastewater, shall install the measuring equipment to measure volumes and test the quality of wastewater and the impacts on the recipient. Relevant data shall be submitted to the competent authority. Regular functioning of equipment must be ensured with a journal kept to record historic usage and operation.</p> <p>Based on Article 74b, paragraph 2 of the Law on Waters, the Government of Montenegro made a <i>Decision on the determination of vulnerable areas in the aquatic area of the Danube and Adriatic basin</i>. Vulnerable areas in the aquatic area Danube and Adriatic basin are the areas that are eutrophic or susceptible to eutrophication. The Zeta River and tributaries (including the Susica River) are particularly vulnerable areas in the aquatic area of the Adriatic basin.</p> <p><i>Regulation on the classification and categorization of surface and groundwater ("Official Gazette of Montenegro", No. 2/07)</i> has established Environmental Quality Standard (EQS) values for all main rivers in Montenegro, in the format AnSnKn where: code A is a category for water representing basic physicochemical standards, S, Š or C is the assessment for fisheries water and K is the assessment for bathing water.</p> <p>Other:</p> <p><i>Rulebook on quality and sanitary-technical conditions for discharge of wastewater into recipient and public sewerage, method and procedure for testing the quality of wastewater, minimum number of testing and content of report on determined wastewater quality ("Official Gazette of Montenegro" No. 45/08, 09/10, 26/12, 52/12, and 59/13).</i></p>
<p>Regulation on permitted quantities of hazardous and harmful substances in the soil and methods for its examination (Official Gazette of the Republic of Montenegro No. 18/97)</p>	<p>The Regulation prescribes the limit values for dangerous and harmful inorganic substances such as: lead (Pb), chromium (Cr), nickel (Ni), fluorine (F), and others. Also, limit values for toxic and carcinogenic organic substances such as: polycyclic aromatic hydrocarbons (PAHs), polychlorinated biphenyls and triphenyls (PCBs and PTCs), pesticides, etc.</p>
<p>Law on Waste</p>	<p>This Law regulates types and classification of waste; planning of waste</p>

<p>Management (Official Gazette of Montenegro, No. 64/11 and 39/16)</p>	<p>management; conditions for waste collection transport, treatment, storage and disposal; rights, duties and responsibilities of legal and physical persons involved in waste management; and conditions and procedures for waste management permits. Based on provision of the Law on waste (article 10) and "polluter pays principle" waste producers (legal or non-legal entities) are responsible for management of waste that they produce. Different types of waste should be collected separately, such as metal, plastic, glass and biodegradables (this is obligatory - article 11, Law on Waste). Collection of waste can only be carried out by registered companies or entrepreneurs with adequate equipment and personnel (Law on Waste, article 36). The Law (Article 54) prescribes methods for storing and disposal of construction waste; the need for development of a waste management plan and its content, reuse of construction waste on site, collecting and processing of the construction waste and handling with the cement asbestos waste.</p> <p>Other applicable regulations:</p> <p><i>Rulebook on more detailed content and method of drafting waste management plan for waste producers ("Official Gazette of Montenegro", No. 05/13 dated 23 January 2013);</i></p> <p><i>Rulebook on methods for testing hazardous waste properties and closer conditions to be fulfilled by an accredited laboratory for hazardous waste testing ("Official Gazette of Montenegro ", No. 21/2014);</i></p> <p><i>Rulebook on waste classification and waste catalogue ("Official Gazette of Montenegro", No. 059/13 o83/16);</i></p> <p><i>Rulebook on construction waste treatment, method and procedure of construction waste processing, conditions and manner of disposal of cement asbestos construction waste ("Official Gazette of Montenegro", No. 050/12).</i></p>
<p>Health & Safety legislation</p>	
<p>Law on Safety and Health at Work ("Official Gazette of Montenegro", No. 34/14, 44/18)</p>	<p>The most important provision of this Law is the following:</p> <p>The employer is obliged to ensure protective measures by preventing, removing and controlling the risk at work, informing and training employees, along with appropriate organization and the necessary resources. Bearing in mind the changing work environment, the employer is obliged to implement safety measures and select such working and production methods that will ensure improved or higher levels of H&S. While assigning an employee to a position with special working conditions or with increased risk, the employer must take into account the employees' abilities, which may affect their protection and health. In accordance with the Law on Safety and Health at Work, the employer is obliged to provide the employees with a training for safe operation, at the time of concluding employment, assigning him or her to another position, introducing new technology, introducing new or replacing work equipment, making changes in work processes and re-assigning him or her to work after absence of more than one year. Additionally, the employer must inform the employers or employees' representative in writing about: Risks related to health and safety at work, protective measures and activities related to each type of workstation and/or job, the manner of organization and provision of first aid, fire-fighting, evacuation procedure for employees in cases of serious and immediate danger and the persons responsible for implementing these measures.</p>

Legislation addressing resettlement and expropriation	
The Constitution of Montenegro ("Official Gazette of Montenegro", No. 01/07, 38/13)	The Constitution of Montenegro defines the legal basis for expropriation of land and protection of property rights, while it only exceptionally allows the possibility of limiting these property rights in cases when it is imposed by public interest and established by or based on the law.
Law on Expropriation ("Official Gazette of the Republic of Montenegro ", No. 55/00, 28/06 and "Official Gazette of Montenegro "No. 21/08, 30/17)	The Law guides the land/property management and serves as a general framework for the land/property expropriation on the territory of Montenegro. The Law provides the right to make appeals at many stages of the expropriation procedure, such as administrative and judicial appeals (i.e. against the decision on public interest, the decision on expropriation, and regarding compensation), among other rights of affected citizens (those with formal legal rights).
Law on Property-Legal Relations ("Official Gazette of Montenegro", No. 19/09)	According to the Law on property-legal relations, no person may be deprived of his/her property or of the rights deriving from it, except in cases concerning the public interest determined by the law. In case of deprivation (complete expropriation) or restriction (partial expropriation), rightful compensation for the property, which is not lower than its market value at the time of expropriation, is guaranteed. The beneficiary of expropriation may submit the expropriation proposal only after determining the public interest in expropriation.
Law on State Surveying and Cadastre of Immovable Property (Official Gazette of Montenegro No. 29/07)	According to the article 45 of the Law, all land suitable for agricultural and forest production shall be divided into eight land quality classes. Within each land quality class, one or more land quality sub-classes can be determined. The most common are the classes III and IV, on karst areas IV, V and VI class, while hilly-mountainous areas are characterized by classes V to VII.
Cultural heritage legislation	
Law on Protection of Cultural Properties ("Official Gazette of Montenegro", No. 49/10 and 044/17)	This Law regulates the types and categories of cultural resources, the ways of establishing protection, the regime and measures of protection, the rights and obligations of owners and holders of cultural resources and other issues of importance for protection and preservation of cultural resources. According to Article 87, if an archaeological site is discovered during execution of construction works and activities on land or in water, the contractor is obliged to stop the works and to protect the site or findings from possible damage, destruction and unauthorized access by other people. Additionally, the contractor is obliged to immediately notify the administration about the findings, i.e. the site. According to Article 88, the administration is obliged to determine whether the subject site represents an archaeological finding and to secure the site, whereby these activities should be carried out no later than one day from notification about the discovery. After the review, a decision will be issued that will determine whether execution of works will be continued under supervision of an archaeologist, the works will be suspended, or whether appropriate archaeological research will be carried out. Temporary suspension may last up to 30 days.

3.1.3 Other Permitting Requirements

3.1.3.1 Construction Permit

The TA started the process of obtaining the construction permit in 2014, when the old Law on Spatial Planning and Construction of Structures was still in force ("Official Gazette of Montenegro", 51/08, 40/10, 34/11, 47/11, 35/13, 39/13, 33/14). Although there is a new Law on Spatial Planning and Construction of Structures ("Official Gazette of Montenegro" No. 064/17, 044/18, 063/18), the old Law will continue to be followed. This is in accordance with Article 238 of the Law, which states that procedures which started prior to enforcement of the new Law on Spatial Planning and Construction of Structures, shall be finished in line with the law which was in force upon initiation.

During August 2014, the Ministry of Sustainable Development and Tourism (MSDT) issued urban-technical conditions, defining the conditions and measures for the development of technical documentation regarding the project. These conditions also stipulate that the developer is obliged to resolve the property-legal relations along the proposed road route for reconstruction. This should be done before submission of the construction permit request, and in line with Article 93 of the Law on Spatial Planning and Construction of Structures ("Official Gazette of Montenegro", 51/08, 40/10, 34/11, 47/11, 35/13, 39/13, 33/14).

Along with the request for a construction permit, the investor should submit the following documents: Main Design, along with a report on the performed revision; Proof of ownership; Consent of all owners of construction land; Other permits and approvals determined by specific regulations, including approval to the EIA Study.

3.1.3.2 Water Permit

According to Article 118, the investor obtained water consent regarding the works in the riverbeds. The water consent requires technical documentation for the facilities and works to be prepared in accordance with water conditions. According to Article 120, prior to the use of facilities and installations for which water consent is required, the investor is obliged to obtain a water permit. This ensures that the facilities and installations are built in line with the water consent.

International Conventions

Montenegro has ratified a number of international treaties and conventions along with the ongoing process of transposing EU law into the National legal and policy framework. All treaties and conventions relevant to the Project will be considered during development of the ESIA, such as the Aarhus Convention.

The Convention on Public Participation, Access to Information and Access to Justice in Environmental Matters (Aarhus, 1998) - the Aarhus convention - is part of the national legal system, implemented in 2009. Access to justice in respect of environmental matters is governed by several laws, which are fully transposing relevant provisions of the EU legislation. This governs public access to environmental information and public participation in making decisions on environmental matters, whilst aligning with Aarhus Convention. The MSDT and NEPA regularly update their websites to contain all relevant documents for access to information. Other institutions are also active such as local authorities, the Agency for Personal Data Protection and Access to Information and the Administrative Court of Montenegro. Dissemination of the information related to the environment is also done through the Aarhus centres in municipalities Podgorica, Niksic, Pljevlja and Berane.

EU Directives

Horizontal environmental legislation of the EU was transposed into the legal system of Montenegro in 2005. At the time when the Strategy was prepared, the major share of the EU horizontal legislation transposed, included six laws and implementing acts. These pieces of legislation are as follows:

- **Directive 2001/42/EC (SEA);**

Directive 2001/42/EC on the assessment of the effects of certain plans and programmes on the environment (SEA), has been fully implemented through the Law on Strategic Environmental Assessment since 2008 at both national and local levels. Strategic environmental assessment is carried out for all plans and programmes where their implementation may have impacts on the environment. As of 2009, Montenegro is a party of the SEA Protocol.

- **Directive 2011/92/EU (EIA), which codified Directive 85/337/EEC and its amendments by Directive 97/11/EC, Directive 2003/35/EC and Directive 2009/31/EC and as amended by 2014/52/EU (EIA);**

Directive 2011/92/EU on the assessment of the effects of certain public and private projects on the environment is fully implemented through the Law on Environmental Impact Assessment (EIA) and its accompanying implementing acts. Impact assessment is carried out for all new projects and for their amendments. Since 2008, the Law has been implemented at both national and local levels. Two lists of projects have been compiled – List I for which EIA is mandatory and List II for which EIA may be required. Moreover, cross-border procedure is also carried out in order to inform the other states if implementation of a project may have a significant environmental impact. Montenegro is a Party of the Espoo Convention, since 2009.

- **Directive 2003/4/EC (access to environmental information);**

Directive 2003/4/EC on public access to environmental information and repealing Council Directive 90/313/EEC is implemented through the Law on Environment and Free Access to Information at a national and local level.

- **Directive 2003/35/EC (public participation and access to justice in EIA procedures and procedures for the issuance of IPPC permits);**

Directive 2003/35/EC facilitates public participation in respect of the drawing up of certain plans and programmes relating to the environment. Regarding public participation and access to justice, Council Directives 85/337 and 96/61 have been fully transposed through the Law on Strategic Environmental Assessment and Law on Environmental Impact Assessment.

- **Directive 92/43/EEC on the Conservation of natural habitats and of wild fauna and flora (“the Habitats Directive”) and Directive 2009/147/EC on the conservation of wild birds (“the Birds Directive”).**

The two principal EU Directives relating to nature conservation are the *Habitats Directive* and the *Birds Directive*.

The *Habitats Directive* prompted a network of Special Areas of Conservation to protect the 220 habitats and approximately 1000 species listed in Annex I and II of the Directive. These are considered to be of European interest. Together with Special Protection Areas which are

designated under the *Birds Directive*, these form a network of protected sites across the European Union called Natura 2000.

- **Directive 2004/35/EC (environmental liability), as amended by Directive 2006/21/EC (mining waste), Directive 2009/31/EC (geological storage of carbon dioxide) and Directive 2013/30/EU (safety of offshore oil and gas operations);**
- **Directive 2008/99/EC (on the protection of the environment through criminal law).**
- **European Directive 2008/96/EC Road Infrastructure Safety Management.**

The provisions of Directive 2008/96/EC define good practice for national road transport infrastructure. PR4 requires these principles to be closely followed. The Directive imposes road safety responsibilities on Project Sponsors to demonstrate that risks have been considered during the design and delivery of the project. During the initial planning stage, this would comprise the production of a Road Safety Impact Assessment, in line with Annex I of the Directive. Subsequently Road Safety Audits should be undertaken as an integral part of the design in line with the criteria set out in Annex II of the Directive. Annex III of the Directive sets out criteria and requirements for the ranking of high accident concentration sections and network safety ranking during operation.

The following directives are partially transposed:

- **Waste Framework Directive 2006/12/EC;**
- **Landfill Directive 1999/31/EC;**
- **Hazardous Waste Directive 91/689/EEC, with accessories 94/31/EC, 166/2006;**
- **The Packaging and Waste Directive 94/62/EC, with accessories 2005/20/EC 2004/12/EC, 1882/2003;**
- **Council Directive 1999/31/EC of 26 April 1999 on the landfill of waste.**

EBRD Requirements

The EBRD categorises each project to determine the nature and level of environmental and social investigations, information disclosure and stakeholder engagement required. This will be commensurate with the location, sensitivity and scale of the project, and the significance of its potential adverse environmental and social impacts. Past and present environmental and social issues and risks associated with project-related existing facilities will be subject to environmental and social appraisal, regardless of the categorization.

A project is categorized 'A' when it could result in potentially significant adverse environmental and/or social impacts. At the time of categorization, these cannot readily be identified or assessed and therefore, require a formalized and participatory environmental and social impact assessment process.

In the case of the Project, it is classified as Category A as it meets the requirements of Appendix 2: Category of Projects: "*Construction of motorways, express roads and lines for long-distance railway traffic; airports with a basic runway length of 2,100 meters or more; new roads of four or more lanes, or realignment and/or widening of existing roads to provide four or more lanes, where such new roads, or realigned and/or widened sections of road would be 10 km or more in a continuous length*".

The appraisal will consider whether the project is capable of being implemented in accordance with this Policy and PRs. It will also include the assessment of potential financial, legal and reputational risks in addition to the identification of potential environmental or social opportunities. The outcomes of the ESIA process are integrated into EBRD's overall appraisal of the project.

EBRD's environmental and social appraisal includes consideration of three key elements:

- The environmental and social impacts and issues associated with the project,
- The capacity and commitment of the client to implement the project in accordance with the relevant PRs, and
- To the extent appropriate, the facilities and activities that are associated with the project but are not financed by EBRD.

EBRD's appraisal requires the clients to identify stakeholders potentially affected by and/or interested in the projects. It also requires the disclosure of sufficient information about the impacts and issues arising from the projects and a consultation with stakeholders in a meaningful and culturally appropriate manner. In particular, EBRD requires its clients to engage with relevant stakeholders, in proportion to the potential impacts associated with the project and level of concern.

Projects are expected to meet Good International Practice (GIP) related to environmental and social sustainability. To help clients and/or their projects achieve this, the Bank has defined specific PRs for key areas of environmental and social sustainability as listed below:

Performance Requirement 1: Assessment and Management of Environmental and Social Impacts and Issues – establishes the importance of integrated assessment to identify the environmental and social impacts/issues throughout the life of the project. Category A projects will require the client to:

- Carry out a comprehensive Environmental and Social Impact Assessment (ESIA), including a scoping stage to identify the potential future environmental and social impacts (scoping study), examination of alternatives to the source of such impacts, and development of recommended measures needed to avoid/minimize potential impacts;
- Establish and maintain an Environmental and Social Management System (ESMS);
- Establish as appropriate, environmental and social policies;
- Develop an Environmental and Social Management Plan (ESMP);
- Establish and maintain an organisational structure for ensuring on-going compliance with relevant national regulatory requirements and the PRs;
- Identify risks associated with its supply chain and exercise reasonable control of primary suppliers; and
- Monitor the environmental and social performance of the project to determine whether the project is being implemented in accordance with the PRs or to take the necessary action to ensure such compliance.

Performance Requirement 2: Labour and Working Conditions – expresses the need for establishing a human resources management system which guarantees respect of workers' rights and provides them with safe and healthy working conditions. The TA will need to ensure the Contractor(s) implements a range of measures to comply with the EBRD's labour and working conditions requirements. These include the development and implementation by the Contractor of Human resources policies to hire, train, assess, and pay the project workforce. These policies should prevent any form of discrimination in the workplace and ensure that all employees are treated fairly and equally, in line with EU non-discrimination requirement. Prior to implementing any collective dismissals of the project workforce, the contractor will be required to conduct an analysis of alternatives to retrenchment. Furthermore, policies should exclude the use of child or forced labour in the project, and that national and international requirements for non-employee workers and supply chain workers are also reflected in these policies. A grievance mechanism for workers will need to be provided for the workforce to be able to raise reasonable workplace concerns. The Contractor will inform the workers of the grievance mechanism at the time of hiring and make it

easily accessible to them. The workers will additionally not be restricted from joining or forming workers organisations or from bargaining collectively, and the contractor will not discriminate or retaliate against those who decide to do so. Working relationships and conditions of work are also to be managed and monitored in implementing the project. Aspects include the working environment; the organisation of work; training; health and safety; working hours; fair wages and decent working conditions; and terms of employment. Lastly worker accommodation must be appropriate for its location - clean, safe and at minimum, meeting the basic needs of workers.

Performance Requirement 3: Resource Efficiency and Pollution Prevention and Control – recognizes the need to adopt and adhere to the approach which enables the client to avoid (where possible) or control, the harm to the environment caused by the project. The design and operation of a project should address the issues of resource efficiency, management of harmful and hazardous substances and materials, waste generation, emissions and discharges.

Performance Requirement 4: Health and Safety – recognizes the need to establish a system for managing health and safety of issues related to road users and affected communities, as well as workers and contractors.

Performance Requirement 5: Land Acquisition, Involuntary Resettlement and Economic Displacement – establishes the need to avoid or minimize involuntary resettlement and to ensure fair compensation to affected persons. The client will carry out a socio-economic baseline assessment and identification of potentially affected communities and individuals.

Performance Requirement 6: Biodiversity Conservation and Sustainable Management of Living Natural Resources – establishes the need to assess the risks and impacts on biodiversity alongside the development of biodiversity conservation measures.

Performance Requirement 7: Indigenous Peoples. (Not applicable to this Project).

Performance Requirement 8: Cultural Heritage – establishes the need to identify, as part of the environmental and social assessment process, potential adverse impact on cultural heritage. If the potential for such impacts exists, the client must develop measures to avoid/ mitigate such impacts and include these measures in the EMS and ESMP (including consultations with affected community groups). In addition, a Chance Finds Procedure will be required.

Performance Requirement 9: Financial Intermediaries. (Not applicable to this Project).

Performance Requirement 10: Information Disclosure and Stakeholder Engagement – recognizes the importance of a Stakeholder Engagement and consultation process. The PR requires:

- Stakeholder identification and analysis;
- Stakeholder engagement planning and implementation of the Stakeholder Engagement Plan (SEP);
- Disclosure of information and reports related to the project in a manner that is accessible and culturally appropriate;
- Consultations and public involvement in the decision- making process; and
- Establishing and maintaining a Grievance Mechanism for the project.

Applicable Guidance Notes

- Good Practices for the Collection of Biodiversity Baseline Data, EBRD, 2015

- Good Practices for Biodiversity Inclusive Impact Assessment and Management Planning, EBRD, 2014
- World Bank Environmental, Health and Safety Guidelines (EHS Guidelines)⁵
- EBRD protocol for assessment of greenhouse gas emissions
- Methodological Tools of UNFCCC/CCNUC/ "Estimation of GHG emissions related to fossil fuel combustion in A/R CDM project activities"
- Relevant international protocols relating to environmental and social issues
- Guidance Notes on 'Managing the Risks of Adverse Impacts on Communities from Temporary Project Induced Labour Influx' WB, 2016.
- Good Practice Note on 'Addressing Gender Based Violence in Investment Project Financing Involving Major Civil Works WB, 2018'
- Good Practice Note on 'Managing Contractors Environmental and Social Performance, ICF 2017)

⁵https://www.ifc.org/wps/wcm/connect/topics_ext_content/ifc_external_corporate_site/sustainability-at-ifc/policies-standards/ehs-guidelines

4. Project Overview

Project Description

Details of the proposed project are included in the Project “Main Design document” and this section summarises key elements of that document. The Project involves the enhancement of the existing 7m wide road to a two-lane boulevard in each direction. Associated elements include areas of pavement and verges, a central reservation and 7 roundabouts, (3 or 4 -way intersections). The Main Design also includes the:

- Reconstruction of the four existing **bridges** and construction of four new associated bridges for the additional lanes. The new bridges will be built parallel to the existing ones.
- **Retaining walls** will be placed at locations where the new road route cuts into the existing slope to help ensure stability of the slopes or where it is above the rivers.
- Embankments will be used to protect the road from flooding from nearby rivers at locations where it is on a lower level than the watercourses.
- Construction of a **stormwater management** system with separators for wastewater treatment, including two parallel collectors that will be connected prior to discharge. Oil and grease separators will be in place before rainwater is discharged into the watercourses (i.e. rivers, streams and drainage channels).
- Connections to local roads located in the vicinity of the settlements with **Bus stops** near these connecting roads.
- Access to local frontages and settlements will be retained in line with the current provision, wherever practical.

The works are planned to start at the end of 2019 and continue for some 24 months.

Road Layout

The upgraded road will be generally constructed at the same level as the existing asphalt to preserve access to existing road connection. The exception is at km 125 + 700 where there is currently frequent flooding and the new road level will be raised in relation to the existing road.

A **central barrier** will be installed as part of the Project in order to discourage pedestrians from crossing the widened carriageway.

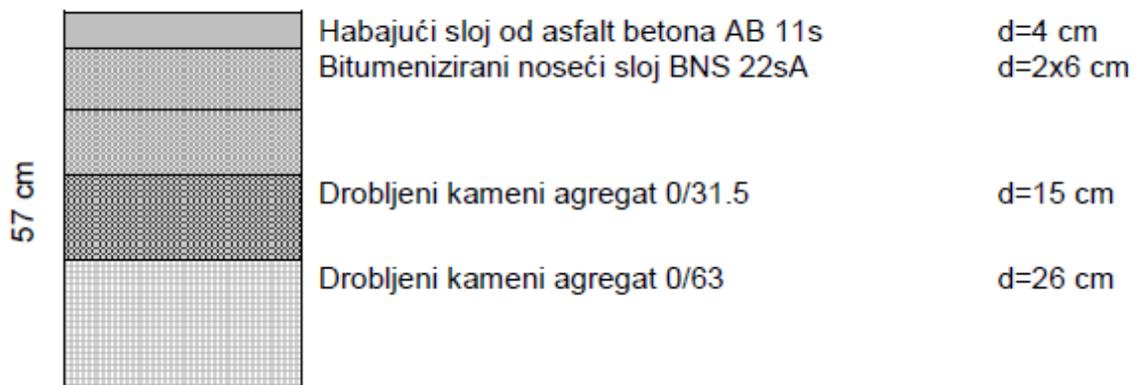
Pedestrian crossings will mainly be located at the roundabouts and intersections.

Pavements for pedestrians will be constructed either side of the road from km 114 + 500 to km 115 + 270 (in Danilovgrad) and from km 129 + 167 to km 129 + 632 (in Podgorica). These will be 1.5m wide in Danilovgrad and 2.0 m wide in Podgorica. No pavements are proposed along other parts of the route apart from the new bridges, where 0.75m wide pedestrian paths will be built on the outside of the bridges, coupled with a 0.75m wide service track which will be placed in the median strip leading towards the existing bridge.

Road surface structure

The road surface structure consists of a wearing surface of asphalt concrete AB 11s (d = 4 cm), bituminous support layer over crushed stone aggregate. The source of the aggregate will be confirmed by the contractor.

Figure 4.3: layers road surface structure



Source: Main Design

The main project is comprised of these key components:

- Rehabilitation / reconstruction of existing bridges and underpasses,
- Construction of new bridges and underpasses,
- Construction of retaining walls,
- Building of culverts.

Objects on the route

4.4.1 Bridges

On the Podgorica-Danilovgrad section of the road, there are 4 bridges that need to be reconstructed and 1 new underpass that will be constructed. Parallel to the reconstructed bridges, another bridge with similar characteristics will be constructed, in order to form a two-lane boulevard:

- Susica Bridge (75 m long);
- Matica Bridge (across Sitnica River) (60 m long);
- 'Komanski' Bridge (across Sitnica River) (66 m long);
- Mareza Bridge
- Underpass (culvert 15 m long).

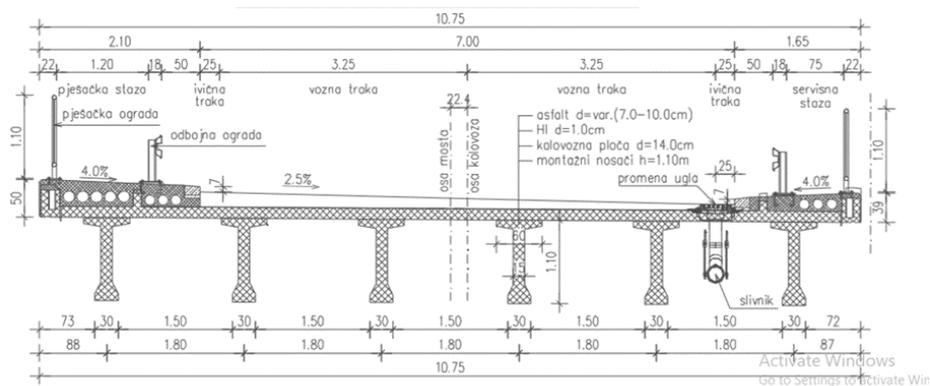
More details about reconstruction and construction of the bridges are provided in the following sections.

4.4.1.1 Susica Bridge

Rehabilitation/reconstruction of the existing bridge.

The existing Susica Bridge has three spans $L=25.0+24.50+24.50=74.0\text{m}$. The spanning structure consists of six prestressed prefabricated girders. Reconstruction works include changes to the characteristics of the prefabricated bridge and the rehabilitation of bridge elements in order to ensure the structure can sustain an additional load. Layout and width of the pedestrian path and service paths of the route are changed, while the overall width and cross-section of the bridge is not changed.

Figure 4.4.1.1a Cross-section of the existing bridge Susica

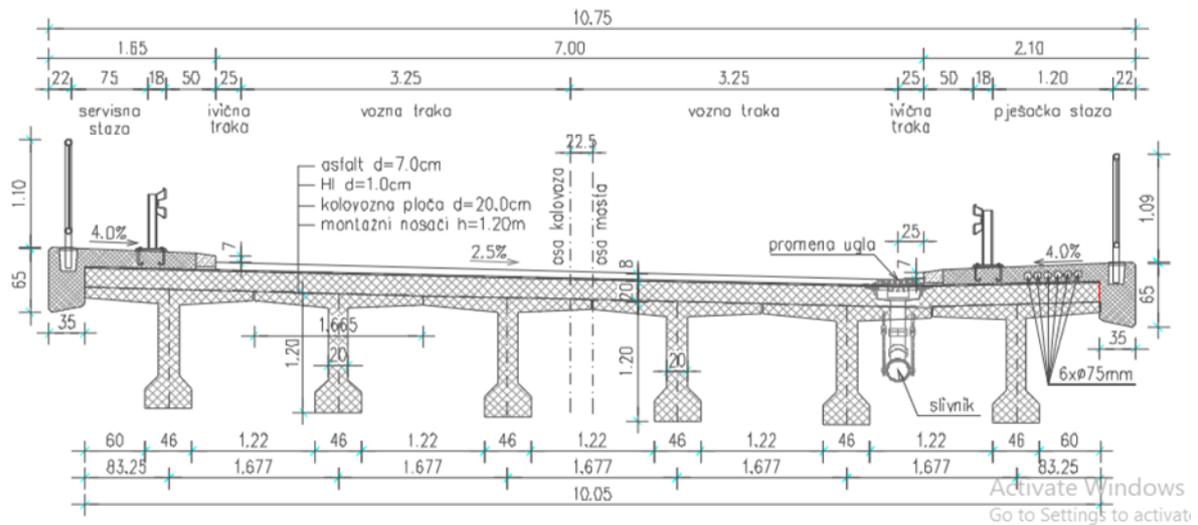


Source: Main Design

Construction of a new bridge parallel with the existing one

The new Susica bridge will be made of reinforced concrete and prestressed construction with three spans of 24.4m; 25m and 24.40m (total 73.8 m). The middle pillars will be circular in cross section. P2 and P3 pillars are based on 4 Ø150cm piers, which are built into the Susica riverbed, whilst the remaining pillars P1 and P4 are based on 6 piers with a Ø150cm diameter. Utility lines will pass through 75mm diameter PVC pipes within the footpaths. Five cast iron drains will be included on the lower edge of the carriageway and the drainage system will be modern and designed for easy cleaning. Waterproofing placed on the concrete slab of the bridge, directs the water into the drainage pipe.

Figure 4.4.1.1b Cross-section of the new bridge Susica



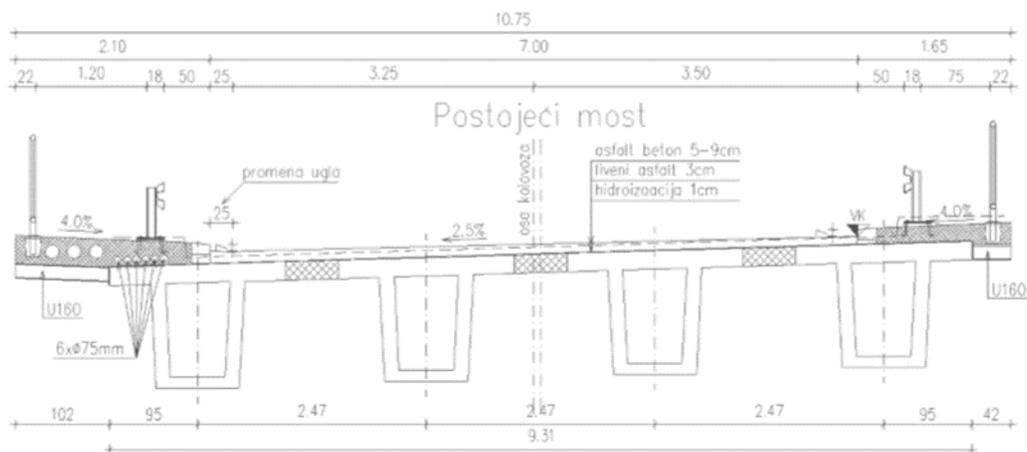
Source: Main Design

4.4.1.2 Matica Bridge (km 126+140)

Rehabilitation/reconstruction of the existing bridge

The existing Matica bridge has a lower structure with two pillars in the banks and two circular columns (200cm diameters) in the river. The upper structure consists of three spans which are laid on three bearings, with a cross section of four connected prestressed box girders. Reconstruction works include changes to the characteristics of the prefabricated bridge and the rehabilitation of bridge elements in order to ensure the structure can sustain an additional load. The layout and width of the pedestrian path and service paths along the route will be changed accordingly. The overall width of the bridge cross-section will also be changed.

Figure 4.4.1.2a Cross-section of the existing bridge Matica

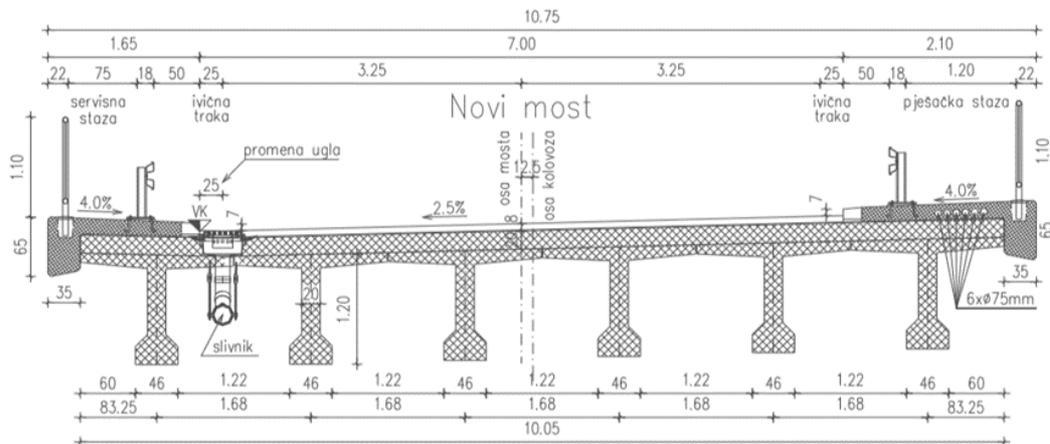


Source: Main Design

Construction of a new bridge parallel with the existing one

The new Matica bridge will be a reinforced concrete structure with 4 prestressed girders, with three 20m spans (60m total) and a width of 10.31 m. The supporting structure consists of two pillars in the banks with wing wall sand a constant height. The middle pillars have circular cross-sections, and are founded in the Matica riverbed.

Figure 4.4.1.2b Cross-section of the new bridge Matica



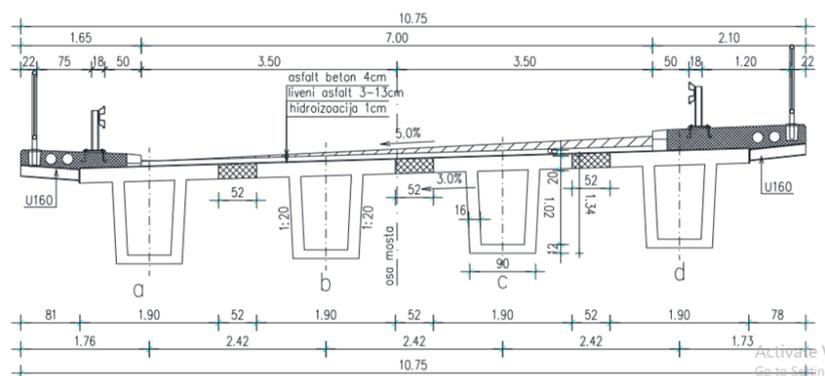
Source: Main Design

4.4.1.3 Sitnica Bridge (Komanski Bridge) (km 129+135)

Rehabilitation/reconstruction of the existing bridge

The existing Sitnica bridge has three spans of 22m each (total 66m), each composed of four box-prestressed girders. Reconstruction works include changes to the characteristics of the prefabricated bridge and the rehabilitation of bridge elements to enable it to sustain an additional load. The layout and width of the pedestrian path and service paths of the route will be modified accordingly. The overall width of the cross-section of the bridge will also be modified.

Figure 4.4.1.3a Cross-section of the existing bridge Sitnica

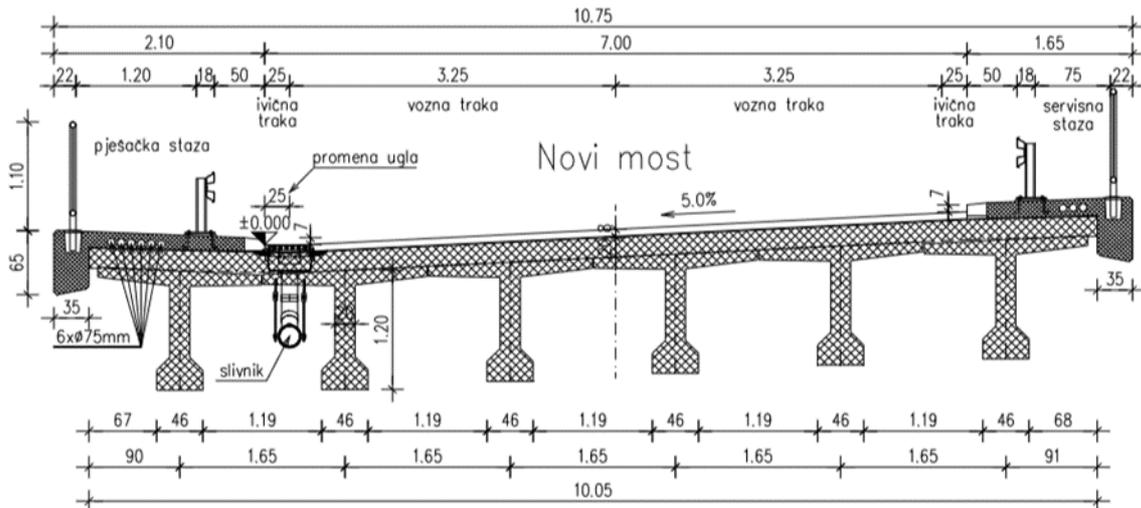


Source: Main Design

Construction of a new bridge parallel with the existing one

This new Sitnica bridge will be made of reinforced concrete and prestressed construction with three spans of 22m (total 66m). Pillars P1 and P4 will have shallow foundations in the rock mass, and wing wall shapes. The middle pillars have a circular cross-section, and will be founded in the Sitnica riverbed.

Figure 4.4.1.3b Cross-section of the new bridge Sitnica



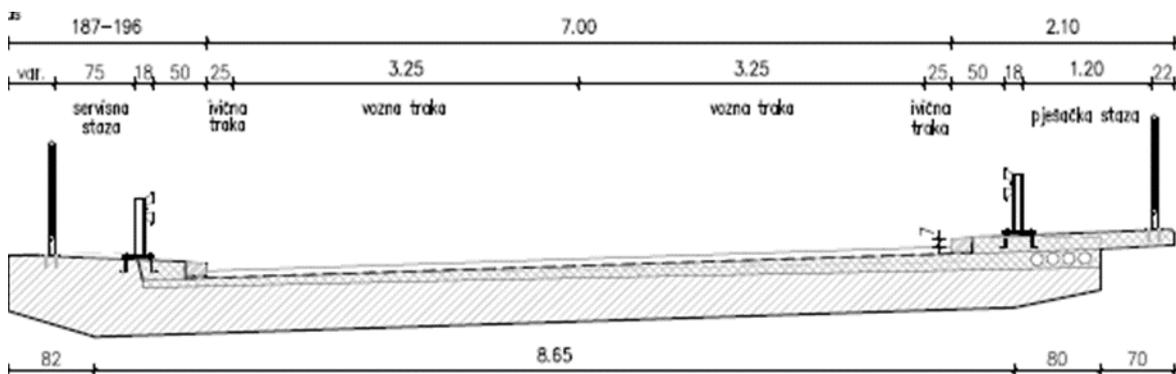
Source: Main Design

4.4.1.4 Marezja Bridge (km 129+400)

Rehabilitation/reconstruction of the existing bridge

This existing Marezja bridge is 10.12m wide and has a shallow founded RC frame structure, with strip footing and piles in the form of wing walls. As the existing bridge does not fit into the newly-designed route in terms of height or width an additional 10-18cm thick layer of concrete has been widened to the roadway and the original pedestrian paths have been widened.

Figure 4.4.1.4a Cross-section of the existing bridge Marezja

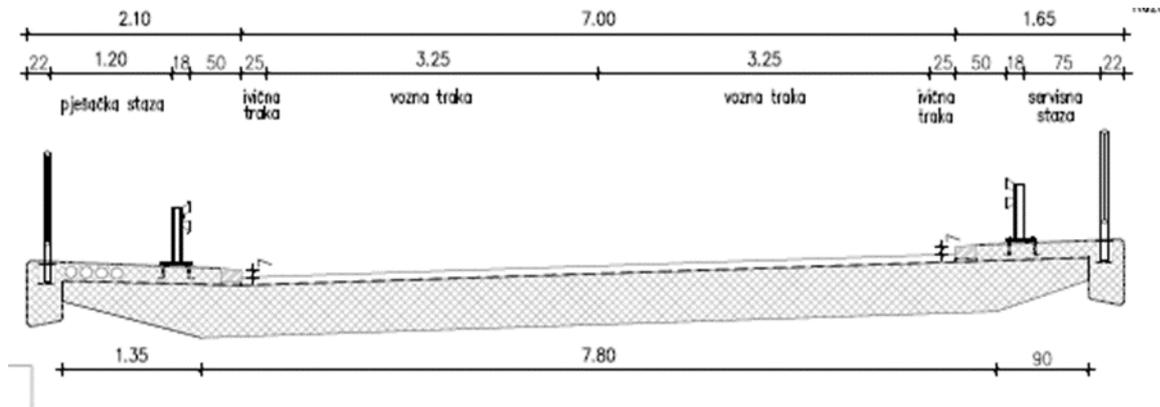


Source: Main Design

Construction of a new bridge parallel with the existing one

This new Mareza bridge will be shallow founded with a concrete connected structure. The cross section of the culvert spanning structure is made of 50cm thick RC slab. Wing walls S1 and S2 have shallow foundations, at the depth of 1.70m. It is planned to make strip footing, with dimensions 3.00 x 0.70 m.

Figure 4.4.1.4b Cross-section of the new bridge Mareza

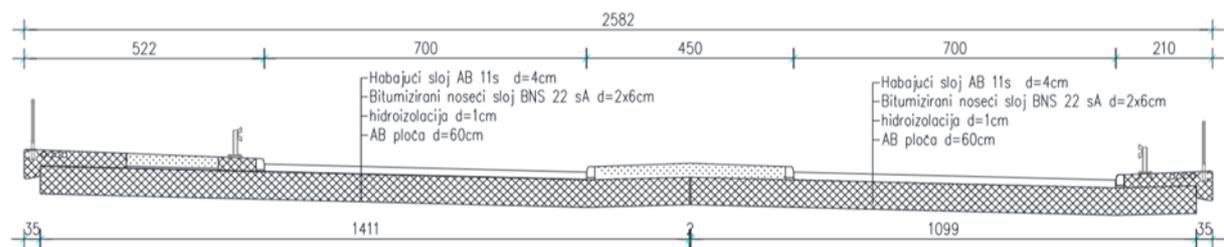


Source: Main Design

4.4.1.5 Underpass (km 123+392)

Existing underpasses are reinforced concrete structure with strip footings, pillars in the form of wing walls and a spanning structure. As the existing opening is 4.0m wide, which is not enough for a two-way road, an underpass will be created with a wider span. This new underpass will have the form of a reinforced concrete connected structure, with 3.50m x 0.90m strip footing, which will have shallow foundations at the depth of 1.60m. A cross section of this structure will be made from a 60cm thick RC slab.

Figure 4.4.1.5 Cross-section of the underpass



Source: Main Design

4.4.2 Retaining walls

Supporting walls will be installed where the newly route cuts into the existing slope to help ensure slope stability. They will also be used where the route runs close to existing rivers or streams. Wall shape is dictated by the elements of the road as well as the height and inclination of the terrain. Seventeen retaining walls are proposed as outlined below.

Table 4.4.2 Overview table with all RC walls

RC Retaining wall				
No.	Location	Chainage	Length(m)	max height (m)
1	Idea 1	114+711	12.00	2.20
2	MB 1	115+840	37.24	1.50
3	Hotel 1	116+700	30.06	1.70
4	Iveco 1	118+850	39.04	2.30
5	Object 1	119+710	48.06	3.88
6	Sušica	119+760	18.00	7.20
7	Rakočević 1	121+900	252.42	8.00
7b	Rakočević 2	122+030	21.02	3.50
8	Pirella 1	122+000	70.12	5.50
9	Montecco 1	122+700	48.06	3.00
10	Montecco 2	122+780	159.24	1.60
11	Milšped 1	122+800	114.18	5.01
12	Object 2a	124+350	48.06	5.60
13	Object 2b	124+390	42.02	6.00
14	Rijeka 1	128+400	84.12	4.50
15	Rijeka 2	128+830	102.16	4.00
16	Object 3	129+240	35.04	3.85
17	Object 4	0+050	30.01	2.70

4.4.3 RC Culverts

Pre-construction surveys indicate that all existing culverts are unusable and new culverts will be created as follows:.

Table 4.4.3 Overview table with all RC culverts

Number	Chainage	Description	Note
Culverts			
1.	114+709.330	slab culvert 2.0 x 1.5m	in the extension of the wall
2.	115+030.920	Pipe culvert Ø1000	with a manhole in the middle belt
3.	115+525.230	Pipe culvert Ø1000	with a manhole in the middle belt
4.	115+710.0	slab culvert 2.00 x 1.00m	on the connecting road
5.	116+113.090	slab culvert 2.00x2.00m	
6.	116+339.480	Pipe culvert Ø1000	with a manhole in the middle belt
7.	116+603.016	slab culvert 1.0 x 1.0m	with a manhole in the middle belt
8.	116+625.00	Pipe culvert Ø800	on the connecting road
9.	116+777.160	Pipe culvert Ø1500	
10.	117+079.07	Pipe culvert Ø1000	with a manhole in the middle belt
11.	117+411.220	Pipe culvert Ø1500	
12.	117+869.730	slab culvert 5.0 x 4.5m	
13.	118+211.830	Pipe culvert Ø1500	
14.	118+535.050	Pipe culvert Ø1500	
15.	119+073.940	slab culvert 2.0 x 1.5m	
16.	119+200.160	slab culvert 2.0 x 2.0m	
17.	119+496.710	slab culvert 5.0 x 4.5m	
18.	120+013.140	Pipe culvert Ø1500	

19.	120+260.810	Pipe culvert Ø1500	
20.	120+513.590	slab culvert 5.0 x 3.5m	
21.	120+604.360	Pipe culvert Ø1500	
22.	120+719.930	Pipe culvert Ø1500	
23.	121+004.600	Pipe culvert Ø1500	
24.	123+211.640	slab culvert 5.0 x 4.5m	
25.	123+964.750	Pipe culvert Ø1000	with a manhole in the middle belt
26.	124+319.650	Pipe culvert Ø1000	with a manhole in the middle belt
27.	124+529.310	Pipe culvert Ø1000	with a manhole in the middle belt
28.	126+571.220	Pipe culvert Ø1500	
29.	127+104.540	Pipe culvert Ø1500	
30.	127+314.300	Pipe culvert Ø1500	
31.	127+600.470	Pipe culvert Ø1500	
32.	127+801.030	Pipe culvert Ø1500	
33.	128+250.430	Pipe culvert Ø1500	
34.	128+728.950	Pipe culvert Ø1500	
35.	129+026.500	Pipe culvert Ø1500	

Pipes are set parallel to the axis of the road at the road intersection with dimensions: 600, 800, 1000, 1600.

Key Infrastructure

4.5.1 Intersections

The following intersections and roundabouts are proposed:

Table 4.5a: Intersections

Number	Chainage	Description
0	-	Existing roundabout Bulevar Danilovgrad
1	km 115+270	Newly designed roundabout in Danilovgrad – the location envisaged by the "General Urban Decision of the Municipality of Danilovgrad"
2	km 116+260	Newly designed roundabout in Ćirilac. Due to the proximity of the buildings of Montenox and the restaurant Muštuluk, the existing road crossroads were moved from km 116 + 620
3	km 118+345	Newly designed roundabout with a turn for settlements Jastreb and Strahinići
4	km 120+000	Newly designed three-way intersection with a turn for the villages Plana and Bileća
5	km 121+280	Newly designed roundabout Novo Selo
6	km 122+890	Newly designed roundabout Bandići
7	km 123+740 k125+230	Several intersections with the connection to the service roads provided under the "Main project for the construction of service roads in the SP Podgorica operation" as well as the three-way intersection (temporary connection) of the existing road for Mareza.
8	km 126+384	Newly designed roundabout with a turn for Ćafa and Baloči. It is foreseen to firstly make the connection to the right (looking from Danilovgrad to Podgorica) and only a part of the connection to the left, which will be done as needed later.
9	km 129+210	Newly designed roundabout at the entrance to Podgorica – Detailed Urban Plan "Gornja Gorica 3 - part A" Podgorica foresees an intersection at the point of crossing of the future road with

		Danilovgrad-Podgorica
10	km 129+365	Newly designed three-way intersection with an attachment for Tološe. Ukida se priključak preko postojećeg propusta sa niskom niveletom na km 129+400 lijevo

Table 4.5b Roundabouts

Number	Chainage	Description
0	/	Existing roundabout in Danilovgradu
1	km 115+270	Newly designed roundabout in Danilovgradu
2	km 116+260	Newly designed roundabout in Ćurilac
3	km 118+345	Newly designed roundabout with a turn for settlements Jastreb and Strahinići
4	km 121+280	Newly designed roundabout in Novo Selo
5	km 122+890	Newly designed roundabout in Bandići
6	km 126+384	Newly designed roundabout towards Ćafu and Baloči
7	km 129+210	Newly designed roundabout at the entrance to Podgorica.

4.5.2 Traffic connections and relocation of local road alignment

A range of buildings of different types and purposes are connected directly to the main road. These include individual households, petrol stations, restaurants, warehouses, sales outlets, supermarkets and other business and private facilities. Where practical existing facilities will be connected directly, and an additional 3.00 m wide strip is planned. For individual households, a direct connection with the main road is planned.

As the construction and expansion of the new road will cause interruption at certain locations, additional roads which connect both existing roads and access roads to the main road, are envisaged as shown in the table below:

Table 4.5.2 Additional roads

Number	Chainage	Description and reason for designing an additional road
1	km 115+315–115+370 right	Enabling port facilities located near the roundabout at the local time.
2	km 115+450 – 115+720 right	Move an existing local path and enable linking objects to the same one.
3	km 116+260 – 116+680 right	This road is not part of the project because it goes beyond the boundaries of the project, but is designated as a possible solution (if necessary) for a future direct link between the village Gruda and the surrounding households, at a roundabout with a turn to the Curilac.
4	km 121+800 – 122+060 right	Road parallel to the main road. Allows connection of existing objects to the main road.
5	km 122+840 right	This road is not the subject of the project because it goes beyond the boundaries of the project task and requires additional land purchase, but is designated as a possible solution (if necessary) of the future direct connection of Milšped and other facilities to the roundabout with a turn for Bandići and Spuž. Without this road you cannot directly turn from these facilities towards Podgorica.

4.5.3 Bus stops

Some 23 bus stops are envisaged as part of scheme as shown below.

Table 4.5.3 Bus Stop Positions

Number	Chainage	Direction	Place
1	km 115+180	Podgorica-Danilovgrad	Roundabout in Danilovgrad
2	km 115+365	Danilovgrad-Podgorica	Roundabout in Danilovgrad
3	km 115+675	Podgorica-Danilovgrad	Near the Eco Pump
4	km 116+165	Podgorica-Danilovgrad	The turn for Ćurilac, Sladojevo Kopito and Grude
5	km 116+350	Danilovgrad-Podgorica	The turn for Ćurilac, Sladojevo Kopito and Grude
6	km 117+540	Podgorica-Danilovgrad	The turn for Jastreb and Grude
7	km 117+620	Danilovgrad-Podgorica	The turn for Jastreb and Grude
8	km 118+25	Podgorica-Danilovgrad	The turn for Strahinjići and Jastreb
9	km 118+435	Danilovgrad-Podgorica	The turn for Strahinjići and Jastreb
10	km 119+550	Podgorica-Danilovgrad	Near the Susica bridge. The turn for Begovinu and Kosić
11	km 119+630	Danilovgrad-Podgorica	Near the Susica bridge. The turn for Begovinu and Kosić
12	km 120+250	Podgorica-Danilovgrad	
13	km 120+155	Danilovgrad-Podgorica	
14	km 121+200	Danilovgrad-Podgorica	The turn for Novo Selo
15	km 121+360	Podgorica-Danilovgrad	The turn for Novo Selo
16	km 122+800	Danilovgrad-Podgorica	The turn for Bandići and Spuž
17	km 122+975	Podgorica-Danilovgrad	The turn for Bandići and Spuž
18	km 124+115	Podgorica-Danilovgrad	Novit Pharm, Top Art Garden and other facilities.

19	km 124+280	Podgorica-Danilovgrad	Novit Pharm, Top Art Garden and other facilities.
20	km 124+565	Podgorica-Danilovgrad	Novit Pharm, Top Art Garden and other facilities.
21	km 124+780	Danilovgrad-Podgorica	Novit Pharm, Top Art Garden and other facilities.
22	km 126+290	Podgorica-Danilovgrad	The turn for Čafa and Baloči
23	km 126+470	Danilovgrad-Podgorica	The turn for Čafa and Baloči

Storm Water Management System

Existing drainage ditches alongside the road will be replaced with new systems with similar hydraulic characteristics. Existing culverts will be replaced with new 1500mm culverts (17 in total) except where the embankment is too low, where 1000mm culverts (7 in total) with inspection fittings will be placed in the central reservation. A further 10 box culverts (various dimensions) will also be constructed and additional pipes will be placed parallel with the road at intersections. (These will be 600mm, 800mm, 1000mm, or 1600mm diameter depending on location). The road carriageways will slope toward the shoulders (edges). In areas without pavements, storm water collector drains will be constructed in hard shoulders to prevent vehicles driving over the drain grates. Where pavements are present along the road, and in narrower areas such as at roundabouts or where there are narrow separator islands, the drains will be placed in the roadway itself.

In areas with slopes and areas of cut and fill where greater run-off is expected, larger (double) drains will be constructed every 120-200m (depending on the slope). Unpolluted run-off from the slope in these areas will also be passed over berms and drain into culverts spaced at distance of ~ 250m. Collectors will be made from 1000mm AB pipes, with rectangular pit basins used for larger amounts of water. Inspection chambers will be built in the separators for maintenance

In flatter areas 405mm high perforated roadsides will be used with rectangular retention catch pits for drainage. In these areas, where flumes will be used instead of curbs, 600mmx600mm drains will be installed every 20-25m. These will have class D400 Monoblock grates with a throughput of around 20l/s). Inspection chambers will have double grates installed. Collectors will be made from 1000mm AB pipes, and this will be done for the drains with the following diameters: 300, 400 and 500. Square inspection pits will be used for the 600mm collector, which will have a 1.00x1.00m clear opening. All pipes will be polypropylene corrugated pipes.

Water Treatment

Some 31 oil and grease separators/filters will be included into drainage design to treat water in line with the SIST-EN 858-1 standards. Separators will generally be located in the central reservation (except for 3 which will be placed between the road and the sidewalk). The relatively large number of separators is the result of the extent of the relatively shallow collectors into which the water will flow after purification. Treated water from the separator will be discharged.

Figure 4.6: Separator for oil and grease



Organisation of Construction Site

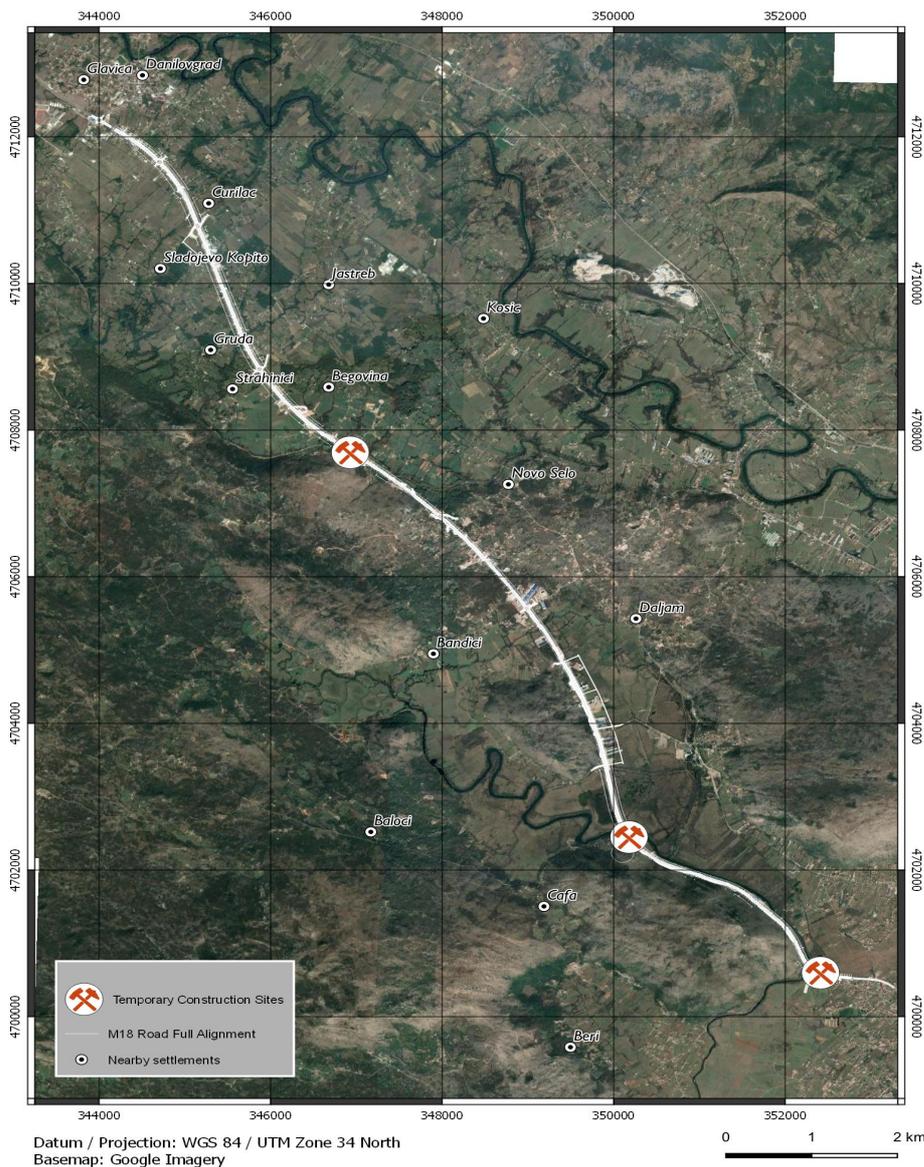
The process of reconstruction of the main road M-18 consists of the following activities:

- Preparation works,
- Ground works,
- Drainage,
- Construction of objects
- Construction of connecting roads
- Construction of a pavement structure,

Three temporary construction sites are planned to be established for the needs of reconstruction and construction of the bridges as follow:

- Construction site 1 in Plana, for the purpose of the construction of Susica bridge (Ch.119 + 902.880 to 119 + 933.050).
- Construction site 2 – at the location of the intersection to Cafa and Baloce, for the purpose of the construction of Matica bridge (Ch.126 + 193.960 to 126 + 341 + 370).
- Construction site 3 – at the location of Komanski bridge, for the purpose of the construction of Sitnica bridge (Komanski bridge) and the bridge over Mareza (CH 129 + 167.220 to 129 + 347.260). See Figure 4.7.

Figure 4.7: Temporary Construction Site Locations



Warehouses, offices, material storage areas, guard houses, mobile toilets etc. will be located along the road route, providing easy access from the main road. Fuel will not be stored on the site. The machinery and vehicles will be supplied using mobile fuel cisterns.

Smaller construction sites will also be established at locations for the construction of culverts, walls and storm water management system. These construction sites will be formed just before work on these facilities commences.

The flow of Traffic During the Execution of Works

The main road needs to remain open during the entire reconstruction period and therefore will not be completely closed to traffic. The construction schedule has been envisaged in such a way that a new bridge will first be built, while traffic continues to flow smoothly over the existing bridge. Reconstruction of the existing bridge will start only when the construction of a new bridge is finished. Appropriate visible traffic signs will be set up at all locations along the route where the work is being performed. Traffic signs will also be placed at the intersections with the existing local roads.

Earthmoving and Disposal of Excavated Material

Earthmoving refers to all excavation of earth material, its transportation to the landfill or its reuse for embankments, backfilling of the foundation pit, arrangement of the ground under foundation etc. To test usability of the soil, samples will be taken during excavation in order to determine its potential use. Material which does not meet the required standards of compactness will be

replaced with material with better geo-mechanical characteristics. In total some 20,000 m³ of material will be removed, mostly from following locations:

- between chainage km 125 + 160 to chainage 126 + 300 (L = 1160m)
- Between chainage km 129 + 165 (Sitnica Bridge) to chainage km 129 + 200 (L = 35 m).

According to the Law, the Contractor is obligated to arrange transportation and final disposal of all the surplus material to a location that must be licenced by the local authority. It is currently proposed that this waste material will be transported to the nearest landfill (located at a distance of up to 25 km). The contractor is obliged to arrange landfills at a location approved by the Supervising Engineer and the Bank.

Whilst locations which will be used for temporary storage of material are not yet precisely defined, **they will avoid natural habitat and areas within 50m of watercourses.** Temporary material storage area will be arranged in a way which ensures that there won't be any landslides. After completion of the construction works, temporary storage sites will be rehabilitated according to the requirements of the Supervising Engineer and restored back to previous condition or better.

Alternatives

As this project includes widening and reconstruction of the existing road, alternative solutions for the locations of bridges and overpasses over watercourses were not been considered. However during preparation of the Main Design a series of different solutions were considered as outlined below.

4.10.1 "No Project" Alternative

The existing road has periods of intensive traffic flow and traffic accidents are common. Flooding is common at several locations along the road, particularly near Danilovgrad. The Project will improve traffic flow and reduce travel time as well as improve traffic safety for drivers and pedestrians (who will also have better access to public transport). The collection of road run-off will be improved and the risk of flooding and pollution of the surrounding land and watercourses will be reduced. Because of these benefits the "no project" option was not taken forward.

4.10.2 Alternative Solutions for Intersections

Intersection option considered included intersections with roundabouts and intersections which interrupts traffic flow. The solution which includes construction of roundabouts has been generally adopted except where other intersections types are already included in other projects and/or by planning documents. The advantages of the different alternatives are outlined in the following table:

Table 4.10.2 - Alternative solutions for intersections in the Preliminary Design

Advantages of the intersection which interrupts traffic flow	Advantages of intersections with roundabouts
Priority of the main direction, continuity of the main course, maintenance of the main direction speed	Reducing the speed of all vehicles. Ensuring better traffic safety.
There is a significant difference between functional classification of connecting roads and traffic loads of connecting routes.	Avoiding traffic light signalization (reducing costs)

Reduced footprint.	Achieving higher throughput and reducing loss of time.
Shorter pedestrian paths.	

The roundabout alternative was chosen primarily to ensure smoother traffic flow since otherwise it would be necessary to use traffic lights at intersections. Roundabouts also ensure conditions for slowing down the traffic flow by providing controlled left turns enhancing traffic safety, including pedestrians' safety.

4.10.3 Alternative Solutions for the Route

Solutions for the widening of the existing road considered included:

- • Widening of the existing road along either left or right side of the road; and
- • Widening of the existing road along both sides of the road (left and right).

Generally widening of the road on one or the other side was considered the most suitable as it allows traffic to continue to run smoothly during construction of the new traffic lanes. In certain location (eg to avoid demolition of buildings or performing major earthworks) widening on both sides has been considered. In such cases it will be difficult to carry out all the works while the traffic is running as the entire existing roadway structure must be destroyed to place a green belt in the right place. Widening of the road along both sides is a solution which is especially unsuitable (impossible) to implement at the locations of bridges, and is therefore avoided.

Alternative solutions have been considered with regards to the width of the separating island. Instead of placing a 4m wide separating island, the alternative solution of placing a 4.5m wide separating island has been chosen, since this solution will provide sufficient space for proper installation of all the hydraulic, electrical and telecommunication installations.

4.10.4 Alternative Solutions for Run-Off Management System

The road is bordered by sidewalks and there is no inflow of stormwater from the area surrounding it. In addition the transverse slope of the berm is facing the road, the surface of the roadway and sidewalk - under the asphalt and greenery of the separating island - represents the catchment area. This is not the case at the sections which are located in cuts where culverts do not exist. Since this is a main road, hydraulic calculation for rainfall intensity, including ten-minute long periods of rain for a period of 2 years, was carried out. Based on the results of these calculations, a stormwater sewage system has been designed, including numbers, dimensions and locations of drainage pipes, as well as collectors and separators which will be placed along both sides of the road.

4.10.5 Alternative Solutions for Intersections and Local Road Connection

During the process of developing the Main Design, some solutions have been adopted as per the request of the local authorities and local population. These solutions include: construction of a roundabout at section 115 + 270 km. This was originally planned as a four-way intersection but was changed due to request received from the Danilovgrad City Council.

Following publication of the tender documentation for preparation of the Main Design, a number of stakeholders (affected population and legal entities) located along the route submitted comments

and requests regarding relocation and connections to local roads. Many of these were adopted through changes in the Main Design (see Chapter 5 of the SEP).

4.10.6 Alternative Solutions for Reduction of Costs

In line with TA's request for a reduction in costs, the designer considered several options in terms of the position of the green belt and public lighting. The MDT adopted the solution which does not envisage placing the green belt between the pavements and the road. This solution will be implemented along a larger section of the route, except at the sections from km 114 + 500 to km 115 + 270 (in Danilovgrad) and from km 129 + 167 to km 129 + 632 (in Podgorica). The remaining works related to the green belts are planned to be carried out at a later stage of construction. With regards to public lighting, this will only be installed in the areas of the roundabouts and in the densely populated areas which are close to the road.

4.10.7 Alternative Solutions for Excavated Material

According to the Main Design, excavated material which will be re-used where practical and surplus material will be temporarily deposited at a site within 25km of works. Alternative solutions for permanent disposal of the excavated material will be developed by the Contractor who is obliged to deposit the excavated material at a site which is approved by the local authorities.

Project Timeframe

Commencement of work is planned for the end of 2019. According to the schedule provided in the Main Design, the work should be finalized in 24 months.

In line with the traffic-technical conditions, the works will be carried out in the following phases:

- **Phase I** - boulevard at Municipality Danilovgrad - Curilac intersection (km 114+500 - km 116+260, L=1.76 km);
- **Phase II** – Curilac intersection - Novo Selo intersection (km 116+260 - km 121+280, L=5.02 km);
- **Phase III** - Novo Selo intersection - Bandici intersection (km 121+280 - km 122+890, L=1.71 km);
- **Phase IV** – Bandici intersection - Mareza intersection (km 122+890 - km 125+230, L=2.34 km);
- **Phase V**- Mareza intersection - Komanski bridge (km 125+230 - km 129+632, L=4.40 km).

5. Supplementary ESIA Approach and Assessment Methodology

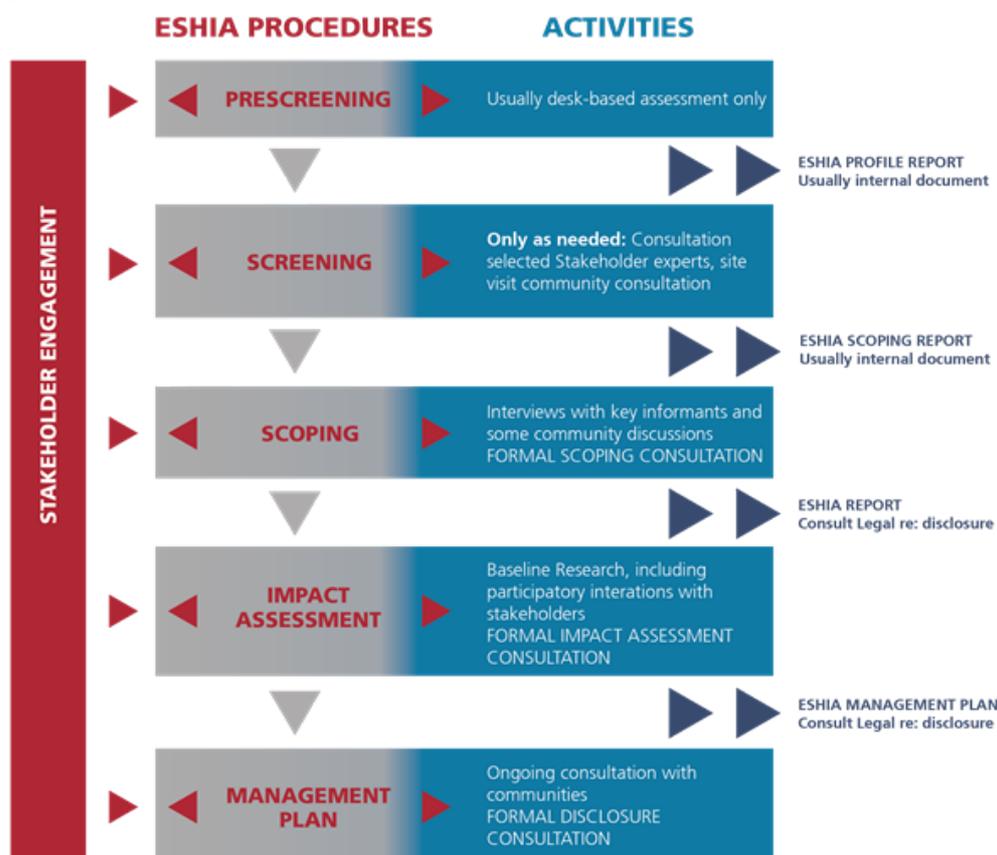
Overview of the ESIA Process

The key steps in the generic ESIA process can be considered in terms of phases as described below:

- Pre-study activities such as screening, preliminary assessment and scoping to help establish key considerations in advance of detailed studies;
- The impact assessment study, which results in the identification and assessment of impacts and the development of measures to mitigate and reduce or eliminate adverse impacts; and
- The post-study stage, which includes steps undertaken for review and monitoring to ensure that mitigation measures are implemented, and are effective during construction and operations. It also includes adaptive management; to modify mitigation measures if they prove to be inadequate or inappropriate.

The overall approach is shown schematically in *Figure 5.1* below.

Figure 5.1 ESHIA Procedures and related activities



Project Affected Area

The area directly or indirectly affected by the project (often termed 'spatial scope', 'project area', 'study area' or 'area of influence (AoI)' is used to describe the extent over which project impacts may arise and are addressed during E&S assessment. The project affected area varies with impact type

and the attributes of the potentially affected receptors⁶. It may also extend across administrative or national boundaries. In each case, however, the project affected area includes all areas within which significant impacts are likely to occur taking into account the:

- physical extent of the proposed works, defined by the limits of land to be acquired or used (temporarily or permanently) by the Project; and
- nature of the baseline environment and manner in which impacts are likely to be propagated beyond the Project boundary.

For the proposed Project, the project area includes the footprint of all project activities⁷ and a 150m buffer either side of the road to include the areas in which a direct or indirect impact on the physical, biological, social or cultural environment might occur..

Associated Facilities

The ESIA process also typically seeks to identify and characterise, to the extent appropriate, potentially significant environmental and social issues associated with activities or facilities which are not part of the project, but which may be directly or indirectly influenced by the project, exist solely because of the project or could present a risk to the project. These associated activities or facilities may be essential for the viability of the project, and may either be under the control of the client or carried out by, or belong to, third parties.

No such Associated Facilities have been identified for the Project at this stage of the design and planning process.

Baseline Survey Methodologies

5.4.1 Aquatic Invertebrate Survey

An initial desk-based assessment has been undertaken using expert knowledge of the area and the probable species presence. This has been followed up by a limited amount of field work. The study has included a project risk assessment to aquatic invertebrates and recommendations for suitable mitigation measures. It has also identified locations, species and survey methods most suitable for a long-term monitoring programme. Indicator species, usually those species reasonably common in the area but indicative of particular ecological conditions, will be part of the selection process.

5.4.2 Bat Survey

Transect surveys for bats have been carried out over 2 consecutive nights, along the whole road, (where it is possible to move without the danger of traffic). A bat detector was used to register and record bats (Petterson D240x). Point observations (counting) was also carried out across 2 nights, along the bridges of the rivers: Sitnica, Matica and Sušica. A bat detector and register was used to record the observation of bats.

Bat movement were also monitored at key times of day (and night) to detect the 'path of movement' towards the locations of bat shelters. Inspections of old trees, attics, places under bridges etc has been performed in these locations to detect the presence of shelters for bats.

5.4.3 Habitat Mapping

⁶ For example, effects on archaeological features are typically confined to those areas physically disturbed by the construction works, whilst the effects of noise or visual intrusion can be experienced at some distance, and air pollution may be dispersed over long distances or even contribute to regional/global impacts (where relevant such changes are described in each section as appropriate)

⁷ This includes the road working strip, any access roads, construction yards, laydown areas, work sites and other related facilities.

Existing land use maps have been reviewed and mapped as an aid to field work and ground truthing. During field surveys maps were printed off for field use, and appropriate field recording sheets printed out so the information could be easily recorded (on a scale appropriate to properly represent the habitats). Polygons of each habitat type were recorded to nearest boundary if possible to enable areas to be calculated. In the case of the limestone hillsides, indication on the outside boundary will be made if this is extensive. Field maps were digitised onto GIS

5.4.4 Traffic Survey

As equipment for an automatic count was not available a manual count has been conducted using recording sheets.

5.4.5 Noise Baseline

The Rulebook on the methods of calculation and measurement of the environmental noise level ("Official Gazette of Montenegro", No. 27/14, 17/17) has been followed during measurement of noise. The measurement was conducted according to the Montenegrin standard: MEST ISO 1996-1:2018 Acoustics - Description, measurement and assessment of environmental noise -

- **Part 1:** Basic quantities and assessment procedures, and
- **Part 2:** Determination of sound pressure levels.

The measurement has been performed three times on each location per 10 minutes in the following periods: 7-12 a.m; 12-7 p.m; 7-11 p.m; and after 11 p.m. Data on traffic flow for determination of measurement uncertainty has been collected.

Impact Assessment Methodology

5.5.1 General Considerations

The assessment of impacts is an iterative process that considers several key questions:

- Identification – how can the Project interfere with the environment and people, considering both the specific project-related activities that will be carried out, and existing baseline conditions;
- Prediction – what will happen to the environment and people as a consequence of the potential impacts associated with the Project?
- Evaluation – does this impact matter? How important or significant is it?
- Mitigation – if it is significant can anything be done about it?
- Residual Impact – is it still significant?

Where significant residual impacts remain, further options for mitigation may be considered and impacts re-assessed until they are as low as is technically and financially feasible for the Project, and would be deemed to be within acceptable levels.

This section describes the general approach followed in the ESIA to address the above-mentioned questions. Further detailed information on specific methodologies, in particular with regards to the significance criteria (and their derivation) applied for the assessment of impacts, is specified in the "Methodology" section of each technical section.

5.5.2 Impact Identification

A logical and systematic approach needs to be undertaken to impact identification, in order to ensure that the key issues are identified and classified into impact categories for further study. It aims to take account of all of the important environmental / project impacts and interactions,

making sure that indirect and cumulative effects, which may be potentially significant, are not inadvertently omitted.

1. The specific project-related activities that will be carried out in order to construct and operate the Project were reviewed and **potential sources of impact** were identified:
2. Taking into consideration the existing baseline conditions and the potential presence of sensitive receptors within the project area, an evaluation was carried out of how the Project will be likely to interfere with the environment and people, and a number of potential impacts were identified for each topic;
3. A preliminary assessment, using professional judgement, was undertaken in order to decide, for each potential impact, whether:
 - a. It is likely to have significant (or important) consequences for sensitive receptors, in which case such impact was "scoped in" for further assessment; or
 - b. It is deemed likely to be insignificant (or have minor consequences), in which case such impact was "scoped out" from further assessment, with an explanation of the reasoning for the "scoping out" provided.

5.5.3 Impact Prediction

For all "scoped in" impacts, the ESIA seeks to predict what changes (impacts) Project-related activities will induce and to assess in further detail the potential scale and characteristics of those impacts. Impacts are classified either as:

- **Negative:** the impact factor causes a worsening of the environmental or socio-economic state or quality; or
- **Positive:** the impact factor causes an improvement of the environmental or socio-economic state or quality.

The ESIA describes the predicted likely impacts (and quantifies these to the extent practicable, which varies depending on the topic being assessed) according to a series of criteria / impact-related features, such as:

- **Magnitude:** Extent of the impact, generally in terms of a quantifiable measure (its size, scale or intensity);
- **Geographic extent and distribution:** Area where the impact exerts its influence (i.e. site specific, local, regional, national, global);
- **Duration:** Length of time when the impact occurs (short term, intermittent, long term, continuous);
- **Reversibility:** Possibility to restore the qualitative state of the component: reversible (short-, mid-, or long-term) or irreversible;
- **Frequency:** How often the potential impact occurs / how frequently the receptor will experience the impact (rare, infrequent, intermittent, occasional, frequent);
- **Probability of occurrence:** Likelihood of the impact occurring or probability of a specified outcome (chance of something happening): related with the uncertainty or confidence in the prediction.

The sensitivity of the identified receptors is also an important consideration. **Sensitivity** is the sum of the conditions that characterise the present quality and/or trends of specific environmental and

social components and/or of their resources. The sensitivity of environmental and social components / receptors is therefore assessed on the basis of the presence/absence of some features, which define both the current degree of quality, and the component's susceptibility to environmental changes. The quality or importance of a resource or receptor is judged taking into account, for example, its' local, regional, national or international designation, its importance to the local or wider community, its ecosystem function or its economic value.

Finally, the prediction takes account of mitigation measures that are already an integral part of the design of the Project.

5.5.4 Impact Significance

The next step in the assessment is to explain what the impact means in terms of its importance to the natural, social and cultural society and the environment, so that stakeholders understand how much weight should be given to the particular issue in determining their view of the Project. If an impact is judged as 'significant', in isolation or in combination with other impacts, it is reported in the ESIA Impact Assessment Sections so that it can be taken into account by others in making decisions on the Project. The evaluation of impacts presented in this ESIA Report is based on the judgement of the ESIA team, informed by reference to national legal standards, national and regional government policy, EBRD's requirements, current international good practice/standards and the views of stakeholders.

In order to maximise the transparency of the ESIA process, criteria for assessing the significance of impacts are defined for each particular "scoped in" impact. Typically, these criteria take into account whether the Project will:

- Cause legal or accepted environmental standards to be exceeded, e.g. air, water or soil quality, noise levels, or make a substantial contribution to the likelihood of exceedance;
- Adversely affect protected areas or features, or valuable resources, e.g. nature conservation areas, rare or protected species, protected landscapes, historic features, high quality agricultural land, important sources of water supply, other key ecosystem services; and
- Conflict with established government policy.

As insufficient quantitative information was available to allow a quantitative classification of the impacts in many instances, a qualitative evaluation has therefore been generated aiming to classify impacts in one of the following five categories: "**very low**", "**low**", "**medium**", "**high**", and "**very high**", encompassing all of the features of the predicted impacts, as described above.

However, the parameters used for the description of the impacts and the receptor sensitivity are specific to each topic. Therefore, no single classification system could be defined that would be suitable to classify all impacts. For this reason, a specific classification system has been developed for each "scoped in" impact, to allow its classification in each or the above-mentioned categories and these are presented in the relevant sections of this report.

Any negative impacts classified as "Very low", "Low" or "Moderate" are considered to be '**not significant**'. Any negative impacts classified as "High" or "Very high" are considered to be '**significant**'.

Mitigation

Impact assessment is designed to ensure that decisions on projects are made in full knowledge of their likely impacts. A vital step within the process is the identification of measures that will be taken by a project to mitigate its impacts. In some instances, mitigation will be inherent in design and in others mitigation measures will need to be identified during the ESIA process. The ESIA process has therefore involved identifying where negative impacts could occur and then working with the Project team to identify and develop technically and financially feasible and cost-effective means of mitigating those impacts to levels that are deemed acceptable.

Assessing Residual Impacts

Following agreement on technically and financially feasible and cost-effective mitigation, the ESIA team has, where necessary, re-assessed the impacts taking into account the further mitigation commitments integrated into the design, construction and operation of the Project.

Cultural Heritage

There have been a range of archaeological finds in the region around Danilovgrad and Podgorica, including a number of Roman artefacts that are now displayed in the Regional Museum of Danilovgrad.

No cultural heritage assets have been identified to date within the Project area during preliminary activities. However, the absence of any tangible and intangible cultural heritage will be verified during the supplementary socio-economic survey work being undertaken to inform the Land Acquisition and Resettlement Plan (LARP). In addition, in accordance with the requirements of the Law on Protection of Cultural Properties ("Official Gazette of Montenegro", No. 49/10 and 044/17) and EBRD Performance Requirement 8, a Chance Finds Procedure will be developed prior to construction that will outline the process for managing any cultural heritage that is encountered unexpectedly during the construction process (including notifying relevant competent bodies and securing the area to avoid further disturbance or destruction until an assessment has been completed by a qualified specialist).

6. Traffic and Transport

Introduction

This chapter addresses potential impacts to the transportation infrastructure affected by the Project. This infrastructure allows people to have mobility and social interaction and represents the backbone for social and economic development.

Due to the scale and size of the Project, the project can have physical effects on a broad range of infrastructures, which may lead to potential effects on peoples' livelihood and daily activities.

Relevant Legislation and Guidance

Table 6.2: Traffic and Transport Legislation

Transport and traffic legislation	
Law on Roads (Official Gazette of Montenegro No. 42/04, 36/11, 92/17)	<p>This Law governs the legal status, development, maintenance, protection, management and financing of the works performed on the public roads.</p> <p>Article 23 defines scope of work in terms of reconstruction of the road. Article 26 stipulates that the Contractor hired for reconstruction of the road (where the traffic closure is not planned) is obliged to perform regular maintenance of the road during execution of works; Articles 34 and 35 define that the Investor is obliged to inform the public about commencement of the reconstruction work at least 10 day in advance.</p>
Law on Road Transport Safety (Official Gazette of Montenegro 33/12, 58/14, 14/17)	<p>This Law governs the rules for road transport, obligations of participants in traffic and other actors in transport, traffic restrictions, traffic signalization, markings, signs and commands that all the participants in traffic must adhere to. Additionally, this Law defines requirements that the drivers must meet in terms of handling vehicles, requirements that vehicles must meet, special measures to be taken in traffic and other rules and measures aimed at ensuring road transport safety.</p> <p>Article 130 defines that the Investor is obliged to inform the public about closure or restriction of traffic during reconstruction works, which must be coupled with setting appropriate traffic signalization.</p>

Scoping Assessment

Key potential sources of impact, potentially affected resources and receptors (and key receptor sensitivities), and potential impacts on traffic and transport during the key Project phases are discussed below. The Table also presents a brief justification for having 'scoped out' some impacts, and identifies as 'scoped in' a number of issues for further evaluation. The following issues were identified for further evaluation at the scoping stage:

Table 6.3 Scoping Matrix –Project Construction Phase

Source of Impact	Receptor(s)	Impact	Key Receptor Sensitivities	Scop ed In/Out	Justification for Scoped In/Out
Increased vehicle traffic to and from the active construction sites	Road Users (including local residents); Biodiversity*, Air Quality*, Noise and Vibration*	Vehicular access to active construction sites may result in localised traffic delay and congestion	Driver delays, pedestrian delays and a reduction in pedestrian amenity value (i.e. the pleasantness of the journey) and an increased risk of accidents, especially around site access points.	In	Disruption caused by the construction of the road.
Partial road closures or diversions	Road Users (including local residents)	Alternative routes may result in Increased journey lengths and times; and localised congestion.	Driver and Pedestrian delays.	Out	This will be covered under the Social Report
Increased vehicle traffic/construction plant levels	Existing Road Network Users	The quality of access roads may reduce	There may be deterioration of roads, an increase in potholes, muddy roads etc.	Out	Scoped out with regard to additional studies,

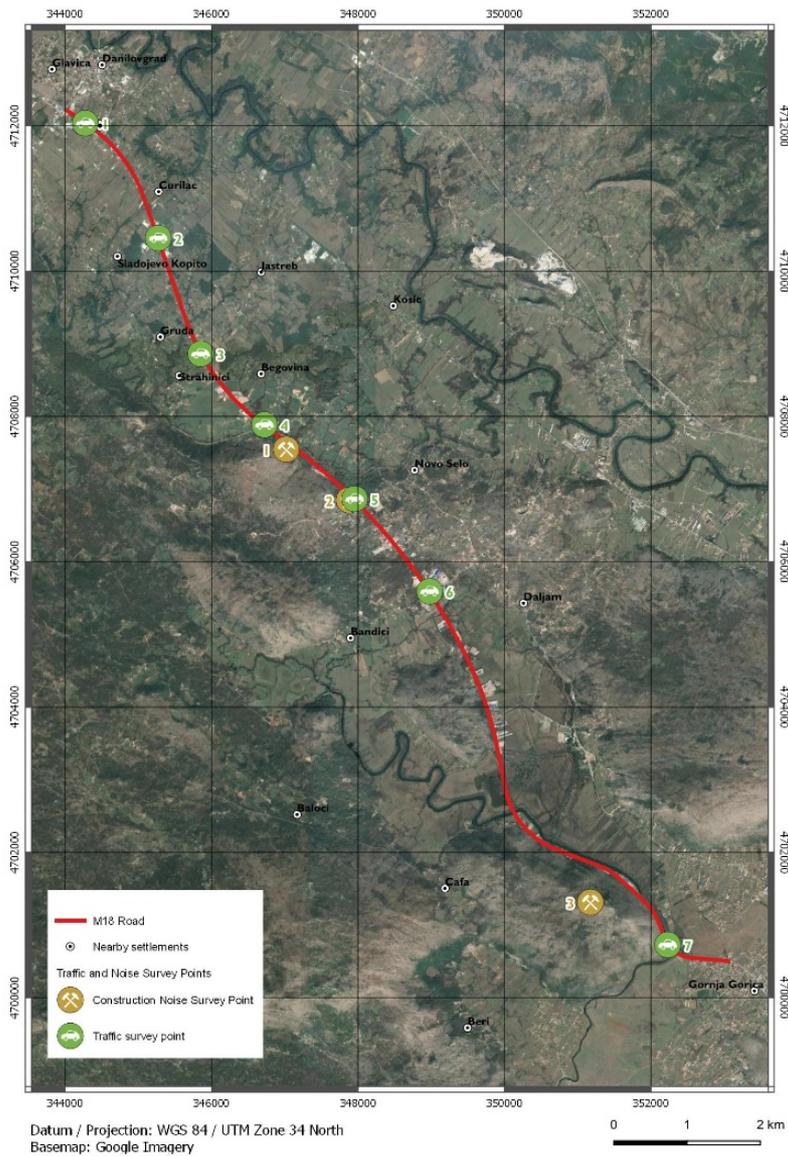
* Potential impacts due to an increase in vehicle traffic/fixed and mobile construction plant levels on noise, air quality and biodiversity are covered in the relevant other Topic Sections within this S-ESIA Report. Following a further assessment of the potential impacts of the project during the construction phase, it became clear that, apart from "Traffic delay and congestion", other impacts should be further analysed in the S-ESIA, namely Road Safety; Vulnerable Road Users; and Public Transport.

Baseline Conditions

6.4.1 Data Collection

Data for this assessment has been obtained from literature review, remote appraisal and insight from comparable studies. Fieldwork was conducted over a 4 day period commencing on Sunday the 23rd June, completing Friday 26th June. Data was collected from 7 locations as shown in Figure 6.4.1.

Figure 6.4.1: Traffic Data Collection Locations



Source: Earth Active (2019)

Data was manually collected and collated for hourly intervals starting at 06.30am and ending at 17.30, giving an 11-hour total. Vehicle types were differentiated; horse and cart, bicycle, motorbike/scooter, car/small van, large van/minibus, bus, HGV/lorry. Counts were made on the routes from Podgorica to Danilovgrad and in the reverse direction between the two towns, with Monitoring point 1 representing egress and ingress from Danilovgrad and monitoring point 7 egress and ingress from Podgorica.

6.4.2 Traffic Flows

6.4.2.1 Current data

Data collected from the 2019 traffic counting exercise⁸ indicates the following:

⁸ FW_Vehicle_traffic_composition_and_volume_reports_Data

- The vast bulk of the traffic is composed of small cars/vans, followed by HGV/lorries – the difference between the two is significant, for instance at location 1 on day 1, 6338 cars were recorded through the day (~576 cars an hour, across the two ways) and only 318 vans (~35 an hour, across the two ways) – this difference is consistent over the monitoring period. Table 6.4.2.1a below records the number of car/van movements as a cumulative total over the monitoring period of 11 hours.
- Traffic flow is on the whole moving between the two end points of the proposed road with only a minor increase (10 – 20%) of traffic joining the road from settlements in between.
- Peak hours from Danilovgrad to Podgorica on Fridays are late afternoon, whilst from Podgorica to Danilovgrad it is morning. This trend is reversed on Monday where peak time for traffic exiting Danilovgrad is in the early morning and returns again in the evening, suggesting an element of commuter traffic.
- Movements over the weekend show heavier flow driving north from Podgorica on Saturday and then for the Sunday roughly the same volume of traffic travelling between both towns (peak times both recorded at 14.30).
- Peak flow on the route Danilovgrad to Podgorica was recorded at 4688 vehicles over the 11 hour monitoring period on a Saturday. Hourly average over the four days was 321 vehicles per hour.
- Peak flow on the route Podgorica to Danilovgrad was 4850 vehicles on the Sunday. Hourly average over the four days was 340 vehicles per hour
- ‘Vulnerable’ users of the road in the form of cyclists and horse/carts are shown in table 6.4.2.1b. It needs to be noted that these are total values taken as an aggregate of the movements between monitoring locations and may represent the same user accessing the route across two or more points. That said the use of the road by these users is clear and evident and must be factored into the final design and its safety assessment.

Table 6.4.2.1a : Cumulative total of car/van movements over the 11 hour monitoring period

		Car/small van traffic flow - Danilovgrad to Podgorica						
		Monitoring Location						
		1	2	3	4	5	6	7
Day	1 (Fri)	3259	3567	4289	3386	4532	3861	3503
	peak hour	17.30 - 18.30	16.30-17.30	7.30-8.30	17.30-18.30	6.30-7.30	7.30-8.30	12.30-13.30
	2 (Sat)	4257	3907	4062	3773	3545	3811	4668
	peak hour	07.30 - 08.30	07.30-08.30	7.30-8.30	6.30-7.30	7.30-8.30	7.30-8.30	6.30-7.30
	3 (Sun)	4452	3857	4149	3984	3945	4038	3904
	peak hour	07.30 - 08.30	6.30-7.30	7.30-8.30	7.30-8.30	6.30-7.30	7.30-8.30	13.30-14.30
	4 (Mon)	4710	3267	3073	3446	4123	3019	3388
	peak hour	06.30 - 07.30	13.30-14.30	17.30-18.30	7.30-8.30	6.30-7.30	17.30-18.30	17.30-18.30

Car/small van traffic flow - Podgorica to Danilovgrad								
		Monitoring Location						
		1	2	3	4	5	6	7
Day	1 (Fri)	3079	3383	3978	3174	4223	3700	3524
	peak hour	11.30 - 12.30	10.30-11.30	15.30-16.30	10.30-11.30	15.30-16.30	15.30-16.30	10.30-11.30
	2 (Sat)	4117	4196	3944	3709	3656	4275	4739
	peak hour	14.30-15.30	15.30-16.30	15.30-16.30	15.30-16.30	16.30-17.30	15.30-16.30	14.30-15.30
	3 (Sun)	4409	4372	4315	3383	4850	4248	4395
	peak hour	11.30-12.30	15.30-16.30	16.30-17.30	10.30-11.30	14.30-15.30	16.30-17.30	16.30-17.30
	4 (Mon)	4427	3832	3049	4163	3924	3294	3668
	peak hour	15.30-16.30	14.30-15.30	17.30-18.30	10.30-11.30	16.30-17.30	9.30-10.30	17.30-18.30

Table 6.4.2.1b: Cyclist and horse/cart movements

Monitoring location	Cyclist movements (total)	Horse movements (total)
1	88	0
2	37	0
3	21	0
4	61	0
5	56	5
6	33	0
7	40	0

6.4.2.2 Historical Data

The Danilovgrad-Podgorica road is currently characterised by intensive traffic flow and common traffic accidents. The TA conducted a survey of traffic flow at the location Curilac, which is located within the Project road route. This survey was carried out in the period from 2009 until 2012. The results of the survey which indicate the traffic intensity are given in Table 6.4.2.2

Table 6.4.2.2 - Estimated traffic intensity at the Danilovgrad-Podgorica road section, 2009-2012

Traffic count data, collected at the location Curilac in the period from 1 st January 2009 until 31 st December 2009, was used for calculation of traffic density	Daily equivalent traffic load in 2009 was: $3,455,264 / 365 = 9.466$ Based on the data, it may be stated that passenger cars, passenger cars with trailers, combination vehicles and combination vehicles with trailers had the highest frequency on this road.
Traffic count data, collected at the location Curilac in the period from 1 st January 2010	Daily equivalent traffic load in 2010 was:

until 31 st December 2010, was used for calculation of traffic density	$3,368,485 / 365 = 9.228$ Based on the data, it may be stated that passenger cars, passenger cars with trailers, combination vehicles and combination vehicles with trailers had the highest frequency on this road.
Traffic count data collected at the location Curilac in the period from 1 st January 2011 until 31 st December 2011	Daily equivalent traffic load in 2011 was: $3,320,707 / 365 = 9.097$ Based on the data, it may be stated that passenger cars, passenger cars with trailers, combination vehicles and combination vehicles with trailers had the highest frequency on this road.
Traffic count data collected at the location Curilac in the period from 1 st January 2012 until 31 st December 2012	Daily equivalent traffic load in 2012 was: $3,258,413 / 366 = 8.902$ Based on the data, it may be stated that passenger cars, passenger cars with trailers, combination vehicles and combination vehicles with trailers had the highest frequency on this road.

Data shows that passenger cars represented the most frequent type of vehicles. Heavy trucks had a low rate of representation in the vehicle flow. There is a peaking of traffic flows in the summer months.

6.4.3 Non-Traffic Flow Issues

- **Pedestrian Flow:** Pedestrian flow data is not currently available. TA or its Contractor will need to determine key locations where this would be required, in consultation with all relevant organisations, and suitable surveys undertaken. This exercise would assist in identifying the impacts of the project on pedestrians, for example identifying areas where heavy vehicle flows increase by a significant percentage and significant numbers of pedestrians are affected. Appropriate remedial measures may therefore be designed in subsequent stages, e.g. construction logistics plan.
- **Public rights of Way and Cycle routes:** Public rights of way have currently not been identified. This would need to be undertaken as part of detailed construction logistics, to ensure public rights of way are maintained, particularly during the construction phase. Cycle routes have not been explicitly identified at this baselining stage, as construction routes are not yet known.
- **Bus services:** Bus traffic between Danilovgrad and Podgorica is organized by four carriers that have direct lines while it takes 36 minutes for bus transport between two municipalities. Only four carriers have direct lines from Podgorica to Danilovgrad: "Krcunovic", "Strikovic", "Dangrad prevoz" and "Dan tours Perovic". Other carriers travel on the route from Podgorica to Niksic and Podgorica to Zabljak. The project design plans for 23 bus stops that will be located along the upgraded route. Possible bus traffic changes will be further elaborated in the Construction Traffic Management Plans that will be prepared by the contractor and coordinated with TA.
- **Personal Injury Accidents:** A review of personal injury accidents in key locations where construction traffic is predicted to interact with general traffic should be undertaken. Ideally this would cover a five-year period, and would be undertaken in consultation with local

government agencies, local police, and other relevant organisations. This would allow specific areas or intersections to be identified, and may reveal locations where remedial measures would be required/recommended.

Impact Assessment

6.5.1 Approach and Methodology

As per the overall methodology for impact assessment, a classification system based on five categories of significance of impacts (“negligible”, “low”, “medium”, “high”, and “very high”) has been utilised. The significance criteria for the assessment of the impacts on traffic and transport are defined in the table below

Table 6.5.1: Significance Criteria for the classification of impacts associated with the Delay and Congestion

Negligible	Low	Medium	High	Very High
Delay and Congestion				
Very minor increase in construction traffic, good highway infrastructure, and no existing congestion.	Very minor increase in construction traffic, poor highway infrastructure, and difficult terrain to overtake HGVs.	Small increase in construction traffic, good highway infrastructure, and some existing congestion at junctions.	Small increase in construction traffic, poor highway infrastructure, and difficult terrain to overtake HGVs or existing congestion at junctions.	Major increase in construction traffic, poor highway infrastructure or congested urban environment.
Road Safety				
Very minor increase in construction traffic. No existing road safety issues, sufficient width and visibility to overtake HGV's, no vulnerable road users	Very minor increase in construction traffic. No/low existing road safety issues, difficult terrain to overtake HGVs, some vulnerable road users	Small increase in construction traffic. Existing road safety issues, difficult terrain to overtake HGVs, some vulnerable road users	Small increase in construction traffic. Significant existing road safety issues, difficult terrain to overtake HGVs, some vulnerable road users	Major increase in construction traffic. Significant existing road safety issues, difficult terrain to overtake HGVs, high numbers of vulnerable road users
Vulnerable Road Users				
Very minor increase in construction traffic. No vulnerable road users	Very minor increase in construction traffic. Some vulnerable road users. Good facilities for vulnerable road users	Small increase in construction traffic. Some vulnerable road users. Good facilities for vulnerable road users	Small increase in construction traffic. Some vulnerable road users. Poor facilities for vulnerable road users	Major increase in construction traffic. High numbers of vulnerable road users. Poor facilities for vulnerable road users
Public Transport				

Negligible	Low	Medium	High	Very High
Very minor increase in construction traffic. No public transport provided	Very minor increase in construction traffic. No or very infrequent public transport services provided. No diversions / suspensions of services	Small increase in construction traffic. No or infrequent public transport services provided. Minor effect on services, e.g. temporary traffic signals	Small increase in construction traffic. Multiple public transport services provided. Diversions / suspensions of services	Major increase in construction traffic. Significant number of public transport services provided. Significant diversions / suspensions of services

6.5.2 Construction Phase Impacts

The sources of impact are assessed as construction vehicles, heavy plant, transportation of materials and goods to the construction worksite as well as the transportation of workers (either communally in buses or in their own private transport), and partial/total road closure. These are likely to increase the volume of traffic using the road creating additional pressures on pinch points and could lead to increased risk of accidents.

Construction traffic has the potential to impact on existing road users, the local population along the proposed road footprint and any haul routes and biodiversity receptors. The risk of construction phase activities is limited by a number of factors, including;

- Size of existing roads;
- Current numbers of vehicle movements on the existing road network (including potential daily and seasonal variations);
- Existing road user delay and traffic bottlenecks;
- Existing road safety hot-spots;
- Existing road condition, i.e. quality of road infrastructure along the route;
- Existing numbers of vulnerable road users;
- Existing public transport provision. .

Overall the additional number of vehicles per day that are estimated to be generated by the works is relatively small, when compared to the subjective volumes of existing traffic using the road network and/or the apparent highway capacity.

The addition of construction traffic to the existing flows is therefore anticipated not to have a **significant impact** upon junction capacity. However, when further details of construction logistics are available, and more robust baseline data, this may need to be investigated further.

However, although absolute numbers of construction traffic generated may not be high, there exists the potential that these vehicle trips do have an impact on the road network. The following impacts will likely arise from the above described construction traffic:

- Road User Delay: Simultaneous construction at more than one site, including spoil, pipework delivery etc., could result in a large amount of traffic in the surrounding area. This may affect baseline road users, including local public transport, school bus services etc.;

- Road Safety Issues: Due to the increase in construction traffic, there is an increased risk of personal injury collisions. The type of construction traffic i.e. slow moving heavy good vehicles, may also increase the level of overtaking especially where heavy vehicles need to use local roads outside of the main road network; Pedestrian safety is also at risk due to increased speeds, more traffic, and less space available for pedestrian users.
- Roadway Infrastructure Degradation: The use of the road network by heavy vehicles can lead to wear and damage of the roadway surface, kerbs and pavements. Traffic volume and certain vehicle parameters, e.g. axle-load and spacing as well as existing infrastructure quality, are the key determinants of infrastructure degradation;
- Vulnerable Road Users: The interaction between construction vehicles and vulnerable road users can lead to increased accidents. This is dependent on the number of vulnerable road users present, existing facilities for vulnerable users e.g. pedestrian crossings, and construction traffic and behaviour;
- Public Transport: Construction logistics may affect public transport routes, e.g. railroad crossings being closed leading to cancelled services, road closures / diversions leading to re-routing of bus services; and
- Increased Levels of Noise, Vibration and Air Pollution from traffic movements: Traffic volume, vehicle types, operating speeds and proximity to receptors are key determinants of these traffic emissions related impacts.

Overall the impact is assessed as **low to medium**

6.5.3 Operational Phase Impacts

Estimates of the expected traffic use of the road for the years 2020 and 2027 are as follows (as referenced in the modelling input).

2020 – 9607 vehicles per day

2027 – 9751 vehicles per day

This is not considered to be a significant increase in volume when compared against the traffic densities recorded in the baseline monitoring completed in 2019. However the modelling does need some clarification and updating using the 2019 data to confirm that the predicted numbers are indeed representative of future road usage.

Although there is some data to confirm current usage it has not been used to predict potential impacts on sensitive points in the current network such as junctions. In this respect impacts related to operational use must be assessed as **medium** until aspects associated with mitigation of sensitive points are more thoroughly considered

Proposed Mitigation

6.6.1 Construction Phase

A Construction Traffic Management Plan (CTMP) will be developed by the Contractor to manage construction traffic generated by the project, to minimise traffic disruption and road user delay and provide for the on-going safety of road users, including pedestrians and cyclists. All of the traffic related impacts described previously can be mitigated very effectively by the implementation of standard best practices in terms of environmental controls and management practices during construction. These measures will be detailed in the CTMP, which will describe in detail the measures that the Contractor will implement during the construction of the Project. **See Annex F** for Key Issues and Minimum Requirements included in the CTMP.

The CTMP will need to be developed in consultation with all relevant national and local authorities and agencies, (such as the police) and local communities and other stakeholders. The Contractor shall regularly update the CTMP as the construction methodology is developed and vehicle movement requirements are identified in detail. The Contractor shall consult with all relevant government agencies to identify where the project plans can complement existing road development plans at the district and provincial level. The Contractor will also consult with the principal representative of any communities that will suffer a significant increase in traffic in order to develop awareness of the mitigation measures within the CTMP.

A CTMP is important both in ensuring the safety of construction personnel and local communities. The CTMP is intended to be a 'live' document and its traffic management principles will form the basis for subsequent detailed construction traffic management arrangements between the Contractor and the highway authorities as and when the site construction contract is awarded.

6.6.2 Operational Phase

Impacts related to the operation of the road are implicitly linked to the safety aspects factored into the final design. At a minimum these must include updated traffic modelling and predicted impact on 'pressure' points such as junction, layby's and access/egress roads and the needs of vulnerable users including those using slow moving vehicles, cyclists and pedestrians. These must take into account the movements associated with the existing residential area and business operations and factor in any predicted business growth (and the movement of vehicles to facilitate goods transfer). The ultimate responsibility of the road safety will be with the TA.

Residual Impacts

The production of and adherence to a detailed Construction Traffic Management Plan will minimise as far as possible the impacts of the project on the highway network and surrounding environment. However, it is inevitable that some residual impacts will remain. On-going dialogue with communities and other stakeholders together with management of change should keep these risks down to **low level of significance**.

Contractor's Commitments

The following commitments are recommended for inclusion into the Contractor's commitments list;

- Traffic data and predictive modelling of the expected volume of traffic to use the road should be completed and the results fed into the final design
- The Contractor is to complete a Construction Traffic Management Plan to include the following (as detailed in the C-ESMP)
 - The Construction Traffic Management Plan (CTMP) should be developed and implemented, and will cover inter alia:
 - The risks assessment that which clearly identifies all risks from the construction works to the travellers, drivers, workers will need to be developed,
 - Identification of the new access roads for construction vehicles and safety measures used for pedestrian access and crossings minimizing,
 - Identification of all public roads and paths that will be affected and proposed for the transport routes during the construction (which sections will be closed and till when, where the traffic will be diverted),
 - Minimization of the traffic disturbance,
 - Public notification of any traffic-related concerns, such as road closures.

- The traffic flow through the site and within the urban areas will be coordinated with the responsible traffic authorities (Traffic Police)
- Construction Traffic Management Plan (CTMP) will be developed for the safe use of vehicles on and off-site; safe access to construction sites with the minimum negative impact on the existing roads and in parallel for ensuring community safety and easy access to their properties (homes, land, etc).
- For traffic control and safety, the information about the project activities and driving standards will be announced through the local radio/TV. The Engineer and the Contractor/s will openly and transparently inform residents of the affected places and villages as a minimum on a weekly basis regarding the planned activities and safety measures to be employed.
- Cross-reference is made with the other chapters in the study – air quality, noise and social, and the commitments offered in these sections.

7. Air Quality

Relevant Legislation and Guidance Baseline Conditions

Key Montenegrin and EBRD's Performance Requirement (PR3) as well as international regulations relevant to this Chapter such as ;

- The **Law on Air Protection ("Official Gazette of Montenegro", No. 25/10, 40/11, 43/15)**,
- **The Rulebook on the manner and conditions for monitoring the quality of air ("Official Gazette of Montenegro", No. 21/11 of 21 April 2011, No. 32/2016 dated 20 May 2016)**; and
- **The Rulebook on the emission of pollutants in the air ("Official Gazette of the Republic of Montenegro", No. 25/01)**; are summarised in Chapter 3 of this Report.

Baseline Conditions

7.2.1 Climate

Influence of a slightly modified Mediterranean climate is dominant in the project area, which means that it is characterized by long, hot and dry summers, while winters are relatively mild and rainy.

The proximity of Skadar Lake and the Adriatic Sea has a significant impact on climatic conditions in Podgorica and Danilovgrad. The climate is also influenced by the Genovian cyclone and the Siberian anti-cyclone.

7.2.2 Air Temperature

In settlements located in the river valleys the temperature in January is lower than in the coastal areas which are located on approximately the same latitude, while in the summer they have a slightly higher temperature. The mean annual air temperature ranges from 4 °C on the slopes of Maganik, up to 15 °C in the Zeta River valley. The most important factor that determines these differences is the altitude, as well as the impact of the Adriatic Sea. July is the warmest month with an average temperature of 24.2 °C, while January is the coldest with the average temperature of 4.3 °C.

Influence of the continental climate is dominant in the hilly and mountainous region. The maximum temperature reached is 42.8 °C, and the minimum is 14.6 °C.

7.2.3 Precipitation

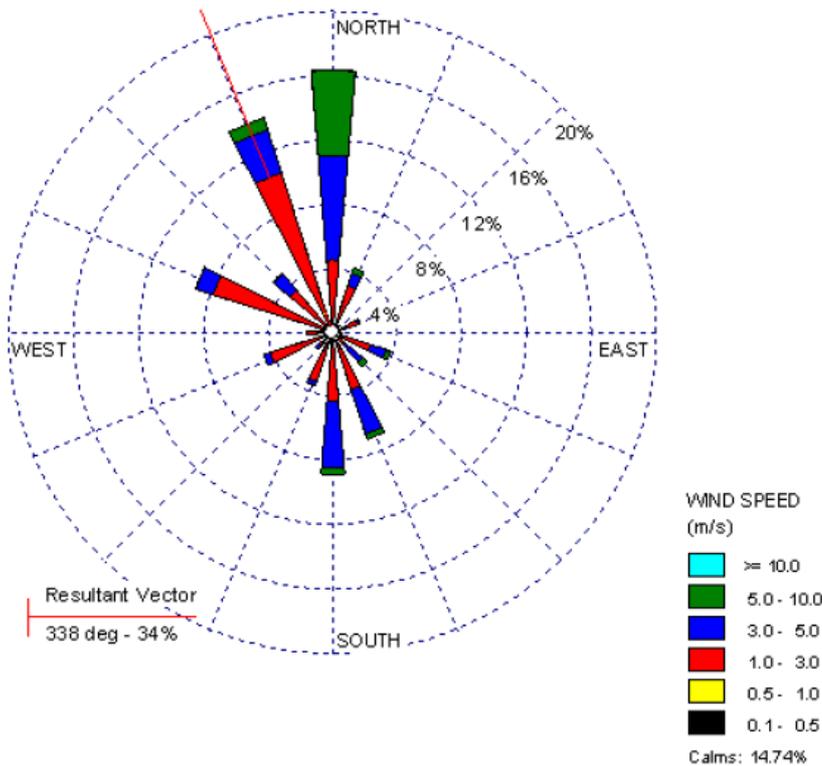
Precipitation is typical for a modified Mediterranean regime which is characterized by total annual precipitation of 2.0-2.5 mm. The highest precipitation in the mountainous region (about 2.500 mm), while these values for the wider area of the Bjelopavlici Plain are around 2.0mm. The greatest precipitation was recorded in 1979 and it was 3.062 l/m², while in recent times, the highest precipitation was recorded in 2010, when it amounted to 2.357 l/m². Snow cover is generally thin, with the average of about 10 cm per year, while the maximum snow cover that has ever been measured in a single year was 53cm.

In terms of floods, the most important data is the frequency of precipitation and high volume of precipitation in a short period of time. Precipitation volume is highest in November and December which is when water levels are highest, which may further lead to flooding and thus endanger the area around the river.

7.2.4 Winds

Among numerous wind directions, two of them mostly define weather conditions (Figure 7.2.1 wind rose), these being from the north and south, which blow mainly during the period from September to April. The power of the north wind almost proportionally increases from the far north to the far south. South winds are less frequent and less strong, and as a rule they bring rainfall.

Figure 7.2.1: Rose of winds in Podgorica



7.2.5 Existing Air Quality

The territory of Montenegro consists of three air quality zones (a 'maintenance' zone in the centre and to the north and the south a 'critical' zone, the former where there is need to keep air quality to its current standards, the latter inferring that chronic pollution loading will have unacceptable adverse impacts to air quality).

Danilovgrad is in the 'maintenance' zone of air quality, while Podgorica is in the southern critical zone indicating that air quality is bad in Podgorica. Each zone is equipped with stationary automatic monitoring stations. The monitoring network was designed with the purpose of meeting the requirements of the national legislation in respect of air quality and management.

Systematic measuring of emissions of basic polluting substances to the air of Montenegro includes continuous 24 hour measuring of: sulphur dioxide (SO₂), total nitrogen oxides (NO_x), tropospheric ozone (O₃), black soot, the overall content of suspended particles including the content of heavy

metals and PAHs. Measurements at established locations have been performed continually since 1998.

Occasional measuring of sulphur dioxide, nitrogen monoxide, nitrogen dioxide, total nitrogen oxides, tropospheric ozone, carbon monoxide, methane, non-methane volatile organic compounds (NMVOCs), suspended particles and meteorological parameters – is performed at high-traffic intersections and roads as required.

Data is uploaded onto the European Environment Agency website where it is collated for public access. Data is available up to 2015.

The closest measuring station where air quality is monitored related to the project area, is located in the urban zone of Podgorica, about 6km from the location of the bridge on Sitnica river. Monitoring is carried out through the automatic stationary station "NOVA VAROS", which is located in the street "Sv. Petar Cetinjski". Monitoring for nitrous oxides, particulate matter (PM₁₀), benzene, benzo (a) pyrene and lead is undertaken at this station.

Data analysis of the results of the monitoring station indicate that PM₁₀ exceeds the annual limit (as of data analysed in 2012).

It is clear that that the south eastern section (Podgorica) of the proposed highway is more sensitive to the potential impacts of additional traffic, particularly in relation to PM₁₀, as evidenced by its inclusion into the 'critical' air quality zone whilst to the north west (Danilovgrad), air quality is less of a priority issue as evidenced by its inclusion in the 'maintenance' zone.

Given the age of the air quality datasets being used for comparison purposes (greater than 5 years) and aware of the sensitivity assigned to the Podgorica section, additional baseline data is required to support the identification of impact. This is critical in respect of PM₁₀ but needs to capture data relating to other pollutants including PM_{2.5}, NO_x, SO₂, CO, hydrocarbons (benzene).

There are no industrial facilities in the Project area that might significantly affect the ambient air quality. Stationary sources include individual heating units in surrounded settlements most likely combusting wood.

It can be concluded that the main air polluting source in the Project area is the traffic on regional road M-18 connecting Danilovgrad and Podgorica including traffic on local roads network.

There is no current baseline data available against which to make a credible assessment of likely impacts. For this reason, the ESMP/ ESAP require the Contractor to perform the baseline monitoring of **air quality** at certain locations commencing prior to construction. This data should be used to refine mitigation and monitoring measures in the Construction Traffic Management Plan relating to air quality

Impact Assessment

Significance criteria for air quality impacts are defined in the table below. No elevated sensitivity receptors have been identified along the route of the road such as schools, hospitals, and residential homes. All potential emissions will need to be addressed through the mitigation hierarchy and captured within an Air Quality Management Plan prepared by the Contractor.

Table 7.3.1 Impact Criteria for Air Quality

Negligible Impact	Low Impact	Medium Impact	High Impact	Very High Impact
Impact: Increase in the concentration of fugitive construction dust in the atmosphere				
Sporadic (less than 1 month) exposure of settlements within the project area to construction dust	Temporary (1 to 5 months) exposure of settlements within the project area to construction dust and precipitation > 0.2mm day ⁻¹ or wind speed <3 m/s	Temporary (1 to 5 months) exposure of settlements within the project area to construction dust and precipitation < 0.2mm day ⁻¹ and wind speed >3 m/s	Continuous (more than 5 months) exposure of settlements within the project area to construction dust	Exposure of high sensitive receptors (Hospitals, clinics, and schools) within the project area to construction dust
Impact: Increase in the concentration of exhaust gases (NO₂ and CO) in the atmosphere				
Sporadic (less than 1 month) exposure of settlements within the project area to levels of exhaust gases exceeding quality criteria	Temporary (1 to 5 months) exposure of settlements within the project area to levels of exhaust gases exceeding quality criteria and wind speed >3 m/s	Temporary (1 to 5 months) exposure of settlements within the project area to levels of exhaust gases exceeding quality criteria and wind speed <3 m/s	Continuous (more than 5 months) exposure of settlements within the project area to levels of exhaust gases exceeding quality criteria	Exposure of high sensitive receptors (Hospitals and schools) within the project area to levels of exhaust gases exceeding quality criteria
Impact: Increase in the concentration of GHG in the atmosphere				
< 5,000 ton CO ₂	> 5,000 ton CO ₂ < 15,000 ton CO ₂	> 15,000 ton CO ₂ < 25,000 ton CO ₂	> 25,000 ton CO ₂ < 100,000 ton CO ₂	> 100,000 ton CO ₂

7.3.2 Impacts during the Construction Phase

7.3.2.1 Sources and Types of Air Emissions

The road improvement works are expected to have short-term impacts on air quality during the construction phase. These are associated with the operation of outdoor machinery, equipment, transportation vehicles (generating both particulates and exhaust pollution gases), the generation of wind-blown dust (particulates) and the generation of gases from refuelling activities. Main activities generating impacts to ambient air quality include;

- Demolition of buildings;
- Earthworks (including land clearing, excavation, levelling, tunnelling);
- Transport and disposal of excavated and surplus filling material and storage of filling and backfill material;
- Operation of construction plant and delivery of concrete;
- Concrete production on site; and
- Movement of construction plant and transport vehicles.
-

There may also be changes in NO₂ and particulate matter due to changes in road traffic during the construction of the proposed project.

Table 7.3.2.1 Key air emissions pollutants

Pollutant	Description
<i>Construction Dust</i>	<p>'Dust' is generally regarded as particulate matter up to 75 µm (micron) diameter and can be considered in two categories. Fine dust, essentially particles up to 10 µm in diameter (invisible to the naked eye), is commonly referred to as PM₁₀. Coarser dust (essentially particles greater than 10 µm) is generally regarded as 'nuisance dust'. PM₁₀ is defined as health risk dust. Research has shown that PM₁₀ penetrate deeply into the lungs and cause a wide range of health problems including respiratory illness, asthma, bronchitis and even cancer. Another major source of PM₁₀ on construction sites comes from the diesel engine exhausts of vehicles and heavy equipment. This is known as diesel particulate matter (DPM) and consists of soot, sulphates and silicates, all of which readily combine with other toxins in the atmosphere, increasing the health risks of particle inhalation.</p> <p>The expression 'nuisance dust' relates to the human perception of, or reaction to, some aspect of dust pollution, such as the long-term, chronic, soiling of surfaces or the visibility of acute, short-lived, dust clouds. In the absence of standards, 'custom and practice' criteria for assessing nuisance dust have been developed. Dust propagation through air is influenced by many factors including particle size, wind energy and disturbance activities. Large dust particles generally travel shorter distances than small particles. It is often considered that particles greater than 30 µm will largely deposit within 100 metres of sources, those between 10 – 30 µm to travel up to 250 – 500 metres and particles less than 10 µm to travel as far as 1 km or more from sources. These distances may be exceeded. Dust can also be hazardous to health when inhaled.</p>
<i>Exhaust Gases and other pollutants</i>	<p>Diesel combustion is also responsible for emissions of carbon monoxide, hydrocarbons, nitrogen oxides and carbon dioxide. Noxious vapours from oils, glues, thinners, paints, treated woods, plastics, cleaners and other hazardous chemicals that are widely used on construction sites, also contribute to air pollution.</p>
<i>GHG</i>	<p>Greenhouse gases (GHG) include atmospheric gases that absorb and emit radiation in the thermal infrared spectrum. These include Carbon dioxide (CO₂), Methane (CH₄), Nitrous Oxide (N₂O), Ozone (O₃) and Chlorofluorocarbons (CFCs). Anthropogenic emissions of GHG are contributing to the build-up of atmospheric concentrations of GHG that, in turn, is a major contributing factor to global climate change. The effects of GHG emissions are generally not relevant on a local scale, except in cases of massive uncontrolled or fugitive emissions, but are rather global in nature as the various gases are rapidly dispersed in the atmosphere, where they reside for varying periods of time, from months to thousands of years, and they continue to exert their effects.</p>

An initial step in the construction phase will be the demolition of objects (buildings, residential properties, fences, etc.) located on the path of the road route. There is a duty on the Contractor to ensure the health and safety of the workforce and safe appropriate disposal of materials. Therefore an Air Quality Management Plan will be required, informed by an inventory and characterisation of demolition targets. Due diligence of the potential impact of the demolition works is required.

7.3.2.2. Fugitive Construction Dust

Dust generation can be expected along the route when the climate conditions are favourable. Dust movement will affect vegetation and can cause a nuisance (visual) and potentially affect persons with respiratory conditions (such as asthma). Impacts are mostly expected to a distance of 100m from the source of the dust.

The majority of the releases are likely to occur during the “working week”. However, for some potential release sources (e.g. exposed soil produced from significant earthwork activities) in the absence of dust control mitigation measures, dust generation has the potential to occur continuously.

Earthworks will involve excavations, levelling, drilling, blasting, material haulage and stockpiling. The greatest impact on air quality due to the emissions from vehicles and plant associated with the construction phase will be in the areas immediately adjacent to the site access and along the likely routes taken by construction traffic to access the Project.

Dust will mainly be generated from earth movements (excavation, levelling, dumping), wheels of trucks and machinery moving /travelling along unpaved surfaces, handling and transport of soil, wind erosion from exposed surfaces.

Settlements located along the road will be impacted by the works. It is estimated that, at the construction site, the possible impacts are expected across the axis of the road (at a distance of 100 to 200 m).

Impact classification for fugitive dust emissions

With regards to the construction footprint of the road, the above-mentioned activities will not have a fixed geographical location, but rather move along the route.

On average, the works in each location will remain in progress for a period of a few weeks only (up to 2 or 3 months). As a result, emissions will be short in duration. Given the distances at which most dust settles out (within 50m generally), in areas along the route where settlements are not present (approximately 50% of the total route) such impacts are expected to be of only a low significance.

Exhaust gases

Machinery and plant are used in a range of activities such as earthworks, excavations, hammering, drilling, stockpile stacking, tunnelling, levelling and general building / construction activities. Therefore, exhaust gases emissions are expected to occur, at different degrees, from all work sites / construction areas throughout the duration of the construction period, although this will be strongly dependant on the particular activity / equipment used (emission source), namely with regards to whether or not emissions will be diffuse or more localised, and also the time-scale (temporary or longer-term).

It is estimated that the following machines will operate:

- Grader;
- Air compressor;
- Dumpers of various payloads;
- Loader;
- Concrete mixer;
- Roller;
- Asphalt pavers;
- Mechanical excavator; and
- Crushing plant.

Table 7.3.2.a. - Construction machinery/vehicles, type of fuel used and estimated consumption

Machine / Vehicle	Fuel	Consumption (lt/day)
Grader	Diesel	112
Mechanical excavator	Diesel	80
Air compressor	Diesel	40
Dumper	Diesel	80
Loader	Diesel	40
Roller	Diesel	110
Asphalt pavers	Diesel	109
JCB excavator	Diesel	108
Concrete mixer	Petrol	17

The exhaust emission factors per ton (tn) of fuel, based on the relevant literature, are given in the following Table.

Table 7.3.2.b - Exhaust emission factors (Kg of pollutant / Kg of fuel)

Fuel	CO	VOC	NO _x	SO ₂	TSP
Diesel	0.049	0.025	0.017	0.006	0.014
Benzine	0.590	0.021	0.052	-	-

Based on the above emission factors and the assumptions that the construction site machines will not work together at the same time, the total emissions of gaseous pollutants for an adverse scenario with the simultaneous operation of most machinery are shown in the following table.

Table 7.3.2.c: Daily fuel consumption per vehicle

Worksite type	Nr of vehicle	Fuel type	Daily Fuel Consumption per Vehicle (lt/d)	Daily Fuel Consumption per Vehicle (Kg/d)
Grader	1	Diesel	112	90
Mechanical excavator	1	Diesel	80	64
Air compressor	1	Diesel	40	32
Dumper	4	Diesel	80	64
Loader	3	Diesel	40	32
Roller	1	Diesel	110	88
Asphalt pavers	1	Diesel	109	87
JCB excavator	1	Diesel	108	86
Concrete mixer	1	Petrol	17	11.9

Table 7.3.2.d: Emission factors and emission rate

Pollutant	CO	NO _x	VOC	SO ₂	TSP
Pollutant Emission Coefficients (kg of pollutant / kg of fuel)					
Diesel	0,049	0,017	0,025	0,006	0,014
Benzine	0,590	0,052	0,021	-	-
Specific Petroleum Weight	Kg/l	0.8			
Specific Gasoline Weight	Kg/l	0.7			
Pollutant Emission Rate (gr/sec)					
Worksite type	CO	NO _x	VOC	SO ₂	TSP

Grader	0.153	0.053	0.078	0,018	0.044
Mechanical excavator	0.109	0.038	0.055	0.013	0.031
Air compressor	0.054	0.019	0.028	0.007	0.015
Dumper	0.435	0.151	0.222	0.054	0.124
Loader	0.163	0.057	0.083	0.020	0.047
Roller	0.150	0.052	0.076	0.018	0.042
Asphalt pavers	0.148	0.051	0.076	0.018	0.042
JCB excavator	0.147	0.056	0.075	0.018	0.042
Concrete mixer	0.244	0.021	0.009	0.000	0.000
TOTAL:	1.603	0.498	0.702	0.166	0.387

The final details of the exact plant and equipment likely to be used on site will be determined by the appointed contractor. The number of plants and their location within the site are likely to vary considerably over the construction period.

As with impacts associated with fugitive dust emissions, the construction will generally not have a fixed geographical location, but rather move along the route. On average, the works in each spread will remain in progress for a period of a few weeks only (up to 2 or 3 months). Therefore, the effects on air quality along the route are expected to last only for a limited number of days / weeks at each given location, depending on the speed of road construction.

In general, where no settlements exist along the road route, it is considered that there is negligible impact.

Where settlements have been identified within the project area that have no 'high sensitivity' receptors (hospitals, clinics and schools)" the severity of impacts associated with exhaust gas emissions along the route has been classified as either **medium** or **low**, according to the weather conditions, respectively medium: wind speed <3 m/s; low: wind speed >3 m/s.

In the case that construction activities along the route last for more than 5 months at any one location and where the route is located immediately against residential properties, the severity of impacts associated with exhaust gas emissions would be classified as **medium** and mitigation measures will need to include a variety of dust suppression measures.

7.3.3 Operational Phase Impacts

Due to the changes in locations of traffic flows, the vehicle numbers and the type of vehicle and speed of movement, changes to local air quality are inevitable.

An assessment has been made of the following main pollutants – carbon monoxide (CO), nitric oxide (NO), nitrogen dioxide (NO₂), sulphur dioxide (SO₂), hydrocarbons (CxHy), lead (Pb) and solid particles.

Representative concentrations were determined at different distances from the pavement on either side, taking into consideration the meteorology. Modelling utilised the Merkblatt über Luftverunreinigungen an Straßen, MLuS 92, to obtain estimates of air quality.

It is noted that detailed air dispersion modelling was not undertaken in the absence of adequate meteorological and traffic loads/air quality baseline information. The implications of this are discussed further (and additional recommendations incorporated into the ESMP/construction management plan).

Table 7.3.3a: Main Pollutants and their effect on local air quality

Carbon monoxide (CO)	CO affects humans as well as all fauna species, binding to haemoglobin and thereby displacing oxygen. The concentration of CO in haemoglobin of 2% can be regarded as negligible, and the concentration of over 2.5% is critical. The consequences are disturbances in balance, eye disorders, weakening of concentration, difficulty breathing and headaches. The effect of carbon monoxide on the plants can be considered insignificant.
Nitric oxides (NO, NO₂)	The effect of nitric oxide on humans is similar to the effects of carbon monoxide. Displaces oxygen from the blood, which threatened the supply of tissues. High concentration of nitric oxide in the blood causing death. Nitric oxide as air pollutants is essential for the creation of nitrogen dioxide (NO ₂), which is toxic and particularly harmful to the respiratory system. Its harmful effect on the plants is reflected in the appearance of wax leaf necrosis and premature decline. Given these influences in the world, today considers that all species of plants are protected from the influence of nitrogen oxides on the long-term concentration of 0.03 mg/m ³ .
Hydrocarbons (C_xH_y)	The hydrocarbons that influence human health may be divided in five groups: paraffins, naphthene, olefins and alkynes, aromatics, oxidized hydrocarbons. Polycyclic aromatic hydrocarbons have carcinogenic effects cancerous lung disease. The content of hydrocarbons in plants is quite complex and is reflected at large number of faults. High concentrations cause necrosis of flowers and leaves and they negatively affect the process of falling of leaves, and cause difficulties in the process of flowering. Very sensitive plants react at very low concentrations of hydrocarbons. The impact of hydrocarbons on building materials is not reliably proven.
Sulphur dioxide (SO₂)	Sulphur dioxide, combined with fine dust particles, has harmful effects on mucous membranes (eyes) and airways. Impacts of Sulphur dioxide on the plant life are reflected in degradation of chlorophyll and withering away of certain tissues. Sensitive species of evergreen forests are under damaging effects already at concentrations of 0.05 mg/m ³ . Out of all the air pollutants, Sulphur Dioxide has the most prominent effect on structures. In combination with moisture, Sulphur Dioxide acts as sulfuric acid, and it thus destroys organic compounds. This is particularly important for the historical and artistic value of the objects. Any damage caused in this way increases with temperature, humidity and light intensity.
Lead and its compounds	The amounts of lead and its compounds that people consume through food on a daily basis are much higher the amounts that they receive through respiratory organs, i.e. from the atmosphere. Permanent exposure to pollution from lead poisoning leads to chronic, which is primarily manifested in the form of loss of appetite, stomach problems, fatigue, dizziness, kidney damage and unconsciousness. However, there is still the dilemma regarding acceptable concentrations limits of lead in the atmosphere. In terms of vegetation, toxicity of lead is low. Concentrations of lead in plants are highly correlated with the content of lead in the soil. Otherwise the presence of lead in plants reduces their ability to grow and their enzyme activity.

Traffic estimates

Estimates of the expected traffic use of the road for the years 2020 and 2027 are as follows (as referenced in the modelling input).

2020 – 9607 vehicles per day

2027 – 9751 vehicles per day

Estimate of Pollutant concentrations

For the purposes of comparison EU emission standards have been used to assess the output of the modelling. These are indicated in Table 7.5.3a.

Estimation of the magnitude of impacts on air quality associated with the operation

Comparison against standards

The following table shows EU/World Health Organisation (WHO) standards relating to the main pollutants arising from vehicle exhausts.

Table 7.3.3a: EU/WHO standards relating to main pollutants arising from vehicle exhausts

Pollutant	Concentration		Exceedances
	WHO	EU	
PM 2.5	25 ug/m ³ - 24 hr mean 10 ug/m ³ – annual mean	25 ug/m ³ – annual mean	None recorded
PM 10	20 ug/m ³ – annual mean	50 ug/m ³ – 24 hr mean 40 ug/m ³ – annual mean	None recorded
Sulphur dioxide	500 ug/m ³ - 10 min mean 20 ug/m ³ – annual mean	350 ug/m ³ - 1 hr mean 20 ug/m ³ – 24 hr mean	None recorded
Nitrogen dioxide	40 ug/m ³ – annual mean 200 ug/m ³ – 1 hour mean	200 ug/m ³ - 1 hr mean 40 ug/m ³ – annual mean	All average values exceed in years 2020 and 2027 at all distances modelled against the annual mean of 40ug/m ³ , all wind speeds
Lead	Na	0.5 ug/m ³ – annual mean	None recorded
Carbon Monoxide	Na	10 mg/m ³ – maximum daily 8 hour mean	None recorded
Ozone	100 ug/m ³ – 8 hour mean	120 mg/m ³ – maximum daily 8 hour mean	None recorded
Benzene	Na	5 ug/m ³ – annual mean	Average values for 1 – 10m in years 2020 and 2027 (wind speed 3m/s) Average values 1m only in years 2020 and 2027 (wind speed 5m/s)

An estimate of the concentration of pollutants in the air was made on the basis of the available, albeit limited, meteorological conditions, the spatial location of the alignment and the speed of the prevailing wind. Based on this the concentrations of the air pollutants for AADT were calculated for the year 2020 and 2027. Permanent and present concentrations of dominant pollutants CO, NO, NO₂, C_xH_y, Pb, SO₂ and solid particles (PM) were calculated at distances from 1 m to 200 m from the edge of the pavement. Results of the calculations are shown in the following tables.

Table 7.3.3b: Air pollution estimate from the Podgorica-Danilovgrad road for 2020(AADT=9607 vehicle/24h, direction of the most common wind: NNE; wind speed: 3 m/s. (right and left side)

Concentration of pollutants (mg/m ³)		Distance from the road (m)						
		1	5	10	50	100	150	200
CO	(average)	0.0544 5	0.0432 3	0.03704	0.02137	0.01439	0.0102 8	0.00736
	(max)	0.1689 8	0.13416	0.1149 4	0.0663 2	0.0446 6	0.03191	0.0228 5
C _x H _y (benzene)	(average)	0.01019	0.0080 9	0.0069 3	0.0040 0	0.0026 9	0.0019 2	0.0013 8
	(max)	0.03057	0.0242 7	0.0207 9	0.0120 0	0.0080 8	0.00577	0.0041 3
NO	(average)	0.03576	0.0283 9	0.0243 3	0.0140 4	0.0094 5	0.0067 5	0.0048 4

	(max)	0.11112	0.0882 2	0.07558	0.0436 1	0.02937	0.0209 9	0.0150 2
NO ₂	(average)	0.07401	0.0663 9	0.0621 9	0.05155	0.0468 1	0.0440 2	0.0420 3
	(max)	0.2299 6	0.2062 8	0.1932 2	0.1601 6	0.1454 4	0.13677	0.13061
Pb	(average)	0.0000 6	0.0000 5	0.0000 4	0.0000 2	0.0000 2	0.0000 1	0.0000 1
	(max)	0.0001 8	0.0001 4	0.0001 2	0.0000 7	0.0000 5	0.0000 3	0.0000 2
SO ₂	(average)	0.0022 8	0.00181	0.00155	0.0008 9	0.0006 0	0.0004 3	0.0003 1
	(max)	0.0070 4	0.0055 9	0.0047 9	0.0027 6	0.0018 6	0.00133	0.0009 5
PM	(average)	0.00033	0.0002 6	0.0002 2	0.00013	0.0000 9	0.0000 6	0.0000 4
	(max)	0.00101	0.0008 0	0.0006 8	0.0003 9	0.0002 7	0.0001 9	0.0001 4

Table 7.3.3c: Air pollution estimate from the Podgorica-Danilovgrad road for 2020 (AADT=9607 vehicle/24h, direction of the most common wind: NNE; wind speed: 5 m/s)(right and left side)

Concentration of pollutants (mg/m ³)		Distance from the road (m)						
		1	5	10	50	100	150	200
CO	(average)	0.03267	0.0259 4	0.0222 2	0.0128 2	0.0086 3	0.00617	0.0044 2
	(max)	0.10139	0.0804 9	0.0689 7	0.0397 9	0.0268 0	0.01915	0.01371
CxHy (benzene)	(average)	0.00611	0.0048 5	0.0041 6	0.0024 0	0.0016 2	0.00115	0.0008 3
	(max)	0.01834	0.0145 6	0.0124 8	0.0072 0	0.0048 5	0.0034 6	0.0024 8
NO	(average)	0.0214 6	0.01704	0.0146 0	0.0084 2	0.0056 7	0.0040 5	0.0029 0
	(max)	0.0666 7	0.0529 3	0.0453 5	0.02617	0.01762	0.0125 9	0.0090 1
NO ₂	(average)	0.07401	0.0663 9	0.0621 9	0.05155	0.0468 1	0.0440 2	0.0420 3
	(max)	0.2299 6	0.2062 8	0.1932 2	0.1601 6	0.1454 4	0.13677	0.13061
Pb	(average)	0.0000 4	0.0000 3	0.0000 2	0.0000 1	0.0000 1	0.0000 1	0.0000 0
	(max)	0.00011	0.0000 8	0.0000 7	0.0000 4	0.0000 3	0.0000 2	0.0000 1
SO ₂	(average)	0.00137	0.0010 9	0.0009 3	0.0005 4	0.0003 6	0.0002 6	0.0001 8
	(max)	0.0042 2	0.00335	0.0028 7	0.0016 6	0.00112	0.0008 0	0.0005 7
PM	(average)	0.0002 0	0.0001 6	0.0001 3	0.0000 8	0.0000 5	0.0000 4	0.0000 3
	(max)	0.0006 0	0.0004 8	0.0004 1	0.0002 4	0.0001 6	0.00011	0.0000 8

Table 7.3.3d: Air pollution estimate from the Podgorica-Danilovgrad road for 2027 (AADT= 9751 vehicle/24h, direction of the most common wind: NNE; wind speed: 3 m/s) (right and left side)

Concentration of pollutants (mg/m ³)		Distance from the Road (m)						
		1	5	10	50	100	150	200
CO	(average)	0.0552 6	0.0438 8	0.03759	0.0216 9	0.0146 1	0.0104 4	0.00747
	(max)	0.17151	0.13617	0.11667	0.06731	0.04533	0.03239	0.0231 9
CxHy (benzene)	(average)	0.01034	0.0082 1	0.0070 4	0.0040 6	0.00273	0.0019 5	0.0014 0
	(max)	0.03103	0.0246 3	0.02111	0.01218	0.0082 0	0.0058 6	0.0042 0
NO	(average)	0.0363 0	0.0288 2	0.0246 9	0.0142 5	0.0095 9	0.0068 6	0.0049 1
	(max)	0.11278	0.0895 4	0.07672	0.0442 6	0.0298 1	0.02130	0.01525
NO ₂	(average)	0.07453	0.0668 6	0.0626 3	0.05191	0.04714	0.04433	0.0423 3
	(max)	0.23158	0.20774	0.1945 9	0.1612 9	0.14647	0.13774	0.13153
Pb	(average)	0.0000 6	0.0000 5	0.0000 4	0.0000 2	0.0000 2	0.0000 1	0.0000 1
	(max)	0.0001 8	0.0001 4	0.0001 2	0.0000 7	0.0000 5	0.0000 3	0.0000 2
SO ₂	(average)	0.00231	0.0018 4	0.00157	0.0009 1	0.0006 1	0.0004 4	0.0003 1
	(max)	0.00715	0.00567	0.0048 6	0.0028 0	0.0018 9	0.00135	0.0009 7
PM	(average)	0.0003 3	0.0002 6	0.0002 3	0.00013	0.0000 9	0.0000 6	0.0000 4
	(max)	0.0010 2	0.0008 1	0.0006 9	0.0004 0	0.0002 7	0.0001 9	0.0001 4

Table 7.3.3e: Air pollution estimate from the Podgorica-Danilovgrad road for 2027(AADT=9751 vehicle/24h, direction of the most common wind: NNE; wind speed: 5 m/s) (right and left side)

Concentration of pollutants (mg/m ³)		Distance from the Road (m)						
		1	5	10	50	100	150	200
CO	(average)	0.03316	0.02633	0.0225 6	0.01301	0.0087 6	0.0062 6	0.0044 8
	(max)	0.10291	0.08170	0.0700 0	0.0403 9	0.0272 0	0.0194 4	0.01391
CxHy Benzene	(average)	0.0062 1	0.0049 3	0.0042 2	0.0024 4	0.0016 4	0.00117	0.0008 4
	(max)	0.0186 2	0.01478	0.0126 6	0.00731	0.0049 2	0.0035 2	0.0025 2
NO	(average)	0.02178	0.01729	0.01481	0.0085 5	0.0057 6	0.00411	0.0029 4
	(max)	0.06767	0.05372	0.0460 3	0.0265 6	0.01789	0.01278	0.0091 5
NO ₂	(average)	0.07453	0.0668 6	0.0626 3	0.05191	0.04714	0.0443 3	0.0423 3
	(max)	0.23158	0.20774	0.1945	0.1612	0.14647	0.13774	0.13153

				9	9			
Pb	(average)	0.0000 4	0.0000 3	0.0000 2	0.0000 1	0.0000 1	0.0000 1	0.0000 0
	(max)	0.00011	0.0000 9	0.0000 7	0.0000 4	0.0000 3	0.0000 2	0.0000 1
SO ₂	(average)	0.0013 9	0.00110 0	0.0009 4	0.0005 4	0.00037	0.0002 6	0.0001 9
	(max)	0.0042 9	0.0034 0	0.0029 2	0.0016 8	0.00113	0.0008 1	0.0005 8
PM	(average)	0.0002 0	0.0001 6	0.0001 4	0.0000 8	0.0000 5	0.0000 4	0.0000 3
	(max)	0.0006 1	0.0004 9	0.0004 2	0.0002 4	0.0001 6	0.0001 2	0.0000 8

A comparison of the data on pollution of air along the Podgorica-Danilovgrad road section, gathered in line with the Merkblatt über Luftverunreinigungen an Straßen MLuS g2 and limit and tolerance values prescribed with the Decree on determination of the types of pollutants, limit values and other standards of air quality (Official Gazette of Montenegro, number 25/2012), shows that the forecasted concentration of pollutants CO, Pb, SO₂ and PM (carbon monoxide, lead, sulphur dioxide and particulate matter respectively) along the proposed road corridor will be lower than the average limit values of emission, even at distance smaller than 1m from the road, with the exception of nitrogen dioxide and C_xH_y.

Nitrogen dioxide shows an exceedance of the limits, as does hydrocarbons, however these are considered to be minor in terms of their potential significance.

From a cumulative impacts perspective, capacity of the concrete and mortar plant, which is located along the Main Road M-18 Danilovgrad-Podgorica (approximately at Ch. Km 116+837) is far below the legally defined capacities in terms of impact on air quality.

Figure 7.3.3: Location of the concrete and mortar plant relative to the route of the Main Road M-18 Danilovgrad-Podgorica (approximately at km 116+837).



Based on the above, the severity of the impacts associated with operation of the road are considered to be **minor**.

Greenhouse Gas emissions

An estimate of greenhouse gas emissions for the operational phase of the road indicates an output of roughly 15000 metric tonnes of CO₂ equivalent.

Emissions were calculated using the United States Environmental Protection Agency (US EPA) simplified GHG emissions calculator (SGEC), version 3.2. Calculations are shown in **Annex D**.

7.3.4 Proposed Construction Mitigation

Most mitigation measures to address impacts on ambient air quality during construction are general mitigation measures that correspond to good practice during construction. These are required to reduce negative impacts on air quality to a minimum and include;

- Prevent the uncontrolled spreading of construction material outside of the construction zone then vehicles will be cleaned and inspected as clean;
- Regular wetting of dusty areas when the weather is dry (and predictions made in advance of the weather for the coming week to avoid situations where equipment is not available for wetting);
- Regular maintenance of vehicles to ensure efficient operation; and
- A construction driving plan will be developed that will address issues of; the location of haulage routes, driver conduct (speeding) and the prevention of vehicle idling.

In addition, and as part of this, an air quality monitoring program should be implemented, especially close to the residential areas identified previously. A response plan shall be developed to be enacted if air quality monitoring shows exceedances of appropriate limits

7.3.5 Proposed Operational Phase Mitigation

No mitigation is required for the proposed operational phase of the project taking into account the output of the air modelling. However, it is recognised that there are limitations to the modelling and additional work is needed to strengthen the baseline on air quality and meteorological conditions. Further modelling using this information may suggest the need for additional mitigation.

7.3.6 Residual Construction Phase Impacts

Overall, through use of the mitigation hierarchy, the project is not expected to have any significant residual impact on air quality during the construction and operational phases.

Cumulative Impacts

Although there is a poverty of baseline ambient air quality information, the apparent absence of significant sources of air pollution arising from the settlements and occupants along the road route leads to the conclusion that it is unlikely that cumulative impacts will arise.

Contractors Commitments

The following are required of the contractor;

- An air quality baseline assessment will be completed prior to the commencement of construction works. This will be completed by a competent authority (see note below) and will be delivered to GIP. Any limitations to this (for instance those related to a reduction in duration of monitoring) will be clearly listed out in the report and an assessment made of their relevance to the final identification of impact;
- Predictive modelling of air quality impacts will be completed using the output from the baseline assessment. Potential impacts will be confirmed (and limitations detailed);
- Mitigation measures will be developed and included into the final design; and
- The contractor will ensure that the following recommendations are carried out as detailed in the ESIA environment and social action plan (ESAP) (additional comments in **bold**)

Measures to be implemented to minimize dust emissions and included with a An Quality Management Plan (by the Contractor in consultation with the competent authority and EBRD): <ul style="list-style-type: none">- Accesses and construction sites will be kept moist to reduce dust formation. Water sprays will be implemented during drilling and excavation activities,- In the dry season, hygroscopic additives will be used in water to increase its presence in the ground,- Dust-generating activities will be slowed down in days of strong wind,- In windy and dry conditions, earth works will be moistened to prevent the lifting of dust particles.
Ground will be moistened during loading and unloading of aggregates/soil in trucks, <ul style="list-style-type: none">- Truck dumpers carrying spoil or other dusty materials will be covered with tarps,- Work sheds will be large enough to allow stockpiling of the excavated material, access of trucks and truck loading operations.
Measures to be implemented to minimize emissions of combustion gases: <ul style="list-style-type: none">- Vehicles and construction machinery will be required to be properly maintained and to comply with relevant emission standards,- No unnecessary idling of construction vehicles at the construction sites will be allowed,- Construction truck traffic will be optimized so as to get a minimum number of trucks carrying the maximum volume of materials. This will be addressed in the Construction Traffic Management Plan,- The truck routes will be planned to avoid peak traffic hours or routes with heavy traffic.
An air quality monitoring as per Montenegrin legislation and GIP will be implemented during the construction and operation phase (to be drafted and approved by a competent authority and to include limits for which exceedances will trigger the activation of response/prevention measures).

- An air quality management plan will be developed for the road during its operational use should the modelling identify the need. This will include, at a minimum the following items;
 - Identification of sensitive receptors;

- Locations of air monitoring equipment;
- Schedule of analysis including frequency;
- Trigger concentrations for action;
- Action/response plan;
- Responsibilities; and
- Reporting and communication plan.

8. Noise and Vibration

Relevant Legislation and Guidance

Table 8.1: Legislation and Guidance for Noise and Vibration

Title of document	Issue of importance for the Project
<p>Law on Protection from Noise in the Environment (Official Gazette of MN, No. 28/11, 28/12 and 01/14)</p>	<p>This Law determines the measures for prevention or minimisation of the harmful effects of noise and other important issues for the protection of the environment and human health. The Law deals with noise arising in the environment, particularly in built-up areas, city parks and other quiet areas in agglomerations, quiet areas in the countryside, vicinity of schools, hospitals and other facilities, where noise may have harmful effects on exposed the population, especially on vulnerable groups (children, the elderly, patients). On the basis of the Law on protection from environmental noise, the Ministry of Sustainable Development and Tourism adopted the <i>Ordinance on limit values of environmental noise, the method of determining the noise indicators and acoustic zones and methods of assessment of adverse effects</i> ("Official Gazette of Montenegro ", No. 60/11).</p> <p>Based on the aforementioned legislation, municipalities in Montenegro have adopted Decisions on acoustic zoning of their territories, which is a basic requirement for implementation of this Ordinance. By determining the acoustic zones, the limit values (Lday, Levening, Lnight) are set for the established parts of the municipal territory (silent zone and zone under strong noise), which is important for protection against noise in the environment, and for future planning of the construction of facilities.</p> <p>Other: <i>Rulebook on the methods of calculation and measurement of the environmental noise level</i> ("Official Gazette of Montenegro", No. 27/14, 17/17);</p>
<p>Other international standards</p>	<p>British Standard BS 5228:2009, <i>noise</i></p> <p>British Standard, BS 5228 Part 2, <i>Vibration</i></p> <p>british Standard BS 7385 – <i>Evaluation and measurement for vibration in buildings Part 1: 1990 and Part 2: 1992</i></p> <p><u>UK Design Manual for Roads and Bridges, Volume 11</u></p>

Baseline Conditions

8.2.1 Noise - Sensitive Receptors

Receptors of noise impacts have been defined in settlements/residential properties along the route (from Ch. km 114+527 to km 115+430, right and left from the road). Vulnerability assessments indicate that there are no high sensitivity communal buildings along the route of the road (e.g. schools, clinics, old peoples homes), although it needs to be acknowledged that individual residential properties may contain vulnerable occupants (young children, old people, sick and infirm).

The definition of the areas was completed using a preliminary analysis of the calculated noise indicators, in respect to the spatial layout of the residential objects along the subject road route. The analysis was based on the data available in the Main Design for Main Road Reconstruction Project, Rehabilitation and upgrade of the Danilovgrad-Podgorica road section, whereby data was gathered from the orthophoto maps and the primary national coordinates for the subject area.

Figure 8.2.1: Areas with residential facilities in which negative impact of noise on population is expected to occur after reconstruction of the Main Road M-18 Danilovgrad-Podgorica (from Ch. km 114+527 to km 115+430, right and left from the road)



Table 8.2.1 offers a more detailed overview of the areas with potential receptors which will be impacted by increased noise levels, road changes, and position of objects relative to the road and the number of residential facilities.

Table 8.2.1 - Areas with residential objects in which negative impact of noise on population is expected after reconstruction of the Main Road M-18 Danilovgrad-Podgorica.

No.	Chainage [km]		Position relative to the main road	Number of residential facilities
	From	To		
1.	114+527	114+967	Right	13
2.	114+635	115+430	Left	11
3.	115+163	115+419	Right	7
4.	115+525	115+660	Right	3
5.	115+600	115+751	Left	7
6.	116+505		Right	1
7.	116+611	116+867	Right	11
8.	116+777	117+018	Left	4
9.	117+007	117+100	Right	3
10.	117+305	-	Right	1
11.	117+471	117+867	Right	13
12.	117+607	117+430	Left	5
13.	118+181	118+272	Right	8
14.	118+287		Left	1

No.	Chainage [km]		Position relative to the main road	Number of residential facilities
	From	To		
15.	118+756	118+786	Left	3
16.	119+209	119+360	Left	4
17.	119+345		Right	1
18.	119+526		Right	1
19.	119+640	119+680	Right	6
20.	119+617	119+680	Left	2
21.	119+849		Right	1
22.	120+038	120+155	Left	6
23.	120+080		Right	1
24.	120+629	120+731	Left	5
25.	120+992	121+330	Right	5
26.	121+065	121+115	Left	3
27.	121+345	121+580	Left	7
28.	121+746	121+837	Right	3
29.	122+200		Left	1
30.	122+768	122+934	Left	5
31.	122+843		Right	1
32.	124+070		Right	1
33.	124+266		Right	1
34.	126+140		Right	1
35.	126+054	126+120	Left	4
36.	126+465		Left	1
37.	126+813	126+888	Left	5
38.	128+995	129+010	Right	3
39.	129+406	129+632	Right	10
TOTAL NUMBER OF RESIDENTIAL FACILITIES IN THE ZONE OF NEGATIVE IMPACT OF NOISE CAUSED DURING OPERATION OF THE MAIN ROAD M-18 DANILOVGRAD-PODGORICA:				169

In total 169 areas of potential impact have been identified, made up of individual or clusters of residential properties. Vulnerability assessment indicates that none of these can be classed as sensitive to noise impact.

Noise Monitoring

There is no regular noise monitoring in the proposed footprint of the road.

Measures were however taken over 3 day/night periods during the week of the 24th June 2019, recovered from 10 locations along the route. Only 2 of these measuring positions (numbers 7 and 10) fall within the Municipality Podgorica, while the remaining 8 are located within the Municipality of Danilovgrad.

Recording profiles were daytime (07-19h), evening (19-23h) and night cycle (23-07h). For the daily cycle: two series of 3 measurements were performed (before and after noon), for the evening cycle: one series of 3 measurements, and for the night cycle: two series of 3 measurements

The results of all measurements are given in tables 1 to 50⁹ in the PRILOG E3 Magistrala M18 PG DG 2019 report

All monitoring and the method for determining the noise indicators and acoustic zones and methods of assessment of adverse effects ("Official Gazette of Montenegro ", No. 60/11).

In addition to the daily, evening and night noise level indicators (L_{day} , $L_{evening}$ and L_{night}), the total all day long noise indicator L_{den} has been calculated. According to the prescribed methodology the logarithmic addition of L_{day} , $L_{evening}$ and L_{night} , the 5 dB has been added to the value of the $L_{evening}$ indicator, and 10 dB is added to the value of the indicator L_{night} .

Table 8.2.1a shows the mean values of the series of measured equivalent traffic noise levels LA_{eq} for daily, evening, night and all-day cycle (L_{day} , $L_{evening}$, L_{night} and L_{den}), as well as the corresponding values of noise level L_{day} , $L_{evening}$ and L_{night} for a given acoustic zone to which the measuring positions belong.

Table 8.2.1a: Measured values of the noise level indicator and the corresponding noise level limit values for a given measuring position.

	Noise measurement level $LA_{eq}(L_{day} / L_{evening} / L_{night} / L_{den})$ (dB)	Limit value of the noise level for $L_{den} /$ $L_{Evening} / L_{Night} / L_{den}$ (dB)
1 - Day	62	60
1 – Evening	61	60
1 – Night	44	55
1- all day	64	/
2 - Day	60	60
2– Evening	60	60
2 – Night	52	55
2- all day	62	/
3 - Day	59	60
3– Evening	60	60
3 – Night	56	55
3- all day	63	/
4 – Day	60	60
4– Evening	59	60
4 – Night	54	55
4- all day	63	/

⁹ Noise Surevy Results: PRILOG E3 Magistrala M18 PG DG 2019

5 – Day	68	60
5– Evening	63	60
5 – Night	60	55
5- all day	69	/
6 – Day	66	60
6– Evening	64	60
6– Night	63	55
6- all day	70	/
7 – Day	66	60
7– Evening	66	60
7 – Night	62	55
7- all day	70	/
8 – Day	53	60
8– Evening	56	60
8 – Night	48	55
8 - all day	57	/
9 – Day	54	60
9– Evening	53	60
9 – Night	49	55
9 - all day	57	/
10 – Day	63	60
10– Evening	56	60
10– Night	58	55
10 - all day	65	/

Impact Assessment

8.1.1 Impact Criteria

Table 8.3.1 Impact Criteria for Noise and Vibration

Negligible Impact	Low Impact	Medium Impact	High Impact	Very High Impact
Impact: Increase in noise				

Negligible Impact	Low Impact	Medium Impact	High Impact	Very High Impact
No increase in noise	Minor increase in noise (up to 2dB against threshold criteria)	Moderate increase, 2 – 5dB increase against criteria	Increased and sustained levels of high noise 5 – 10dB against criteria Likely impact on sensitive receptors (vulnerable population and biodiversity)	>10dB increase in noise levels resulting in sustained and negative impact on local residents and biodiversity receptors

Noise caused by traffic flow is discontinuous and of variable intensity and intermittent. It has a negative impact on the quality of life of the local population and potentially also a deleterious impact to health. Some 169 properties have been identified as being at risk of impact from the construction and operation of the new road and appropriate mitigation measures are needed to reduce the impact to these. That being so, the majority of the route passes through rural landscapes with a low population density.

On the basis of the Decision on the determination of acoustic zones in the Municipality of Podgorica city - Podgorica and the Municipality of Danilovgrad, the subject area belongs to the Zone under the strong noise influence of road traffic, for which the noise threshold values are 60 dB (A) for the day and evening and 55 dB) for the night. Thus, even with the limited recent data it is clear that baseline noise levels are sporadic and on occasion, exceeds these thresholds.

8.3.2 Construction Phase Impacts

Construction Noise

Guidance on acceptable levels of noise from construction activities is given in British Standard BS 5228:2009. Part 1 of this standard indicates that for long term and large-scale activities involving earth movements, noise from daytime construction activities would not be significant below 55 dB LAeq. For smaller schemes, noises from daytime construction activities would not be significant if below 65 dB LAeq. The effect of dispersal of equipment and plant along the route during its construction and its continuous use will in itself undoubtedly offer some reduction in noise impact. Three locations have been identified for construction sites and it is anticipated that these will present zones of elevated noise impact.

Detailed aspects of the construction method statements will be used to derive more location-specific information on sources of construction noise. For example the nature of construction methods in areas of rocky outcrop will be a crucial determinant of noise levels. Location-specific measures will be employed such as limiting construction (especially if it involves blasting) during sensitive periods of the day (school hours, church services for example).

For the most part, the construction plant will generate sporadic and short term noise and this is difficult to characterise and assess at this stage. One key source of noise impact is the concrete batch plant on the *M-18 Danilovgrad-Podgorica road (approximately at km 116+837)*. The plant will be a focal point for the delivery of aggregates and cement as well as the movement of mixer trucks.

Properties near the roads that will be used for construction traffic have the greatest potential for increase in noise due to construction traffic.

The magnitude of the noise impact from the outdoor equipment will depend on:

- construction machinery, transportation vehicles and equipment's noise emission levels,
- the number of machineries, plant and vehicles in any one area used at the same, and
- the distance of the source to the sensitive receptors.

In the table that follows, the average noise level specifications for the outdoor equipment most commonly used in the construction of civil works are presented. The equipment will usually be distributed at specific points of the route for a certain period of time and not all machines will work at the same time.

Table 8.3.2a: Construction Machinery and Noise Levels

Type of equipment (extraction–discharged work)	Sound level dB(A)	Time of Duration	Type of equipment (excavation-earth work)	Sound Level dB(A)	Time of duration
Bulldozer	90	long-term	Finisher	83	long-term
Compressor	80	short-term	Truck	85	linear
Grader	83	long-term	Watering machine	87	long-term
Water jet machine	87	long-term	Pneumatic drill	85	short-term
Truck	85	short-term	Concrete pump	110	short-term
Drilling machine	85	short-term			

Noise will dissipate in the air and be reduced as it meets obstacles. Noise levels will drop with the increase of the distance between the source and receptor (a reduction level of 6 decibels is assumed as the distance from the source doubles) (Table 8.3.2b).

Table 8.3.2b: Noise levels at various distances from the construction site during ground extraction, transportation and earth work stage

Distance from the source to the receptors (m)	Sound equivalent level at source (dB(A))	Sound equivalent level at receptor (dB(A))
40	81	73
60	78	71
80	76	68

100	74	66
200	68	60
300	64	57
400	62	54
500	60	52

The effects of noise changes relate to the magnitude of the impact as compared to the baseline value. This is presented below in the Table 8.3.2c that follows.

Table 8.3.2c: Change in Noise Levels and Magnitude of Impacts

Noise Level increase dB(A)	Subjective Response	Impact Magnitude
0-0.9	Imperceptible	Negligible
1-2.9	Barely perceptible	Minor
3-4.9	Noticeable	Moderate
5.0-9.9	Up to a doubling or halving in loudness	Significant
10.0	More than a doubling or halving in loudness	Very significant

Based on the modelling/calculation on noise levels in the area where the road will be constructed, an average of 57 dB(A) was estimated for the baseline scenario – it is recognised that there is no baseline data and that large assumptions have been made relating to this value.

Considering a sound level of 73dB(A) at a receptor at a distance of 40m from the source (construction area), the increase in noise levels has been estimated at 18 dB(A) and the magnitude of the potential impact will be **high**.

Where construction noise levels are anticipated to be above 57 dB, during the day, significant noise impacts are expected to be registered. These impacts are classed as **moderate**.

Construction vibration

The vibrations produced by the construction phase of a road project are generally not considered significant unless the source of impact is adjacent to structures. Vibration travels:

- Through the ground: the vibrations are transmitted through the ground and affect the structure through its foundation.

- Through the air: sounds (of relatively low frequencies) transmitted through the air can enter through openings (such as windows and doors) into the building and affect their structural components.

In relation to vibration reference has been made to a British Standard, BS 5228 Part 2, *Vibration*. This gives recommendations for basic methods of vibration control relating to construction and open sites, as well as guidance on effective liaison between developers, operators and regulators and on measuring and assessing the effects of vibration. For determination of the significance of vibration impacts on people, BS 5228 cross refers to BS 6472 - *Guide to evaluation of human exposure to vibration in buildings; Parts 1 and 2: 2008* which presents guidelines for the evaluation of vibration issues relating to human perception. Table 8.3.2d below reproduces the resulting 'Guidance on effects of vibration levels'

Table 8.3.2d: BS 5228 Guidance on Effects of Vibration Levels

Vibration Level	Effect
< 0.14 mm/s	Vibration might be just perceptible in the most sensitive situations for most vibration frequencies associated with construction. At lower frequencies, people are less sensitive to vibration
0.14 - 0.3mm/s	Vibration might be just perceptible in residential environments
0.3 - 1.0 mm/s	It is likely that vibration of this level in residential environments will cause complaint, but can be tolerated if prior warning and explanation has been given to residents
> 10 mm/s	Vibration is likely to be intolerable for any more than a very brief exposure to this level

BS 5228 also refers to the damage threshold criteria presented in BS 6472 for structural responses to vibration. Part 1¹⁰ of BS 6472 examines vibration from sources other than blasting, including piling, ground stabilisation, drilling and other conventional construction techniques. Vibration is also classified as:

- i) **Continuous:** The vibration is uninterrupted for the assessment period. This can be either a daytime period of 16 h, e.g. 7:00 to 23:00, or a night-time period of 8 h, e.g. 23:00 to 7:00;
- ii) **Intermittent:** The vibration is perceived in separately identifiable repeated bursts. Its onset can be sudden, or there might be a gradual onset and termination bounding a more sustained event. Bursts may happen several to many times in a day or night period;
- iii) **Occasional:** The vibration occurs less often than intermittent vibration, and might be less predictable;
- iv) **Impulsive:** The vibration, whether continuous, intermittent or occasional, is characterised by rapid build up to a peak, which may or may not be sustained for a period, followed by a damped decay, which may or may not involve several cycles of vibration (dependent upon frequency and damping). It can also consist of a sudden application of several cycles at approximately the same amplitude, providing that the duration is short.

Table 8.3.2e below summarises the guidance contained in the standards with respect to human perception thresholds and presents values at which vibrations from construction activities are likely

¹⁰ Part 2 of the Standard covers blast-induced vibration and as such is not deemed relevant to this scheme.

to result in adverse comments from occupiers in terms of 16hr daytime (07:00 – 23:00) and 8hr night-time (23:00 – 07:00) Vibration Dose Values (VDV). Vibration Dose Value (VDV) can be defined as the relationship between the duration of the exposure and the magnitude of a vibration event for the assessment of impulsive and intermittent vibration. VDV is a time dependant based parameter whereby “a two-fold decrease in vibration magnitude is equivalent to a 16-fold decrease in the duration of the vibration”. This is due to the relationship between the exposure and magnitude, which is defined by the fourth root of the integral of the fourth power of the frequency weighted acceleration.

Table 8.3.2e: BS 6472 Vibration Dose Value¹¹

Building/Location	Period	Threshold Criterion, in mm/s ^{-1.75}		
		Low probability of Adverse Comment (ms ^{-1.75})	Adverse Comment Possible (ms ^{-1.75})	Adverse Comment Probable (ms ^{-1.75})
Residential Building	Day-time	0.2 to 0.4	0.4 to 0.8	0.8 to 1.6
Residential Building	Night-time	0.1 to 0.2	0.2 to 0.4	0.4 to 0.8

With respect to damage criteria associated with ground borne vibration the appropriate guidance is contained within BS 7385 – Evaluation and measurement for vibration in buildings Part 1: 1990 and Part 2: 1992 It is stated within of BS 7385 that “Peak Particle Velocity (PPV) has been found to be the best single descriptor of vibration induced damage”. The standard recommends the simultaneous measurement of the three components of particle velocity (Longitudinal, Vertical and Transverse) in order to attain the maximum value in any plane. The figures stated below relate to this maximum value. With regard to damage to buildings resulting from vibration, BS 7385 defines the following three categories in order to aid with description:

- **Cosmetic:** the formation of hairline cracks or the growth of existing cracks in plaster, drywall surfaces or mortar joints.
- **Minor:** the formation of large cracks or loosening and falling of plaster on drywall surfaces, or cracks through bricks / concrete blocks.
- **Major or Structural:** damage to structural elements of a building.

The guidance limits proposed for the prevention of cosmetic damage within this Standard are contained within Table 8.3.2f below. The Table presents thresholds at which vibration from construction activities may result in damage as measured in Peak Particle Velocity (PPV).

Table 8.3.2f BS 7385 Building Damage Criteria

Line	Type of Building	Peak Component particle velocity in frequency range of predominant pulse	
		4Hz to 15Hz	15Hz and above
1	Reinforced or framed structures. Industrial and heavy commercial buildings	50mms ⁻¹ at 4Hz and above	
2	Un-reinforced or light framed structures. Residential or light commercial type buildings	15mms ⁻¹ at 4Hz increasing to 20mms ⁻¹ at 15Hz	20mms ⁻¹ at 15Hz increasing to 50mms ⁻¹ at 40Hz and above

¹¹ NOTE – For offices and workshops, multiplying factors of 2 and 4 respectively should be applied to the above vibration dose value ranges for a16 hour day.

BS 7385 also states that the onset of Minor damage is possible at magnitudes greater than twice those presented within Table 8.3.2e above, with Major damage to the structural elements of a building occurring at values in excess of four times the values quoted above. With regard to the onset of cosmetic damage the “probability of damage tends towards zero at 12.5mms⁻¹ peak component particle velocity”. Cosmetic damage resulting from continuous vibration events (as defined within BS 6472: 2008) may be evident at values of 50% of those presented within Table 8.3.2e above.

Taking into account the fact that the construction footprint moves in proximity to residential areas in some areas, the magnitude of the impacts of the construction works has been estimated to be moderate. There is scope to reduce this to ‘low’ with the use of appropriate mitigation measures such as limiting plan operation at night and during religious services in nearby sites of worship, or in schools etc.

8.3.3 Operational Phase Impacts

In general the noise caused by traffic flow is discontinuous, of variable intensity and with intermittent pulses. It can have a negative impact on the quality of life of the surrounding population and its health, as well as a potential negative impact on biodiversity.

Calculations of the predicted noise levels relating to operation of the road was carried out by using Software package “Predictor-LimA Software Suite – Type 7810”, made by Brüel & Kjær. This was used for calculation of noise indicators, which may be expected after reconstruction of the Main Road M-18 Danilovgrad-Podgorica, i.e. while the traffic is running along the subject section. The German method “RLS90 - Richtlinien fuer den Laermschutz an Strassen” was adopted for calculation of noise caused by road traffic. This method is in line with Directive 2002/49/EZ.

Note; the baseline data collection exercise completed in June 2019 has not been used in the modelling and as such, an update of the modelled output will be undertaken by the Contractor prior to construction using current data sets and need to inform appropriate actions under the mitigation hierarchy.

Calculations of the noise indicators was done in conditions of flat spreading of sound, whereby this process was based on the first degree of reflection, data on the perspective road traffic density in 2027 (PGDS=9751 vehicles/24h, 15% freight vehicles, the projected speed is 80 km/h) and characteristics of the reconstructed road. The results that were obtained through this process are shown in Table 8.3.3 below.

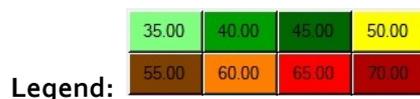
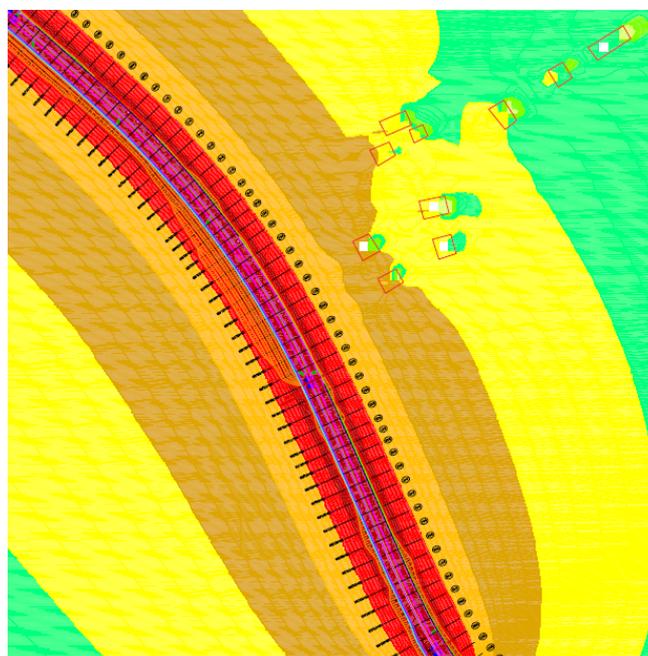
A graphical overview of the noise indicators caused by traffic along the reconstructed Main Road M-18 Danilovgrad-Podgorica, which were obtained through the abovementioned calculation for the evening period, is shown in Figure 83.3 below.

Table 8.3.3: Traffic noise levels during the operational phase of the reconstructed road M-18 Danilovgrad-Podgorica, in conditions of flat spreading of sound, which were obtained through the abovementioned calculation (forecast PGDS: 9751 vehicles/ 24h, for 2027)

Distance of the emission point from the road, m	Equivalent level in dB (A)	
	Day (60dba)	Night (55dba)

25	67	59
50	62	54
75	59	52
100	57	50
125	56	49
150	55	47

Figure 8.3.3: Graphical overview of calculated traffic noise indicators at night along the reconstructed Main Road M-18 Danilovgrad-Podgorica.



On the basis of the decision on the determination of acoustic zones in the Municipality of Podgorica city - Podgorica and the Municipality of Danilovgrad, the subject area belongs to the Zone under the strong noise influence of road traffic, for which the noise values are 60 dB (A) for the day and evening and 55 dB) for the night. On the basis of the calculation Table 8.3.3 it can be concluded that the noise levels, in the given conditions of free spreading of the sound - due to traffic flow, will be above the limit values at a distance of about 60 m from the source of noise.

Detailed analysis of vulnerability of the local population, due to traffic noise created along the reconstructed road M-18 Danilovgrad-Podgorica, creation of noise maps and definition of protective measures will be a matter of the next phase of development of technical documentation,

i.e. development of the Study on Noise Protection in the Area of Impact of the Reconstructed Main Road M-18 Danilovgrad-Podgorica.

Summarizing, the magnitude of the impacts on the acoustic environment, due to the operation of the project, will be **Moderate**. These impacts can be partially mitigation with the implementation of sound barriers. It should be pointed out that in the baseline scenario the impacts on the acoustic environment have also been estimated to be **Moderate**, as the existing road operates in close proximity to residential areas and sensitive receptors.

8.3.4 Proposed Construction Phase Mitigation

The primary construction mitigation proposed is the development of an effective Construction Noise and Vibration Management Plan (CNVMP) by the Construction Contractors to include specific limits to be used to control noise and vibration associated with the road project. The Plan should include a protocol which when implemented will identify sensitive receptors, and determine the risk of adverse impacts. The plan will consider the siting of plants, the routes of construction traffic and the timing of construction activities in relation to receptors. It will also highlight mitigation measures that could be considered where necessary and appropriate should the need arise as well as a monitoring protocol that can be used to policy/verify compliance of the construction works with appropriate noise and vibration limits.

Construction Noise Limits

Specific construction noise limits will be defined in accordance with *BS 5228: Noise Control on Construction and Open Sites (Part 1); 2009 (+A1: 2014)*. It is recommended that Category "A" values from the BS5228 "ABC Methodology" are used for the construction noise limit unless baseline noise data identified that a higher limit would be appropriate.

Table 8.3.4 Construction Noise Limits

Assessment category and threshold value period (L_{Aeq})	Threshold value, in decibels (dB)		
	Category A ^(A)	Category B ^(B)	Category C ^(C)
Night-time (23:00 – 07:00)	45	50	55
Evening and Weekends ^(D)	55	60	65
Daytime (07:00 -19:00) and Saturdays (07:00 – 13:00)	65	70	75

Given that construction impacts will be actively monitored and managed in accordance with the mitigation hierarchy, noise levels should be kept within acceptable limits.

Generally, it is understood that work will be undertaken during daytime working hours, with no construction works occurring during evenings, overnight or weekends. Exceptions to the normal working schedule may occur as a result of site specific parameters, safety concerns or emergencies and in such instances further assessment should be carried out to determine impacts upon any noise sensitive receptors in the vicinity.

Construction Vibration Limits

General road construction activities are not expected to generate significant levels of vibration that would be discernible at the nearest sensitive receptor. Certain activities do however have the potential to generate ground borne vibration and could result in adverse impacts if not suitably controlled.

These include horizontal drilling; rock hammering; and compaction of road bases. Whilst in most cases separation distances involved mean that these activities are expected to result in only a moderate level of impact¹², specific construction vibration limits should be defined for the project¹³ and should a specific project requirement become apparent along the route, or a complaint regarding construction generated vibration be received, the issue of vibration management should be addressed at that time.. With this in mind the following limits should be considered:

Human Perception: short term vibration generated by construction activities at any surrounding sensitive receptors (residential) should remain below the levels considered by BS6472 to prevent Adverse Comment ($0.8 - 1.6\text{mms}^{-1.75}$);

Damage Potential: short term vibration generated by construction activities at any surrounding sensitive receptors (residential) should remain below the levels stated in the CNVMP.

Construction Risk Based Noise and Vibration Controls

Control at source and the implementation of Best Available Technique (BAT) is considered the most appropriate method of noise and vibration control, combined with active management of noise and vibration levels. Specific measures and protocols should be used to control noise and vibration from Project construction activities, based on a clear:

- Risk based assessment of activities and control measures;
- protocol for noise and vibration monitoring during construction activities;
- Only 1 Grievance Mechanism (GM) is needed for all complaints and impacts

Table 8.3.5 overleaf provides an initial risk based assessment which outlines the general activities which have the potential to generate noise and/or vibration, and provides details of appropriate control measures that could be implemented where appropriate. The list of control measures outlined in the table is by no means exhaustive however, and other options should be considered if necessary.

8.3.5 Proposed Operational Phase Mitigation

Moderate levels of impact have been assessed on the basis of the modelling completed to date. This has identified exceedances of the permissible values for properties that sit within a 25m 'contour' for day and night time exceedances, and a 50m contour for daytime exceedances. It is noted that the latter, the 50m contour, is only a marginal exceedance and requires confirmation prior to the investment necessary for permanent mitigation.

Appropriate project design criteria for the development of mitigating features (such as noise barriers), such as that outlined in *BS4142: 2014 Methods for Rating and Assessing Industrial and*

¹² It is understood that blasting will not be required as part of the construction process through areas of hard rock. However, should this change further analysis of this issue will be undertaken.

¹³ To be in accordance with *BS 5228: Noise Control on Construction and Open Sites (Part 2); 2009 (+A1: 2014)*; *BS 6472: Guide to evaluation of human exposure to vibration in buildings – Part 1: Vibration sources other than blasting, 2008* and *BS 7385: Evaluation and measurement for vibration in buildings – Part 2: Guide to damage levels from ground borne vibration, 1993*.

Commercial Sound should be considered. A suitable design limit for the control of operational noise in this project would be as follows:

The final design of any mitigation should only be completed with the proper assessment of the noise climate currently prevailing at the receptor points, and confirmation of the predicted impact.

Should additional measures need to be implemented, this could be done either through the project design (further reducing the noise levels at fence), or by providing additional acoustic insulation at the receptor. Additional measures that could be considered at the site (should further assessment demonstrates a requirement) include the following:

- Appropriately high/laterally extensive acoustic fencing or earth bunds installed around the perimeter of the site; and
- Sound insulation panels to external walls of the buildings

To confirm whether any such work is needed, additional baseline surveys will also be undertaken to understand ambient noise conditions near moving and 'fixed' activities and facilities. These should be undertaken by a specialist acoustic consultancy to ensure the data is representative and robust and will meet the following conditions:

- The survey will be undertaken using appropriate Class 1 sound level meter equipment as defined under IEC 61672-1:2002 (or the equivalent BS EN 61672-1:2003) standard;
- The duration of the survey and the locations selected will be appropriate to consider the noise impacts throughout the daytime/night-time at the nearest noise sensitive receptors to the facility;
- Surveys will be undertaken in appropriate weather conditions as defined within BS4142: 2014 and BS 7445: 2003

Table 8.3.5 Indicative Construction Noise and Vibration Assessment and Management

Hazard	Source Operations	General control measures (Best Available Technique)
<p><u>Hazard:</u> Shouting, PA systems and amplified noise</p> <p><u>Notes on hazard:</u> Nuisance caused by shouting on site, any PA systems and audio radios at nearby receptors</p>	<ul style="list-style-type: none"> • Shouting between operatives on site to relay instructions; • Audible levels of amplified music on site at workstations and within cabs (with open doors/windows); and, • CB Radio noise between staff and within cabs (with open doors/windows) if volumes are set too high. 	<ul style="list-style-type: none"> • Personnel will be instructed on best practice measures to reduce noise and vibration as part of their site induction training; • Shouting and raised voices will be kept to a minimum e.g. in cases where warnings of danger must be given. • Use of audio radios in the open environment will be prohibited except where two-way radios are required for reasons of safety and communication; • Control of noise introduced into site induction to ensure that all operators on site, including contractors, are working in such a way to minimise noise; and, • Compliance monitoring of noise to ensure limits are being met.
<p><u>Hazard:</u> Unacceptable "out of hours" noise</p> <p><u>Notes on hazard:</u> Nuisance caused by audible noise at the closest residential receptors during unsociable hours</p>	<ul style="list-style-type: none"> • Noisy operations being undertaken during unsociable hours for safety reasons or emergency situations or requirements. 	<ul style="list-style-type: none"> • General construction hours will be in accordance with the guidance of the environmental agreement. Limited to: <ul style="list-style-type: none"> • between 07:30 and 17:30 Monday to Friday; • between 07:30 and 13:30 Saturdays; and, • no operations on Sundays and during bank/public holidays. • Prior liaison with the Montenegrin Planning Authority regarding any requirements for out of hours work for Health and Safety, or emergency reasons; • Appropriate complaint procedure to ensure complaints are logged, investigated and resolved; and, • Control of noise introduced into site induction to ensure that all operators on site, including contractors, are working in such a way to minimise noise.
<p><u>Hazard:</u> Activity noise levels (allowable hours)</p> <p><u>Notes on hazard:</u> Nuisance caused by the audible level of noisy activities on site at the nearest Sensitive Receptors</p> <p>There is a lower possibility of adverse comment arising from commercial and industrial operations in the area</p>	<ul style="list-style-type: none"> • Noise generated by careless material movement and management on site; • Noise generated by careless loading and unloading of road lorries/ dump trucks • Noise generated by activities involving mechanical plant and equipment; • Noise associated with falling/dropped material on site; and, • Manual noise including hammering, breaking out of concrete etc. 	<ul style="list-style-type: none"> • Where appropriate and possible burning equipment or hydraulic cutting will be used in preference to cold cutting techniques; • All materials will be handled, stored and used in a manner that minimises noise, this include the preclusion of dropping material which would be placed in all instances; • Routes and programming for the transportation associated with the works will be carefully considered in order to minimise the overall noise impact generated by these movements and will conform to the operational hours of the works as specified by the Montenegrin Planning Authority; • Provision of temporary acoustic barriers (or other means) for use when operations are exposed or are identified as problem activities; • Compliance monitoring of noise to ensure appropriate limits are being met; • Appropriate complaint procedure to ensure complaints are logged, investigated and resolved; and,

		<ul style="list-style-type: none"> Control of noise introduced into site induction to ensure that all operators on site, including contractors, are working in such a way to minimise noise.
<p><u>Hazard:</u> Plant and equipment noise levels (allowable hours)</p> <p><u>Notes on hazard:</u> Nuisance caused by the audible level of noisy plant on site at the nearest Sensitive Receptors</p> <p>There is a lower possibility of adverse comment arising from commercial and industrial operations in the area</p>	<ul style="list-style-type: none"> Increased noise levels as a result of general wear and tear; Use of noisy equipment; Use of generators for power supply; Increased noise levels due to incorrect operation of equipment; Engine idling noise when not in use; Increased noise levels as a result of lack of appropriate lubrication; and, Rattling noises from older equipment. 	<ul style="list-style-type: none"> Where possible modern, silenced and well-maintained plant will be used at all times, conforming to standards set out in EU Directives; Equipment including vehicles will be shut down when not in use; Engine compartments will be closed when equipment is in use and the resonance of body panels and cover plates should be reduced by the addition of suitable dampening materials. Any rattling noise will be addressed by the tightening of loose parts or the addition of resilient materials if appropriate; Semi-static equipment will be sited and orientated as far as is reasonably practicable away from noise-sensitive receptors and to have localised screening if deemed necessary; Generators and water pumps required for 24-hour operation will be super-silenced or screened/located as appropriate to reduce noise; Crane spindles, pulley wheels, telescopic sections and moving parts of working platforms will be adequately lubricated in order to prevent undue screeching and squealing; and, Where possible mains electricity will be used rather than generators.
<p><u>Hazard:</u> Materials handling generating vibration (allowable hours)</p> <p><u>Notes on hazard:</u> Damage or Nuisance caused by the level of generated Vibration specifically with regard to:</p> <ul style="list-style-type: none"> Hammering Horizontal drilling 	<ul style="list-style-type: none"> Vibration generated by inappropriate material handling on site including dropping and careless placement; Vibration generated by falling unsecured material and items; and, Vibration generated by toppling of inappropriately stacked materials. 	<ul style="list-style-type: none"> Careful consideration of material placement and handling; No dropping of material from uncontrolled heights; Appropriate training with regard to material handling and operational techniques so as to minimise vibration generation; Control of vibration introduced into site induction to ensure that all operators on site are working in such a way to minimise vibration; and, Appropriate complaint procedure to ensure complaints are logged, investigated and resolved.
<p><u>Hazard:</u> Operational plant generated vibration</p> <p><u>Notes on hazard:</u> Damage or Nuisance caused by the level of generated Vibration specifically with regard to:</p> <ul style="list-style-type: none"> Equipment Plant Ground Stabilisation 	<ul style="list-style-type: none"> Vibration generated by fixed and mobile plant operational on site; and, Piling and other ground stabilisation works. 	<ul style="list-style-type: none"> Piling and ground stabilisation would be suitably controlled on site if necessary (However, due to the large separation distances to the nearest receptors this is not considered an issue); Isolation of pumps and generators when positioned in close proximity to sensitive receptors to prevent direct vibration transfer; Selection of appropriate equipment for the task required; No use of hydraulic percussive breaking equipment; Appropriate training with regard to plant operational techniques so as to minimise vibration generation; Control of vibration introduced into site induction to

<ul style="list-style-type: none"> • Hammering • Horizontal drilling 		<p>ensure that all operators on site are working in such a way to minimise vibration; and,</p> <ul style="list-style-type: none"> • Appropriate complaint procedure to ensure complaints are logged, investigated and resolved.
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8.3.6 Residual Construction Phase Impacts

No residual phase impacts are considered likely during the construction phase.

8.3.7 Residual Operational Phase Impacts

The noise modelling has shown that noise exceedances occur in both day and night time scenario's and that some form of noise mitigation is required. In the absence of the mitigation outlined above, the residual impact would likely be 'high'.

Contractors Commitments

The following are offered in respect of the contractor's commitments;

- The contractor will ensure that the following recommendations are carried out as detailed in the ESIA environment and social action plan.
- A full time environmental supervisor will be appointed to oversee the delivery of the Construction Noise and Vibration Management Plans
- A noise assessment and management plan will be developed for the road during its operational to ensure the effectiveness of the noise mitigation measures. This will include, at a minimum the following items;
 - Identification of sensitive receptors;
 - Locations of monitoring points;
 - Schedule monitoring frequency;
 - Action/response plan;
 - Responsibilities; and
 - Reporting and communication plan

<p>Construction Traffic Management Plan, to be developed by the Contractor, will establish speed limits for construction vehicles and machinery at the construction site and the haulage roads used, and organize traffic so as to avoid disturbance of traffic flow in the other lane (traffic flow will not be interrupted during reconstruction of the road)</p>
<ul style="list-style-type: none"> - All construction equipment will comply with the requirements of EU Directive 2000/14/EC on noise emission in the environment by equipment for use outdoors (there is a lack of national legislation on outdoor equipment emission noise levels), - The equipment will be fitted with appropriate noise muffling devices that will reduce sound levels, - Construction works shall not be permitted during the night; the operations on site shall be restricted to the 07.00 -19.00 h, - The construction traffic plan shall establish speed limits for construction vehicles and machinery at the construction site and the haulage roads used, and organize traffic so as to avoid as much as possible populated areas, - Affected local residents will be kept informed on due time of the planned works and noise levels and Periods during which they will occur, - The location of noisy equipment will be chosen as far as possible from sensitive receptors. When near sensitive receptors, construction works will be scheduled and provided with the necessary resources so

<p>that the time of exposure is as short as possible,</p> <ul style="list-style-type: none"> - Good management practice will be used to distribute heavy noise equipment along the route so as to avoid the cumulative effects of noise, - In the case where noisy works would need to be performed at night or during a longer Period than one day at a given site, a noise shield shall be erected around the working area.
<ul style="list-style-type: none"> - Operate earthmoving equipment on the construction site far away from vibration-sensitive receptors as possible, - Activities such as demolition, earthmoving and ground-impacting operations shall be scheduled so as not to occur in the same time Period. The total vibration level produced could be significantly less when each vibration source operates separately, - Select demolition methods not involving vibration impact, where possible. - Avoid vibratory rollers and packers near sensitive receptors.
<ul style="list-style-type: none"> - All vehicles and machinery used at the construction sites will be subject to regular maintenance, - The equipment will be fitted with appropriate noise muffling devices that will reduce sound levels, - Every effort shall be carried out to comply with the correspondent noise limits for each area where the construction works will take place.
<p>Proposed noise mitigation measures leading to the decrease of noise exposure include measures implemented at the source of noise and measures that intercept the noise between the source and the receptor:</p> <p>Between source and receptor:</p> <ul style="list-style-type: none"> • Noise barriers (protective walls) with noise reduction potential by 5-15 dB (A). • Insulation of house windows and facade with noise reduction potential by 10-30 dB (A).
<p>Monitoring of traffic noise as per Montenegrin legislation and GIP will be implemented during the operation phase. Appropriate maintenance activities will be carried out to uphold the barriers' effectiveness of sound attenuation.</p>

9. Water Resources

This Chapter addresses likely significant Project impacts on local water resources. As such it includes an assessment of impacts on hydrology, hydrogeology and water quality during both the construction and operational phases of the proposed project. Information regarding the ecological importance of water resources is covered in Chapter 11: Biodiversity.

Water resources are critical to a wide range of human and ecological functions, and can be threatened by pollution and abstraction, as well as impacts of climate change. Impacts may affect both the water resources themselves (primary receptors) and users of those water resources (secondary receptors). Examples of such sensitive secondary receptors that could be affected by changes in water quality, flows and levels as a result of project construction or operation include:

- Abstractors of surface water or groundwater (for e.g. potable water or irrigation purposes);
- Aquatic flora/fauna;
- Water dependant habitats e.g. flood meadows.

Construction activities that can contribute to impacts on the water environment include abstraction (from surface water courses or groundwater), de-watering, wastewater discharge, excavations/blasting and the operation of machinery or vehicles that could result in oil/chemical spills. During project operation wastewater discharges and run-off from areas of hardstanding (which could contain mobilised contaminants) could all contribute to impacts on water resources.

Relevant Legislation and Guidance

Protection of the water environment is a target of Montenegrin, European and international legislation as well as a requirement of the EBRD's Performance Requirements (PR3), both for the protection of water users and the preservation of ecosystem integrity. The key Montenegrin and international regulations relevant to this Chapter are summarised in Chapter 3 of this Report.

Title of document	Issue of importance for the Project
<p>Law on Waters ("Official Gazette of Montenegro", No. 27/2007, 32/2011, 47/2011 48/2015 and 52/2016, 55/16, 02/17).</p>	<p>The Law regulates the legal status of water related resources and management. According to Article 114, the investor is obliged to prepare technical documentation for the construction/reconstruction of new and existing facilities. This involves carrying out hydrogeological research that can permanently, occasionally or temporarily influence the changes in the water regime. According to Article 118, the investor is obliged to obtain a Water consent before the construction or reconstruction of facilities where water related issues are evident. As such, technical documentation for the facilities and works is executed in accordance with the established Water conditions. According to Article 120, the investor is obliged, prior to the use of facilities and installations for which Water consent is required, to obtain a Water Permit that determines that the facilities and installations have been built in accordance with the Water consent.</p> <p>The Law requires wastewater treatment which is to be performed by the polluter. Pollutants must be partially or completely removed before the water is discharged into the public sewage system or another recipient. Additionally, the removal process should be carried out in compliance with the regulations on effluents (<i>emissions</i>).</p> <p>Article 84 of this Law prescribes that companies, other legal entities and persons discharging wastewater, shall install the measuring equipment to measure volumes</p>

	<p>and test the quality of wastewater and the impacts on the recipient. Relevant data shall be submitted to the competent authority. Regular functioning of equipment must be ensured with a journal kept to record historic usage and operation.</p> <p>Based on Article 74b, paragraph 2 of the Law on Waters, the Government of Montenegro made a <i>Decision on the determination of vulnerable areas in the aquatic area of the Danube and Adriatic basin</i>. Vulnerable areas in the aquatic area Danube and Adriatic basin are the areas that are eutrophic or susceptible to eutrophication. The Zeta River and tributaries (including the Susica River) are particularly vulnerable areas in the aquatic area of the Adriatic basin.</p> <p><i>Regulation on the classification and categorization of surface and groundwater ("Official Gazette of Montenegro", No. 2/07)</i> has established Environmental Quality Standard (EQS) values for all main rivers in Montenegro, in the format AnSnKn where: code A is a category for water representing basic physicochemical standards, S, Š or C is the assessment for fisheries water and K is the assessment for bathing water.</p> <p>Other: <i>Rulebook on quality and sanitary-technical conditions for discharge of wastewater into recipient and public sewerage, method and procedure for testing the quality of wastewater, minimum number of testing and content of report on determined wastewater quality ("Official Gazette of Montenegro" No. 45/08, 09/10, 26/12, 52/12, and 59/13).</i></p>
<p>Law on Waste Management (Official Gazette of Montenegro, No. 64/11 and 39/16)</p>	<p>This Law regulates types and classification of waste; planning of waste management; conditions for waste collection transport, treatment, storage and disposal; rights, duties and responsibilities of legal and physical persons involved in waste management; and conditions and procedures for waste management permits. Based on provision of the Law on waste (article 10) and "polluter pays principle" waste producers (legal or non-legal entities) are responsible for management of waste that they produce. Different types of waste should be collected separately, such as metal, plastic, glass and biodegradables (this is obligatory - article 11, Law on Waste). Collection of waste can only be carried out by registered companies or entrepreneurs with adequate equipment and personnel (Law on Waste, article 36). The Law (Article 54) prescribes methods for storing and disposal of construction waste; the need for development of a waste management plan and its content, reuse of construction waste on site, collecting and processing of the construction waste and handling with the cement asbestos waste.</p> <p>Other applicable regulations:</p> <p><i>Rulebook on more detailed content and method of drafting waste management plan for waste producers ("Official Gazette of Montenegro", No. 05/13 dated 23 January 2013);</i></p> <p><i>Rulebook on methods for testing hazardous waste properties and closer conditions to be fulfilled by an accredited laboratory for hazardous waste testing ("Official Gazette of Montenegro ", No. 21/2014);</i></p> <p><i>Rulebook on waste classification and waste catalogue ("Official Gazette of Montenegro", No. 059/13 083/16);</i></p> <p><i>Rulebook on construction waste treatment, method and procedure of construction waste processing, conditions and manner of disposal of cement asbestos construction waste("Official Gazette of Montenegro", No. 050/12)</i></p>

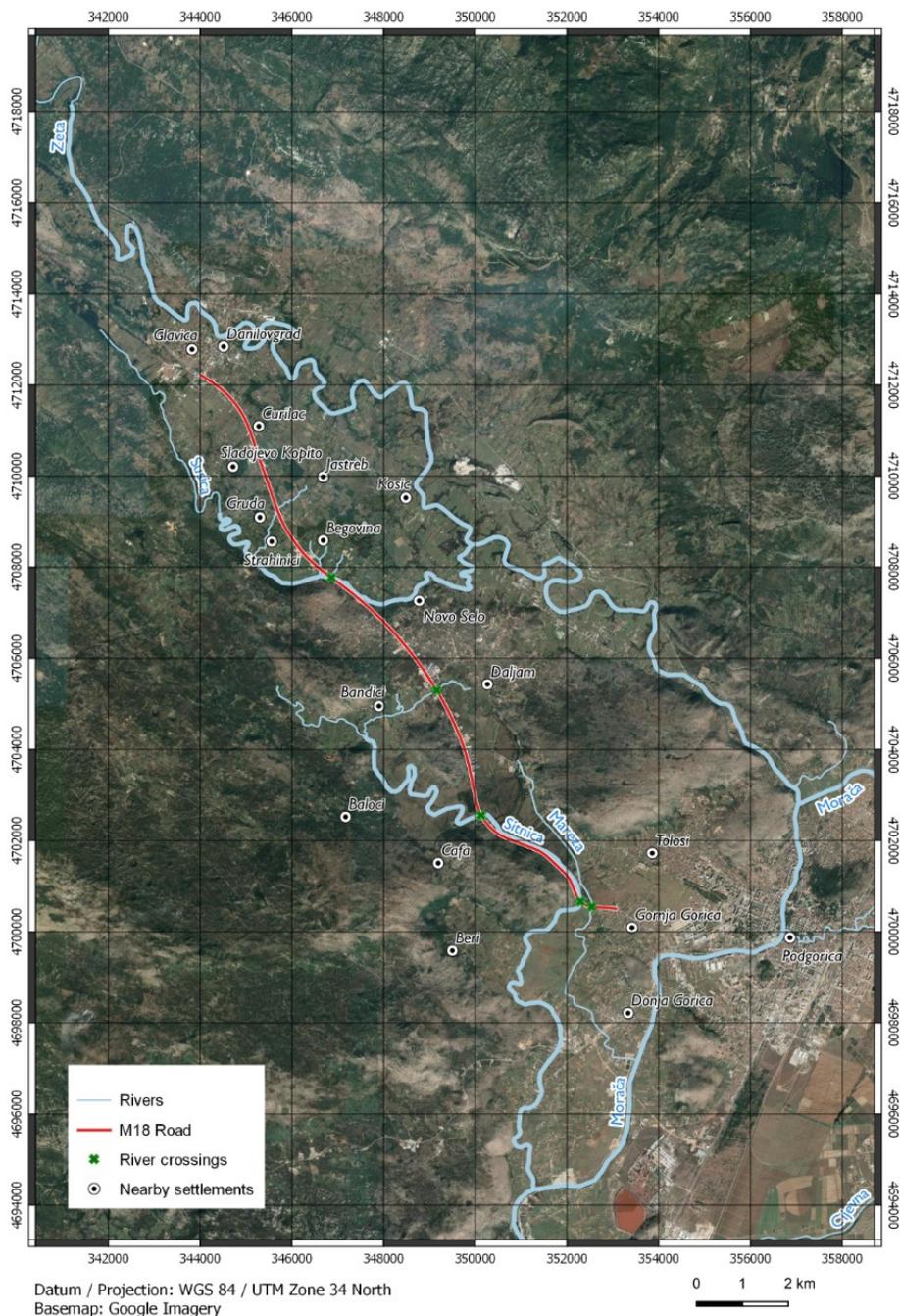
Baseline Conditions

This Section has been developed based on available Reports and documentation provided by E3 Consulting (i.e. a desk study) and the Client. No specific additional hydrometric or water quality surveys or monitoring have been undertaken to inform the S-ESIA.

9.2.1 Hydrology

Four watercourses will be directly impacted by the Project as a result of the reconstruction/rehabilitation of existing road bridges and the construction of new, parallel road bridges. Bridges will be constructed across the Susica, Matica, Sitnica and Mareza Rivers (please See Section 4 of this Report for a description of the works). In addition, the road expansion runs immediately adjacent to stretches of both the Rivers Susica and Sitnica. This is shown in Figure 9.3.1 below.

Figure 9.3.1: Rivers within Danilovgrad –Podgorica Area



The Zeta River is the most important tributary of the Morača River, which runs through Podgorica and is enriched by the waters from several karst springs as well as the Susica River. It is, however, also the main recipient of untreated wastewater and transporter of pollutants to the Morača River and ultimately to Skadar Lake. The Zeta joins the Morača just above Podgorica.

The **River Susica** is the largest tributary of the main **River Zeta** and is an ephemeral river; the main source of which is several karst springs located at the foot of the Dubrava Mountain (including the Oraska cave – see below). The River is approximately 15 km in length, and follows the approximate route of the M18 road from Bogetici to Podgorica. During January and February the water in the river can freeze if flow volumes are low enough. During November to March the River typically experiences high flows due to seasonal high levels of rainfall and is known to cause flooding of the surrounding area, including the village of Strahinjici. Snow melt from Garac (to the north) during April, can also result in high flows extending into May and June, especially when combined with intermittent rainfall events. During the summer, some stretches of the River contain pockets of still water, which is often used for agricultural irrigation purposes, but the watercourse is predominantly dry.

The source of the River Matija is at Donji Zagarac, from a number of karst springs located near to the village of Dandici. In its lower course, the River Matija is called 'Sitnica'. The upper reaches of the river are also fed by a number of small tributaries and flow volumes increase downstream until the confluence with the River Mareza. In total the River (Matija and Sitnica) is approximately 18km in length, with a catchment area of 183km². The River Sitnica is a tributary of the River Morača. The average flow rate is 10 m³/s, with high flows reaching over 200 m³/s. During the summer, the river can dry out (during July and August).

9.2.2 Hydrogeology

There are numerous groundwater sources in the Podgorica and Danilovgrad municipalities, due to the karst landscape and the presence of a number of limestone and dolomitic limestone aquifers. All groundwater flows are assumed to be towards the Susica, Matija and Sitnica Rivers.

The aquifer beneath the (River) Zeta plain is an important regional water resource; groundwater is abstracted to provide good quality potable water. However, most groundwater sources in the Project area comprise karst reservoirs, located in the landscape to the north east and south west of the River Zeta.

There are seven springs that are used for public water supply in the Municipality of Danilovgrad:

- Slatina springs
- Oraška Jama
- Žarića Jama
- Brajovića Jama
- Viški bunar
- Milojevića vrelo
- Mareza (although the water is pumped to the Podgorica municipality)

Yields are typically adequate during the spring, autumn and winter but water levels drop during the summer due to higher demand, including for irrigation of arable crops.

There are six main springs that are used to supply water in the Podgorica municipality:

- Mareza
- Zagorič
- Ćemovsko polje
- Vuksanlekići
- Milješ
- Dinoša

The Oraska Jama is an estavelle¹⁴ and is an important and reliable water source for Danilovgrad. The capacity of the Oraska Jama water source is 140 l/s (there is a possibility of reaching 180 l/s capacity through reconstruction of an old pumping plant).

The Mareza karst aquifer located in the Municipality of Danilovgrad is the main source of potable water for Podgorica (and supplies over 60% of the city's population). The capacity of the Mareza 1 water source is 470 l/s and the capacity of the Mareza 2 water source is 1600 l/s.

Vucji studenac is also a karst aquifer that provides an occasional / intermittent source of water for surrounding settlements during periods of heavy rainfall. There is no data available relating to the capacity of this aquifer.

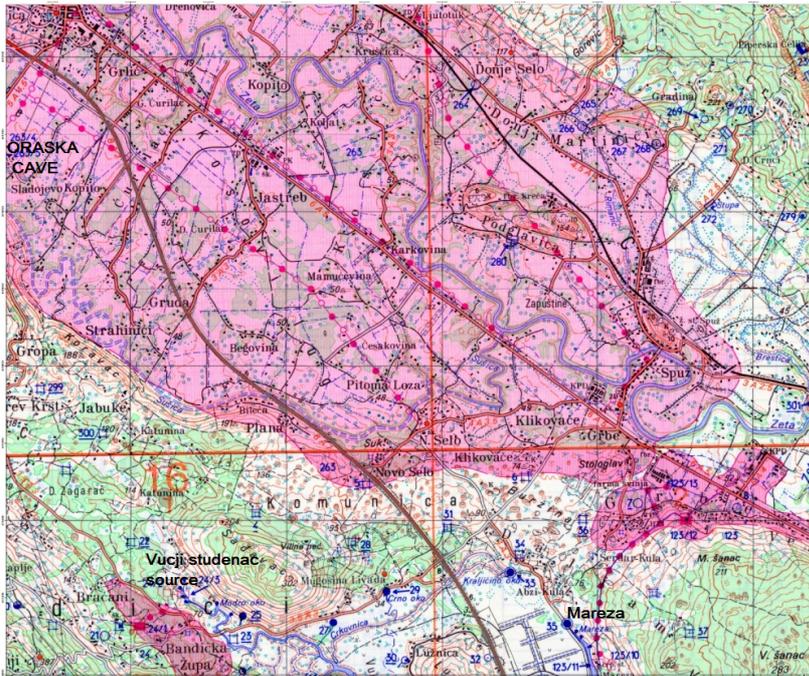
In accordance with the national Law on Waters (“Official Gazette of Montenegro”), the developer is obliged to prepare technical documentation relating to the construction of new facilities or the reconstruction of the existing facilities, and **carry out geological research**. This is seen as a key gap in the available baseline data for this Project, and will need to be addressed not only to ensure compliance with national legislation but to enable the likely significant impacts of the Project to be accurately predicted and effective mitigation measures identified where necessary.

9.2.3 Water Abstractions

Potable water supplies to settlements in the Project area are primarily sourced from groundwater from the Mareza karst aquifer (Podgorica) and the Oraska Jama (Danilovgrad), as well as from the intermittent rural water source, Vucji Studenac karst aquifer. All potable water is supplied by the Municipalities. The location of these three groundwater sources is shown on Figure 9.3.3 below.

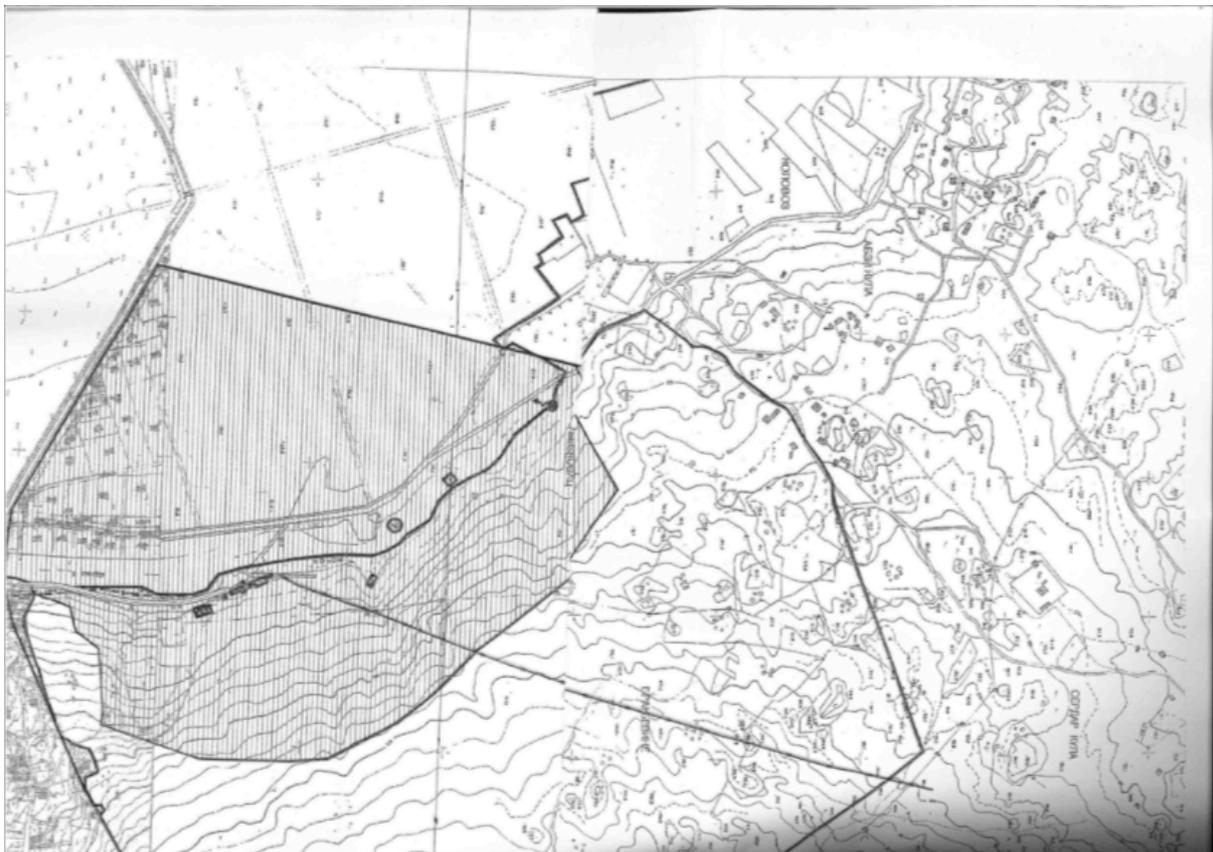
Figure 9.3.3: Location of Groundwater Sources

¹⁴ A karst landscape feature that can either act as a sinkhole or a spring, depending on groundwater levels.



There are no municipal or reported private water supply abstractions from the rivers being directly affected by the Project.

Figure 9.3.3b: Location of Mareza Spring



There is no available data on any private surface or groundwater abstractions. However, it is assumed that there are abstractions from rivers and boreholes by landowners / farmers for irrigation purposes.

The table below shows the water sources for each of the settlements within the immediate Project area.

Table 9.3.3: Water Sources for each of Settlement within the immediate Project Area

Water supply	
Settlement	Source / Pumping station (PS)
Bandici	Mareza
Curilac	PS Oraska Jama
Jastreb	PS Oraska Jama
Novo Selo	PS Mareza
Donji Zagarac	PS Vucji Studenac
Grlic	PS Oraska Jama
Glavica	PS Oraska Jama
Tolosi	Mareza
Baloci	Mareza
Beri	Mareza
Donja Gorica	Mareza

9.2.4 Water Quality

9.2.4.1 Surface Water Quality

There is no water quality baseline data for the four smaller rivers (the Susica, Matica, Sitnica and Mareza Rivers) that will be directly affected by the Project.

Water quality in the River Zeta is regularly monitored by the state via a fixed monitoring station and classified according to the Regulation on Classification and Categorization of Surface and Groundwater has established Environmental Quality Standard (EQS) values for all the main rivers in Montenegro. Water quality in the River Zeta (assumed to be current) is classified in Table 9.3.4.1 below.

Table 9.3.4.1: Water Quality Classification in the River Zeta

River	Reach	Water Quality Class	Water Characteristics
Zeta	Upstream from Brezovik (Vidrovan)	A ₁ ,S,K ₁	<p>Class A₁ indicates that water can be used for drinking after a simple physical treatment and disinfection.</p> <p>Class S indicates that water can be used for cultivation of noble fish species (Salmonidae).</p> <p>Class K₁ – excellent. Water that can be used for bathing.</p>
	Downstream from Brezovik to the point of confluence with Moraca	A ₂ ,C,K ₂	<p>Class A₂ indicates that water can be used for drinking after proper conditioning (coagulation, filtration and disinfection).</p> <p>Class C indicates that water that can be used for cultivation of less noble fish species (cyprinids).</p> <p>Class K₂ – satisfactory. Water that can be used for bathing.</p>

The River Susica is anecdotally known to be polluted as a result of wastewater discharges from the military barracks (Milovan Saranovic) in Danilovgrad and from the septic tanks / direct discharges of wastewater from households in the area. However, there is no baseline data available to verify this or to demonstrate the extent of any pollution.

9.2.4.2 Groundwater Quality

There is limited data available on the quality of groundwater in the Danilovgrad Municipality and this data is mostly old.

Groundwater quality testing of the Zeta Plains aquifer is undertaken via a number of private wells (not piezometric boreholes) at the following locations: Farmaci, Grbavci, Gostilj, Golubovci, Vranj, Dresaj and Cijevna. The water from this aquifer is categorised as Class A (Waters that are in natural condition, with possible disinfection, can be used for drinking) according to the Regulation on the classification and categorization of surface and groundwater ("Official Gazette of Montenegro", No. 2/07).

The groundwater from the Oraska Cave has a pH value of 7-7.8, a high oxygen content (O₂) up to 11 mg/l, in the absence of free ammonia (NH₃) and nitrite, with the consumption of KMnO₄ up to 5 mg/l and electric conductivity 140 to 370 µS/cm. No Sanitary Protection Zone (SPZ) has been established for this water source.

The water source Vucji Studenac is an occasional rural water source. There is no groundwater quality data relating to this resource.

The Mareza groundwater abstraction is of critical importance, as it is the main source of supply of drinking water to Podgorica (over 60% of the population). There is an on-going initiative to develop a Special Purpose Spatial Plan, with the aim of preserving the Mareza water source. This Plan would include part of both the Podgorica and Danilovgrad Municipalities. A Sanitary Protection Zone (SPZ) has already been established for the Mareza water source consisting of a total area of direct protected area of 64.08 ha plus a broader sanitary protection zone of 103.570 ha. It has not been

possible to confirm whether the road route passes through the Mareza SPZ or obtain a map of the SPZ from the Municipality.

9.2.5 Flood Risk

The existing M18 road passes through the flood plains of the Susica and Sitnica Rivers and there is frequent flooding of the road and surrounding landscape (at km 125+700, 125+160 to 126+350) and in the vicinity of the bridge on the Susica River during periods of heavy rain.

The Susica River causes flooding of 150 ha of land, including the Strahinjici settlement, where water levels can reach the houses.

Impact Assessment

9.3.1 Impact Criteria

Criteria for the assessment of impacts on the Water Resources have been developed based on professional judgement. As outlined in Section 5 of this Report, high impact and very high impact criteria are considered to be 'significant impacts'.

9.3.2 Construction Phase Impacts on Surface Water

9.3.2.1 Reduction in downstream flow volumes following surface water abstractions for construction activities

It is unknown at this stage whether surface water abstractions are proposed to provide water for construction activities (such as dust suppression, vehicle wheel washing or washing down the finished road surface), or from which watercourses they would be sourced. There are no known private surface water abstractions for potable water and local communities are assumed to rely entirely on drinking water supplied by the municipalities. However, local landowners can abstract water for irrigation purposes. The abstraction of surface water for construction activities could therefore have an impact on these receptors downstream, the severity of which would depend on the volume of water abstracted and the prevailing flow regime of the river.

Given that the rivers in the Project area do not have reliable flows all year and can be dry during the summer months, it is expected that water will be supplied from alternative sources (i.e. supplied by tanker from the municipal supply). However, if there are any surface water abstractions required for construction purposes, it is expected that these would be intermittent and temporary (i.e. over a period of hours or at the most days, not weeks) and therefore **medium criteria impacts** are expected at the most (i.e. **not significant**). There could be more severe impacts in the summer compared to the winter. This would need to be confirmed following the provision of a detailed construction methodology.

9.3.2.2 Mobilisation of suspended solids and or pollutants from washing down finished road surfaces resulting in direct contamination of any receiving watercourse

It is assumed that the storm water drainage system will have been installed prior to this activity taking place. It is also assumed that the oil/grease separators will effectively remove any hydrocarbons from the run-off. However, wastewater containing suspended solids and other pollutants (including bitumen and concrete compounds) following the washing down of the finished road surfaces may be discharged directly into watercourses, especially from the road surfaces on bridges, resulting in an increase in turbidity and decrease in water quality downstream of the point of discharge.

The detailed design (and proposed operation) of the storm water drainage system will ensure that water will not be discharged into rivers without adequate treatment and where the points of

discharge will be. However, it is possible that discharges following washing down of the finished road surface (especially as they could contain concrete and bitumen compounds) could result in significant impacts on water quality in receiving rivers.

9.3.2.3 Mobilisation of suspended solids and / or pollutants from dust suppression activities resulting in direct contamination of any receiving watercourse.

Emissions of dust and particulate matter (Pm₁₀) will occur during the construction phase during earthmoving and stockpiling activities, or as a result of vehicles and traffic driving over unmade access roads or the construction site. Elevated levels of dust can have adverse impacts on biodiversity and human receptors (nuisance and health). A GIP approach to mitigating elevated dust levels is to use water spraying to dampen down working areas and access roads. However, this can produce run-off containing mobilised particulate matter and suspended solids.

It is proposed that water will be sprayed as a dust suppression measure, given the presence of residential housing receptors within 100 m of the road construction site.

It is proposed that a 'crushed rock embankment' will be constructed to intercept run-off and protect rivers from sediments suspended in runoff during both the construction and operational phases of the Project at the following locations:

- The River Sušica bridge;
- Embankment 127,200 – 127,290 (90 m);
- Embankment 127,515 – 127,630 (115 m)
- At the Komanski bridge

The design of the embankment will be developed by the Contractor and its permeability and dimensions will be appropriate to prevent suspended solids from directly entering rivers. Furthermore, the installation of a barrier to surface run-off may have indirect effects on soil contamination and flood risk.

On the assumption that any dust suppression activities involving water spraying will be temporary and intermittent and that a proportion of the run-off will dissipate into the ground before reaching any watercourses, the impact criteria is predicted to be **medium** at most and therefore not significant.

9.3.2.4 Increased turbidity in rivers resulting from the disturbance of the river bed during bridge construction/reconstruction works

Typical impacts of turbidity on aquatic biodiversity receptors include the following:

- Reduction in the depth of light penetration into the water column affecting photosynthetic activity and thus primary productivity in submerged plants (a basic food source for aquatic animals).
- Physical damage to leaf surfaces by abrasion and smothering.
- Adversely affecting invertebrate populations, interfering with the behaviour, feeding and growth of fish species. It can also cause damage to fish gills by abrasion (hyperplasia), and clogging.
- Increasing the susceptibility of fish to disease. Mucus secreted by fish in response to high concentrations of suspended solids attracts bacteria and fungus.

Streams and rivers have different levels of sensitivity to increases in suspended sediment concentrations, depending on natural background levels and their seasonal use by certain animals.

Other factors are gradient of channel-bed, the adaptability of the flora and fauna and the particle size distribution of the sediment.

Occasional periodic increases in both suspended and deposited sediment are a natural phenomenon, and stream and river habitats adapt to cope with a range of sediment concentrations resulting from natural events. However, if the frequency and/or magnitude of sediment loading resulting from construction activities exceeds those of natural events, this can put serious stresses on watercourses and associated habitats.

Where there are high flows in a watercourse, the suspended sediments are likely to be diluted relatively quickly. However, where the watercourses are slow flowing or have limited flow it may take longer for sediments to be diluted/deposited and for baseline conditions to be restored.

Impacts from turbidity can therefore range from Negligible to Very High depending on the duration of the construction activities and the prevailing flow regime of the river.

As no construction methodology or schedule is available at this stage to define the scope of any in river construction activities to be undertaken or the duration of the works, it is not possible to determine whether or not any in river works associated with the reconstruction of the existing road bridges and construction of new, parallel road bridges will result in significant impacts.

9.3.2.5 Pollution of any receiving watercourses from concrete, bitumen or waterproofing compounds.

The proposed road structure incorporates a surface of asphalt concrete, with an underlying bituminous layer. Liquid cement is corrosive due to its high alkalinity and is highly toxic in aquatic environments. Bitumen compounds are also highly polluting if they enter watercourses. Any surface run-off that contains mobilised concrete or bitumen compounds will result in pollution of surface water should it discharge directly into watercourses, and impact on aquatic biodiversity and the suitability of water for irrigation purposes. It is not known at this stage whether any waterproofing materials will be used but these would also pose a risk of pollution to watercourses via surface run-off.

Owing to the toxicity of these pollutants, there is the potential that they could result in the localised degradation of baseline water quality by over 25% and therefore result in significant impacts. There is currently no baseline water quality data available for the watercourses in the Project area, however water quality monitoring is being proposed prior to and during construction activities that will trigger appropriate mitigation measures should thresholds for specified water quality parameters be exceeded. Monitoring and mitigation measures will need to be outlined in a Water Resource and Water Quality Management Plan to be implemented by construction Contractors.

9.3.3 Construction Phase Impacts on Groundwater

9.3.3.1 The collapse of karst landscape features due to blasting activities

Where possible the preference will be for pecking over blasting. This will not only be to avoid the legislation / security / storage associated with the use of explosives but to avoid significant impacts on groundwater resources and potential impacts on biodiversity within caves or caverns (such as bats).

However, if blasting is required, there are a range of potential impacts that can result as follows:

Impacts on groundwater flow and ground stability: the impact of the explosion can collapse or disrupt solution channels and develop areas of subsidence and sink holes, causing groundwater to

flow along different conduits or in different directions, which can also alter groundwater quality and quantity, localised depth to groundwater and the recharge characteristics of the aquifer.

Impacts of groundwater quality: Depending upon the explosive charge used, blasting can release a wide variety of soluble chemicals, such as nitrates, nitrites, perchlorates, and semi-volatile organic compounds. These products can enter the groundwater and therefore contribute to water pollution. Other potential complications with blasting include the incomplete combustion of explosive material, the “leaking” of chemical charges into surrounding cracks and fractures prior to detonation, increased turbidity within wells and karst conduits and geochemical reactions caused by the exposure of fresh geologic surfaces.

A comprehensive and appropriate blasting plan will be needed that considers and adequately addresses all potential impacts before this activity is undertaken. However, there is still the potential that blasting activities will result in significant impacts on groundwater quality and yield with associated impacts on the availability and suitability of groundwater for municipal water supplies and the water quality and volumes of groundwater spring fed rivers.

9.3.3.2 Creation of a pathway for contaminants from soils to leach into groundwater due to clearing and excavating the new road

No soil quality surveys have been undertaken to inform the S-ESIA or ESIA. In 2017 a soil quality assessment was undertaken at Donija Gorica in Podgorica (located near the south eastern end of the road route). This indicated elevated levels of chromium, nickel and fluoride as well as polycyclic aromatic hydrocarbons (PAH), above the maximum allowable concentration (MAC) stipulated by the Rulebook on permitted quantities of dangerous and harmful substances in soil and methods for their examination (“Official Gazette of the Republic of Montenegro”, No. 18/97).

Further soil quality surveys and assessments will need to be undertaken along the road route to ascertain whether there are additional areas of soil contamination that could be exposed during construction activities, especially given existing sources of soil contamination located along the road route in the form of re-fuelling stations.

Clearing and excavating the working strip to expand the road may create a direct pathway for contaminants present in the soil to leach into underlying groundwater. Any contaminated soil identified should be dug out and removed to an appropriate licensed landfill site. This should prevent any leaching of contaminants from contaminated soils into underlying groundwater.

9.3.3.3 Contamination of groundwater from the leaching of pollutants from cement, bitumen or waterproofing compounds

As outlined in Section 9.3.2.5 above, the proposed road structure incorporates both concrete and bitumen. As cement is highly alkaline, this can result in elevated levels of hexavalent chromium (Cr VI) if chromium is present in the soil. There may be a need to balance pH in retention and balancing periods to prevent this.

All of the municipal water supplies in the project area are sourced from groundwater, and the hydraulic connectivity of karst landscapes may result in a dispersal of any toxic pollutants present. .

9.3.4 Operational Phase Impacts on Surface Water

9.3.4.1 Direct contamination of receiving watercourses from the use of salt as a de-icing agent.

It is possible that discharges containing high concentrations of salt following de-icing activities could result in direct impacts on water quality in receiving rivers. Applied salt may also enhance the release of toxic metals from silts and sludge.

The use of salt as a de-icing agent will be temporary and infrequent and the impact on water quality is not expected to last longer than one month. It is also assumed that salt will be used during the winter months when flows in the rivers will be high and the dilution factor is therefore also high. As such, this is not predicted to result in significant impacts.

9.3.4.2 Direct contamination of receiving watercourses due to run –off from the road surface containing routine deposits from vehicles

A broad range of potential pollutants is associated with routine run-off from operational roads. These include:

- Combustion products of hydrocarbons
- Fuel and fuel additives
- Metal from friction and corrosion of vehicle parts
- Lubricants
- Particulate contaminants originating from vehicles and vehicle related activities including carbon, rubber, rust and metal filings.

The maximum permissible concentrations of contaminants in wastewater being discharged into a 'natural recipient' according to the Official Gazette of Montenegro 45/08, 9/10, 26/12, 52/12 and 59/13 are shown in Table 9.4.4.2.

Table 9.4.4.2: Maximum permissible concentrations of contaminants in wastewater being discharged to rivers

Parameter	Concentration
Temperature	30°C
Suspended substances	20 mg/l
Sedimentation substances	0.5 ml/l/2h
pH	6.5-9
COD	45mg/l
BOD	30 mg/l
Aluminium	10 mg/l
Arsenic	0.05 mg/l
Barium	4 mg/l
Lead	0.2 mg/l
Boron	1 mg/l
Cadmium	0.01 mg/l
Total chrome	0.5 mg/l
C _r ⁶⁺	0.0 mg/l
Iron	1.0 mg/l
Copper	0.5 mg/l
Nickel	0.5 mg/l
Mercury	0.005 mg/l
Silver	0.1 mg/l
Zinc	1.0 mg/l
Tin	0.3 mg/l
Selenium	0.01 mg /l
Active chlorine	0.05 mg/l
Ammonium	0.5 mg/l
Cyanide	0.005 mg/l
Fluoride	2 mg/l
NO ₂ ⁻	0.5 mg/l
NO ₃ ⁻	40 mg/l
Phosphorus	1 mg/l
Sulphates	250 mg/l

Sulphides	0.1 mg/l
Thiocyanate	0 mg/l
Oil and fat (plant and animal origin)	5 mg/l
Mineral oils	0.5 mg/l
Aldehydes	1 mg/l
Chlorinated hydrocarbons	0.1 mg/l
Nitro solvents	0.05 mg/l
Phenols	0.01 mg/l
Detergents	0.5 mg/l
Aromatic hydrocarbons	0.01 mg/l
Chlorinated pesticides	0.0025 mg/l
Organic-phosphorus pesticides	0.0025 mg/l
Organic components	0.01 mg/l
Total alcohols	1 mg/l
Total radioactivity	0.27Bq/l
Total insoluble substance	80mg/l
Coliforms TC in 100ml	5000MPN/100ml
Coliforms FC in 100ml	1000MPN/100ml
Faecal Streptococcus FS in 100ml	100 MPN/100ml
Pathogenic microorganisms	Without

Most organic compounds occurring in routine run-off have a very low solubility in water (i.e. polycyclic aromatic hydrocarbons) and can therefore be filtered out.

Further details of the design and proposed operation of the storm water drainage system are required to confirm whether or not water will be discharged into rivers without adequate treatment and if so, where the points of discharge will be. The design description in the national EIA states that "controlled collection of roadway storm waters is planned, and their purification to the required quality for getting into the recipient" (i.e. the nearest watercourse)". It is therefore expected that some form of wastewater treatment will be required in order to meet the maximum permissible concentrations of contaminants listed in Table 9.5.4.2 above. However, without the design details, it is not possible to confirm that discharges containing contaminants from routine deposits from vehicles will not result in direct impacts on water quality in receiving rivers. The proposed 31 oil and grease separators are expected to remove hydrocarbons, however there may be other residual contaminants in the wastewater such as heavy metals and particulates.

9.3.4.3 Increased local flood risk due to the introduction of additional in-river structures (bridges and culverts)

The River Susica is known to cause flooding in surrounding areas during periods of heavy rainfall (including flooding of houses in the Strahinjici settlement) and high flows in the River Sitnica can reach over 200 m³/s. The introduction of new structures (obstructions) within the river channel i.e. to support the new road bridges, will impede or change the path of floodwaters, thereby changing the shape and / or extent of the flood envelope. Design will need to ensure that return periods (in 100years) allow for elevated flood discharges. Flood control measures may also be required along riverbanks up and downstream of new in-river structures.

9.3.4.4 Direct contamination of surface water courses due to spills from vehicles following a road accident

On all operational roads, there is the risk that spillages will occur from vehicles following a traffic accident that may result in an acute pollution incident. The storm-water system is likely to intercept any spills, however there is the potential that spillages of e.g. chemicals or fuels will flow directly into rivers (especially if accidents occur on one of the road bridges). Where spillages do reach surface watercourses the pollution impact (whilst potentially severe) is typically of short duration

and the impact on water quality downstream will also depend on the flow velocity and volume in the river at the time. The development and implementation of Operational Emergency Preparedness and Response and Spill Response Plans in collaboration with local emergency services and the maintenance Contractor, should help to ensure that any spillages that occur are effectively controlled and impacts on watercourses are limited as far as possible.

9.3.5 Operational Phase Impacts on Ground Water

9.3.5.1 Infiltration of contaminated road run-off into underlying groundwater

Given that all municipal water supplies in the project area are sourced from groundwater aquifers it will be important to ensure that measures are built into the design of the road to prevent groundwater contamination.

Further details of the design and proposed operation of the storm water drainage system are required to understand whether or not wastewater will be discharged to the ground via soakaways. A soakaway would capture and gradually filter wastewater to capture contaminants and limit groundwater pollution. A Road Accident and Spill Plan is needed to address both the construction and operation phases of the road.

Cumulative Impacts

As outlined in the baseline section, there are existing surface water quality issues in the River Susica due to wastewater discharges from local houses and the military barracks in Danilovgrad. In addition, the recent and expected future increase in the volume of light industry in the project area may also result in an increase in wastewater discharges to this and other watercourses. This will further exacerbate any existing water quality issues in receiving water courses. The Municipalities and competent authorities are responsible for monitoring and managing such potential cumulative impacts.

Proposed Construction Phase Mitigation

In order to avoid or mitigate impacts to surface and groundwater quality during the Construction phase, the following best practice mitigation measures should be implemented:

- Handling of fuel, lubricants, oils and chemicals should take place in secure, bunded areas.
- Spill kits should be provided to clean up any polluted soils resulting from minor spills of fuel, lubricants, oils or chemicals.
- Fuel, oil or hazardous materials required to be stored, should be stored within secondary containment (designed to contain at least 110% of the total capacity of the storage containers) located greater than 100m from a watercourse or waterbody. Walls and floors should be constructed of concrete or other suitably impermeable material. No drains from the storage area should be installed.
- On-site vehicles and equipment should be inspected regularly for leaks and all leaks shall be immediately repaired. Incoming vehicles and equipment should be checked for leaks. Leaking vehicles/equipment should not be allowed on-site.
- All exposed soil and any soil stockpiles should be covered to prevent erosion run-off of mobilised suspended solids, or turfed with grass.
- Washing of construction equipment or vehicles should be forbidden within 100m of a watercourse.
- Construction equipment and vehicles should not be re-fuelled within 100m of a watercourse and re-fuelling should be undertaken on an impermeable surface.
- Secondary containment devices (drop cloths, drain pans) should be used to catch leaks or spills while removing or changing oils from vehicles or equipment. For small spills, absorbent materials must be used.

- Soil stockpiles should not be higher than 2m or have slopes greater than 25° to prevent run-off of sediment.
- Drip trays should be placed beneath all high risk equipment to contain spills/leaks of fuels/oils.
- The discharge of any untreated wastewater into a surface water body should be prohibited.
- Treated wastewater discharges should comply with specified water quality standards (including Project and national standards).
- Discharge of cement contaminated water to water bodies should be avoided as cement pollution results in high alkalinity and raises the pH, which can be toxic to aquatic life.
- All materials should be stored above flood level.
- No more than 100 liters of fuel, lubricant or any other hazardous material stored at any one point in the RoW.

The following mitigation measures should be implemented specifically relating to the construction / refurbishment of river ridges:

- Bridge construction activities should be undertaken when rivers are dry (i.e. during the summer months) to avoid silt pollution.
- If bridge construction works cannot be avoided when there are flows in the river, appropriate isolation techniques should be employed i.e. the installation of a coffer dam, to keep water out of the works area and controls installed downstream of the works to trap sediments such as silt fences, rock groynes, geo-fabric barriers and hay bales. In addition, turbidity should be monitored daily if sensitive biodiversity or human receptors are present, immediately upstream and downstream of the work site. If turbidity levels are shown to exceed specified Project standards, the operations in the river should cease until the river is flowing more clearly again.
- Spill kits should be provided for all worksites around rivers.
- Vehicle refueling should not occur within 100 meters of any surface watercourse.
- No waste materials should be dumped in the river, including concrete debris.
- Generators should be located more than 20 meters from the river on impermeable surfaces.
- No concrete waste from concrete mixers should be dumped in the river.
- Areas where concrete mixers can wash out leftover concrete without polluting the environment should be provided. This may be in the form of a lined settling pond at each bridge site.
- No hazardous liquids should be placed within 20 meters of the river.
- Portable toilets should be provided at bridge construction sites.

Proposed Operational Phase Mitigation

- Silt traps should be installed into the storm water drainage system to capture suspended sediments.
- All drainage structures should be designed to prevent uncontrolled discharges of wastewater to surface water courses.
- The use of pesticides should be avoided.
- The integrity and capacity of the storm water drainage system should be regularly maintained to avoid blockages, overflow and the direct discharge of untreated runoff into receiving rivers.
- Water quality in wastewater recipient watercourses should be monitored at least monthly during periods of river flows.
- Maintenance of the road and bridge decks should only be performed during dry weather to prevent runoff contamination.

Project Commitments

In addition to the implementation of all of the above listed mitigation measures, the following Project commitments should be adopted:

- A soil quality assessment will be undertaken to identify any existing areas of soil contamination. Any contaminated soil must be excavated and removed from the site to an appropriate licensed landfill.
- The storm water drainage system will not discharge untreated wastewater directly into local rivers.
- Any water required for construction activities will be provided by tanker from the local municipal supply.
- A water quality baseline and flow duration curves for all rivers to be directly affected by the Project will be established prior to construction commencing.
- A blasting plan will be produced.
- An assessment of afflux resulting from the introduction of new bridge structures in rivers and how this will impact on local flood risk will be undertaken.
- A Water Quality Management will be developed which will include pollution prevention and control management will be produced
- A Construction and Operational Spill Response Plan will be produced.
- A Method statement for bridge crossings will be produced.
- A Construction and Operational Emergency Preparedness and Response Plan will be produced.

Residual Construction Phase Impacts

If the relevant mitigation measures and Project commitments outlined above are implemented during the construction phase, especially that no untreated wastewater or water contaminated with cement should be discharged into a surface water body, no significant residual impacts are expected to surface water quality from the Project.

Until more details of the hydro-geological baseline and the proposed construction methodology are understood, it is not possible to state that there will no significant residual impacts on receptors of groundwater quality or yield. However the series of mitigation measures outlined above should be sufficient to avert or minimize any potential groundwater contamination from accidents and spills.

Residual Operational Phase Impacts

If the relevant mitigation measures outlined above are implemented during the operational phase, no significant residual impacts are expected on surface or groundwater quality or quantity from the Project.

There may be a residual impact on flood risk due to the construction of new bridges

10. Geology and Soils

Relevant Legislation and Guidance

Table 10.1: Relevant Legislation and Guidance for Geology and Soils

Title of document	Issue of importance for the Project
Spatial planning and construction legislation	
<p>Law on spatial development and construction (Official Gazette of Montenegro 51/08, 40/10, 34/11, 47/11, 35/13, 39/13, 33/14)</p>	<p>The Law governs the system of spatial planning, manner and requirements for construction of structures, as well as other matters of importance in terms of spatial planning and construction of facilities. The new Law envisages application of works with the documentation prescribed by the Law as construction conditions instead of construction permit. Instead of the use permit, the Law envisages the merger of technical inspection and professional supervision, which relieves the system of double controls.</p> <p>Chapter 3 prescribes requirements for construction of facilities. Additionally, it defines requirements and obligation of the Employer (Investor), Contractor and Engineering Supervision, as the main participants in construction.</p>
<p>Law on spatial planning and construction (Official Gazette of Montenegro No. 064/17, 044/18, 063/18)</p>	<p>The Article 93 prescribes that the Employer shall submit the stamped and reviewed final design in electronic and analogue forms to the Contractor prior to commencement of construction. The Article 100 prescribes that the Employer shall provide an engineering supervisor during the construction. The same Article prescribes that the engineering supervisor shall perform control of execution of works as per the reviewed final design, the present Law and separate regulations; control of compliance of works; control of quality of materials and works execution; regular monitoring of the pace of execution of works and adherence to contracted time limits; control of undertaking of measures he ordered to the contractor in order to eliminate deficiencies in the execution of works; control of undertaking of environmental protection measures etc.</p> <p>According to the Article 95, the contractor shall execute works in accordance with the reviewed final design; is marking boundary and building lines, elevation points of the structure and terrain alignment, in compliance with the reviewed final design; is organizing the building site in a manner which ensures access to the location, unimpeded traffic and protection of the environment during the building; is ensuring the safety of the structure, health and safety at work of employed persons and protection of the environment (adjacent structures and infrastructure); is keeping a construction log and a measurement book; is ensuring measurements and geodetic monitoring of soil and structure behaviour during the building; treating construction waste created during building at the building site in compliance with the waste management plan, drawn up in compliance with separate regulations; is removing temporary structures that served for the execution of works at the building site within 30 days as of the date of works finalization. Article 58 stipulates basic requirements for structures, Articles from 76-80 prescribed types of design and other technical documentation; Articles 27, 32, 33 and 34 prescribe the obligation of MSDT for public disclosure and consultation during development and approval of spatial plans.</p>

<p>Law on Waters ("Official Gazette of Montenegro", No. 27/2007, 32/2011, 47/2011 48/2015 and 52/2016, 55/16, 02/17).</p>	<p>The Law regulates the legal status and integrated water, water and coastal land and water facilities management, conditions and methods of water activity and other significant issues of water management and water resources. According to the Article 114, the Investor is obliged, in order to prepare technical documentation for construction of new or reconstruction of the existing facilities and carrying out geological researches and other works that can permanently, occasionally or temporarily influence the changes in the water regime, acquire the Water Conditions. According to the Article 118, the Investor is obliged to obtain a Water consent before the construction of new and reconstruction of existing facilities and installations and other works for which water conditions are required. By Water consent it is determined that the technical documentation for the facilities and works is done in accordance with the established Water conditions. According to Article 120, the Investor is obliged, prior to the use of facilities and installations for which Water consent is required, to obtain a Water Permit that determines that the facilities and installations have been built in accordance with the Water consent.</p> <p>The Law predicts the obligation of wastewater treatment which is to be performed by the pollutant. This process is to be performed in the way that the substances which may pollute water are partially or completely removed before the water is discharged into the public sewage system or some other recipient. Additionally, the process of removing these substances should be carried out in compliance with the regulations on effluents (<i>emissions</i>).</p> <p>Article 84 of this Law prescribes that the companies, other legal entities and physical persons discharging wastewater into recipients and public sewerage systems, shall install the measuring equipment, measure the volumes and test the quality of wastewater and the impacts on the recipient, and shall submit the relevant data to the competent authority, as well as they shall keep such equipment in order, ensure its regular functioning and shall keep the journal on the operation of the wastewater treatment equipment.</p> <p>Based on the Article 74b, paragraph 2 of the Law on Waters the Government of Montenegro made a <i>Decision on the determination of vulnerable areas in the aquatic area of the Danube and Adriatic basin</i>. Vulnerable areas in the aquatic area Danube and Adriatic basin are the areas that are eutrophic or susceptible to eutrophication, areas intended for catching of drinking water and other protected areas. Among vulnerable areas in the aquatic area of the Adriatic basin is the Zeta River with tributaries (including Susica river).</p> <p><i>Regulation on the classification and categorization of surface and groundwater ("Official Gazette of Montenegro", No. 2/07)</i> has established Environmental Quality Standard (EQS) values for all main rivers in Montenegro, in the format AnSnKn where: code A is a category for water representing basic physicochemical standards, S, Š or C is the assessment for fisheries water and K is the assessment for bathing water.</p> <p>Other: <i>Rulebook on quality and sanitary-technical conditions for discharge of wastewater into recipient and public sewerage, method and procedure for testing the quality of wastewater, minimum number of testing and content of report on determined wastewater quality ("Official Gazette of Montenegro" No. 45/08, 09/10, 26/12, 52/12, and 59/13).</i></p>
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Key Issues from Scoping

Road projects can have major impacts on soil by causing temporary increased exposure to wind and water erosion following vegetation removal, creating changes in physical properties through compaction, and changes in chemical properties through uncontrolled discharge of polluting substances, discharge of wastewater and deposition of air pollutants, etc. The following specific issues were identified for further evaluation:

10.3.1 Construction Phase

Table 10.3.1 Scoping Matrix - Project Construction Phase

Source of Impact	Receptor(s)	Key Receptor Sensitivities	Scoped In/Out	Justification for Scoped In/Out
Construction Phase				
Loss of soil, including removal, erosion and surface sealing	Land use (agricultural) Biodiversity and habitat loss	Loss of soil and soil productivity reduces the potential of the land for productive use in particular agriculture, although it is acknowledged that land use currently is of low sensitivity Biodiversity impact through habitat loss as soil is removed/deposited.	In	Issues of soil erosion and quality/productive use reduction as a result of loss of structure and chemical contamination require further assessment and mitigation plans developed to ensure good practice and compliance with legal requirements.
Disturbance and degradation effects on soil quality and productivity, including land use			In	
Impacts from compaction and erosion of sensitive soils, especially along elevated areas			In	
Existing contamination and potential for contamination from released solid and liquid material	Ground and surface water both considered to be high sensitivity. Potential risk to workers	Local rivers offer habitat for ecological receptors. Groundwater has potential for potable abstraction (drinking water).	In	

10.3.2 Operation Phase

Table 10.3.2 Scoping Matrix - Project Operation Phase

Operations Phase				
Operation of the road	Land use proximal to the road	Sensitive habitats falling within 50m of the road edge. Land use for agricultural use within	In	Potential for chemical contamination of productive land and impact to local biodiversity.

Baseline Conditions

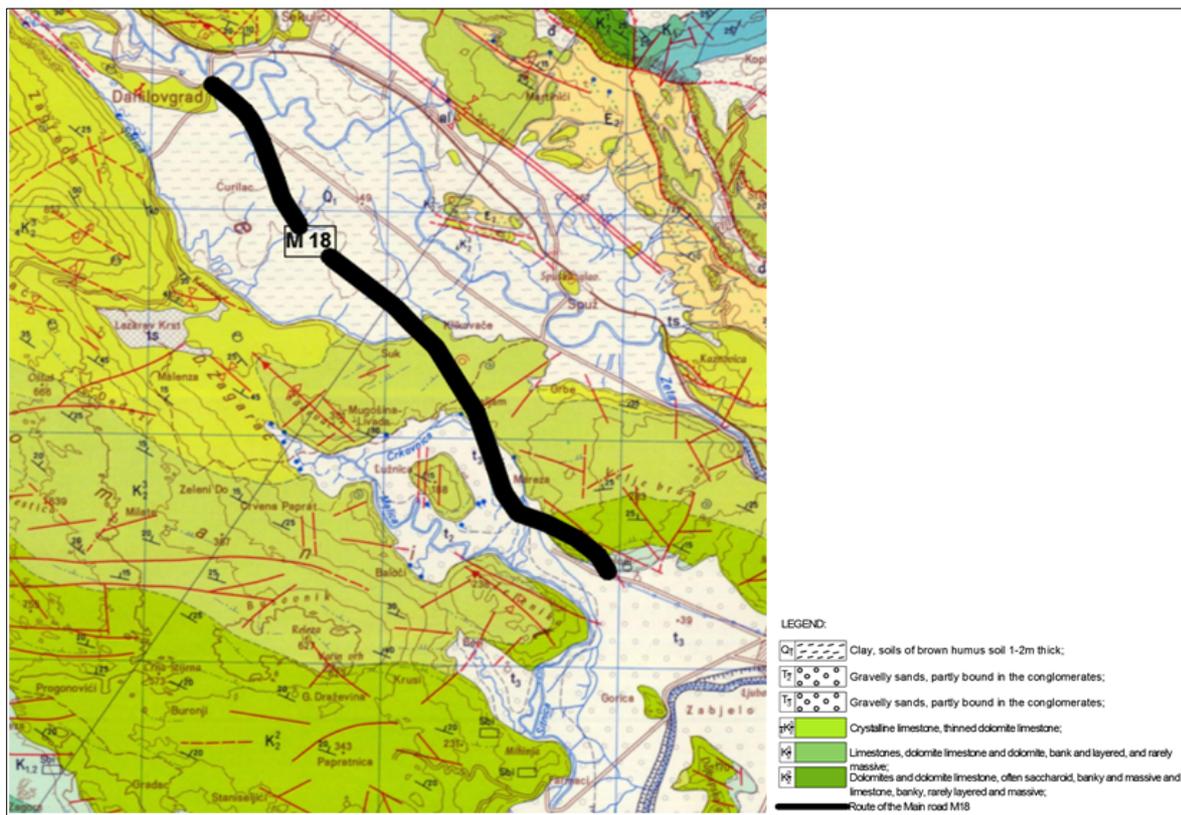
10.3.1 Geology

From south east to north west the proposed route of the road crosses over 'drift' geological deposits comprising sediments sitting over a periglacial karst field, specifically terraced sediments of gravelly-sand composition. These pass in 'solid' geology towards the centre point of the route formed of carbonite-dolomite, passing back into Quaternary clay (Q) which occupies the largest part of valley of Zeta river in Bjelopavlici. These are green, yellow or whitish clays, whose thickness reaches up to 80 m. They have a mild humus layer with a thickness of 1-2m.

This intense sedimentation in the plains has resulted in a dipping of the strata to take on a sub horizontal inclination giving a slight (less than 5°) drop to the south.

The hills rise above the plain part of the terrain, locally named as the Zelenika, Luznica, Sancevi and Plana hills with a height of about 200 m (above sea level).

Figure 10.3.1a: Geological map of the area of Project



The terrain belongs to the geotectonic unit of the Old-Montenegrin overlapping fault. The oldest rocks are from the upper Triassic period the youngest with sediments from the Eocene period. Turonian age sediments (K_2^2) are represented by yellow-whitish banked and massive, often saccharide dolomites, dolomite limestone and banked rarely layered and massive limestone. This section is characterised by predominance of dolomite and dolomite limestone, above limestone.

Xenon age sediments (K₂³) construct the terrain in the Koman area, occurring as grey-whitish to grey-yellow limestones, as well as dolomite limestones and dolomite. They are usually banked and layered, rarely massive.

10.3.1.1 Geotechnical characteristics

According to the engineering-geological composition and geotechnical characteristics of the terrain, the following geotechnical types are found along the proposed route of the road:

1. Embankment
2. Clay, glacial-limnal origins, ochre-grey
3. Clay, diluvial origin, dark brown black
4. Sandy gravel
5. Clayey gravel
6. Limestone, dolomite limestone and dolomite

The following table gives a description of all the listed geotechnical areas.

Table 10.3.1a - Detailed description of geotechnical areas in the Project area

Geological Areas	Description
1. Embankment	<p>The embankment exists along the entire road, but it is isolated as a separate unit in the part of the road where its thickness exceeds 2 m. The embankment is composed of the upper layers of the traffic structure, the area 1a and the lower layer, the area 1b.</p> <p>This is assumed to be the man-made structure that make up the road formation.</p> <p>The area 1a is represented by sandy-dusty gravel from which the buffer and the final layer of the roadway were built. The area 1b is represented by a clayey debris, subordinate with gravel and clay with debris.</p> <p>The observed thickness of area 1a ranges from 0.9 to 1.6m, while area 1b is characterised by thickness which ranges from 1.0 to 2.2m, i.e. it reaches the depth of 3.1m. The embankment where it reaches a thickness of 2m or more is found along the following chainages: km 115+405 – 119+780 (bridge on the river Susica), km 123+175 – 123+980, km 125+160 – 126+120 (bridge on the river Matica), km 126+160 (bridge on the river Matica) -126+390 and km 129+770- 129+931 km (bridge on the river Mareza), which is characterised by composition in which clayey gravel represents the dominant component. According to the GN200 categorization, the material of the area 1 belongs to the II and III excavation categories.</p>
2. Clay, glacial-	<p>Clay sediments are predominant in the subject area. Clay in area 2 is characterised by variable dust-sandy composition, along with medium to high plasticity. Sand occurs in the form of interlayers, usually mm-dimensions, with unequal distribution in the space. The</p>

liminal origins, ochre-grey	<p>geotechnical area 2 is found from the initial chainage to the bridge on the Susica river km119+780.</p> <p>According to the GN200 categorization, the material in the area 2 belongs to the I and II category of excavations.</p>
3. Clay, diluvial origin, dark brown black	<p>Clay characterised by dark brown to black colour also has dusty-sandy attributes, whereby it may also be characterised by medium to high sandiness. It reaches a thickness up to 2.5 m. Area 2 is located below this layer, thus it significantly predetermines the conditions of the road construction with its position and characteristics.</p> <p>The part of the terrain that makes up this area is occasionally floated, characterised by a high degree of flooding, which partially overlaps the road. It makes up the foot of the embankment at the chainage: km: 125+160 - 126+350.</p> <p>According to the categorization, material in the area 3 belongs to the I and II category of excavations.</p>
4. Sandy gravel	<p>This gravel of glacial-fluvial origin is sandy, variably dusty and poorly clayey on the surface and up to the depth of 1.0 m.</p> <p>The sediments are well granulated and partially less to more strongly connected into conglomerates by carbonate binder.</p> <p>The area 4 makes up the terrain from the chainage km 129+210 to the end of the route.</p> <p>According to the GN200 categorization, the material of the area 4 belongs to the II-IV category of excavation.</p>
5. Clayey gravel	<p>Sediments of alluvial origin are heavily clayey and poorly compressed in relation to gravel of glacio- fluvial origin. They are also dusty sandy, but unevenly granulated.</p> <p>These sediments were found in the Sitnica riverbed, at the institute Komanski most), the borehole Bkm-2, up to the chainage km 129+210.</p> <p>According to the GN200 categorization, the material of the area 5 belongs to the II-III category of excavation.</p>
6. Limestone, dolomite limestone and dolomite	<p>The complex of carbonate rocks is represented by limestone and dolomite limestone in rare stratification with dolomites and marlstone limestone. According to the GN 200 categorisation, it belongs to the V-VI category of excavations, where the excavation will be carried out mechanically, by the mandatory use of explosives. Terrain surface in the subject area has characteristics of the IV category terrain, where excavation also can be done using heavy construction machines with the use of a concrete breaker.</p> <p>Limestone and dolomite limestone represent favourable material for formation of embankments.</p> <p>It makes up the terrain on the following chainages: after the bridge on the Susica River km119+830 to km123+175, chainage km123+980 - 125+160, chainage km126+350-129+105,</p>

	bridge on the Sitnica river.
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10.3.1.2 Geotechnical findings

Geotechnical conditions of the proposed construction have been analysed by sections, in accordance with the change in the composition of the soil and subsequent change in the geotechnical conditions of construction.

Geodynamic processes and phenomena are noted at the following sites:

- Geotechnical area 1a (chainage 117+850- to 117+880, 119+450 to 119+550 and 119+750 to 119+789), medium load bearing capacity with CBR = 7-9% and high subsidence;
- Geotechnical area 2 (chainage 123+160 to 123+900), medium load bearing capacity with CBR = 7-9% and high subsidence, the possibility of groundwater in the excavations;
- Geotechnical area 5 (Ch.km 125 + 160 to Ch.km 126 + 330), recently flooded terrain, low load and increased landing, with an average height of about 2.5-4.5m up to a height of 6m. It is proposed to replace this unit with appropriate carbonate rubble, coupled with a stabilization process which will include use of limestone.
- Geotechnical area 6, bridge Sitnica (chainage 129+165 – bridge "Sitnica" to chainage of 129+200). The terrain occasionally floods, and it is prone to erosion and situation processes depending on the flow of the Sitnica river.

Hydrogeologically, the right of way varies from being water permeable to watertight:

- Water permeable areas are part of the area 1, embankment, i.e. area 1a, areas 4, 5, and 6. According to the type of porosity, water permeable areas have intergranular and crack-cavernous porosity. Good water-permeable intergranular porosities have been recorded in the areas 1a, and 4. When it comes to the construction zone of the designed road and objects, significant layers of conglomerates which would affect the character of the water permeability of the area have not been identified. Laboratory experiments showed that the coefficient of permeability (USB) is 4×10^{-1} to 1×10^{-2} . The water-permeable area of good to low water-permeability was recorded in area 5. It is characterized by the locally higher content of the clay component, so the coefficient of permeability (USB) can reduce to 4×10^{-4} . In the area 6, carbonate rocks are considered to have attributes of high water-permeability, characterized by cracks and cavernous porosity.
- Watertight areas are: areas 1b, 2, and 3. The watertight areas are characterized by a low coefficient of permeability (USB) of 4×10^{-7} , as confirmed by laboratory tests. Within the watertight areas, especially in area 2, there are layers of sand that are water-permeable and contain groundwater.
- Groundwater occurs both in the layers of sand and in the carbonate rocks in the area 6, where the groundwater level was determined during exploratory drilling for the "Matica" bridge, on

Bm-2, at the point of reaching the area of the carbonate rocks at the depth of 35m. All groundwater gravitates towards the existing streams Susica, Matica and Sitnica.

- Surface waters also gravitate towards the mentioned streams and their tributaries, but during heavy precipitation, there is a regular flooding of terrain in the vicinity of the bridge on the Susica river and the terrain in area 3.

10.3.1.3 Seismicity

The territories of the Municipality Podgorica and the Municipality Danilovgrad are located within an area with very pronounced seismic activity.

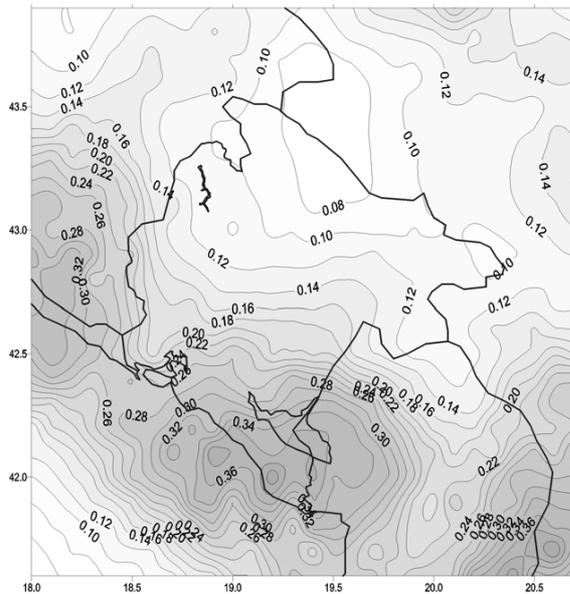
Figure 10.3.1c shows a map of seismic hazards in regards to Montenegro and the environment (expected maximum horizontal acceleration of ground in parts of gravity) within a return period of 475 years (EUROCOD 8) and a 70% probability of occurrence.

Figure 10.3.1b - Map of seismic regionalization of Montenegro



Figure 10.3.1b. Map of the seismic hazard of Montenegro and the environment (expected maximum horizontal acceleration of ground in parts of the weight of gravity) within the return period of 475 years (EUROCOD 8), and a probability of realization of 70%.

Figure 10.3.1c: - Map of the seismic hazard of Montenegro



According to Figure 10.3.1b (map of seismic micro-regionalization), road right of way falls within the zone with the lowest degree of seismic intensity (VIII). However the areas of Podgorica and Danilovgrad belong to seismologic zones from B₃ to C₃, which indicates a significant difference in ground acceleration, i.e. the intensity of earthquake effects on the surface of the terrain.

On the basis of the average maximum ground acceleration expected in these zones, the seismic parameters for the design have been determined for the indicated return periods of time. This assessment uses the assumption that the road structure has a normal period of depreciation of 50 years and a period of operation of 100 years.

The expected maximum horizontal acceleration of a_{max}^0 (% g) and the expected maximum intensity of the earthquake I_{max} (EMS98) in the return period of 50 years, with a probability of realization of 63% is shown in Table 10.3.1b.

Table 10.3.1b: Expected maximum horizontal acceleration and expected maximum earthquake intensity

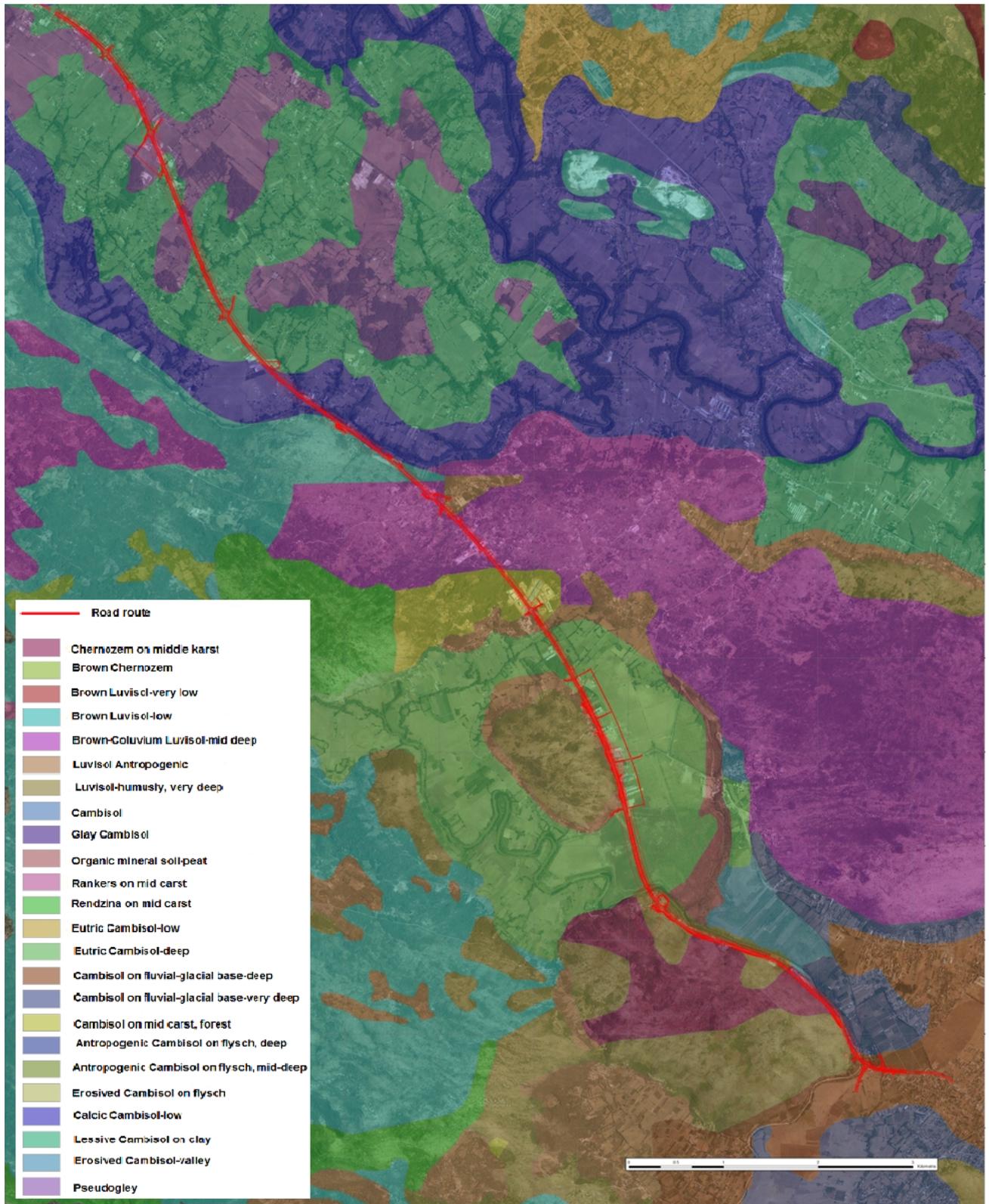
Seismic parameter	Type of earthquake for a return period of 50 year-zone B ₂	Type of earthquake for a return period of 50 year-zone C ₃
I_{max} (EMS98)	7,30 – 7,35	
a_{max}^0 (%g)	0,14	0,22
Ks	0,035-0,037	0,055

10.3.1.4 Soil

Along the route of the road the most represented soil types are:

- Leached eutric brown soil on lake sediments. As a consequence of the heavy mechanical composition and subsequent poor water-physical properties, especially poor water-permeability and low air capacity, cultivation of land made up of this soil type is difficult. Therefore, the largest part of this soil is taken up by meadows, while only small areas are arable land.
- Vertic eutric brown soil on lake sediment (Eutric Cambisol) commonly occurs along the Zeta and Susica rivers, then in the area of Podglavica, Donji Martinici, Klikovaca, Sladojevo Kopito, Podkula. The soil is taken up by arable land, meadows and orchards. Limits occur in water-physical properties because of the heavy mechanical composition, especially in the (B) horizon, which is poorly water-permeable and due to unfavourable nugget structures.
- Pseudogley is represented in the lowest parts of the Bjelopavlicka Plain, in the central part of the Kosovo-Luski Plateau, in the area of Brinje, Mlak, Kosic, Duboke Lazine, Cesakovina and Pitome Loze. Factors that have influenced on the creation of Pseudogley, besides the plain relief, are the clayey substrate of forests and underbrush. The clayey substrate is poorly water-permeable, so due to the changing of the wet and dry phase, there are occurrences of gleisation of soil. Areas characterised by pseudogley are mostly taken up by meadows and pastures.

Figure 10.3.2a: Pedological map of the Project area



10.3.1.5 Land use

Areas proximal to the proposed route are composed of built up land with settlements interspersed with a mosaic of parcels of land of semi-natural vegetation, grasslands and shrub. According to the

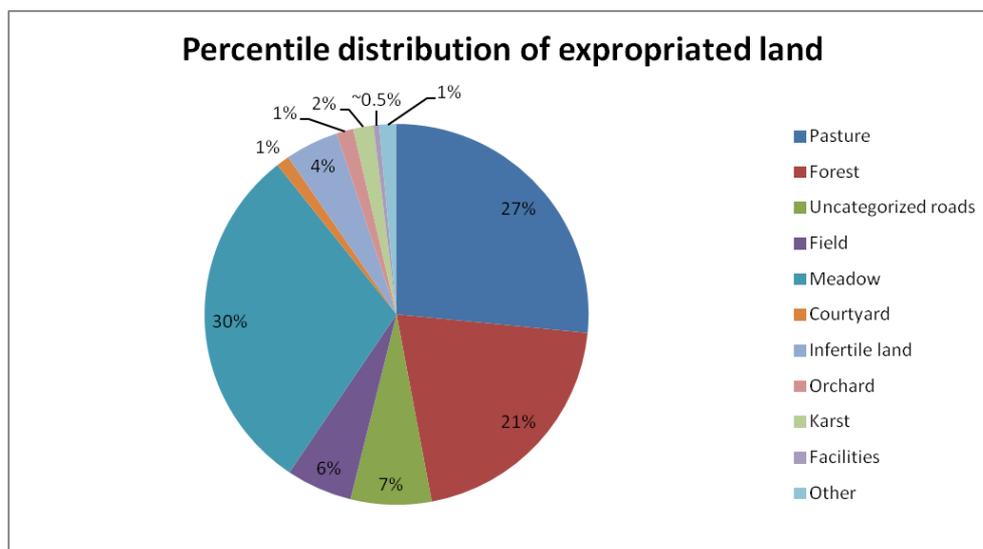
information from the expropriation plan the land use is characterized by low quality fertile land which is classified into different categories (fields, meadows, forests etc.). Intensive agriculture is not present.

Table 10.3.2: Overview of cultures by cadastral municipalities of Danilovgrad along the Project zone

Cadastral municipality	Agricultural land				Woods	River basin land	Building land and other land (rubble/karst terrain, infertile land and other)
	Workable agricultural land			Grasslands, swamps, reeds and wetlands			
	Fields and gardens	Orchards and vineyards	Meadows				
Bandici	31,6	14,7	203,7	145,1	1014,5	7,2	606,7
Curilac	116,9	45,1	362,5	26,5	76,4	5,1	57,1
Donji Zagarac	27,1	33,3	220,3	384,5	876,9	15,8	97,4
Glavica	34,8	23,2	297,1	92,5	160,3	2,9	119,6
Grlic	59,9	13,9	87,2	7,2	14,8	1,3	23,8
Jastreb	55,7	24,4	491,7	76,1	81,8	3,3	69,8
Novo Selo	39,3	14,1	199,5	289,3	94,5	13,8	56,1

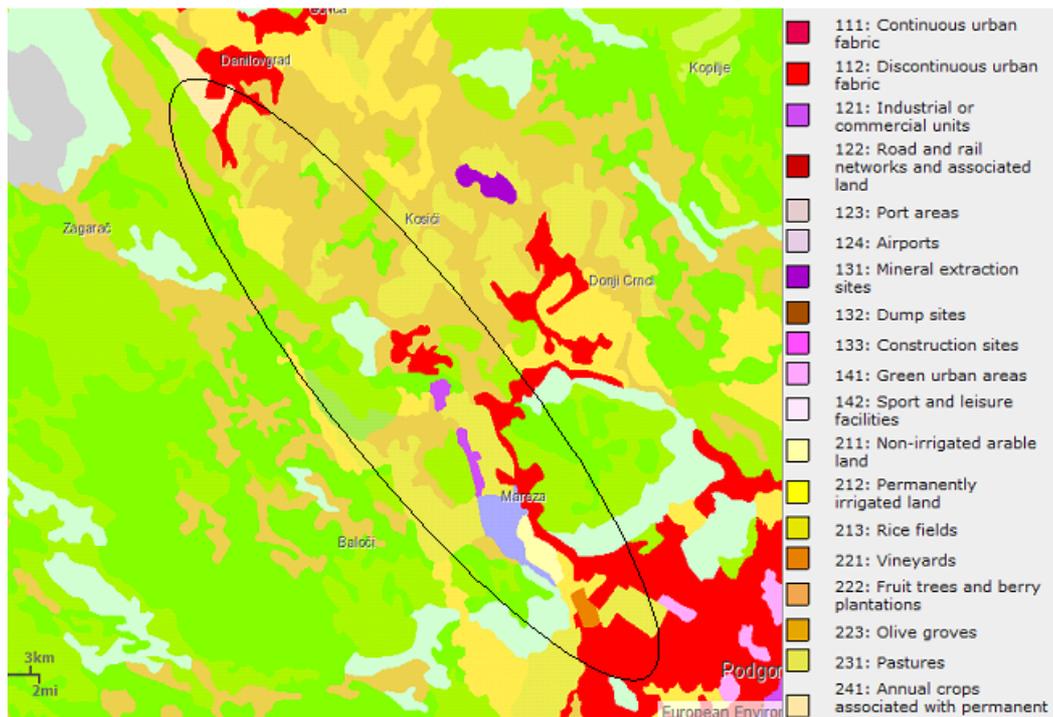
About 18ha of land in total will be occupied for the purpose of widening the road. The following figure provides the percentile distribution of different types of land that will be expropriated.

Figure 10.3.2b: - Percentile distribution of different types of the expropriated land



The key areas of urbanization are Danilovgrad and Spuz. In addition, there are significant settlements on the Bjelopavlici plain which had a stable demographic development in the period from 2003 to 2011, and in which a significant increase in housing construction has been recorded recently. Contrary to the aforementioned process, dispersed construction is present in the highland parts of the municipality. Informal construction is also included (it is mostly related to individual housing units in the procedure of the General Urban Plan of Danilovgrad). Types and categories of land in the Project area are presented in the following figure.

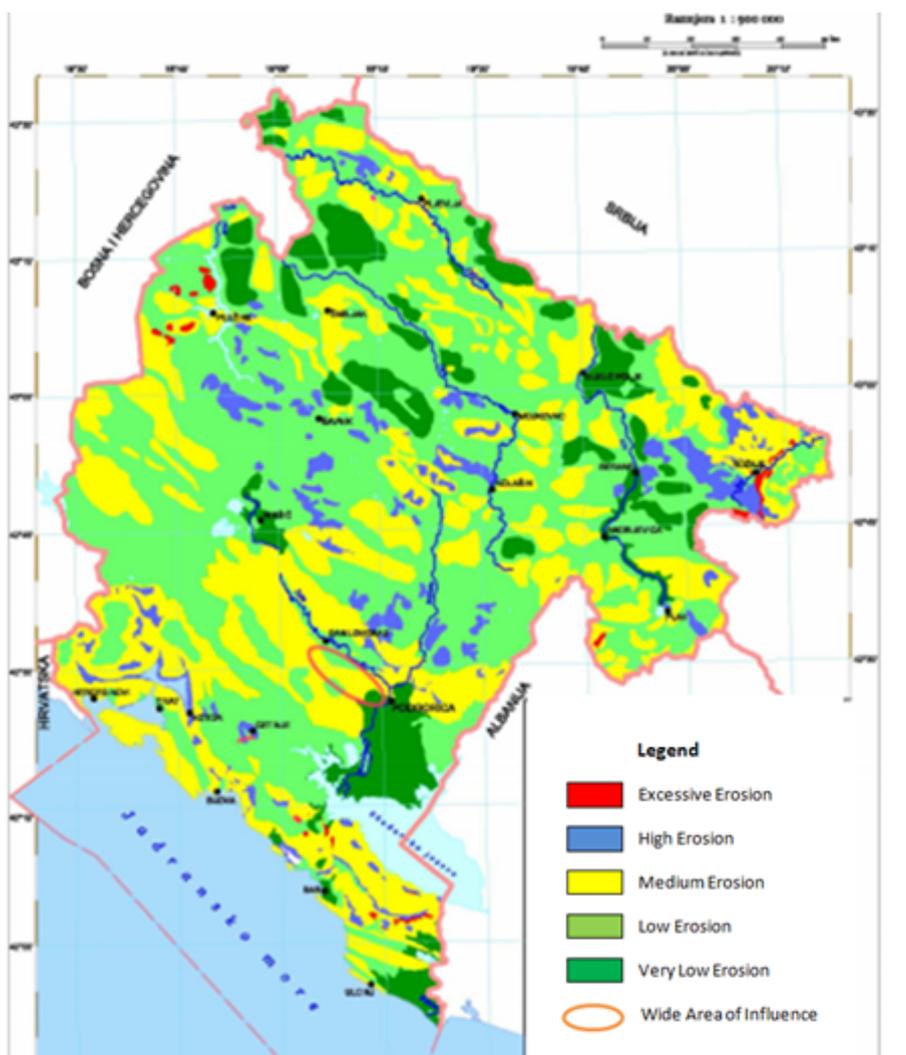
Figure 10.3.2c: Corine land use in the Project area



10.3.1.6 Erosion

The territory of Montenegro is characterised by all erosion types, excessive through to very low. The route of the project passes through very low to medium erosion types, see Figure 10.3.2d.

Figure 10.3.2d: Erosion – existing condition



Source: Spatial Plan of Montenegro by 2020

10.3.1.7 Soil Quality

A soil quality assessment was carried out during 2017 across Montenegro with sampling and analysis of soil at 33 locations, in 10 urban settlements. The purpose of this was to get some background data on potential environmental sensitivities in relation to ground contamination and impact to human health and the environment.

The closest location where monitoring was performed was Donja Gorica in Podgorica, which is located near the south east point of the road route. This sampling location was chosen due to the high density of traffic movements.

The recovered samples were analysed in order to determine the possible presence of inorganic materials (cadmium, lead, mercury, arsenic, chromium, nickel, fluorine, copper, molybdenum, boron, zinc and cobalt) and organic matter (polycyclic aromatic hydrocarbons, polychlorinated biphenyls – PCB, triazines, dithiocarbamates, carbamates, chlorophenoxy and organochlorine pesticides).

Test results were compared with the maximum allowable concentration (MAC) stipulated by the Rulebook on permitted quantities of dangerous and harmful substances in soil and methods for their examination ("Official Gazette of the Republic of Montenegro", No. 18/97).

The results indicate increased content of chromium, nickel and fluorine as well as polycyclic aromatic hydrocarbons (PAH).

A number of potential sources of soil contamination exist along the route of the current road, mainly in the form of re-fuelling stations (five have been identified operating along the RoW). Additionally road run off and leachate is likely to be contaminated with organic hydrocarbons, particulate matter (potentially with adsorbed contaminants) and dissolved heavy metals (lead).

Impact Assessment

10.4.1 Impact Criteria

Impacts on soils have been assessed based on the following criteria

Table 10.4.1: Impacts and mitigation for Soil

Issue	Negligible Impact	Low impact	Medium impact	High Impact	Very High Impact
Degradation of soil with high agricultural potential	No detectable effect on soils or ground conditions	Minor effects expected to last for up to three months after reinstatement	Minor losses of productivity expected to last up to six months after reinstatement.	Moderate losses of productivity predicted to last more than one year after reinstatement	Major losses of productivity predicted to last more than one year after reinstatement
Erosion in areas high erosion potential	No detectable soil erosion, soil creep.	Minor or localised soil erosion, soil creep.	Soil erosion evident and potentially leading to some rill or shallow gully erosion.	Rill and gully formation predicted to be extensive enough to impacts on neighbouring land and pipe integrity.	Major rill and gully formation predicted with significant potential impacts on neighbouring land and pipe integrity.
Contamination of soils	Areas with low sensitivity to contamination	Areas with low exposure or sensitivity to potential spills or low intensity impact factors, which require slight mitigation/management measures	Areas with medium exposure to potential spills due to sensitivity or to the effects of project component acting by low-medium intensity impact factors, which require limited mitigation/management measures	Areas with high exposure to potential spills due to sensitivity or to the effects of project component acting by medium-high intensity impact factors which require site specific mitigation/management measures and/or further in-depth studies	Areas with very high exposure to potential spills due to sensitivity or to the effects of project component acting by medium-high intensity impact factors (mainly AGIs or pipeline in HGWC), which require site specific mitigation/management measures and/or further in-depth studies

10.4.2 Construction Phase Impacts

Road construction is characterized by the transportation of large volumes of material either from excavations on site or brought in from elsewhere. This results in compaction of existing soils, altering their physical characteristics. Additionally, there is a need for the removal of topsoil horizons, again exposing subsoils to compaction.

Potentially sensitive soil resources are found in areas around the rivers Susica, Sitnica and Mreza and several intermittent watercourses.

Provided the mitigation measures and plans outlined in the water resources section are adhered to, impacts to soils from contamination should be localised and 'low'.

10.4.2.1 Impact on agricultural land during construction

Impacts on agricultural land are mostly felt in the construction zone however these are temporary and the adverse impact considered to be **negligible**. This includes the loss of topsoil and subsequent compaction of underlying layers.

The opening of borrow pits leads to soil loss and unless backfilled will become a permanent feature resulting in loss of potential agricultural land. However, the agricultural land is of low value (pasture and low intensity arable) and therefore the impact is considered 'low'.

Soil contamination during highway construction can be caused by improper handling of oil and its derivatives that are used for machinery. Pollution can also be caused by vehicles and machinery washing outside planned locations, inadequately regulated construction sites, and other activities that are not carried out under recommendations of technical measures of protection during construction works. The magnitude of this impact can be considered as small in large part due to the likely limited volumes of spilled substances, while sensitivity of the receptor is assessed as 'low' for soil and 'medium' for ground and surface water, therefore, the significance of the impact can be considered as 'low' overall.

10.4.2.2 Soil degradation

The most important land degradation types that occur during construction and operation of highways are landslides and other mass movements, soil erosion, changes in soil permeability and deterioration of soil characteristics in a wider zone.

Small scale construction works will take place on hilly terrains. Erosion will mainly occur in the areas where the road will run on the side of the hills, which is where the cuttings will expose large surfaces of soil. Cuts and embankments of the road with maximum height are presented in the following table. Obviously higher cuts offer more potential for erosion. With GIP construction and erosion control practices in place, impacts should be localised and 'low' overall.

Table 10.4.2: Higher cuts and embankments of the road

	Kilometres		Length (m)	Right Side (m)		Left Side(m)	
	From	to		Cut (Max)	Embankment (Max)	Cut (Max)	Embankment (Max)

LOT 1							
1	129+332	129+184	148		2.3		4.2
2	129+072	128+995	77			2.0	
3	128+995	128+857	138			6.0	
4	128+842	128+789	53		2.8		Retaining wall
5	128+713	128+050	663	16			
6	127+619	127+588	31				3.5
7	127+283	127+207	76	9.5			
8	127+055	126+389	666	18			
LOT 2							
9	126+299	126+179	120		3.7		2.5
10	126+100	125+234	866		4.7		-
11	125+112	125+022	90	10.3		0.5	
12	124+815	124+320	495	5.0		5.0	
13	123+552	123+160	392		2.4		2.0
14	123+115	122+965	150	4.2		6.4	
15	122+185	122+140	45	-			-
16	122+034	121+595	439	3.4			Retaining wall
17	121+521	121+295	226	4.0		4.5	
LOT 3							
18	121+201	120+842	359	4.8			2.5
19	120+506	120+355	151		4.2		-
20	120+261	120+080	181			6.5	
21	119+948	119+870	78				4.0
22	119+768	119+678	90		Retaining wall		1.0
23	119+557	119+285	272		2.6		-

24	119+270	118+998	272		1.3		-
25	118+907	118+196	711		2.3		-
LOT 4							
26	118+075	117+698	377		2.3		
27	116+882	116+717	165		1.5		-
28	116+475	115+811	664				-
LOT 5							
29	116+173	115+886	287		2.2		-
30	115+781	115+585	196				0.50

High cuts are at:

- from km 128+995 to km 128+857 (max 6.0 m) and from km 128+713 to km 128+050 (max 16.0),
- from km 127+283 to km 127+207 (max 9.5 m) and from km 127+055 to km 126+666 (max 18),
- from km 122+949 to km 123+099 (max 11.60 m).

High embankments are foreseen at:

- from km 126+299 to km 126+179 (max 3.7 m) and km 126+100 to km 125+866 (max 4.7m),
- from km 120+506 to km 120+355 (max 4.2) and 123+175 to km 123+371 (max 6.0m)

A deep cut on the right side:

- from 126+389 to km 126+556 and km 126+690 to km 128+713 (max 29.0)

Results of the geomechanical investigation propose to strengthen the bearing capacity of soil at the km 125+700 to km 126+000.

Temporary camps will be established during reconstruction of the road M-18, whereby they will have a minimal impact on landscape because they will be located in the zone of construction sites, thus they will not take additional land.

Temporary Camp 1 – from km 119+902.880 to km 119+933.050, for the purpose of construction of the Susica Bridge.

Temporary Camp 2 – from km 126+193.960 to km 126+341+370 for the purpose of construction the road.

Temporary Camp 3 - from km 129+67.220 to km 129+347.260 for the purpose of construction of the Sitnica Bridge (Komanski Bridge) and the Mareza Bridge.

Our understanding is that aggregate will be sourced within the RoW, with no use of quarries. However, should the need arise, there are existing quarries located in the promixity of the road alignment which can potentially meet the demand for construction material.

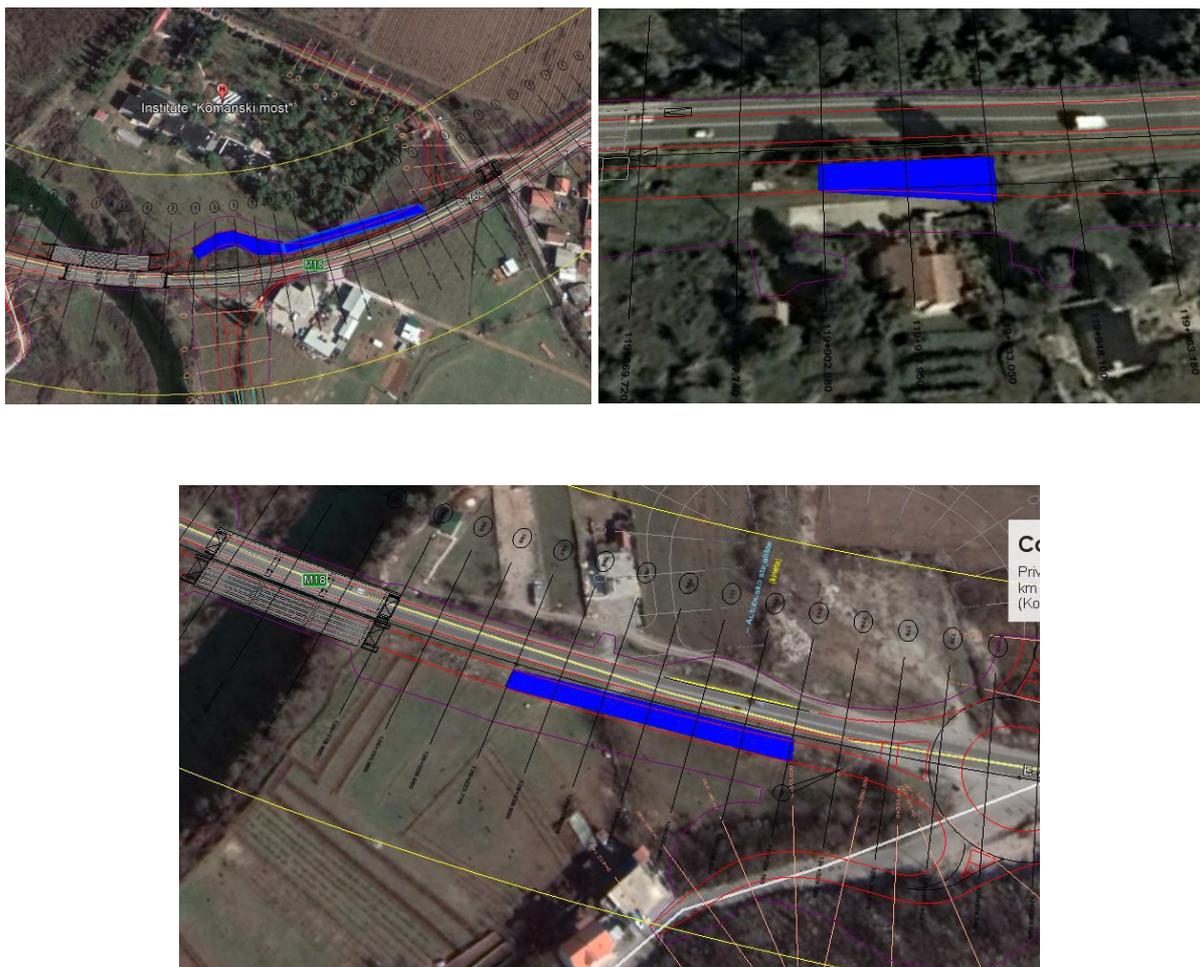
Borrow pits will need to be rehabilitated especially if there is a risk of standing waters that could prove hazardous.

10.4.2.5 Landtake and Loss of Soil

The proposed widening of the road will mostly affect parts of land which are characterized by anthropogenic land use (including farming), which have already been negatively impacted by the existing road, or which have been under the impact of the surrounding facilities in the road area and which are not characterized by preserved environmental functions. However some intersections and roundabouts will be located in field areas with a higher degree of vulnerability than land characterized by more active anthropogenic land use.

Construction of temporary construction camps has been envisaged at three locations, although no additional land-take is expected as all the camps will be located in the zone of reconstruction of the road M-18.

Figure 10.4.2 - Temporary Camp 1, 2 and 3



All the planned locations are situated along the road route and they cover the area of approx. 1,780 m². Impact on topsoil is not considered to be significant relating to the existing land use and the reduction of topsoil quality through previous use.

Around 18.69 ha of land will be occupied for the purpose of reconstruction of the road. However, a part of land will be returned and renewed by planting vegetation after the reconstruction is completed, whereby the surface of this land will be around 9.61 ha. The final surface of land which will be permanently occupied is 9.08 ha.

Loss of top soil areas will be limited to a narrow linear area next to the existing road, and it will not otherwise affect the integrity of the soil resource in the area.

10.4.3 Operational Phase Impacts

10.4.3.1 Impairment of soil quality (soil contamination) due to introduction of pollutants

Soil contamination can arise from road run off, exhaust emissions, dust generated by the traffic, road surface wear, wearing of tire and other car parts. Clay soils are more susceptible to organic contamination than other soil types such as sand, clay being the predominant soil content in the area. Pollutants settling in the road-side soil can impair the growth of vegetation and of soil organisms, thus increasing the likelihood of erosion. These effects are usually much localized, affecting only a narrow band on either side of the road and the contaminants are not normally at high concentrations that could cause an adverse impact. The magnitude of the impact depends on many factors including traffic flow, vehicle technical condition, land development, climate conditions or the width of the drained road prism. Traffic flows along the road are expected to rise but are not expected to influence significantly the magnitude and any impact will be mitigated by the advancement of technology and subsequent reduced emissions of today's, and future, cars. The magnitude of the impact is therefore considered 'low'.

10.5.4 Proposed Construction Phase Mitigation

10.5.4.1 Erosion Protection Measures

Properly designed slope protection and stabilization have to include two components: a vegetation-biological and a mechanical-structural component. Maximum effect is obtained when both components are integrally planned before road construction. The best protection is properly designed and planted forest cover or another vegetative cover. Forest reclamation measures include all types of afforestation; forest protective belts planting, erosion protection belts, and other measures within watersheds.

Technical (mechanical-structural) erosion protection measures include levelling, terracing (bench and sloping terraces), design of graded ditches, level ditches, transversal and longitudinal objects (belts, bunds and barriers) made from wattle, gabions, stones, concrete and other materials, dams, pansand embankments.

10.5.4.2 Soil Mitigation measures during construction

Soil conservation measures during the phase of highway construction should be conducted in accordance with established measures and terms of environmental protection specified by relevant authorities and in line with construction best practice. It includes the following measures:

- Complete topsoil material which will be removed during highway construction should be used for highway side slopes. It would be the best to embed the humus material without previous storage. If the storage is necessary, it must be provided on regulated dumps and based upon principles of humus material conservation;
- To avoid effects of soil compaction it is necessary to rationalize all vehicles movement. This particularly refers to soils having groundwater level, as in costal zones of Toplica River and its tributaries. Excavation in this type of soil should be performed under optimal conditions of soil moisture. Removal of the humus material should be done in as a single action to avoid soil subsurface horizons compaction.
- Take into consideration maximum slope degree on which vegetation can be naturally maintained during the covering of side slopes and embankments. Under the steeper slopes soil should be firmed with wire mesh and grasses and autochthonous bushes should be grown below it.
- Sand and borrow pits can be opened and reclaimed only in accordance with the biodiversity action plan requirements. Protected habitats, fertile, arable and similar areas should not be used as a landfill locations.
- After embankment construction, all mechanization, construction material and containers should be taken away, and any open soil areas should be revegetated using approved species.¹⁵

10.5.6 Residual Impacts

There are expected to be no residual construction phase impacts within the RoW. However, this needs to be confirmed once detailed construction related plans and measures are prepared. There are expected to be no residual operational phase impacts.

Contractors Commitments

The following are offered in respect of the contractor's commitments;

- The impact of the excavation works to remove the solid (Karst) geology on the hydrogeology needs to be assessed. This would be undertaken before finalisation of the design and any potential impacts taken into account and mitigated for.
- The contractor will ensure that the following recommendations are carried out as detailed in the ESIA environment and social action plan.

Plans and Measures

In accordance with the mitigation hierarchy specific plans will address identified potential impacts. These include the following:

- Waste management plan
- Hazardous Materials Management and Spill Prevention Plan

-
- ¹⁵ The soil inside the road fence needs to be seeded with grasses and arranged to prevent wind erosion, as well as the dispersion of dust to wider areas, and by this manner to prevent soil pollution. Only native species should be used and not alien ones.
 - Areas planned for grasses seeding should be seeded with reclamation grasses from families of Brassicaceae, Euphorbiaceae, Asteraceae and Lamiaceae, since these species behave as hyper accumulators of pollutants. They have increased the ability of accumulation of pollutants, which decreases their concentration in soil and water.
 - All areas of road belt arranged by reclamation measures should be maintained seasonally by mowing, pruning, or treated with plant protection products, etc.

- Method Statements
- River Crossing Plans
- Soil Quality and Erosion Control Management Plan

A competent authority (defined as a person or organisation with proven experience in the development of environmental management plans) shall be used to draft the requirements necessary for ensuring the environmental robustness of the erosion control plan, hazardous substances control plan, waste management plan and any other environmentally focused management plans.

A full time environmental supervisor will be appointed to oversee the delivery of the management plans.

11. Biodiversity and Nature Conservation

This Chapter addresses likely significant Project impacts on the biodiversity and nature conservation of the proposed road corridor associated with the construction and operation of the proposed scheme. The work is based on a combination of desk studies and field surveys, as well as consultation with key stakeholders, as outlined further below. Information regarding the impacts to water resources *per se* is covered in Chapter 9: Water Resources.

Relevant legislation and guidance

Protection of biodiversity is a target of Montenegrin, European and international legislation as well as a requirement of the EBRD's Performance Requirements (PR6). Montenegro has adopted EU framework directives, and key Montenegrin and international regulations relevant to this Chapter are summarised in Chapter 3 of this Report. These include:

National Legislation

- Law on Liability for Environmental Damage ("Official Gazette of Montenegro", No. 27/14).
- Law on Nature Protection ("Official Gazette of Montenegro", no 51/08 and No. 54/16)
- Law on Environment ("Official Gazette of Montenegro", No. 52/16)
- Law on ratification of the Bonn Convention (Official Gazette of Montenegro – international agreements 06/08147);
- Rulebook on the protective measures and how to maintain crossings for wild animals ("Official Gazette of Montenegro", No. 80/10);

International Commitments

- Directive 92/43/EEC on the Conservation of natural habitats and of wild fauna and flora ("the Habitats Directive") and Directive 2009/147/EC on the conservation of wild birds ("the Birds Directive").
- Convention on Biological Diversity;
- Cartagena Protocol on Convention on Biological Diversity;
- Convention on the Conservation of European Wildlife and Natural Habitats (Bern Convention);
- Convention on Migratory Species (Bonn Convention)
- Ramsar Convention on Wetlands;
- Convention Concerning the Protection of the World Cultural Heritage;
- European Landscape Convention;
- Convention of International Trade in Endangered Species of Wild Fauna and Flora (CITES Convention);
- The Protocol concerning Specially Protected Areas and Biological Diversity in the Mediterranean;
- EUROBATS Agreement;
- AEWa Agreement.

National Strategy Biodiversity Action Plans have also been developed for the periods 2010-2015 and 2016-2020, and a separate Biodiversity Action Plan has been developed for the Podgorica Area.

Study Area

The study area for this section has been taken as the project affected area , which includes a 150m corridor on either side of the RoW and any associated infrastructure. This is considered as the area most significantly at risk from direct impacts from the Project. As any watercourse leaving the construction or road site is a potential pathway for pollutants, an extended area has been taken into account for such feature including up to 500 m downstream of any bridge crossings.

Scoping Assessment

A number of potential sources of impact associated with the construction and operation of the proposed project were identified during project scoping study (prepared as part of the National EIA process). These include those listed below which are discussed in more detail in the impact assessment section.

Table 11.3: Initial Assessment of Potential Sources of Impact

Source of Impact	Receptors (core)	Potential Impacts and Key Sensitivities
Direct Habitat Loss from Vegetation Clearance (Road corridor & compounds)	Terrestrial and riparian habitats Breeding birds; migrant birds; Roosting bats; Mammals (small and large) (breeding and sheltering); Reptiles (breeding and hibernating); Invertebrates; Plants.	Loss of vegetation, fragmentation, disturbance, direct mortality. The clearance of vegetation will remove habitat but more significantly increase fragmentation of existing corridors, this could lead to disturbance of faunal species; and could cause direct mortality, as well as potential loss of notable plant species.
Impacts from vehicle movements (including transport of people and equipment) and use of machinery and equipment	Terrestrial habitats; Mammals including bats; Migrating and breeding birds Endangered Plants (Dust)	Disturbance of fauna due to noise, direct mortality due to Road Traffic Accidents (RTAs) and degradation of habitats due to compaction dust and vegetation destruction or the ingress of non-native invasive species. This is less likely to have a significant effect on less mobile species such as reptiles, amphibians and notable invertebrates including those in riparian areas. Mitigation developed for these core receptors is likely to fulfil mitigation requirements for all receptors.
Impacts from working compounds and camps (including production of wastes and indirect worker pressure).	Terrestrial and riparian habitats; Breeding & migrating birds; Small and large mammals; Reptiles; Amphibians; Fish; Invertebrates	Disturbance of fauna, particularly while breeding, degradation of habitats, direct and indirect pollution of habitats, potential for direct mortality through illegal hunting and fishing.
Water crossing construction	Riparian habitats and associated bird; mammals (including otter); amphibians; fish; and invertebrates; Other aquatic receptors . Plants. Fauna and flora from adjacent habitats	Indirect and direct pollution due to sedimentation of watercourses and construction consumables and waste. Disturbance. Whilst aquatic species are less likely to be affected by general terrestrial construction disturbance they may be particularly affected by pollution and sedimentation during river crossings. Other species impacts will be as for terrestrial habitats.
Water abstraction eg for cement production, dust control	Riparian habitats and associated terrestrial and aquatic species	Potential for degradation to banks and direct mortality to fauna, disturbance while breeding. The abstraction of water for construction purposes such as damping down and cleaning machinery as well as cement manufacture could result in species being abstracted along with the water and during that abstraction habitat may be damaged and local fauna disturbed.
Unplanned events, such as landslides, fires,	All	Potential effects on all receptors. Loss of habitat, direct mortality, disturbance effects.

Source of Impact	Receptors (core)	Potential Impacts and Key Sensitivities
Cumulative effects	All	There is a potential for other developments to have an effect when assessed in combination with the Project. Increased disturbance or the need for wider infrastructure improvements to facilitate accesses etc. In addition, existing threats to notable habitats and species may be exacerbated.
Operational Issues: Road operation and Maintenance	Habitats mammals including bats; Wintering and breeding birds; Reptiles.	Disturbance of breeding animals and potential for direct mortality eg from bats, other mammals and amphibians travelling along or crossing the road. Habitat fragmentation could make some animals more vulnerable to predation when attempting to cross the gaps or could "sterilize" some areas by preventing commuting.

Baseline Conditions

This Section has been developed based on a combination of available reports and documentation, initial work provided by E3 Consulting (desk study and walkover studies) and a Rapid Biodiversity Assessment (RBA) undertaken by Earth Active in June 2019. The section will be updated as results from supplementary surveys become available.

11.4.1 Study Approach and Methodology

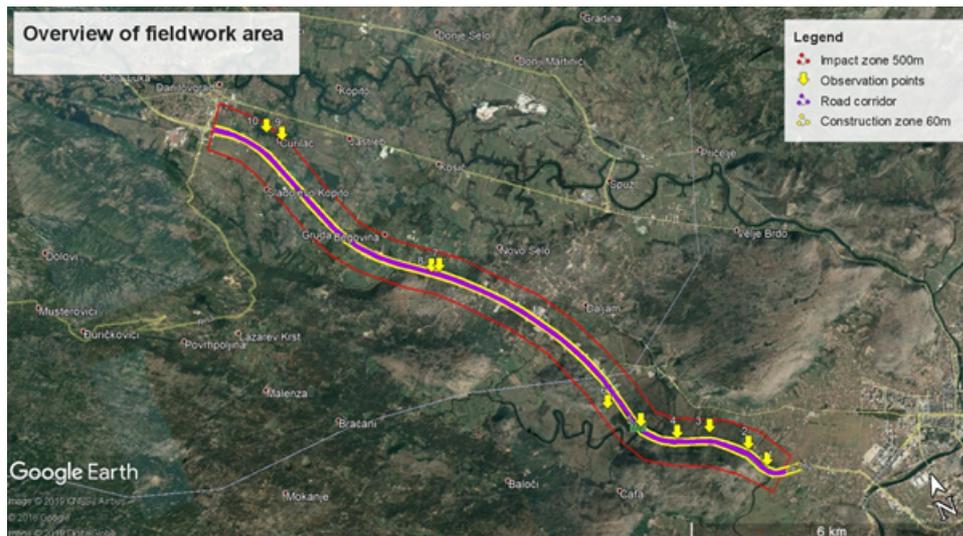
11.4.1.1 Initial Field Studies

An initial ecological baseline survey was carried out over 3 days in spring 2019 (30th March and 6th and 7th April)¹⁶. The work was carried out by a team of biologists including the following specialists:

- Dr Snežana Vuksanović –flora and habitats expert, team leader, habitat mapping
- Dr Katarina Ljubisavljević –amphibians and reptiles' expert
- Čeda Ivanović MSc mammals' expert (including bat survey)
- Andrej Vizi MSc – bird expert
- Katarina Burzanović BSc – fish expert

The work provided an initial overview of the flora and fauna (amphibians, reptiles, mammals birds and fish) present within the project affected area and identified ten locations selected for more detailed study, of which eight represented wetter habitats as shown in the figure below.

¹⁶ The report for the vascular flora, habitat types and fauna (fish, amphibians, reptilians, birds and mammals) on the projected route of the boulevard Danilovgrad - Podgorica with photo documentation.



The study was, however, very time constrained and took place in a cold spring that was not considered representative. No detailed habitat mapping was carried out at the time but this has since been undertaken.

11.4.1.2 Rapid Biodiversity Assessment (RBA)

Given the above constraints, a RBA has been undertaken of the Project affected area, led by Dr Imogen Crawford and with the help of both the E3 team and Dr Vladimir Pesic, a national specialist on aquatic invertebrates. The results of this are reported, alongside the original study findings, in this Chapter. The RBA has also resulted in the following additional surveys being carried out:

- **Detailed Habitat Map:** Survey using EUNIS classification - the purpose of which is to describe the baseline situation in such a way that valid assumptions can be made to inform a project focused risk assessment quickly and effectively. A habitat map is considered an essential first step for a Biodiversity Action Plan.
- **Bat Survey:** Bat caves exist in the nearby limestone cliff faces including the Magara Cave which is known to support bats and lies some 1.5km away on the other side of the valley. All bat species are protected and additional surveys were required.
- **Aquatic Invertebrate Survey:** Several endemic and protected species are known from the area and further surveys are proposed to identify these and suitable indicator species for future monitoring.

The results of these surveys are reported to the extent that they are available in this ESIA document and have also been used to inform both the Project Critical Habitat Assessment (CHA) and Biodiversity Action Plan (BAP). All documents will be updated as more information becomes available.

The Integrated Biodiversity Assessment Tool (IBAT – see www.ibat-alliance.org) has been used to provide an initial screen of species that could potentially be present in the area. This has then been reviewed by local experts and compared with habitats present to provide a more accurate screening of potential species which could then be surveyed for. A precautionary approach has also been adopted for the impact assessment (and proposed mitigation measures) which has assumed that protected species are present if the habitat exists for them and there is no evidence to the contrary.

11.4.1.2 Critical Habitat Assessment Analysis

Within the project affected area there are habitats that are known to support a number of “notable” (ie uncommon and/or protected) species . The project therefore has the potential to

impact upon areas that could be considered either Critical Habitat and/or Priority Biodiversity Features as defined by EBRD Performance Requirement 6. A Critical Habitat Assessment has therefore been undertaken and is provided as a stand-alone annex to this document.

11.4.2 Internationally Designated Sites

The existing road near Danilovgrad runs through the north-western fringes of the proposed **Zeta Stream Key Biodiversity Area (KBA) and proposed protected area** (the site will be referred to as the “Valley of River Zeta-lower course”). Whilst the KBA/protected area designation process was only initiated in February 2019 and no boundary has yet been agreed for the site, an indicative map is shown in the figure below. Official field surveys of the area to support the designation process and delineation process are currently underway and the process is planned to be finalized later this year. The KBA is noted for several species as outlined in the table below (also see notable “fauna” section).

Table 11.4.2: Species of Note within the KBA

Group	Details
Fish	The Zeta River and some of its tributaries have been recorded as providing favourable freshwater habitat for salmonid fish including <i>Salmo trutta</i> (Brown trout), IUCN LC , <i>Salmo marmoratus</i> (Marble trout), IUCN LC and the endangered <i>Salmo obtusirostris</i> (Softmouth Trout), IUCN (EN) . The latter is an endemic species specifically protected according to the Law on Nature Protection. It used to be locally abundant; but intense poaching means that their numbers have drastically declined, and some ichthyologists believe that the taxon may now actually be extinct ^[1] . Two other notable fish species have also been recorded from the river including Anguilla anguila (European eel), IUCN CR and Gobio skadarensis (Skadar gudgeon), IUCN EN whilst the Southern barbel <i>Barbus meridionalis</i> is IUCN NT . The Zeta river itself will not be affected by the project, whilst its main tributary that is crossed, the Susica, is an ephemeral stream that dries out in summer and is not expected to support endangered fish species. Further details are provided under the rivers and fish sections of this document.
Freshwater Invertebrates	The majority of Zeta river invertebrate groups have not been well researched. However a number of endemic or endangered freshwater snails have been recorded. These are discussed further under fauna. Two specific species Plagigeyeria zetaprotogona (IUCN EN) and Saxurinator orthodoxus (IUCN CR) have been recorded from the River Zeta near Tunjevo (several km north of Danilovgrad) ^[2] . and the Rheocrenic springs of the Zeta valley ^[3] respectively but neither have been recorded from the Project Area..
Amphibians and Reptiles	A number of species of reptile and amphibian are commonly encountered within the KBA including LC species such as <i>Bufo bufo</i> (common toad), <i>Lissotriton vulgaris</i> (common newt) <i>Vipera ammodytes</i> (horned viper), <i>Podarcis melisellensis</i> (Dalmatian wall lizard), <i>Lacerta viridis</i> (European green lizard), as well as the IUCN NT <i>Testudo hermanni</i> (Hermann’s tortoise).
Butterflies	Around 16% of all European butterfly species are also found in the Zeta-Skadar Plain.
Agro-biodiversity	The KBA supports key agrobiodiversity species such as domestic white corn (a large glass grain) and fine-grained white corn; domestic wheat and domestic hard wheat; as well as raspberries, blackberry, wild apples, wild pear, autochthonous figs, pomegranate, myrobalan and white plum and local grape varieties (rozaklija, krstac and petrovsko grape), as well as local varieties of potatoes, tomatoes, peppers, beans, green beans.

[1] https://web2.mendelu.cz/af_291_projekty/files/11/11-prezeatce_salmo.pdf

[2] <https://www.iucnredlist.org/species/155795/4843793>

[3] <https://www.iucnredlist.org/species/155491/4786450>

Overall some **53ha** of the KBA area as currently described may fall within the project affected area (ie the buffer zone 150m either side of the road) but even this representing <0.3% the total 21,040 ha of the proposed KBA below. Of this 53ha less than 5% (around 2.5ha) is actually expected to be affected by the works and this is primarily heavily modified habitat in the outskirts of Danilovgrad .

Figure 11.4.2 Zeta Stream KBA



11.4.3 Nationally Designated Sites

The “**Mareza source with Sitnica and area of Velje Brdo**” is located at the southern end of the Project. This is listed within Podgorica's Biodiversity Action Plan as a potentially protected area but there has not been any official ecological survey of the habitat and the procedure to formalise its status has yet to be initiated. The site represents a complex of freshwater, terrestrial and karst habitats and includes flooded and occasionally flooded meadows, canals, streams and springs which support various endemic or otherwise notable species, which are considered unique in the central region of Montenegro (Ikovic, 2017). No boundary has yet been established for the proposed protected area (the boundary provided in the figure below is illustrative based on the current description) but the area is expected to include parts of the Rivers Sitnica and Mareza (as well as the existing road).

The **Magara Cave Natural Monument (IUCN category III)** is a dry cave that may support bats is also found in the village of Tolosi, approximately 1km away from the existing road.

The proposed project is also located within 5 km of the **Morača River KBA** and within 10 km of the **Cemovsko Field; Cijevna Canyon and Hum Orahovski; Kakaricka Gora and Lake Skadar KBA sites**. These are not, however, expected to be affected by the project.

The project is also not located in any existing Candidate Emerald site and as such no Appropriate Assessment is required. As the project does however slightly overlap a portion of the Zeta Stream Key Biodiversity Area; and the current road also runs through the “Mareza source with Sitnica and area of Velje Brdo” site, both of these have been specifically addressed in detail (along with potential species/habitats of notable conservation importance) through the critical habitat assessment (CH) and Priority Biodiversity Features (PBF) assessment and associated Biodiversity Action Plan.

11.4.4 Existing Habitats

In the north of the scheme the proposed road will mainly pass through the residential and agricultural lands of the River Susica flood plain which are mostly highly modified by agricultural and developmental activities and are considered in general to be of limited ecological value. At either end of the scheme near the two large cities, the area here has suffered particular anthropogenic influence, although the whole road is affected to some extent. For example the

transmission lines cross Zelnika hill, there are five petrol stations along the road, and a number of restaurants, café stops and shops. Light industry workshops and warehouses, typical of urban fringes, are also creating a near continuous ribbon development alongside the road. These are all considered to be of **low ecological sensitivity**.

Just behind the ribbon development, large arable fields also dominate the landscape and these are generally also considered of **low sensitivity**. A number of fields in the northern half of the scheme are, however, still undergoing a traditional hay cut and this results in a rich flora considered of **moderate sensitivity**. The area has, however, seen a decline in small scale farming and cattle grazing in recent years and these fields are gradually being changed.

The road crosses five main watercourses and these and the streams and drainage ditches associated with support a network of woodland habitats. These habitats also link to larger plots of woodland and create essential corridors for amphibians, reptiles, small mammals and invertebrates as well as navigational aids for bats. The presence of large old trees and scrub provide roosting/nesting opportunities for bats and birds and the woodland habitat and its connectivity is considered of **high sensitivity**.

Further south, in and around the **“Mareza source with Sitnica and area of Velje Brdo”** area, the Scheme passes through areas of greater ecological interest. These include the limestone massifs of Luznica hill and Zelnika hill and the wetland between them which are bisected by the road. The habitats of the limestone massif, wet grasslands and hay meadows that lie adjacent to each other also create areas of important diversity with a range of opportunities for faunal land use and are considered of **high sensitivity**.

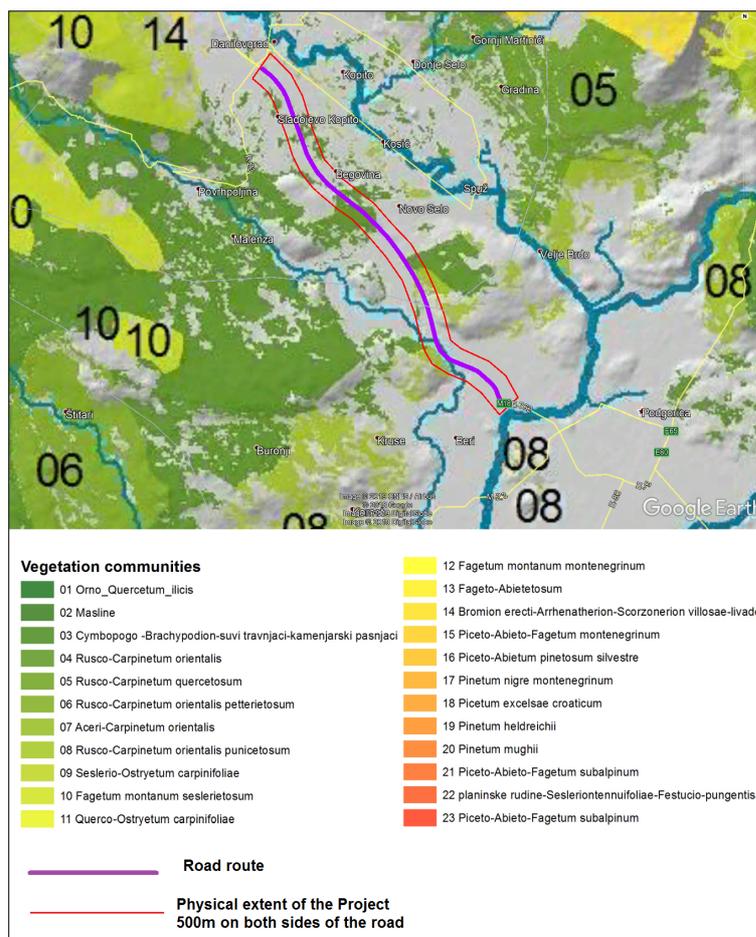
It is noted, however, that the wetland here is increasingly drying out as a result of local land management practices. In the recent past this wetland would have presented a mosaic of small ponds, swampy hollows dominated by reeds and wet grassland dominated by *Molinia* and other wetland grasses. Now, the west part is being lightly cattle grazed, and maintains this mosaic, while the east and larger part is not grazed, allowing *Salix* scrub to take over and dry up the wetland to a much more homogenous and less species rich habitat. This area is used by local people for hunting (mainly waterfowl) and they also note the decline in open pools. There is the potential for the project to help remove the *Salix* here, dig some ponds and rejuvenate the wetland here, as discussed further in the BAP.

Habitat surveys identified four specific Natura 2000 habitats of greater interest along the rivers Sušica, Matica and Sitnica and the flooded meadows at Lužnica toward Matica. Habitat type - 92A0 is recorded at the Curilac location (old river Zeta arm, standing water), at around 300 m from the scheme. The habitats are described in the Table below and shown, alongside other areas of interest in the general habitat map provided as Figure 11.4.4 (the CHA and BAP have more detailed maps).

Table 11.4.4a: Natura 2000 habitats identified in the Project area

Natura 2000 Code	EUNIS: Code	Habitat Description
3150;	C1.3, C1.32, C1.33	Natural eutrophic waters with Magnopotamion and Hydrocharition vegetation types
3260	C2.1, C2.18, C2.19, C2.1A, C2.1B, C2.2, C2.25, C2.26, C2.27, C2.28, C2.3, C2.33, C2.34	Water courses of plain to montane levels with Ranunculion fluitantis and Callitricho-Batrachion vegetation
6420	E3.1, E3.1	Mediterranean tall humid grasslands of the (<i>Molinio-Holoschoenion</i>)
92A0	G1.1, G1.112, G1.3, G1.31	<i>Salix alba</i> and <i>Populus alba</i> galleries

Figure 11.4.4 Overview of habitats along the research area according to the vegetation type



This broad habitat map (for which the red line shows a zone of 500m on both sides of the road) shows that extent of the highly modified landscape. However, nine localities were identified that include habitats of greater value namely:

- *Curilac;*
- *Area of Susica Bridge;*
- *Novo Selo;*
- *Swampy meadows in Luznica towards Matica;*
- *Flood meadows in Luznica towards Matica;*
- *Area of Matica Bridge;*
- *Area along Sitnica river;*
- *Komanski Brdige (on Sitnic river); and*
- *Area of Mareza Brdige*

Habitats here include meadows, wet meadows, common reed marsh, riparian forests, emergent floating and submersed vegetation in waterways and remnant forest areas on the hilly terrain. A more comprehensive habitat map, with habitats classified according to EUNIS (European Nature Information System) is currently being finalised and will be provided as a standalone appendix to this report. An assessment of habitats in relation to criteria for Critical Habitats and/or Priority Biodiversity Features; relatedness of habitats as relevant to their use by specific fauna and notable species both encountered and expected from the habitat classification is also part of this is also provided in the stand-alone CHA.

In summary, however, most habitats within the project affected area are somewhat compromised by anthropogenic activity, or in the case of cattle grazing of traditional hay meadows, by the

cessation of management. All habitats represented in the project affected area are also generally well represented nationally, with the exception of the habitats included within the **“Mareza source with Sitnica and area of Velje Brdo”**. This, area (and to a lesser extent some of the other wooded corridors) are of greater value as a result of the complexity created by the many different habitat types present in a small area. The rivers, streams and ditches with their aquatic and emergent vegetation and associated riparian forest; together with wet grasslands and swamps; karst massifs, flood meadows and hay meadows provide a complex mosaic, with interconnectedness and integrity that requires a degree of protection irrespective of the individual rarity status of any individual habitat or species. This is discussed further in the CH/PBF analysis.

11.4.5 Birds

Information on birds was obtained through a combination of desk studies and field visits. During the initial field investigation (March/April 2019) three areas were found to be of greater conservation value to birds namely the:

- Sitnica river from Komanski bridge to Mareza floodplains (6 points)
- Sušica river valley around the bridge (2 points)
- Flooded area of Zeta oxbow near Curilac (2 points).

Both resident breeding and migratory species are found in the project affected areas. In total some 183 bird species have been recorded, approximately half of the total bird species in Montenegro of which about 52 have been recorded as breeding. Ten species present are noted 'Near Threatened' or 'Vulnerable according to the IUCN.

Table 11.4.6a: Notable birds recorded from within the Project area

English Name	Latin Name	IUCN RDB	Birds ¹⁷
Rock partridge	<i>Alectoris graeca</i>	NT	I*, II/1**
White-fronted Goose	<i>Anser erythropus</i>	VU	I
Meadow Pipit	<i>Anthus pratensis</i>	NT	
Greater Spotted Eagle	<i>Aquila clanga</i>	VU	I
Pochard	<i>Aythya farina</i>	VU	II/1, III/2
Ferruginous Duck	<i>Aythya nyroca</i>	NT	I
Red-breasted Goose	<i>Branta ruficollis</i>	VU	
Red-footed falcon	<i>Falco vespertinus</i>	NT	I
Turtle Dove	<i>Streptopelia turtur</i>	VU	II/1, III/2
Redwing	<i>Turdus iliacus</i>	NT	II/2

IBAT also records the following notable species from the wider area: *Falco cherrug* (Saker falcon - EN) *Neophron percnopterus* (Egyptian vulture – EN); *Acrocephalus paludicola* (Aquatic warbler-VU ((vulnerable))); *Aythya farina* (Common pochard – VU) and *Podiceps auratus* (Horned grebe -VU). None of these have, however, been recorded to date in the project area itself..

It is noted that local migration research, including bird ringing, indicates that the Zeta river valley represents a migratory corridor for birds, including both forest songbirds in winter and Common Crane (*Grus grus*) passing as a long distance migrant in this area. Ducks and geese here are increasingly endangered by both destruction of wetlands and over-hunting (eg the recent loss of an area of Sitnica riverbed and Mareza flood plains), whilst raptors, such as Red-footed falcon and Greater Spotted Eagle, are seasonal visitors. Rock Partridge, which is recorded here, inhabits much of Montenegro where the Mediterranean habitat association of rocks, rocky pastures and scrublands is found (as on the hills along the western border of the road corridor).

11.4.6 Mammals

The diverse, but mostly disturbed, habitats of the project area include a diverse range of habitats such as fields, meadows, vineyards, semi-marsh and wetlands, riverbanks, degraded forests, shrubs and bushes of the karst hills as described earlier. These support a range of small mammals including voles, shrews, moles and mice. Bats are also present in the area. Six sites were noted as being of particularly importance for mammals:

1. Bridge on Sitnica (Komanski bridge) meadow and coastal surface of riverbed
2. Bridge on the Matica river
3. Swamp and semi-marsh from the bridge on the Matica river
4. Lužnica
5. Novo Selo - Tomaševići
6. The bridge on the Sušici river

Data from literature reviews (including unpublished recent research) and anecdotal reports indicate that the following mammals may be expected to be found.

¹⁷ EU Directive (2009/147/EC)

Table 11.4.7a: Notable mammals (other than bats) recorded from the vicinity of the Project area (HD – Habitats Directive)

Species name (English)	Species name (Latin)	Conservation status (IUCN)	Locality with coordinates
Montenegrin /Balkan Vole	<i>Microtus (Pytymus) thomasi</i>	Endemic	Beri, Doljani, Vranići, Donji Kokoti (Sitnica)- lit.
European pine marten	<i>Martes martes</i>	LC; HD Annex V (a)	Lužnice, Zelenika, Novo Selo
European wildcat	<i>Felis silvestris</i>	LC; HD Annex IV	along the entire route
Grey wolf	<i>Canis lupus</i>	LC; HD Annex V (a)	Široka Lazina, near the Sitnica river (occasional)
European polecat	<i>Mustela putorius</i>	LC; HD Annex V (a)	along the entire route

Other IUCN RDB Least Concern species recorded from the area include Eastern broad-toothed field mouse, (*Apodemus mystacinus*) Long-tailed Field mouse (*Apodemus sylvaticus*) Hedgehog (*Erinaceus roumanicus*), Rabbit (*Lepus capensis*), Water vole (*Arvicola terrestris* -especially in marshy and semi marshy meadow at Zagred); Common mouse (*Mus domesticus*); Red Fox (*Vulpes Vulpes*) Stone marten (*Martes foina*); European badger (*Meles meles*) and Common weasel (*Mustela nivalis*). The majority of these species recorded are common with the exception of wolves (which rarely appear).

IBAT also reports that the following are present in the broader project area:

- *Mustela lutreola* (European mink- CR, although now possibly extinct here – see CHA)
- *Dinaromys bogdanovi* (Balkan snow vole -VU)
- *Vormela peregusna* (Marbled polecat VU)
- *Lutra lutra* (Eurasian otter - NT)

Further details of these are provided in the CHA and otter in particular may well be found in and around the rivers of the study area.

In terms of bats, a number of species have been recorded from the project area including the following:

Table 11.4.7b: Bat Species Recorded from Project Area (HD – Habitats Directive)

Species name (English)	Species name (Latin)	Conservation status (IUCN)	Locality with coordinates
Greater horseshoe bat	<i>Rhinolophus ferrumequinum</i>	NT; HD Annex II & IV	Vilina pećina, Čafa(42,4538°N, 19,1760°E), 258mnv,
Lesser horseshoe bat	<i>Rhinolophus hipposideros</i>	NT;	Along the entire route, Vilina pećina, Čafa(42,4538°N, 19,1760°E), 258mnv
Kuhl's pipistrelle	<i>Pipistrellus kuhlii</i>	LC; HD Annex IV	Close to Susica, around lampposts, bushes in karst area along road, close to the Zeta River
Soprano pipistrelle	<i>Pipistrellus pygmaeus</i>	LC; HD Annex IV	Near Sušica river, along road around street lamps and shrubs in the karst, near Zeta River
Nathusius' pipistrelle	<i>Pipistrellus nathusii</i>	LC; HD Annex IV	Near Sušica river along the road around the streetlamps and shrubs in the karst
Whiskered bat	<i>Myotis mystacinus</i>	NT; HD Annex IV	Meadows along the route
long-fingered bat	<i>Myotis capaccinii</i>	NT; HD Annex II & IV	Shrubs in the karst, near the Zeta River

All bats are protected under the EU Habitats Directive, and further information on these species is included in the CHA.

11.4.7 Amphibians and Reptiles

The project affected area includes several habitats of value to reptiles and/or amphibians including areas of rocks, forests remnants, field edges, hedges and overgrown embankments, wetlands, streams and rivers. Several notable species are recorded in the literature, and based on the review the following locations were chosen for more detailed study during the initial surveys:

1. Terrain around Mareza bridge
2. Terrain around Komanski bridge
3. Terrain around Matica bridge
4. Terrain near road to Bandici (Crkovnica river)
5. Terrain around Susica bridge
6. Terrain between Curilac and Susica bridge (locality Gruda)
7. Curilac

The desk study and field survey recorded the following species as present¹⁸.

Table 11.4.8a: Notable Amphibians and Reptiles in the Project Affected Area

Name (Latin)	Name (English)	Sites	IUCN RDB & Endemicity	Habitats directive
<i>Pelophylax ridibundus</i>	Marsh frog	All sites	LC	HD Annex V
<i>Bufo bufo</i>	Common toad	Around Komanski and Sušica bridge	LC	
<i>Hyla arborea</i>	European tree frog	Around Matica bridge	LC	Habitats: Annex IV
<i>Pelophylax shqipericus</i>	Albanian water frog	Around Matica and Sušica bridges	EN, Endemic to the Balkans	
<i>Emys orbicularis</i>	European pond turtle	Gruda and Curilac	NT	Habitats: Annex II, IV
<i>Lissotriton vulgaris</i> *	Smooth newt	Gruda	LC	*
<i>Rana dalmatina</i>	Agile frog	Curilac	LC	Habitats: Annex IV
<i>Podarcis muralis</i>	Common wall lizard	Around Mareza, Matica and Sušica bridges; Curilac	LC	Habitats: Annex IV
<i>Podarcis melisellensis</i>	Dalmatian wall lizard	Around Mareza and Sušica bridges; Gruda	LC Endemic to the Balkans	Habitats: Annex IV
<i>Natrix natrix</i>	Grass snake	Around Matica bridge Crkovnica river	LC	/

In addition to the above, IBAT also records the Lizard *Dinarolacerta mosorensis* (VU) and the Meadow viper *Vipera ursinii* (VU) as present in the area. Further information on species present is provided in the CHA.

11.4.8 Fish

Four locations were selected during the initial survey for further investigation as follows:

- Mareza bridge (Mareza river)
- Komanski bridge (Sitnica river)

¹⁸ For raw data see: "Final Report Amphibians and Reptiles"; "Report on fish fauna on the projected route Danilovgrad Boulevard (circular stream) – Podgorica (bridge on Mareza)"; "Izještaj o flori I staništima na projektov anoj trasi bulevara Danilovgrad (Kružni Tol) – Podgorica (most na Marezi)"

- Matica bridge (Matica river)
- Susica bridge (Susica river)

During the surveys only 9 species of fish were detected in the rivers, all of which were considered common, although a number were endemic. Whilst this may reflect the inability of short-term surveys to provide realistic fish biodiversity data, it was noted that many of the rivers are seasonal and the trap net in the Mareza River was completely empty and the channel found to be both shallow and full of garbage. Fish were recorded at the other three survey sites, but numbers were still lower than expected and no salmonid species or eels were recorded. Species that were recorded are shown in the table below:

Table 11.4.9a: Fish species caught during the initial survey

name of the species	Endemic	IUCN RDB	Where detected
<i>Cobitis ohridana</i>	Ohrid – Drim- Skadar	LC	Matica, Sitnica, Sušica
<i>Barbatula zetensis</i>		LC	Matica
<i>Rutilus prespensis</i>	Ohrid – Drim- Skadar	LC	Matica, Sušica, Sitnica
<i>Squalius platyceps</i>	Ohrid – Drim- Skadar	LC	Matica, Sušica, Sitnica
<i>Telestes montenigrinus</i>	Skadar	LC	Matica, Sitnica
<i>Gobio skadarensis</i>	Skadar	LC	Matica, Sitnica
<i>Cyprinus carpio</i>		LC	Matica, Sitnica
<i>Carassius gibelio</i>		LC	Matica, Sitnica
<i>Pachychilon pictum</i>		LC	Matica, Sitnica, Sušica

Other fish species recorded by IBAT that may be present in the local rivers are shown below and discussed further in the CHA.

Table 11.4.9b: Other fish species recorded in IBAT that may be present in the local rivers

name of the species	IUCN RDB/Endemic
<i>Salmo faroides</i>	Not evaluated
<i>Salmo marmoratus</i>	LC
<i>Salmo zetensis</i>	EN
<i>Scardinius knezevici</i>	LC (Endemic)
<i>Anguilla anguilla</i>	CR
<i>Alburnus scoranza</i>	LC
<i>Alburnoides ohridanus</i>	LC

The Matica, Sitnica and Susica are reported to be used by these notable species as their prey (fish species, smaller aquatic animals, spawn, crayfish, larvae and worms) is commonly encountered. **Salmonid species are reported to breed in the upper streams of these rivers during winter months (November until January) whilst Cyprinid species, breed from mid-March until mid-June.** *Salmo zetensis* is the only legally protected fish species in Montenegro, while eel is an IUCN Critically Endangered species. Reports from local fishermen indicated that the low levels of fish stock may be a direct consequence of electrofishing or other prohibited techniques, and that whilst salmonids and eels are present in the area weather conditions may not have been appropriate to make the fish 'active'.

11.4.9 Invertebrates

Only limited information is currently available on the invertebrates of the area, although around 16% of all European butterfly species are found in the Zeta-Skadar Plain. Invertebrates are generally unlikely to be affected by the proposed scheme unless they are restricted to specific habitats. Two notable species of freshwater snails have been recorded from the Zeta river: the endangered *Plagigeyeria zetaprotogona* (IUCN EN) and the critically endangered *Saxurinator orthodoxus* (IUCN CR), and whilst these are not expected to be present in the Project area a number of other endemic and endangered snails have been recorded as reported in the CHA and BAP.

Other invertebrates recorded by IBAT from the wider area include the following

- **Beetles:** *Ampedus quadrisignatus* (EN) and *Buprestis splendens*(EN) *Ropalopus ungaricus* (EN) *Anisarthron barbipes* (VU) *Pedostrangalia revestita* (VU)
- **Crickets:** *Metrioptera prenjica* (Prenj meadow bush-cricket – EN); *Pachytrachis frater* (Monk bush-cricket – EN) *Arcyptera brevipennis* (Western banded grasshopper- VU)
- **Butterflies:** *Coenonympha orientalis* (Balkan heath – VU)
- **Crayfish:** *Troglocaris presence* (VU); *Astacus astacus* (Noble crayfish-VU) and *Austropotamobius pallipes* (White-clawed crayfish – EN)

In general most of the beetles are found in wooded areas and the crickets and butterfly at higher altitudes. Crayfish may however be present in the project area and this is described further in the CHA.

Impact Assessment

11.5.1 Assessment Criteria

The impact assessment has taken into account both the **sensitivity** of potential receptors to impacts and the **magnitude** of the potential impact arising. Sensitivity has been determined based on the following criteria:

- **High Sensitivity:** Habitats and species considered notable at an international or national level. This includes IUCN RDB uncommon species listed as Endangered or Critically Endangered, habitats or species listed in Annex I, II and/or IV of the EU Habitats Directive and internationally recognised sites such as IUCN protected areas (I, II, III & IV); key biodiversity areas;
- **Medium:** Habitats and species considered notable at a local or regional level. This includes IUCN RDB species listed as Vulnerable or Near Threatened, more common species and habitats from the annexes of Habitats Directive and areas of designated at a national level for nature conservation.
- **Low:** Habitats and species that are considered as IUCN as if Least Concern species are not listed in the key EU Directives and that are typically locally common.

The following criteria have therefore been used for the assessment of impacts. Impacts rated as 'very high' and 'high' are considered to be 'significant impacts':

Table 11.5.1a: Impact Assessment Criteria

Negligible Impact	Low Impact	Medium Impact	High Impact	Very High Impact
The activity is not expected to result in observable impact on species or habitats.	The activity may have limited impacts on species or habitats of low sensitivity. No observable impacts on species of medium or high sensitivity.	No observable impacts are expected on species of high sensitivity. Limited impacts may occur at an individual level to species or habitats of medium sensitivity. Impacts may occur to species or habitats of low sensitivity.	Limited impacts may occur at an individual level to species or habitats of high sensitivity. Impacts may occur to species or habitats of medium sensitivity that are significant enough to reduce the ability to sustain population levels of affected species or habitats.	Impacts may occur to species or habitats of high sensitivity that are significant enough to reduce the ability to sustain the habitats, complex of habitats and/or the population levels of species of interest.

11.5.2 General Impacts and Mitigation: Habitats

Impacts to receptors (habitats and species) of **High or Medium Sensitivity** are considered further below. Impacts to receptors of **Low Sensitivity** will be managed through the implementation of Good Industry Practice (GIP) mitigation. Where mitigation is proposed it has been applied in line with the mitigation hierarchy and is presented as follows:

- **Good International Practice:** generic mitigation to be adhered to throughout the enabling and construction period. This include as standard site supervision by an Ecological Clerk of Works (ECoW) throughout the scheme’s construction period, and is included within the construction EMP;
- **Bespoke Construction Mitigation:** This has been developed for particularly sensitive habitats and/or species by receptor type and will also be included and cross referenced in the Contractor’s obligations) along with habitat restoration methods;
- **Operational Mitigation:** This will include significant maintenance and monitoring required to ensure that the construction impacts are adequately mitigated and that the maintenance for the road is carried out appropriately.

The following generic impacts and sources of impact have been identified:

Table 11.5.2a: Generic Impacts and Sources

Direct Impacts	Construction Sources	Operational Sources
<ul style="list-style-type: none"> Habitat loss, degradation and simplification Habitat Fragmentation Changes in water conditions (hydrological impacts) Habitat pollution Direct mortality Disturbance to species Spread of non-native or invasive species 	<ul style="list-style-type: none"> Vehicle mobilization, including transport of people and equipment within the works area Compound working camps construction and operation, including wastes and indirect pressure of workers presence Working corridor vegetation clearance and topsoil removal Construction activities including disturbance of soils & pollution from construction, including river crossings Water abstraction Unplanned Events 	<ul style="list-style-type: none"> Increase in hunting or predation utilising the road for access Spread of non-native invasive species along the road Impacts upon habitats and species directly resulting from the road maintenance Increased disturbance due to increased accessibility Visual, noise and air quality issues related to the operation of the road and associated areas Impacts from habitat severance

For each of these potential generic impacts, the following table identifies potential construction sources of impact, proposed generic mitigation to avoid or reduce the impact and the potential for residual significant adverse effects to important ecological receptors. More detailed receptor-specific assessments, including impacts associated with operation of the road, are provided in the sections that follow.

Table 11.5.2b: Generic Habitat Impacts and Mitigation

Impact	Effect	Proposed Mitigation	Significance (post mitigation)
Habitat loss; degradation and simplification	Vegetation clearance for the preparation of the working corridor, and supporting infrastructure (construction camps, laydown areas etc). Degradation from soil compaction and erosion, dust and temporary roads and access areas	Land outside of the direct project footprint will not be disturbed, and any needed for temporary works will be restored as soon as practical following construction to equal or better condition. Most impacts are therefore expected to be short-term only. Areas with permanent habitat loss will be primarily in areas of limited ecological value (agricultural land & pasture) with the exception of areas of notable habitat outlined in table 11.5.5.1a	Low-moderate.
Habitat Fragmentation	Disruption to general fauna movement through the landscape (physical and disturbance).	Specific mitigation for notable species is included later.	Low – moderate
Changes in surface & ground water conditions	Impacts to aquatic species (surface waters) and species dependent upon using shallow	River construction will be primarily undertaken in the dry season to avoid impacts. Project design also seeks to minimise impacts as described earlier. Water will be treated prior to discharge (see	Low-moderate. See water section

Impact	Effect	Proposed Mitigation	Significance (post mitigation)
	groundwater/ infiltration.	water section).	
Habitat pollution; including deposition and runoff	Nitrogen deposition from vehicles can affect sensitive habitats (woodland, grasslands and riparian areas). Dust can impact on vegetation and affect productivity and/or change local soil PH levels. Pollution (including salt) from road run off and de-icing may affect habitats and can create surface water films.	GIP mitigation will ensure that there are no significant impacts from run off. For particularly sensitive areas near watercourses bespoke mitigation and monitoring by the Ecological Clerk of Works (ECoW – see later and BAP) will be used to minimise the risk of significant effects. Effects from dust are expected to be limited to up to 100m from the source (25m with the application of GIP) and are unlikely to be significant. ECoW should advise on particularly sensitive areas deposition and salt spray should be monitored.	Low-moderate
Direct mortality may arise of notable species	Notable species may be affected by collisions with vehicles, habitat clearance, hunting and other sources of direct mortality.	Pre-clearance site surveys will map sensitive areas and apply additional mitigation where required. Construction camps will be located away from sensitive areas. A hunting ban will be in force for construction workers. Speed limits on vehicles and restriction to existing and/or dedicated haul routes will prevent direct mortality and disturbance from vehicles during construction. Pre-clearance site surveys and the movement of animals out of the working corridor by the ECoW, combined with timing of works in sensitive areas will prevent direct mortality. Some low level unavoidable direct mortality may still happen but this would not be significant in the short or long term.	Low – moderate
Disturbance (including visual and noise)	Construction noise and visual disturbance can result in short term, localised effects, although many animals will become habituated to the noise. Birds are amongst the best studied animal receptors in response to noise and only noise levels in excess of 65dB long term or spikes over 70dBs are	Construction noise and visual disturbance will result in short term, localised effects, although many animals will become habituated to the noise. The noisiest activities will be associated with any drilling and blasting required for the area near the chalk hills (see noise chapter) which could result in temporary abandonment of nearby areas and this will result in short-term adverse effects. In the most sensitive habitats and species, works will be confined to the least sensitive timeframes. Monitoring by ECoW will also ensure that should valuable species be breeding in an area, works do not take place during these sensitive times i.e. for birds	Low

Impact	Effect	Proposed Mitigation	Significance (post mitigation)
	likely to have an adverse effect ¹⁹ .	that the young have successfully fledged or that fish have successfully spawned.	
Spread of non-native / invasive species	Spread of non-native invasive species will reduce the ecological value of an area.	Pre-clearance site surveys combined with the demarcation and treatment of non-native species will prevent their spread. Monitoring post-construction will ensure that newly restored areas are not colonised by non-native species from adjacent areas.	Low

11.5.3 General Impacts and Mitigation: Species

The Project has the potential to impact on notable species as described above. Although these will be reduced where practical through the application of construction good industrial practice (GIP), such impacts will include the following:

Table 11.5.3a: Generic Issues that may Affect Notable Species

Issue	Description
Habitat loss, conversion, degradation and simplification	Permanent land-take will affect habitats used for breeding, feeding and other activities by notable species. For areas of temporary land-take, pre-works surveys will be used to confirm baseline conditions to which habitats should be restored post construction. Whilst this will minimize long term impacts, some short-term degradation and disturbance will be inevitable whilst mid-term loss will occur in areas that, once replanted, take time to mature (e.g. forest). Additional mitigation may be needed to compensate for this
Fragmentation	The construction and operation of the road has the potential to cause fragmentation of habitats used by notable species including otters and bat and amphibians. Additional mitigation may be required for some species as discussed later in this chapter.
Changes in water conditions (hydrological impacts)	The proposed scheme requires a limited number of water crossings. Appropriate pollution prevention measures will be put in place at each crossing and vegetation cover will be retained on the banks where possible to retain habitat and minimize soil exposure. Silt fences will be used to prevent silt from travelling downstream, and banks will be restored to pre-construction contours to the extent practical using temporary erosion control measures (such as straw bales, silt fence, etc.). Pre-clearance site surveys will map sensitive vegetation for restoration and reinstatement of banks will use mid-term soil stabilization measures (if required) such as willow revetments, gabions and/or geo textiles membranes to retain soil until the vegetation has established.
Habitat pollution including deposition and runoff.	GIP mitigation will be used to minimize impacts from run off. Where there are particularly sensitive watercourses bespoke mitigation and monitoring by the Ecological Clerk of Works will ensure no significant adverse effects. Impacts from dust (with appropriate damping down and other mitigation) are expected to be reduced to a distance of 25m from the works and are unlikely to be significant. Should the ECoW identify any particularly sensitive areas, deposit gauges will monitor the dust and appropriate action taken if required.
Direct mortality	Locating construction camps away from sensitive areas and enforcing a hunting ban of construction workers will help ensure that there are no significant adverse effects. Good site practice regarding the storage of waste and food will be implemented. Speed limits on vehicles and restrictions to existing and/or dedicated haul routes will prevent direct mortality and disturbance from vehicles. Direct mortality will be reduced through the use of

¹⁹ Dooling RJ, Popper AN, (2007). The effects of highway noise on birds. Environmental BioAcoustics LLC for the California Department of Transportation, Division of Environmental Analysis.

Issue	Description
	pre-clearance site surveys. The movement of animals out of the working corridor by the ECoW, and appropriate timing of works in sensitive areas.
Disturbance to species including visual and noise disturbance	Construction noise and visual disturbance will result in short term, localized effects, although many animals will become habituated to the noise. Noisy activities (e.g. from static plant use) may result in abandonment of areas closest to construction sites by some species. Impacts to the most sensitive habitats and species will be reduced by confining works to the least sensitive timeframes. Monitoring by the ECoW will also ensure that should valuable species be breeding in an area, works do not take place during these sensitive times.
Spread of non-native or invasive species.	Pre-clearance surveys combined with the demarcation and treatment of non-native species will prevent their spread. Monitoring post-construction will ensure that newly restored areas are not inundated with non-native species from adjacent areas.

Overall, the Project proposes to adopt the **mitigation hierarchy** to avoid impacts to notable species through a sequential approach of impact avoidance, mitigation, restoration and finally offsetting if no other approach is effective. The project has sought to avoid impacts to notable species from the outset through design of the route to avoid sensitive habitats. Wherever practical already degraded habitats (e.g. existing roads) are used or habitats of low biodiversity value. Construction works will employ GIP (Good International Practice) to further prevent or reduce impacts wherever practical. This includes avoidance measures during construction such as seasonal timings of works (for example to avoid impacts to nesting birds or roosting bats as determined by the ECoW – see below) as well as other generic mitigation measures as elaborated in the table below.

Ecological Clerk of Works (ECoW) – The Project proposes to proactively further reduce residual impacts and risks through the use of an Ecological Clerk of Works (ECoW) who will ensure that detailed pre-construction/pre-clearance surveys are undertaken and will ensure that commitments in the Projects **Biodiversity Management Plan (BMP)** are delivered in accordance with Project commitments. The ECoW will be well trained in the practical elements of protected species including handling of species that they may have to move and the recognition of sensitive habitats. They will also have a working understanding of wider environmental issues and the construction/engineering process. The BMP will be updated once the habitats and species within the project area have been further mapped under the guidance of the ECoW prior to and during the construction²⁰. This is described further in the Project BAP.

Table 11.5.3b: Generic Construction Mitigation (GIP) to Minimize Impacts to Notable Species

Impact	Mitigation
Impacts due to scarcity of data	Ahead of all works, sensitive habitats and notable species will be identified and mapped in 'pre-works surveys' (details below) by the ECoW. Bespoke mitigation will be applied in all areas where sensitive habitats and notable species are identified. This will allow suitable mitigation to be identified and the success of any remediation to be monitored. A monitoring report and hazard map will be prepared of sensitive locations by the ECoW and shared with workers so that sensitive areas can be avoided or bespoke mitigation implemented. The ECoW will ensure that habitat degradation is minimized and baseline data for the species BAPs (Biodiversity Action Plans) is obtained. Prior to any enabling works site survey,

²⁰ This will specify the baseline condition of each habitat and species, the target condition and the recommended actions required to achieve this restoration.

Impact	Mitigation
	mapping and/or demarcation of non-native invasive species will also be required.
General impacts from works and operation – avoidance	The works footprint will be reduced as far as possible e.g. through the use of a single vehicle track policies and use of low-impact vehicles where practical. Vehicles will be driven at designated speed limits. Off-road travel will be prohibited where practical. Laydown areas and compounds will be sited to avoid unnecessary clearance of vegetation. Natural breaks in vegetation will be used as preferred access routes where possible. The workforce will adhere to working corridors. All staff will be provided with environmental awareness training. The workforce will not deviate from approved clearance areas. Workforce hunting and fishing bans will be enforced and cutting of wood by workers will be prohibited. Fencing will be minimized (apart from where put in place for operations to reduce roadkill) to ensure that areas vital for wildlife are not isolated by workforce activities, unless this is for species protection measures. Temporary barriers will be used to prevent wildlife from accessing waste disposal areas and similar areas.
Habitat Restoration	Any reseeded or replanted of selected areas to be restored will use locally collected seed mixes and saplings. A local source of indigenous saplings suitable for replanting programs will be identified in advance to facilitate restoration. All efforts will be made to minimise removal of mature/significant trees and maintain connectivity between areas of forest habitats. Soils will be removed as subsoil and top soil and these will be stored separately as per good working practice for subsequent restoration. Workforce will be educated on preventing bush fires and this will not be used as a land clearance method.
Woodland habitats	Mitigation will include limiting working areas within woodland habitats, avoiding the felling of mature trees wherever possible and restricting working hours to daytime preventing noise pollution during twilight (dusk and sunrise).
Riparian Habitats	Works will be minimised within riparian areas to safeguard aquatic organisms. Crossing points across rivers will be conducted where there is clear access to the banks and vegetation clearance is minimised. The ECoW will determine for which riparian works a site-specific method statement is required. Standard pollution control measures will be implemented in all sites (e.g. to prevent silt contamination water will be kept out of the works area using appropriate isolation techniques, such as coffer dams, silt fences and by-pass channels). Demarcation and offsets for camp and storage locations and field activities will be at least 50m from watercourses where practical. Erosion control using 'polders', pads of plants and geo-nets will be implemented. Where trees have to be removed to facilitate the crossing, these will be replanted with a similar species composition.
New Habitats	New habitat features will include boulder piles, dead wood piles and brash, and creation of appropriate ponds.
Habitat pollution	Standard pollution control measures will be implemented. The ECoW will determine when further monitoring (e.g. for turbidity) and/or bespoke mitigation are required. Dust emissions due to road travel will be minimized by regulating vehicle speed and watering roads (where required). Spill kits will be available and standard industry refuelling protocols will be followed, e.g. use of drip trays. Erosion control will be implemented as appropriate.
Direct mortality of notable	All food and food waste will be stored securely to deter opportunistic species and minimize interactions between humans and animals. The location of sensitive species identified by the ECoW will be reported to the workforce appropriately. The

Impact	Mitigation
species	ECoW will be present during commencement of all works to conduct pre-construction checks and prevent animals present within the working area being killed or injured during the works. Checks will be for all vertebrate species including ground nesting birds, reptiles, amphibians and bats, amongst others. Checks will include within hollow trees and other places of shelter. As far as possible tree and scrub clearance will not be undertaken during the breeding bird season (March to August inclusive). Should clearance during this time be necessary a pre-clearance nesting bird check of the vegetation to be cleared will be undertaken by the ECoW and a decision on whether to move the nest or defer the clearance will be made by the ECoW.
Lighting	Works will not be lit where this is practical. Where lighting is required it will be directional and the lighting strategy will be designed with the input of the ECoW. Only non-UV lighting sources will be employed.
Excavations	Pits and excavations will be filled in as soon as possible following works. Trenches and pits to be created for longer than 48h periods will have 45° ground ramps to allow escape by fauna should they fall in. A pre-start check for fauna will be completed prior to works commencing in the morning if trenches are left open overnight. Regular crossing points will be installed to ensure wildlife can cross excavations, berms and drainage channels.
Noise	Noise is likely to be highly localised and most receptors will likely avoid the noisiest areas or become habituated to certain noise. Some species may be particularly vulnerable and additional mitigation measures will be implemented as appropriate, eg by altering timing of works, using less noisy machinery where appropriate. Noise barriers will be considered for use around static equipment.
Non-native or invasive species	Native plants that are locally sourced will be used for re-planting. A site wide ban will be placed on workers bringing vegetation or soil from outside the site area to prevent dispersion of non-native invasive species. Minimize topsoil movements. Wash down of all vehicles and equipment before entering the sensitive sites. Follow species specific mitigation regarding invasive species which includes demarcation and avoidance.
Unplanned events	Mitigation for unplanned events will include training of staff in: 1) the sensitivities of the habitats and species in the area via toolbox talks including health and safety recommendations regarding poisonous or otherwise dangerous plants or animals, provided by the ECoW 2) Prevention of accidents by adhering to good practice behaviour throughout the works 3) Delegating authority to a ECoW whose job it is to ensure compliance of the required mitigation 4) Training in immediate response to bush fire, spillages etc. 5) Emergency numbers provided for ECoW should protected species be found on site in the absence of site supervision. The ECoW will be present at all times if works need to take place in particularly sensitive areas.

Pre-works surveys – Prior to works starting, the proposed RoW will be further surveyed by suitably qualified ecologists to map up-to-date baseline conditions. The work will focus on the presence / potential presence of notable species, as discussed earlier in this document. It will:

- Consider all vertebrates (mammals, birds, reptiles, amphibians, fish).
- Employ survey techniques that are fully auditable, repeatable and in line with good practice guidance and undertaken by a suitably qualified professional.

- Be conducted at a suitable time of year for the target habitats and species (likely spring and autumn but to be confirmed for each receptor by the ECoW).
- Be used to update the Biodiversity Management Plan (BMP) from which the success of the species and habitat restoration can be compared to the BMP targets and **Biodiversity Action Plan**.

The ECoW will be responsible for confirming that adequate information has been collected to ensure that there is an appropriate baseline to inform the bespoke mitigation and monitoring.

The ECoW will also reassess the Project Right of Way (RoW) ahead of the works through a 'walkthrough' to be conducted ideally one to two days ahead of the works to obtain up to date information on the presence of flooded areas; nesting birds etc.

These two types of surveys can be summarized as follows:

- Pre-commencement detailed baseline data collection – To be undertaken well in advance of enabling works: These will allow habitat and species distribution to be accurately mapped in order to inform mitigation, confirm baselines and therefore targets for offsetting and KPIs for monitoring. To take place no later than 2 weeks and no more than 6 months before work commences. To be conducted by an appropriately qualified Biodiversity Specialist in Spring / to Autumn and focus on notable habitats and species.
- Pre-commencement walkthrough (rapid assessment) – To be undertaken just before enabling works to identify presence of sensitive receptors such as nesting birds, roosting bats and sheltering reptiles etc. Expected to take place no later than 1 day and no more than 2 weeks before work commences. To be conducted by an appropriately qualified Biodiversity Specialist and focus on notable habitats and species.

Specific Impacts and Mitigation are addressed in the sections below.

11.5.4 Impacts on Designated Sites

11.5.4.1 Impacts from Construction

The proposed road expansion will pass along the edge of the **Zeta Stream Key Biodiversity Areas (KBA)**, notable for a number of species that it supports, including fish and freshwater invertebrates. Whilst the scheme will result in only a limited amount of landtake from the KBA, the sensitivity of the associated watercourses means that any impacts to water quality (eg from disturbance of the river beds and/or accidental pollution during construction) could result in significant damage to its ecological value. This risk of pollution combined with its high sensitivity means that unmitigated effects are considered likely to result in a **high impact**. A specific working methodology will therefore be required for in-stream and near-stream works to minimise associated impacts (see also Chapter 9 Water Resources) and mitigation below.

The scheme will also pass through the proposed "**Mareza source with Sitnica and area of Velje Brdo**" site. Details of areas to be affected are included within the CHA and BAP appended to this document. Given the specific sensitivity of this site it is considered a **Priority Biodiversity Feature (PBF)** and specific working methods and a site-specific Biodiversity Action Plan (BAP) are to be implemented for this site.

No impacts are expected to other designated sites as a result of the construction of the Scheme.

11.5.4.2 Impacts from Operation

Impacts to the Zeta Stream KBA and "Mareza source with Sitnica and area of Velje Brdo" during operation will be limited to disturbance impacts and impacts associated with road run off. The latter will be minimised by run-off water management systems included within the Scheme

design. As result of these water quality protection measures operation of the Scheme is expected to only result in **medium level impacts** to the KBA.

No other internationally or nationally designated sites are expected to be affected by the operation of the proposed project.

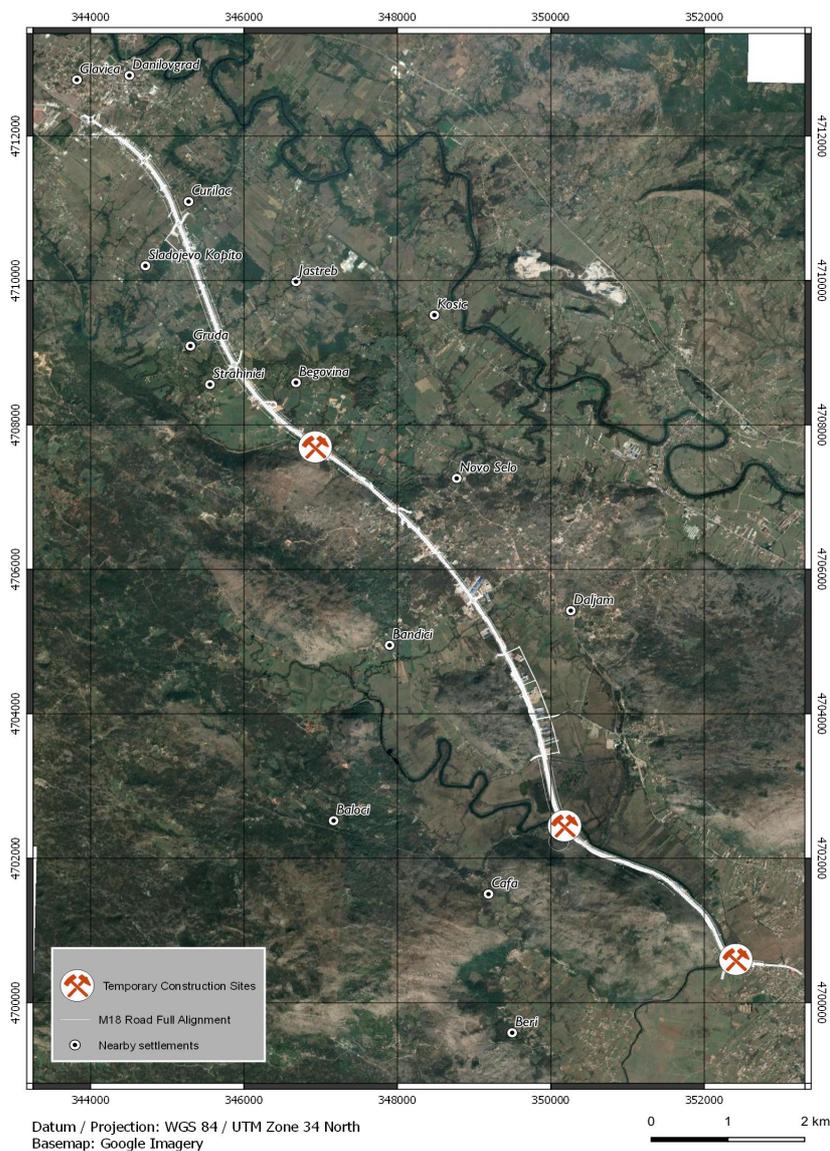
11.5.5 Impacts on Notable Habitats and Flora

11.5.5.1 Impacts from Construction

Habitat Loss

Construction of the road will result in permanent loss of a range of natural and modified habitats as well as impacts associated with habitat degradation and fragmentation. These will include impacts associated with the three temporary construction sites for the construction of the Susica, "Matica", Sitnica (Komanski) and Marezja bridges. The planned locations are situated along the existing road route and they cover the area of 1780 m² (see Figure 11.5.5.1a).

Figure 11.5.5.1a Location of Temporary Construction Sites along the road route



Source: Earth Active (2019)

A summary of the habitats to be lost is provided in the table below. Overall some 28.1 ha of habitat will be lost to the scheme, of which over 63% (17.7ha) is highly modified urban habitat, including buildings and artificial habitats. A further 7.7ha (27.5%) consists of a broad mosaic of hornbeam wood /dry grasslands areas. Overall impacts associated with loss of these specific habitats during construction are considered to be a **moderate, impact**.

Eunis classification	Description	Natura 2000 Classification	Total area in 150m Aol (ha)	% of total Aol	Area to be lost permanently	Area to be lost temporarily	Total area affected (ha)	% of habitat in AOl affected	% of total habitat lost
Other (J)	Constructed, industrial and other artificial habitats		46.3	12.1%	7.2	0.0	7.2	15.5%	25.6%
J1	Buildings of cities, towns and villages		141.0	36.9%	10.5	0.2	10.7	7.6%	38.0%
Mosaic G1.7C2, E1.55	Oriental hornbeam woods G1.7C2, Eastern sub-Mediterranean dry grassland		50.7	13.3%	5.4	0.0	5.4	10.6%	19.2%
G1.7C2	Oriental hornbeam woods		54.0	14.1%	1.6	0.0	1.6	3.0%	5.7%
E1.55	Eastern sub-Mediterranean dry grassland	62A0	6.9	1.8%	0.7	0.0	0.7	10.4%	2.6%
N/A	Mosaic of strongly degraded wet habitats		4.0	1.0%	0.6	0.0	0.6	15.4%	2.2%
G1.33	Mediterranean riparian ash woods	92A0	5.8	1.5%	0.5	0.0	0.5	7.7%	1.6%
D5.1	Reedbeds normally without free-standing water		5.8	1.5%	0.4	0.0	0.4	7.2%	1.5%
D5.13	Reedmace (Typha) beds normally without free standing water		3.6	1.0%	0.3	0.0	0.3	7.4%	1.0%
E3	Seasonally wet and wet grasslands		15.2	4.0%	0.2	0.0	0.2	1.4%	0.7%
E3.44	Flood swards and related communities		17.0	4.5%	0.2	0.0	0.2	1.1%	0.7%
G1.1	Salix alba galleries		1.2	0.3%	0.1	0.0	0.1	9.2%	0.4%
D5.11	Common reed (Phragmites) beds normally without free-standing water		3.8	1.0%	0.1	0.0	0.1	2.6%	0.4%
C3.21	Phragmites beds		1.8	0.5%	0.1	0.0	0.1	4.5%	0.3%
C2.33	Mesotrophic vegetation of slow-flowing rivers	3260	0.3	0.1%	0.0	0.0	0.0	6.2%	0.1%
C1.34	Rooted floating vegetation of eutrophic waterbodies	3150	0.6	0.2%	0.0	0.0	0.0	0.0%	0.0%
Mosaic G1.1, G1.3	Mediterranean riparian woodland	92A0	9.2	2.4%	0.0	0.0	0.0	0.0%	0.0%
Mosaic J, E3	Constructed, industrial and other artificial habitats /seasonally wet and wet grasslands		14.3	3.8%	0.0	0.0	0.0	0.0%	0.0%
Total			381.7	100%	27.8	0.2	28.1	100%	100%

Remaining habitats make up less than 10% (2.8ha) of the area to be lost, with most habitats losing less than 0.3 ha (3000 m²). However some of these areas, particularly the marginal strips along the river, are considered of notable ecological importance for their diversity and connectivity rather than just their area. These include areas of sensitive habitats (eg riparian forests along the rivers) such as the:

- River Zeta arm (standing water, along with swamp forests and meadows)),
- River Susica (which is characterised by interrupted flow already in March),
- River Matica, along with swamp forests and riparian vegetation,
- River Sitnica along with flooded forests and riparian vegetation,
- River Mareza, along with swamp forests and riparian vegetation, swampy meadows with the pertaining drainage channel,
- Swampy meadows which are covered with common reed (*Phragmites australis*) and
- Novo Selo hill with Macedonian oak forest (*Quercus trojana* - a Habitats Directive Annex I species in Italy and Greece).

Unmitigated construction impacts in any of these areas are considered to be a **high impact**.

Other Impacts

Construction works may also result in impacts from:

- air emissions, including dust from earthworks and material transfer.
- Noise from machine operation and vehicle movement.
- Loss of soil structure including erosion of the upper territorial horizon, leaching of construction sites and soil pollution from waste.
- Degradation of the quality of surface or groundwater due to discharges from the areas where earthworks are being carried out or because of water pollution by substances used in the construction phase.

- Changing the direction of surface run-off due to earthworks.

Overall up to around 62.5 ha may be affected by these impacts. However given the relatively small scale, short-term and partially reversible nature of these impacts, and the fact that they can be readily mitigated through the application of Good Industry Practice (GIP) they are considered a **medium impact**.

In areas with particularly sensitive habitats (including Natura 2000 habitats) unmitigated effects would be regarded as **high impact**.

11.5.5.2 Impacts from Operations

Impacts on habitats during operation will be restricted to impacts from road run-off, dust etc. Such impacts are considered to be **low**.

Habitat Loss and Fragmentation

The Project currently proposes to set up three construction sites along the route, of which two will be located in the immediate proximity to swampy and flood-meadows (Luznica and Mareska swamps) and Matica-Sitnica River (Construction site 2 – intersection to Cafa and Baloci; Construction site 3 – Komanski Bridge). Works at these sites will include clearance of vegetation and could directly impact on a Habitats Directive Appendix 1 habitat (92A0 - white ivy and white poplar forest). Further loss of this habitat will result from clearance works along the course of the Matica-Sitnica, from the current bridge to the Komanski bridge, with the river banks near the latter particularly affected. Field elm and narrow-leafed ash trees are also proposed to be felled near the proposed Susica, Matica, Komanski Bridges. These works are considered to have a high level of impact (significant). It will be important that the project Ecological Clerk of Works (ECoW – see above and later) marks out specific areas of habitat here to be protected during the construction works.

During construction there is a risk of erosion and abrasion of material into the watercourses (see Water Quality). Whilst the Rivers are slow-flowing with low water levels and a proneness to drying up (especially the Susica and Sitnica), any material increases in water turbidity and/or accumulation of sediments here may affect the Natura 2000 habitats (3150 and 3260). Impacts to these habitats may also occur during the process of drilling the riverbed and placing piers, and any change in the morphology of the riverbed could also have an impact. **This would be considered to represent a high level of impact (significant) and must be supervised by the project Ecological Clerk of Works (ECoW).**

Watercourse Pollution and Changes in River Bed Morphology

The Susica and Matica-Sitnica are at risk of pollution from a range of sources, including oil leaks or spills or uncontrolled waste disposal during the works. Dust generated from works (eg due to the vehicle movements, blasting of Zelenika hill, removing old asphalt etc) may be blown into the watercourses, which may also suffer from run-off from earthworks during rainy periods. River bank excavations and construction of retaining walls here may cause high water turbidity and /or pollution from accidental releases of construction materials. Further impacts may occur through accidental infilling of watercourses including by erosion of riverbanks or uncontrolled or accidental unloading of earthen material. **These issues are addressed further under Chapter 9 “Water Resources”.**

Invasive Species

Contractors may inadvertently bring in and/or spread invasive plants such as *Ambrosia artemisiifolia*, *Ailanthus altissima*, *Robinia pseudoaccacia* during the works. Vegetation clearance can create new areas of disturbed habitat which may be favoured by invasive plants. Such cutting and clearance of vegetation and earthworks is proposed to be carried out in reed beds area along the route. Impacts in sensitive habitats are considered **High**.

11.5.5.4 Impacts from Operations

Impacts on vegetation and flora related to road use are primarily associated with indirect effects from increased human activity, leading to degradation in habitat quality, although such impacts are expected to be limited in scale and effect. Overall the operation of the proposed scheme is expected to have a **low impact** on the flora and habitats of the study area. The road development will result in the fragmentation of habitats and such effects will be greater in sensitive habitats. The areas where fragmentation of habitats can occur and where sensitive habitats are present is shown in the following table:

Table 11.5.5.4a: Assessment of the Significance of Fragmentation

Location and Type of habitat	Sensitivity	Magnitude of Fragmentation
1 – Ćurilac River Zeta arm, standing water characterised by flood-forests and meadows, along the right side of the road, at the distance of around 272 m from the project impact area	No change	Negligible
2 – Susica Bridge River Susica (characterised by interrupted flow already in March)	Medium	Minor (adverse)
3 – Novo Selo Hill covered with Macedonian oak forest <i>Quercus trojana</i> , whereby the total surface of the habitat is around 7.6 ha. Permanent loss due to implementation of the project is around 0.42 ha.	Low	Minor (adverse)
4 – swampy meadows Swampy meadows characterised by common reed <i>Phragmites australis</i> , total surface of the habitat is around 12.8 ha. Permanent loss due to implementation of the project is around 1.18 ha	High	Mid (adverse)
5 – Flood-meadows Flood-meadow, together with the pertaining drainage channel. Total surface of habitats is around 126.87 ha. Permanent loss due to implementation of the project is around 1.10 ha.	Medium	Minor (adverse)
6. Matica Bridge River Matica, along with flood-forests and riparian vegetation. Total surface of habitats which will be under impact caused by the project is around 0.14 ha.	High	Mid (adverse)
7. River Matica River Matica, along with flood-forests and riparian vegetation. Total surface of habitats which will be under impact caused by the project is around 0.7 ha.	High	Major (adverse)
8 – Sitnica Bridge River Matica, along with flood-forests and riparian vegetation. Total surface of habitats which will be under impact caused by the project is around 0.2 ha.	High	Major (adverse)
9 – Mareza Bridge River Mareza, along with flood-forests and riparian vegetation. Total surface of habitats which will be under impact caused by the project is around 0.1 ha.	Low	Minor (adverse)

According to the above, the initial significance of this impact, without mitigation measures, is **Moderate**.

11.5.6 Impact on Birds

11.5.6.1 Impacts from Construction

Construction impacts on birds will include loss and disturbance of habitats for nesting, feeding and resting. The proposed road alignment does not pass through any areas of particular sensitivity for birds and generally, given the highly modified landscape present, such impacts are expected to be

local only and only represent a **moderate impact**. Some areas of greater value to birds will be affected however, such as the proposed "**Mareza source with Sitnica and area of Velje Brdo**" site, and particular care will be needed here. Other more notable areas include the following:

- Open areas with or without low vegetation (hill pastures, meadows, ruderal sites),
- Forest type vegetation, consisting of forest trees (black locust stand, mixed tree stands, Tree lines, Willow and Poplar belts and woodlands).
- The riverine ecosystems of the Mareza, Sitnica and Sušica Rivers

These sites are, however, located close to the existing road and as such are already subject to considerable disturbance. Vegetated areas may still provide nesting areas for birds, and these will be managed through the use of the ECoW, but species recorded are generally common and no important nesting areas for rare or protected bird species have been identified to date. Specific mitigation measures will also be taken to avoid impacts to nesting birds, including avoiding cutting vegetation during the nesting season (April-June) as described in mitigation. In general impacts are considered **moderate**, although removal of areas of riparian vegetation, willow and poplar belts and woodlands is considered to represent a locally **high** level of impact.

11.5.6.2 Impacts from Operations

Impacts to birds during road operations will be mostly restricted to disturbances, habitat fragmentation and direct collisions with vehicles. No notable species are expected to be affected and the significance of these impacts is considered as **low**.

11.5.7 Impacts on Mammals

11.5.7.1 Impacts from Construction

During construction, impacts to mammals will result from:

- Loss and fragmentation of habitat
- Cutting down old trees (potential shelters for bats)
- Removing a part of the wetland vegetation (feeding source)
- Mortality and injuries during execution of works caused by mechanization
- Harassment

With the exception of bats (addressed below), and potentially otters, no particularly sensitive species are expected to be affected by the proposed works. The significance of construction impacts is therefore generally considered to be **moderate**. Fragmentation of habitats already occurs on the existing road, and the current lack of underpasses has created a barrier and led to significant mortality of certain species. During construction fragmentation should be reduced through the planned construction of animal passages.

11.5.7.2 Impacts from Operations

During operation impacts will be associated with mortality and injury due to collisions as well as disturbance from noise, light and other elements. The existing road represents a significant risk to mammals, with large numbers of roadkill from direct collision with vehicles (including bats, hedgehogs and marten). Many of these were recorded near Zelenika hill or in the Luznica area and to reduce such impacts, specific passage and crossing areas have been included in the design. The significance of operational impacts is considered to be **moderate**.

Specific Impacts on Otter

Otter may be present and are currently under threat from a combination of declining wild fish stocks, habitat destruction (e.g. removal of bank side vegetation), and persecution due to perceived predation on fish. Pollution from organochlorines, polychlorinated biphenyls and mercury is also a major threat as is drowning in culverts and road kill. Construction and operation of the road could result in direct mortality of otters as well as loss and

fragmentation of habitat, disturbance, pollution and other indirect effects. Mitigation for such impacts is shown in the table below and will be implemented in all likely habitats where otters may be present or likely to be present..

Otter habitats and lying-up sites are subject to change over time and further surveys will be conducted in 2019 and immediately prior to the start of construction. This will involve surveys of all watercourses within 100m of the alignment for signs of otters including holts and couches. If any otter lying-up sites are found, mitigation will be adjusted as required. If any holts or couches being used for breeding are found all works in that area will need to be suspended until the cubs have left the holt/couch. Where otters are confirmed to be present, annual post-construction monitoring is proposed for five years to confirm whether the mitigation measures have been effective or if any alterations and/or enhancements are necessary.

Immediately prior to construction, for every river crossing or activity within a river there will be a **pre-enabling dedicated survey** to confirm absence of holts or other resting features within the direct zone of impact of the works. If features are found, exclusion of the features will be ensured prior to works commencing. During works within rivers, movement through the works area by otters will be permitted over the banks.

If the above mitigation is implemented the project is expected to have no residual impacts on these species.

Otter Mitigation Strategy

Sources of Impact	GIP Construction Mitigation	Bespoke Construction Mitigation	Design and Operational Mitigation
Direct Mortality			
<p>Otters are inquisitive animals and may be attracted onto construction sites to investigate machinery or spoil heaps. As a result they can become trapped in pits, piping, chemical containers wire mesh etc. As nocturnal animals they can also be particularly susceptible to night time accidents. They are also particularly susceptible to accidents/ death on roads.</p>	<p>Holes/pits will be covered at night or mammal ramps positioned to allow any trapped animals to escape.</p> <p>Night working will not be permitted where the proposed scheme comes within 30m of any watercourse where otters may be present to reduce the risk of otter being run over by construction traffic.</p>	<p>Otters to be excluded from dangerous areas by erecting temporary otter proof fencing where they are present (whilst avoiding otter commuting routes). Fencing may be e.g. chestnut paling fence with stakes at 25mm gaps or stiff plastic mesh that otters cannot scale. Temporary fencing to be positioned to guide otter to safe routes through the working areas. This may include underpasses for site access and haul roads, (min internal diameter > 600mm)</p>	<p>Construct watercourse crossings to enable safe passage of otters. All bridges or buried structures will have sufficient space between the abutments and the watercourse to enable otter to pass safely during high water levels. Provision will be made for otters to gain access to the water at such structures and ledges will be incorporated in the bridge design as appropriate. The proposed scheme is not expected to cross any smaller watercourses at grade. Should this change, and otters be considered likely to be present continued, access along the watercourse would be maintained through the use of appropriate culverts²¹.</p>
Habitat Loss and Fragmentation			
<p>Otters are secretive, and holts and couches are particularly important. Each otter knows where shelter is available in its home range. Loss of holts and other lying-up sites requires animals to travel further to find suitable cover. Habitat loss results from direct landtake siting of works compounds and material (including spoil) excavation of cuttings, construction of embankments and access roads, and building of bridges and culverts. Impacts will be greatest where construction requires diversion and re-alignment of watercourses.</p>	<p>Compounds etc to be sited at least 30m away from watercourses and to avoid nearby areas of woodland, dense scrub and/or wetland.</p> <p>After temporary loss habitat to be returned to its former quality or better (habitat creation for other species groups will also support otter where close to waterbodies). Reinstate any realigned sections of watercourses to as near as natural as possible or create new channels with meanders and riparian</p>	<p>Consider planting of trees such as willow, oak and ash along riverbanks and encouraging dense scrub nearby. Fence off overgrazed areas of land near watercourses to encourage vegetation growth. Where mature trees along riverbanks need to be removed, retain the root systems where practical to provide potential holt sites. Where works result in damage to river and stream banks, protected them eg by piling large concrete blocks to create attractive cavities for otter (in areas where the safety of otter can be assured by restricting their access to the carriageway).</p>	<p>Construct bridges and culverts where the road dissects watercourses to allow safe passage of otters during spate conditions, (presence to be confirmed by the ECoW).</p> <p>Should extensive stretches of road be fenced, install dry underpasses to enable otter to move between habitats.</p>

²¹ Depressed invert box culverts are typically used as they do not fill as rapidly as cylindrical culverts which helps swimming otters. Culverts should be fitted with dry ledges that are accessible during high water levels. These should be made of solid concrete and integral with the culvert, 500mm wide and accessible both from the bank and the water by the provision of ramps or groups of large boulders. Ledges should be sited at least 150mm above the appropriate high flood level, allowing 600mm headroom. Where appropriate otters can be guided to the ledge by planting dense scrub on the opposite bank or providing the ledge on the appropriate side of the culvert. Further surveys will be undertaken prior to the construction of culverts should they be needed.

Sources of Impact	GIP Construction Mitigation	Bespoke Construction Mitigation	Design and Operational Mitigation
	planting		
Habitat Fragmentation			
Works/the road may prevent otter from moving freely within and between existing areas of habitat, Culverts may act as a barrier to migratory fish movements and this could affect eg salmonid populations. The scheme could divide otter home ranges, leading them to either abandon parts or make frequent road crossings, with associated risk of accident. Severance of an otter's home range can also place it in direct competition with other otter, and otter are capable of inflicting serious and potentially fatal injuries on each other during disputes over territory.		Install temporary or permanent otter underpasses if required (eg under access roads). During construction of bridges and other structures one side of the river or stream being bridged will remain intact for as long as possible to provide safe access, and the area around the water course to be disturbed will be minimised by the provision of temporary barriers and safe working areas. In addition, if lighting is used it should be shone away from the river during construction at dusk or in the morning. Or if needed in the river it should use shrouding to ensure that not all the river is lit up and passage along it is still possible in unlit locations.	
Disturbance			
Includes physical disturbance, noise and light as well as possible obstruction of holts and otter pathways.	Appropriate siting of construction compounds and/or storage sites to minimise such impact.	Provide relevant contractors with an overview of otter ecology prior to works commencing. Any holts and couches to be identified to contractors in confidence to ensure that they are not accidentally disturbed and marked so that contractors must not enter. Site clearance must be preceded by a thorough survey of the area for holts, couches and otter, and once completed working areas in suitable habitat must be fenced to prevent otter returning. If a holt or couch is discovered during construction, an exclusion zone of 30m must be established and all works suspended. If an occupied breeding site is found, it may lead to the cessation of work for up to 10 weeks until cubs are mobile and able to leave the area. Night working (one hour after sunset to one hour before sunrise) will not be permitted where the scheme comes within 30m of a holt/couch or watercourse in order to prevent disturbance to otter and their routines.	During the operational phase, otter would be likely to suffer disturbance from traffic noise as well as from road lighting. Otter may become accustomed to these impacts over time but could abandon any holts or couches in the immediate vicinity of the scheme. Potential disturbance caused by the operation of the scheme will be partially mitigated for through the planting of natural screens along the scheme which will reduce noise and light disturbance to otter. Areas of lighting should be low where the operational scheme crosses or runs parallel to watercourses thus reducing disturbance to otters.
Pollution and Other Indirect Impacts			
Water pollution could create long-term damage to the productivity and diversity of nearby habitats, affecting both otters and their food supply. Local rivers already have seasonally high sediment	Contractors to adhere to pollution prevention GIP, as outlined in relevant guidelines on eg: Prevention of Water Pollution; Use and Design of Oil Separators; Works In, Near, or Liable to Affect Watercourses etc.		Pollution from the operational road can be worst following storm water runoff or accidental spillage. Runoff may contain toxic compounds used in the manufacture of cars, including zinc, cadmium and copper, as well as PCBs. Spillages occurring during

Sources of Impact	GIP Construction Mitigation	Bespoke Construction Mitigation	Design and Operational Mitigation
<p>loadings but construction works (including gravel extraction and in-river works) can result in sediment deposition downstream. This can impact on both aquatic invertebrates and fish populations (and fish fry) which in turn would affect otter prey availability. Accidental spillages, e.g. from oil and diesel drums would also impact on prey, and if chronic could lead to bio-accumulation of contaminants which could result in otter mortality. Pollutants such as oil and diesel can also affect 177iltshi-regulation qualities of an otter's coat and cause mortality.</p>	<p>Any chemical and oil storage tanks will be set back at least 20m from any watercourse and secondary containment must be provided. Construction vehicles will be prohibited from crossing watercourses used as breeding grounds by salmonid fish and silt traps will be installed as appropriate. Disturbance to streambeds will generally be kept to a minimum to prevent erosion and siltation.</p> <p>During both construction and operation pollution control measures will include installation of drainage systems to divert runoff into drains, soak-aways and detention basins to avoid contamination of watercourses. Detention basins should be fenced for health and safety purposes which would also act to deter otters from gaining access and becoming trapped. Drainage systems should be grilled to prevent otter entering and becoming trapped.</p>		<p>the operational phase would have impacts similar to those from construction.</p>

Specific Impacts on Bats

Road construction has the potential to result in impacts to bats as a result of habitat loss and disturbance and direct mortality amongst others. These will generally be mitigated through the use of the ECoW as outlined earlier.

Operational roads can also have a number of significant effects on bat populations including those outlined further in the table below. Many effects of roads on bats are species-specific. Larger, fast-flying species, adapted to foraging in the open, appear to be less affected by roads since they typically fly high above the ground and their greater flight efficiency and speed mean that even if diverted, the consequences are less likely to be important. Smaller, slower flying, woodland adapted species are more maneuverable but less efficient flyers. Woodland species are also more reluctant to fly in the open and tend to commute along linear features in the landscape such as tree lines, waterways, and woodland edges. These features provide protection from weather and predators, are sources of insect prey, and provide conspicuous acoustic and visual landmarks for orientation. The species most likely to be affected by roads are the slow-flying, woodland-adapted bats, such as *Rhinolophus* and some *Myotis* species, and these are also those that have suffered most from habitat loss.

The detrimental effects of artificial lighting will be reduced where practical by limiting unnecessary installations and using cut-off lighting. This is considered particularly important in areas commonly used by light-averse bats to forage, commute or roost during key times such as reproduction. Bats are also particularly faithful to maternity roosts due to the specific conditions they provide, and so conserving them is important for maintaining bat populations.

Proposed mitigation includes the following:

- Any tree above 100mm in diameter to be checked by the ECoW for the potential of roosting bats prior to removal. If bats are found, the roost will be left undisturbed until vacated by bats.
- All felled trees with potential to support bats (i.e. with suitable cavities) to be left in situ (on the ground) for 24 hours to allow any bats to move.
- Where practical avoid felling trees between April-August.
- Use of non-UV sources of lighting at working sites, deposits and permanent facilities to avoid attracting nocturnal insects and the bats that feed on them.
- Installing of bat boxes within appropriate habitat to mitigate for loss of roost sites.
- If any habitat corridors are found to be severed, identify key locations for replanting to retain commuting routes and if appropriate raise the height of the planting so that crossings are above traffic.
- If routes are near cuttings provide appropriate infrastructure across the cutting where practical to ensure bats avoid the cut area and being hit.
- Use down lighters as standard given the very undeveloped nature of the project area.
- Further information is required as a priority for bat species from the ECoW to determine the extent to which **species-specific BAPs** are required to mitigate impacts.

Impacts of Operational Roads on Bats

Issue	Effect
Habitat Loss	The proposed road development will involve the removal of trees and buildings that hold potential or actual bat roosts. The removal of trees, hedges, scrub, water bodies and unimproved ('natural') grassland also reduces available foraging habitat ²² .
The Barrier Effect	Roads are potential barriers to flight between roosts and foraging sites and between summer, mating and winter roosts. Bats have been shown to make major detours (with associated energy costs) to avoid roads or to find appropriate crossing points. This can also deny bats access to parts of their habitat which can reduce home range size and quality and restrict migration. Roads may act as barriers because they interrupt existing linear flight lines, because some species are reluctant to cross open ground, because some species avoid lit areas (road and vehicle lights) and, at least initially, because they represent sudden changes in the bats' familiar landscape. Roads may also fragment habitat, decreasing its area and quality. Impacts are however species specific. Studies in Germany have shown that Bechstein's bats (<i>Myotis bechsteinii</i>) will avoid crossing roads, whilst barbastelle bats, <i>Barbastella barbastellus</i> will fly over roads and <i>Nyctalus</i> species will cross busy roads at heights above 20 m. behaviour that is likely to make them less susceptible to the barrier effects of roads and to collision mortality. Others will use underpasses, if strategically located.
Direct Mortality	Bats that attempt to cross roads also risk collision, and hotspots for mortality have been found where there is favourable habitat for bats and flyways cross roads. Although agile and manoeuvrable in flight, most bat species fly at low speeds (< 20 km/h) and many fly close to the ground (0-4 m) particularly when crossing open spaces. These behavioural traits make bats highly vulnerable to moving vehicles when either foraging along roads or when attempting to cross roads on commuting flights. Being small, bats can probably be pulled easily into the slipstream of passing vehicles.
Light	Lighting tends to deter many bat species, notably slow-flying, woodland-adapted species such as <i>Rhinolophus</i> , <i>Myotis</i> and <i>Plecotus</i> , from approaching roads and probably exacerbates the barrier effect. Both high-pressure sodium and white LED light deter woodland-adapted species, even at low intensity. ²³ As light intensity drops rapidly away from the source, effects of isolated sources are not likely to be far reaching, but large arrays of high intensity lights will have a significant effect. Light can also attract some bat species, in particular open-air foragers such as <i>Nyctalus</i> and generalists like <i>Pipistrellus</i> , since short wavelength light attracts insect prey, concentrating them around lights and increasing bat foraging efficiency, although they may also be at greater risk of collision with traffic.
Noise	Most insectivorous bats rely on echolocation calls to orientate, detect prey and communicate. Some also locate and capture prey by listening for sounds they generate. (e.g. wing movements or mating calls). Traffic noise may mask all of these sounds and reduce the feeding efficiency of bats (eg <i>Myotis myotis</i>). It is likely that habitats adjacent to noisy roads would be unattractive as feeding areas for such species. Vehicle noise may also exacerbate the barrier effect, although noise effects over unlikely beyond 60m away.
Cumulative effects	Most of the factors discussed above are also cumulative. The effects of each individually need not therefore be great for the combination to have a profound effect on a bat population. Full effects, however. May not be seen for several decades and this has important implications for monitoring the effects of roads and assessing the effectiveness of mitigation. Data ²⁴ indicates that the decline in diversity and abundance of bats extended to at least 1.6 km from a motorway.

²² Road surfaces alone removes some 7 ha of habitat for every 10 km of 7 m wide, two-lane, single carriageway road. Roadside hard shoulders, verges, junctions, service areas and other structures remove additional potential habitat.

²³ (Stone et al. 2009, 2012).

²⁴ Berthinussen & Altringham (2012a, 2013)

11.5.8 Impacts on Amphibians and Reptiles

11.5.8.1 Impacts from Construction

Construction impacts to reptiles and amphibians include death, injury or disturbance during land clearance and construction works and pollution of aquatic habitats. These will be most significant where they affect sensitive species such as Albanian water frog, *Pelophylax shqipericus*; Hermann's Tortoise, *Testudo hermanni*; and European Pond Turtle, *Emys orbicularis*. The following summarises potential impacts:

- Loss of amphibians and reptile refuges used for breeding, resting and hibernation (as well as habitats for prey) as a result of vegetation clearance works.
- Loss, degradation and disturbance of aquatic habitats used by amphibians and reptiles especially during reconstruction of bridges across the rivers (Mareza, Sitnica, Matica, Susica) and where the road route which runs across streams (Crkovnica) and channels (Gruda).
- Degradation and loss of a part of the sensitive swampy area, located between the Matica Bridge and Luznica hill, which supports the endangered species *Pelophylax shqipericus*.
- Disturbance effects as a result of noise and vibrations during the construction phase.
- Pollution of habitats through emission of dust, waste, excavated soil or other material along the river banks, creeks, or directly into the aquatic and swampy habitats.
- Habitat loss from parking and operation of mechanisation, as well as storage of material on the ground, outside of the zone of the existing roads and the urban area.
- Increased mortality of adult and juvenile fauna when crossing the road, notably for Hermann's tortoise, which has been marked by a high rate of road kill.

General impacts are expected to be **moderate**, although impacts on notable species are considered **high**.

Operation phase

During road operation impacts will include arise as a result of habitat fragmentation, direct mortality from collisions, and impacts associated with road run-off. Several species already suffer high levels of roadkill (eg *B. bufo*, *T. hermanni*, *Podarcis Melisellensis* - Dalmation Wall Lizard), and this should be improved with the introduction of the new culverts. Impacts during operation are expected to be **moderate** significance, although this should be confirmed through monitoring.

11.5.9 Impacts on Fish

11.5.9.1 Impacts from Construction

Impacts on fish during construction could include the following:

- Temporary and permanent loss of aquatic habitats, including river banks.
- Impacts on water quality due to changes of morphology and pollution (including turbidity).
- Disturbance by noise and vibration.
- Inadvertent introduction of invasive alien plant and animal species.
- Degradation of the existing habitats as a result of changes in hydrodynamic conditions.
- Spillage of harmful chemical substances into the environment, e.g. petroleum products).
- Loss of connectivity between the upstream and downstream habitats.
- Degradation of the flood zone and the surrounding vegetation from the Matica Bridge to Komanski Bridge.

In general impacts to local watercourses are expected to be site-specific and temporary in nature, with natural regeneration expected once works cease. As a result, impacts are generally considered **moderate**, except should they affect endangered species such as *Anguilla Anguilla*- European Eel (CR) and *Salmo zetensis* (EN)), when they would be considered **high**. Of note, however, is that fish

stock can be disturbed by changes to water velocity, oxygen levels, and temperature with shallower watercourses being warmer. This can pose a problem in areas supporting salmonid species. Under such conditions, premature hatching may occur at the time when other conditions, primarily conditions related to feeding, are not satisfactory. The ECoW will be required to implement appropriate monitoring to avoid such conditions occurring.

11.5.9.2 Impacts from Operations

During operation fish may suffer from decreases in water quality associated with road run-off downstream from the bridges, as well as loss of connectivity between the upstream and downstream habitats. Any of the issues that could impact upon water quality could also affect fish stock. This includes impacts affecting places for hatching and laying eggs as a result in changes to the riverbed following bridge construction. Increased water turbidity can adversely affect both light levels, oxygen dissolution, water temperature, and availability of food, and can lead to suffocation of fish eggs and fry. Increased PH value leads can also lead to a more pronounced toxicity of many metals, aluminium, cadmium, zinc, iron and copper etc which can lead to morphological changes on gills, whereby this causes reduction of their respiratory and osmoregulation efficiency, slow down the spawning process and development of fertilized eggs, whereby it also increases the mortality of embryos and fish larvae. The significance of such impacts is considered as **low** on common species and **moderate** on notable species.

11.5.10 Impacts on Invertebrates

No significant impacts are expected on notable terrestrial invertebrates from either construction or operation if impacts on their habitats are successfully managed. Potential significant impacts on freshwater invertebrates could arise from loss of habitat or water quality, including species for which CH/PBF has been identified. Mitigation for habitats is described above and for water resources in Chapter 9. Further information is also provided in the CHA and BAP.

Proposed Project Mitigation

The above sections include a range of generic mitigation to be included in the Biodiversity Management Plan and, for CH or PBF, developed further in the Biodiversity Action Plan. In addition to the above, the following is also proposed:

11.6.1 Protected Areas

Whilst no specific mitigation is proposed for the Zeta Stream KBA during construction or operation a range of mitigation will be applied for specific habitats and species which will also be relevant to the KBA. This will include the application of newt/reptile fencing around the road and the use of chippings or very short vegetation to discourage animals from going onto the road.

A specific Biodiversity Action Plan will be developed for the "Mareza source with Sitnica and area of Velje Brdo" site. This includes consideration of options to rejuvenate the wetland (which is drying out) for example by digging of ponds, and removal of salix trees to enable net gain of more sensitive habitats.

11.6.2 Habitats

11.6.2.1 Mitigation during Construction

During construction and as guided by the ECoW, the contractor will be prohibited from entering sensitive habitat areas, except where absolutely necessary. Good construction controls will be built into the construction contracts and will include rehabilitation of all areas where vegetation has been damaged. Areas required only temporarily, such as areas disturbed by construction of the bridges will be rehabilitated. Specific mitigation measures will be implemented to minimize the effect of fragmentation on fauna including the use of a sufficient number of wildlife crossings (as outlined

later). In addition the riparian vegetation along the Mareza, Sitnica and Susica will be restored and this and other riparian areas will be vegetated with native plant species that are attractive to local fauna and with plantation patterns designed to lead the animals towards the wildlife crossings. The rehabilitation program should incorporate a wide variety of species typical of the regional ecosystem. The species composition for rehabilitation will depend on the type of ecosystem in question.

Specific measures will be included for sensitive habitats (eg Natura 2000 habitats) are shown in the following table;

Table 11.6.2.1a: Specific Measures for Habitats Listed in the Appendix I of the Habitats Directive

Approach	Detail
Siting of worksites	Arrange construction sites (2 and 3) to reduce risks of construction impacts such as fuel spills, oil spills, hydraulic oil spills, inadequate and unprofessional use of the planned landfills, scattering of material, different types of waste on the surrounding swampy and aquatic habitats (habitat types 3150, 6420, 95A0).
Working corridor	Enabling and construction works should be carried out in the access road corridor (service road) so that the natural morphology of habitats is degraded to the smallest possible degree and in order to ensure preservation of autochthonous flora and vegetation.
Vegetation retention	Retain existing vegetation, especially the border trees on river banks – habitat type 92A0, wherever practical.
Timing of clearance	Clear vegetation cover in the areas around bridges (Susica, Matica-Sitnica) and in the area from the Matica Bridge to Komanski Bridge (habitat type 92A0) carefully ideally during the dormant period (from 1 st October until 15 th March).
Water levels	Carry out works in watercourses during the time of the year when water levels are minimal, while making sure that the riverbed is preserved in its natural relief. Avoid destruction of riverbed and divert streams to minimise negative impact on aquatic flora and fauna.
Management of soil	Material generated during excavation should be used for construction of the necessary infrastructure and for landscaping the areas along the road. Excess earth material should be deposited in line with the regulations at pre-designated locations (Contractor should sign the agreement with the local authorities), and the surrounding habitats may not be covered with this material (especially Susica, Matica-Sitnica and swampy meadows). Hummus should be deposited at a temporary storage area and then laid out again as the upper layer during rehabilitation of the surrounding area. This will be managed through a Soil Quality and Erosion Control management plan.
Specific Methodologies	During the process of carrying out excavations along Susica, Matica-Sitnica, drilling the riverbed for the purpose of placing piers, blasting the surrounding hills and building reinforcement walls, the physical parameters (turbidity) and chemical parameters (PH, O ₂ saturation) should be regularly checked in specialised laboratories (habitats type 3150 and 3260).
Invasive species	In case of identifying invasive species, such as: <i>Ambrosia arthemissifolia</i> , <i>Ailanthus altissima</i> , <i>Xantium</i> sp., they should be immediately removed.
Vegetation Restoration	Areas from which vegetation is going to be cleared for the purpose of enabling works and using access roads should be restored into their original condition. All locations along the Matica-Sitnica River which will be subject to significant degree of clearing (eg habitat type 92A0), should be subject to biological restoration, whereby this process should be carried out by planting autochthonous tree species (narrow-leafed ash, black poplar and willow).

With regards to reinstatement in areas with temporary impacts, disturbed land will be reinstated as far as this is consistent with safety and visibility for road traffic. River banks will be the most impacted through the construction of new bridges. Banks will be reinstated to their original profile, with the aid of gabion baskets or rip-rap if this is necessary to prevent erosion. Soft engineering techniques would be preferable. Tree planting will use two -year pot grown trees of local provenance. Seeding will be from seeds gathered from the local vegetation. A technique that is both cheap and effective is the laying of hay cut just before grass seeds drop on the areas of bare earth.

In addition, at all sites GIP practices will be employed such as the use of an ECoW, checking of trees to be removed for bats and nesting birds (and avoiding their removal until hibernation or nesting is finished), and work on bridges to focus on the dry period. Large trees and bat roots will be inventoried and where practical mature trees (eg oak and walnut) will be retained with compensatory planting also undertaken for any trees to be cut down. Bat boxes will also be considered where appropriate. Blasting in karst areas will be avoided if practical and if it cannot be avoided no blasting should occur between 5 pm and 5 am to minimize the impacts on bats leaving or entering cave areas. Machine operators and blasters should be made aware of the sensitivity of the area and trained to identify potential consequences of their actions such as wildlife disturbance, developing of karst features (sinkholes, caverns), and hydrologic disturbance.

11.6.2.2 Mitigation During Operation

A regular control and maintenance of drainage structures shall be conducted to check they do not become clogged with debris or sediments. Regular maintenance activities will also include maintenance of verges in the median strip and in the road area, removal of food, waste, animal carcasses, etc.

11.6.3 Birds

11.6.3.1 Mitigation during Construction

To minimise construction impacts on birds , the following measures shall be applied.

- Care will be taken to avoid nesting birds during construction. Habitats of greater importance will be marked out for particularly sensitive works. These will include parts of river corridors along the Sitnica river and Zeta river (Curilac), as well as reed beds and flood meadows in the area of Mareza and Luznica.
- Fragmentation of grassland habitats will be avoided to prevent impacts to ground-nesting species. Access roads will be clearly defined before commencement of works.
- Works will be planned during the period of reduced activity of birds, or in the period outside the reproductive season. The optimal period is after the reproductive season, from the end of August, or before the beginning of the reproductive season in April. Works related to changes in the riverbed will be undertaken where practical at the period of the lowest water level, i.e. after the nesting period which occurs during the end of July.

11.6.3.2 Mitigation during operation

No mitigation is proposed for birds during the operation of the road.

11.6.4 Mammals

11.6.4.1 Mitigation During Construction²⁵

The following mitigation is proposed for the construction period;

Table 11.6.4.1: Mitigation Measures for Mammals during Construction Phase

Approach	Detail
Lighting	Lighting will be minimised as far as practical whilst taking account of safety requirements. Cut-off lighting will be used and mercury and halogen lamps will not be used.
Bat Roosts	Before cutting down the trees, old trees will be checked for the presence of bat roosts and hibernaculae (used from March to November).
Vegetation Management	Vegetation along the road will be cut down and cleared (in the zone from 3 to 10 m) to reduce the attractiveness of the habitat for certain mammals, and increases the transparency of the terrain and visibility for drivers. This is also for operations.
Culverts	Culverts will be planned for passages for animals using expert recommendations in places that have been determined as important in terms of habitat conservation and increased mortality due to collision (see section 4.4.3). During the construction of passages, it is necessary to preserve the surrounding flora in order to enable the natural movement of animals towards passage.
Signage	Install traffic signs and signalling for the drivers (blinking mark) with animal signs at locations which have been determined as important for mammals through the study.
Ledges	On bridges and under bridges ledges will be provided for movement of small mammals and otters (during high water levels as well).
Fencing	Install a temporary fence around the construction site in places that the study has defined as important for mammals, in order to prevent their entry during the night (2m-high fence should be planned within the Site Organization Plan).

Fauna passages

To avoid traffic mortality and allow crossing of animals from one to the other side of the road underpasses, box culverts, bridges and tube culverts can be used. Habitat fragmentation for each category of animal is also related to the distance between suitable crossings. The smaller the distance the smaller are the consequences related to habitat fragmentation.

For the small mammals and reptiles, the recommended criteria are the following: According to the bibliography (luell et. al, 2003 and kallisto, 2010), underpasses for small animals such as amphibians and reptiles consist of pipes or rectangular tunnels with a diameter/width of usually 0,4-2 m. The distance between two appropriate and available passages must not exceed the 200 meters in natural areas²⁶ or 500 in agricultural areas according to expert judgment. The longer the length of the road fulfils the above-mentioned criteria the less impacts are caused to the biotope fragmentation. It is also noted that no significant impacts are expected in case the above criteria are not fully covered in residential or agricultural areas.

11.6.4.2 Mitigation During Operation

²⁵ Incorporates requirements of national legislation ("Rulebook on protection measures and method of maintaining the passage for wild animals" (Official Gazette of Montenegro No. 80 / 2010), European guidelines from COST 341 Habitat fragmentation due to transportation infrastructure - (Wildlife and Transportation - Handbook for Identifying Conflicts and Designing Solutions).

²⁶ (under passage every 150 -200 meters for amphibians and reptiles - luell, B., Bekker, G.J., Cuperus, R., Dufek, J., Fry, G., Hicks, C., Hlavač, V., Keller, V., B., Rosell, C., Sangwine, T., Torslov, N., Wandall, B. le Maire, (Eds.) 2003. Wildlife and Traffic: A European Handbook for Identifying Conflicts and Designing Solutions)

Mitigation for operation includes use of animal passes under the road and control of rain run off from the road. These have been adopted by the Design team and will be installed at the locations recommended. Long term biodiversity management to ensure no net loss, and where possible net gain, will be included in the Biodiversity Action Plan. Specific mitigation for otters and bats is provided in the previous section.

11.6.5 Amphibians and Reptiles

11.6.5.1 Mitigation during Construction

The following general protection measures will be applied for reptiles and amphibians during construction:

Table 11.6.5.1a: Mitigation Measures for Amphibians and Reptiles during Construction Phase

Approach	Details
Culverts	Culverts will be designed in the way to enable passage for terrestrial animals (see Main Design)
Toad crossing	A wildlife crossing for <i>B. bufo</i> will be built at the ch. 119 + 662.560. The crossing should be made from 30x30cm polymer-concrete which can easily be installed on the road, providing that the top edge of the tunnel is in line with the asphalt and that the tunnel provides conditions for passing of light, air and water. Direction guides should be placed next to the opening – fences which guide the amphibians and prevent them from accessing the road. The fence should be 30-50 cm high, and it should have a rounded top section so that the animals cannot climb over it, but so that it still ensures that the animals which accidentally reach the road can easily cross over the fence. Additionally, it is required to transport the animals across the road route during the migration season.
Pollution Prevention	Possibility of accidental pollution of aquatic habitats used by amphibians and reptiles should be prevented as per previous chapters.
Manoeuvring	Use of heavy machinery will be strictly limited to the Project RoW to avoid additional fragmentation and degradation of habitats, as well as subsidence of soil.
Waste management	Wastes, including spoil, must not be deposited along the river banks, creeks, channels, or in swampy areas. The Law on Waste Management will be complied with.
Temporary areas	Areas which are temporarily used during construction will be backfilled with soil, which would enable reinstatement of autochthonous vegetation and reptiles, as well as uninterrupted spring and fall migration of amphibians.

A range of specific protection measures will also be put in place for the notable species as shown below:

Table 11.6.5.1b: Specific Protection Measures for Notable Species

Species	Specific Mitigation
<i>General</i>	Maintenance and repairing of mechanisation, oil change, fuelling up, etc. should not take place in the areas which are close to watercourses and wet habitats). Use of heavy machinery will be strictly limited to the Project RoW to avoid additional fragmentation and degradation of habitats, as well as subsidence of soil.
<i>Pelophylax shqipericus</i> (EN)	Works to be carried out during the time of the year when water level in the watercourses is minimal. During the dry periods, some animals migrate from the swampy area (which dries up) to wetter central area around the Matica River and is further away from the impact area. Special attention should be paid to preserving the swampy area between the Matica Bridge and Zrnica Hill to the greatest possible extent. This area is located 60m away from the project impact area. Thus, it is suggested to place info boards which will provide information about representation of the endangered species in the subject area, and thus make it clear to the construction workers that the works, i.e. operation of machinery must take place in the designated area.

<i>Emys orbicularis</i> (NT)	Special attention should be paid to the locations Gruda and Curilac at which the European pond turtle has been identified.
	Bearing in mind that it is planned to carry out reconstruction of the culvert at the location of the existing one (Ch. 117 + 864.290), soil and material should not be deposited in proximate vicinity to the channel, whereby any possible intentional or unintentional filling of the channel must be avoided. The channel should be protected during the construction phase. It is suggested to make a culvert which will enable passage of both the aquatic and terrestrial animals, while providing elevated plateaus for passage of animals along each side of the culvert.
<i>Testudo hermanni</i> (NT)	ce a thick protection fence at locations where a significant rate of Hermann's tortoise roadkill is recorded (from the Ch. 120+513.59 to Ch. 121+004.60). The fence will need to have the following dimensions: 10 x 10 mm, 50 cm (height) – including 10cm which would be founded into ground.

11.6.5.2 Mitigation during Operation

Monitoring of the mitigation measures is mandatory in order to assess their effectiveness. Consequently, condition of the wildlife crossings and unimpeded access needs to be periodically monitored during road use.

11.6.6 Fish

11.6.6.1 Mitigation During Construction

The following specific mitigation measures are required during construction:

Table 11.6.6.1: Mitigation Measures for Fish during Construction Phase

Provide temporary site drainage channel to avoid erosion and environmental impacts.
Wastewater treatment should be carried out via the system for additional treatment and drainage, which operates through the precipitator and separator.
Avoid turbidity impacts through use of sedimentation or infiltration method.
During reconstruction of the bridges, protect the riverbed and carry out the works when water levels in the watercourses are minimal (mid June – mid October).
Avoid accidental pollution of watercourses (spills of oil, lubricants or oil derivatives into the watercourses).
Prevent wastewater inflow, which should be done by installing special drainage channels, while wastewater should be treated via the precipitator and separator.

National legislation requires provision of conditions for fish migration to ensure that fully mature species can migrate during winter for spawning. Bridge works should occur outside of the key wet seasons of November-February and at all such times fish should be able to pass up permanent rivers. "Pool" fish ladders may need to be constructed at Komanski Bridge and Matica Bridge (to be advised by ECoW). Construction of a fish ladder is not required at the location of Susica Bridge, as these activities will be carried out during summer, when there is no water running under the bridges.

11.6.6.2 Operation Phase

Limited mitigation is required for the operational phase, especially as the construction area should be subject to rehabilitation to ensure that vegetation is restored to its original condition. Monitoring should be undertaken of fish populations. Improvements in fish stock by adding trout

should be considered **only if** monitoring indicates long-term impacts on fish populations (also important for otter food).

Residual and Cumulative Impacts

11.7.1 Residual Construction Phase Impacts

Full details of construction mitigation will be addressed through both the Contractor's Biodiversity Management Plan, and the Project's Biodiversity Action Plan. Once this mitigation (as outlined above) has been implemented, project construction will only have a limited number of residual impacts including:

- Loss (albeit with subsequent restoration) of around 11 ha of natural habitat of which around 7.7ha consists of hornbeam wood /dry grasslands areas.
- Temporary disturbance impacts to a number of notable species
- Temporary loss of foraging, resting nesting and hibernating habitat
- Impacts during construction to streams and rivers and associated habitats.

Throughout construction an Ecological Clerk of Works will be present on site and an adaptive management approach will be put in place, supported by monitoring. Should any of the above impacts be deemed to be more significant than initially anticipated further mitigation will be implemented as required. As a result these residual impacts are expected to be of only **minor significance**.

11.7.2 Residual Operational Phase Impacts

Following implementation of the proposed mitigation, the operational project will still have a limited number of residual impacts, primarily associated with disturbance, habitat severance, roadkill, and pollution run-off. The use of mitigation such as cut-off lighting, animal underpasses amphibian fencing and stormwater run-off treatment means that these residual impacts are expected to be of only **minor significance**.

11.7.3 Cumulative Impacts

The ecology of the River Susica and its downstream elements is already adversely affected due to wastewater discharges from local houses, local industry, agriculture (including pig farming) and the military barracks in Danilovgrad. The recent and expected future increase in the volume of light industry in the project area is also expected to result in an increase in wastewater discharges to this and other watercourses. Impacts of the Project stormwater drainage system are discussed further in Chapter 9 but residual Impacts are expected to **further exacerbate existing water quality issues in receiving water courses and have an associated impact on aquatic biodiversity**.

With regard to notable species, it should be noted that:

- *Anguilla anguilla* (EN) has not been seen in the area for many years, and its demise appears due to habitat destruction from encroaching agriculture and urbanisation. It does not seem likely that it will regain a footing in this area.
- *Emrys orbicularis* (NT) has been seen frequently; the prescribed mitigation is appropriate for its protection and offsetting should focus on suitable habitat creation and connectivity.
- *Pelophylax shqipericus* (EN) is a new record for the area, and the most northerly sighting. It was identified in four different locations during the brief baseline survey. The species are known to hybridise so DNA testing would be a necessary part of further research. The prescribed mitigation measures are appropriate for its protection.

Summary of Project Commitments

The above section includes a range of specific project commitments, which will form part of the overall Project commitments register. These commitments will be implemented through the Contractor's Biodiversity Management Plan (BMP) and the Project's Biodiversity Action Plan (BAP). The BMP will help ensure that best practice will be applied in all project affected areas. Priority commitments include, but are not be limited to, the following:

- **An Ecological Clerk of Works**, accompanied by an appropriate specialist where relevant, will inspect the works area on a daily basis and be on site to advise in times of unforeseen circumstances or incident recovery. This person will review all documented Management of Change procedures.
- **Work activities** will be restricted to areas of permanent landtake. There will be no temporary landtake.
- **Top soil** will be stripped from all works areas and stored for use during reinstatement. Top soil piles will be no more than 3m high and protected from works activities. Top soil will be monitored to ensure there is no compaction or waterlogging.
- **Water Discharge** will never be released directly into a watercourse. Sediment laden water from the work sites will be filtered through the ground or settlement lagoons prior to controlled release to a water course. Earth bunds will be created to prevent an accidental spill of hydrocarbons or other noxious chemicals escaping from the work sites reaching the watercourse. Maintaining good water quality is crucial for the protection of the species depending on this habitat. Water quality will be monitored closely throughout the works.
- **Refuelling** will take place at least 20m away from any watercourse. **Spill kits** will accompany all refuelling operations and be available at every watercourse crossing. Booms will form part of the watercourse kit.
- **Dust** control and prevention measures will follow normal Best Practice. This includes that vehicle speed will be restricted in dry weather and dusty stretches; haulage lorries will be covered water will be sprayed on the road as a dust suppressant as required
- **Invasive aliens**, the species *Ambrosia arthemissifolia*, *Ailanthus altissima*, *Xanthium* spp. will be removed and disposed of when encountered.
- **Bridge construction** will take place during the dry season and outside the fish spawning season – normally mid June to end September. It is anticipated that the Mereza Channel and the Susica River will be dry but the Sitnica River will still have a low flow. Cofferdams will be used on the Sitnica River while the smaller channels will be dammed and over-pumped for the duration of works in their proximity. Activities in the river and on the banks will be well planned and executed in the smallest possible time.
- **Bat** baseline survey will identify and create an inventory of all suitable bat roosting habitats, such as large trees, barns, bridges etc.
- **Tree felling** and scrub clearance will be minimised and only take place outside the bird and bat nesting periods (April- August) and not within the bat hibernation period in the winter. This activity will be overseen by the Ecology Clerk of Works or designated specialist. Old trees are ecologically important micro-habitats in their own right and their loss will be avoided where possible. Evidence that every large tree has been the topic of an avoidance discussion between the engineers and ecologists will be demonstrated. Heavy pruning may be an alternative to felling and protection erected to keep project machinery at a certain distance from the tree.
- **Amphibian fencing (see illustration)**, will be erected to form a barrier between the work site and any habitat, especially rivers, ditches, flood meadows and wet grassland, where reptiles, amphibians and small mammals could gain access. For a 2-metre strip alongside the fence the vegetation will be strimmed very short to create an open and therefore unattractive habitat for these small animals, further deterring them from the work site. Bucket traps for translocation will be installed at specific locations determined by the



specialist and these will be emptied very early every morning. In addition, a specialist will inspect suitable habitat prior to enabling works and set translocation traps in these areas. During periods of toad migrations a specialist will be on site with a watching brief and work may be curtailed during the evenings for the duration of the migration. The Community engagement team will explain the purpose of the fencing to the local population.

Information leaflets will be prepared.

- **Erosion** prevention and control measures will be planned and implemented especially when works encroach on river banks. This will be a combination of hard and soft engineering techniques; using gabion baskets and planting of bank stabilising species such as Salix. If possible stumps should not be removed if by doing so creates an erosion risk.
- **Limestone massif**, Zelnika Hill and Luznica Hill, will be cut into for road widening. This may involve blasting with the associated noise and vibration impacts on wildlife. Vibration tends to be the most detrimental to animals. There is no effective mitigation measure other than to complete the works in the shortest possible time and to avoid the breeding season and hibernation period, ie late summer/autumn.

A **Framework BAP (F-BAP)** has been developed for the Project and will be further refined into a detailed BAP as the project progresses in line with the principle of adaptive management. The BAP will include details of proposed species and habitat monitoring to demonstrate the effectiveness of the mitigation measures proposed and will provide a basis for the Project to establish adherence to the principles of no net loss/net gain to biodiversity. The BAP will include a range of commitments including, but not limited to, the following:

- Support to long-term management of the **“Mareza source with Sitnica and area of Velje Brdo”** Intervention in the area of swamp and wet grassland on the east side between the two crossings of the Sitnica River is under grazed and drying out. Salix scrub is taking over which increases the drying. Rejuvenation of the area back to an area of ponds, reeds and wet grass could be achieved if the Salix was removed and ponds roughly excavated. This action would also increase the populations of water fowl using the area.
- Specific commitments for otters, freshwater invertebrates and bats, including erection of Bat boxes (and Bird nesting boxes) to compensate for the loss of larger trees,
- The F-BAP is included as an appendix to this document.

12. Socio – Economic Impacts

Introduction

This section presents the methodology and assessment of potential socio-economic impacts associated with construction and operation of the Project.

Relevant Legislation and Guidance

The key Montenegrin and international regulations relevant to the social assessment are summarised in Section 3.

Assessment Objective

The overall objective of the assessment is to identify aspects of the Project (during construction and operation) that are likely to result in significant impacts on socio-economic resources or receptors; and define appropriate mitigation and/or enhancement measures to manage these impacts, detailing them as commitments in the Project's Framework Environmental and Social Management Plan (ESMP).

12.3.2 Scope of the Assessment

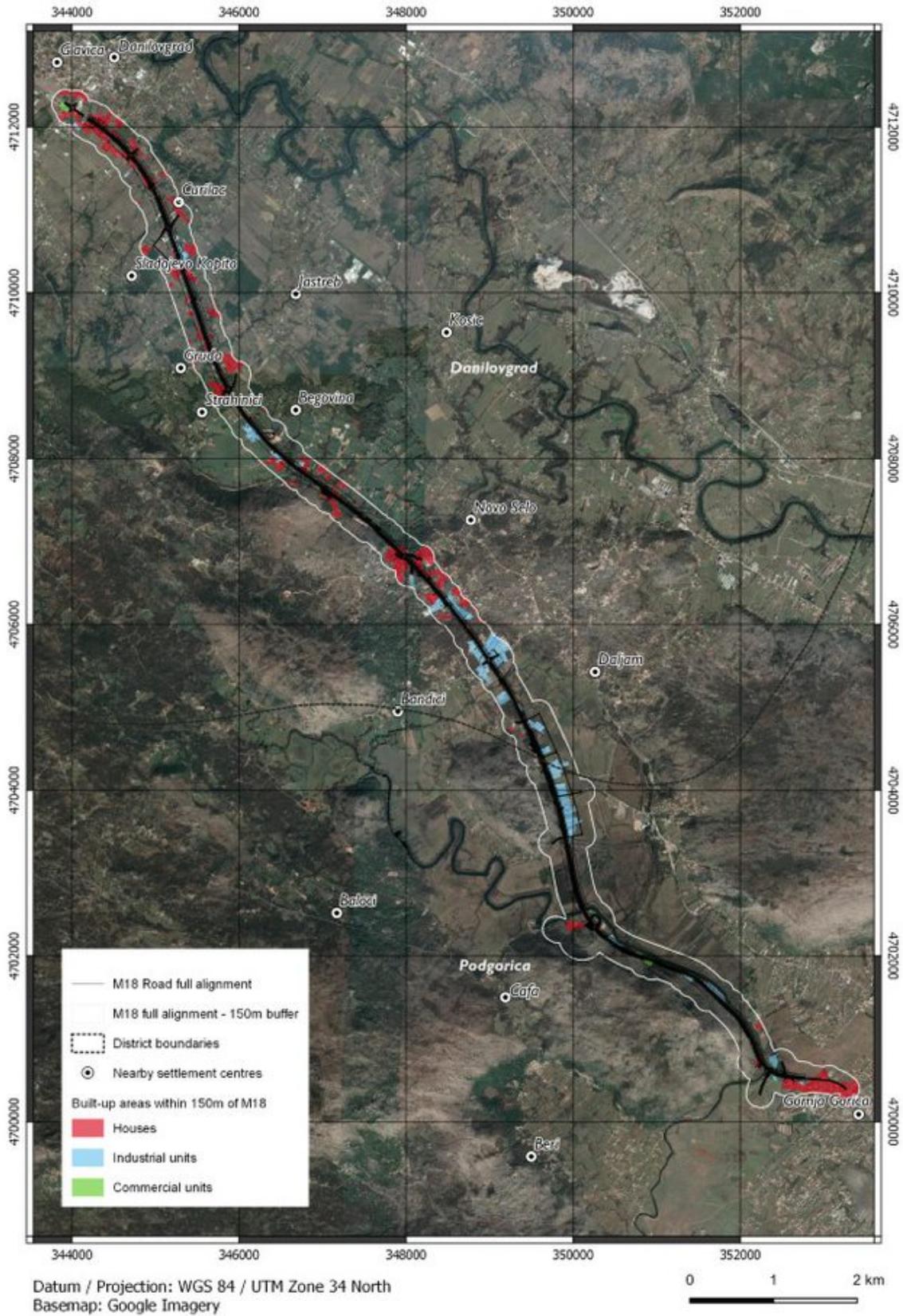
To achieve this objective, the scope of work for this social impact assessment has included the:

- Identification of the project affected area with respect to social receptors;
- Characterisation of the existing socio-economic baseline conditions for the project area;
- Identification of socio-economic impacts that are likely to occur as a result of the Project;
- Identification of appropriate mitigation and/or enhancement measures;
- Incorporation of the Project's commitments, related to socio-economic impacts, within the Framework ESMP.

12.3.3 Project Affected Area

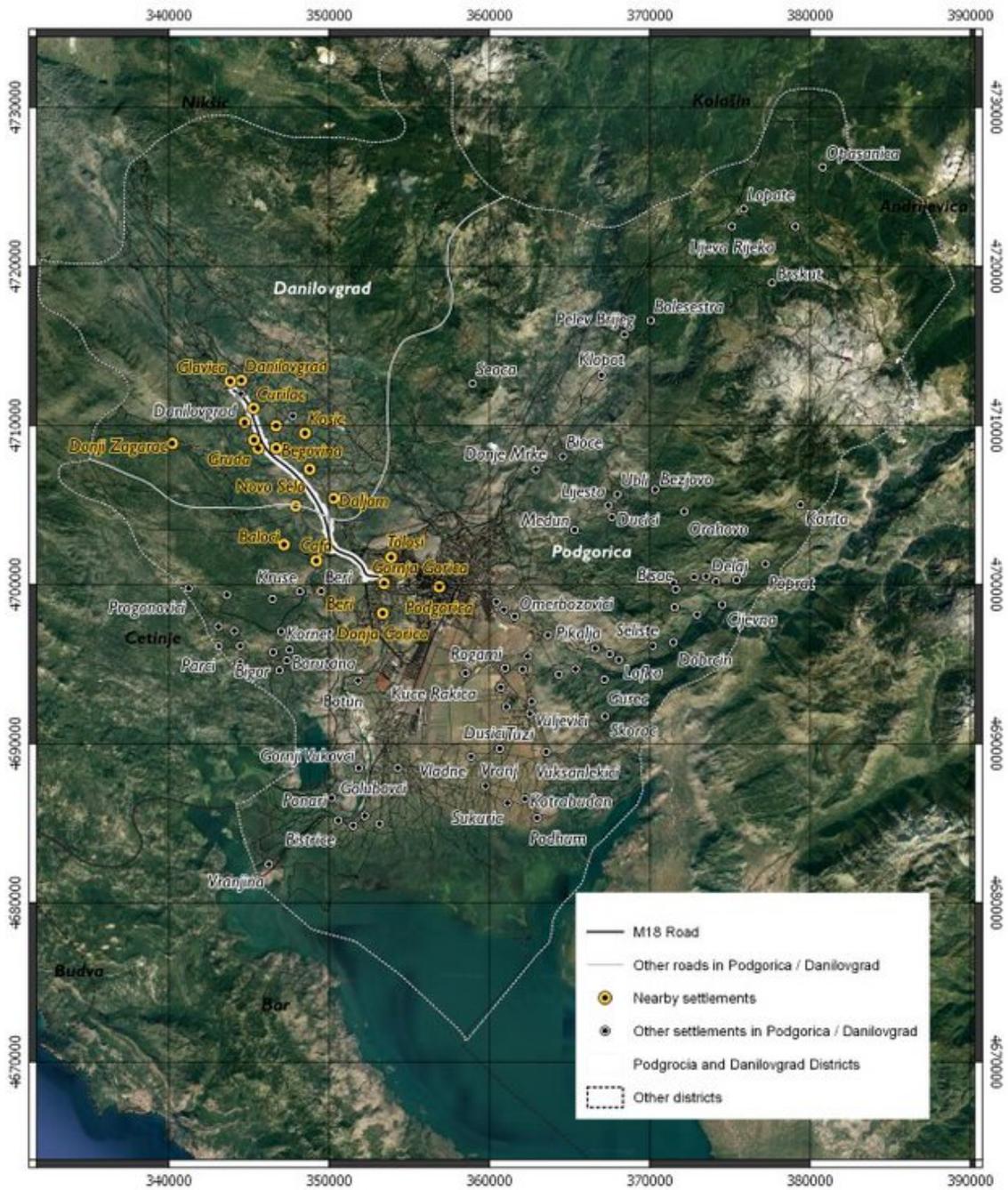
The project affected area has been delineated based on the guidance of EBRD PR1 and includes all the Project activities and facilities that are directly owned or managed under the Project (including by subcontractors) that are likely to generate social risks and impacts. This includes the areas and communities likely to be most affected by Project activities during construction and operation, which has been defined as the social receptors located within 150m of the road alignment.

Figure 12.3.3a Project Affected Area of 150m



Source: Earth Active (2019)

Figure 12.3.3b The Broader Perspective of Project Potential Impact



Datum / Projection: WGS 84 / UTM Zone 34 North
 Basemap: Google Imagery

0 1 2 3 4 5 km

Source: Earth Active (2019)

Methodology

12.4.1 Overview

The social baseline was informed by socio-economic studies undertaken in March and May 2019 in eleven (11) settlements along the M-18 road (the Project) and supplemented with desk-based research. Quantitative data for the study area was obtained from the following main secondary sources:

- MONSTAT (Statistical Office of Montenegro) data viewed online (<http://www.monstat.org>);
- United Nations, Department of Economic and Social Affairs, Population Division. World Population Prospects: The 2017 Revision (<https://www.worldometers.info/world-population/montenegro-population/>);
- Labour market transitions of young women and men in Montenegro. ILO, Geneva, 2016;
- Spatial-Urban Plan of the Municipality of Podgorica by 2025, Capital city of Podgorica, 2014;
- Spatial Urban Plan of Danilovgrad 2011-2020, Municipality Danilovgrad, 2014;
- Main Design (Technical Description) for the Main Roads Reconstruction Project M18 Podgorica-Danilovgrad Section. Government of Montenegro, Montenegrin Transportation Administration, 2018; and
- Expropriation study for the Main Roads Reconstruction Project M18 Podgorica-Danilovgrad Section. "Građevinski nadzor i laboratorijska ispitivanja a.d. Podgorica", 2017.

Stakeholder engagement meetings were also undertaken in June 2019 to supplement information gathered and to discuss potential Project impacts with affected stakeholders. These meetings also provided an opportunity for stakeholders to raise any specific concerns/views they had about the Project.

12.4.2 Impact Assessment Methodology

The social impact assessment follows the methodology described in Section 5. Magnitude and vulnerability/sensitivity designations have been combined to evaluate impact significance. Tables 12.4.2a, 12.4.2b and 12.4.2c present the definitions used for magnitude, vulnerability/sensitivity and impact significance, in the social assessment.

Table 12.4.2a: Magnitude Definitions

Value	Definition
Large	Change dominates over the baseline conditions. Impact affects the majority of the project area and/or is long-term.
Medium	Clearly evident difference from baseline conditions. Impact affects a substantial area of the project area and/or is medium-term in duration.
Small	Perceptible difference from baseline conditions. Impact is local and/or short-term in duration.
Negligible	Changes remain within the range normally experienced in the project area.

Table 12.4.2b: Vulnerability/Sensitivity Definitions

Value	Definition
High	Multiple levels of vulnerability. Project Affected People (PAP)s are unable to adapt to the changes experienced as a result of the Project.
Medium	Some areas of vulnerability. PAPs are mostly able to adapt to the changes experienced

	as a result of the Project.
Low	Very low vulnerability. PAPs are able to adapt to the changes experienced as a result of the Project.

Table 12.4.2c: Impact Significance Definitions

Value	Definition
Very Low	Effects are imperceptible to PAPs.
Low	Potential aggravation caused, but no consequences to livelihoods, health or quality of life.
Medium	Adverse impacts that are short-term and do not result in long-term consequences to livelihoods, health or quality of life.
High	Adverse impacts that may be reversible, but have long-term effects on livelihoods, health or quality of life.
Very High	Adverse impacts that are diverse and impossible to reverse. Potential for long-term impoverishment and health consequences.

12.4.3 Limitations to the Methodology

The limitations to the social study related to the difficulty in reaching key stakeholders within the project affected area. The socio-economic survey was undertaken during the day when many workers were out of the house. Survey respondents were therefore typically older members of the household (average age of respondents was 58 years) and therefore not a representative cross-section of the local population. Additionally, a poor understanding of the rationale for the survey led to stakeholders not wishing to answer all questions. The socio-economic survey was also undertaken over a short period of time (between 9-14th March and 13-16th May 2019) limiting the number of questionnaire surveys that could be completed. In total, 88 households were interviewed; which was less than 20% of the total households most directly affected by the Project (i.e. those directly adjacent to the road and affected by land acquisition). A higher proportion of survey participants would have provided a more robust socio-economic baseline for the assessment of impacts.

The socio-economic baseline has used publicly available data, including national census data for Montenegro, which was collected in 2011, and so is outdated. There was limited opportunity to triangulate and verify data presented. The baseline has therefore drawn heavily on the socio-economic survey and direct observation from the field.

Stakeholder engagement has been limited. The TA has held several public meetings as part of the regulatory EIA process, but the baseline has not been well-informed by focused discussions with stakeholders - there have been no focus group discussions (for example to gain the views of women) or key-informant interviews (to gain deeper insights into specific issues with those well-informed about certain topics). Roundtable discussions were, however, held with local residents in June 2019 and further engagement is planned during the supplemental survey that will be undertaken as part of the Land Acquisition and Resettlement Plan (LARP) over the coming months.

Baseline

12.5.1 Introduction

This baseline presents an overview of the current socio-economic conditions prior to development of the Project.

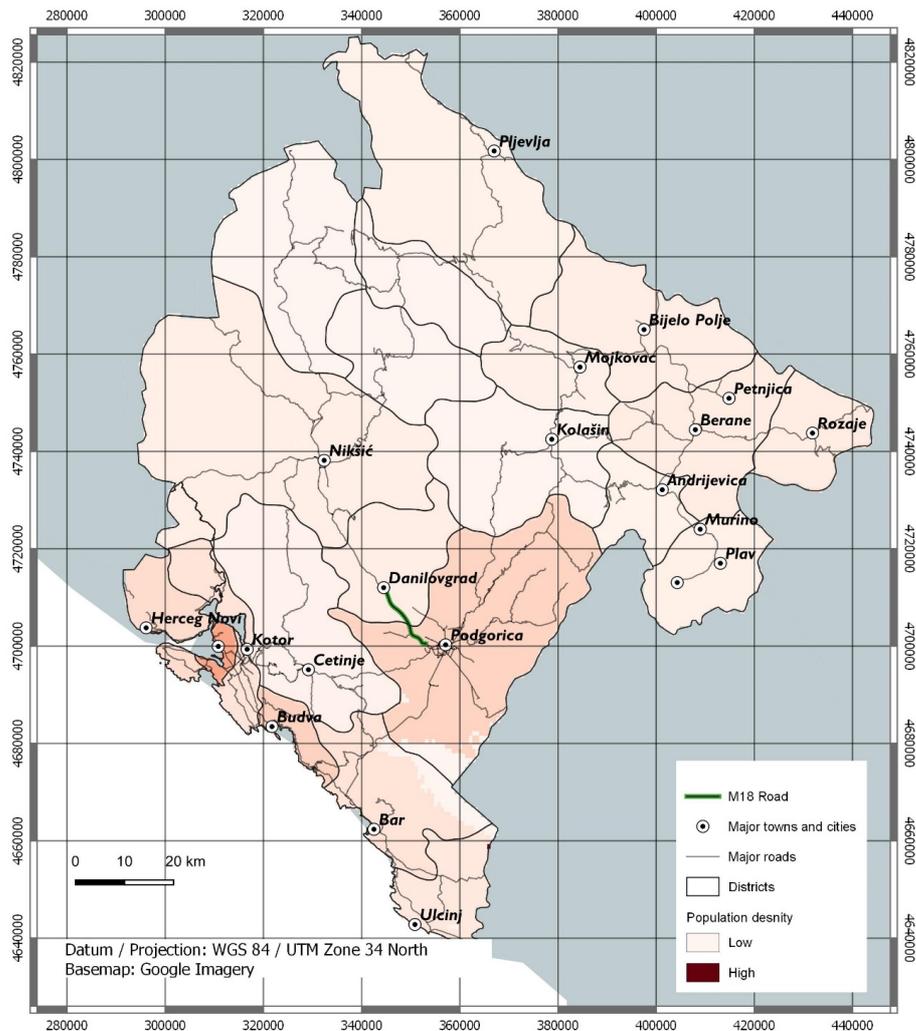
The aim of the social baseline is to provide (a) an understanding of socio-economic factors that are likely to interact with the Project; and (b) define which receptors may be sensitive to changes, either

negative or positive, brought about by the Project. The key socio-economic factors identified as relevant to this Project are: population demographics (Section 12.5.2), economy and livelihoods (Section 12.5.3), and infrastructure (Section 12.5.4).

12.5.2 Project Affected People (PAP): Demographics

Demographic Overview

Figure 12.5.2a: Project Location



Source: Earth Active (2019)

The Project passes through two municipalities; Podgorica and Danilovgrad. The municipality of Podgorica has a population of 185,953 and contains the capital city (also called Podgorica) with 30% of the national population.²⁷ It is divided into 82 cadastral units (Cadastral Municipalities (CMs)) and 149 settlements.²⁸ The municipality of Danilovgrad has a population of 18,473 (3% of the national population²⁹), divided into 35 cadastral units and 80 settlements. Montenegro has a declining

²⁷ Total population of Montenegro = 622,373. World Bank (2017 data) <https://data.worldbank.org/indicator/SP.POP.TOTL?locations=ME>

²⁸ Spatial-Urban Plan of the Municipality of Podgorica by 2025, Capital city of Podgorica, 2014

²⁹ Statistical Office of Montenegro-Monstat, 2017.

population (0.34%)³⁰, which is reflected in the municipality of Danilovgrad (0.9%), whilst the municipality of Podgorica (containing the capital city) is currently growing at a rate of 6.3%.³¹

The population density in Montenegro is approximately 47 per km squared,³² less than half the European Union (EU) average, and the life expectancy in the country is also below the EU average, by six years for men and eight for women.³³ The highest population density is concentrated in the coastal municipalities (130-300 people/km²) with the mountainous regions often having less than 10 people/km².

According to the censuses of 2003 and 2011, the population has stagnated, and the country has an aging population. Based on MONSTAT (Statistical Office of Montenegro) analysis, those aged 65 and over have increased from 12 per cent (in 2003) to 12.8 per cent (in 2011) and this expected to increase to 15.4 per cent by 2021. The proportion of the population aged 14 years or under decreased from 22.6 per cent in 2003 to 19.2 per cent in 2011, and expectations are that by 2021 it will be reduced to 16.8 per cent.³⁴

According to the data presented in the Main Design³⁵ and Expropriation study³⁶, the total number of Cadastral Municipalities (CM) in the project area is 11. Four (4) belong to the municipality of Podgorica (Baloci, Beri, Donja Gorica, Tolosi) and seven (7) to Danilovgrad (Bandici, Curilac, Donji Zagarac, Glavica, Grlic, Jastrebo, Novo Selo). Additionally, these CMs consist of smaller settlements, such as Filindar, Komani, Gruda, Plana, Tomasevici, Bileca, Begovina, Strahinici, Cafa, Daljam. Reliable data on demographics was not available for all these settlements; census data was only available for 9 of them; and determined to be outdated (2011).

The focus of primary data collection for the Project was a corridor of approximately 150m along either side of the road boundary. It includes the Right of Way (RoW) required for the road (2m on either side of the carriage way) and is where potential impacts (such as land acquisition, air quality, noise, etc.) are likely to be most significant. Data collected from households and businesses situated within this corridor is presented in the following sub-sections.

³⁰ <https://www.cia.gov/library/publications/the-world-factbook/geos/mj.html>

³¹ Statistical Office of Montenegro-Monstat, 2017.

³² United Nations, Department of Economic and Social Affairs, Population Division. World Population Prospects: The 2017 Revision. <https://www.worldometers.info/world-population/montenegro-population/>

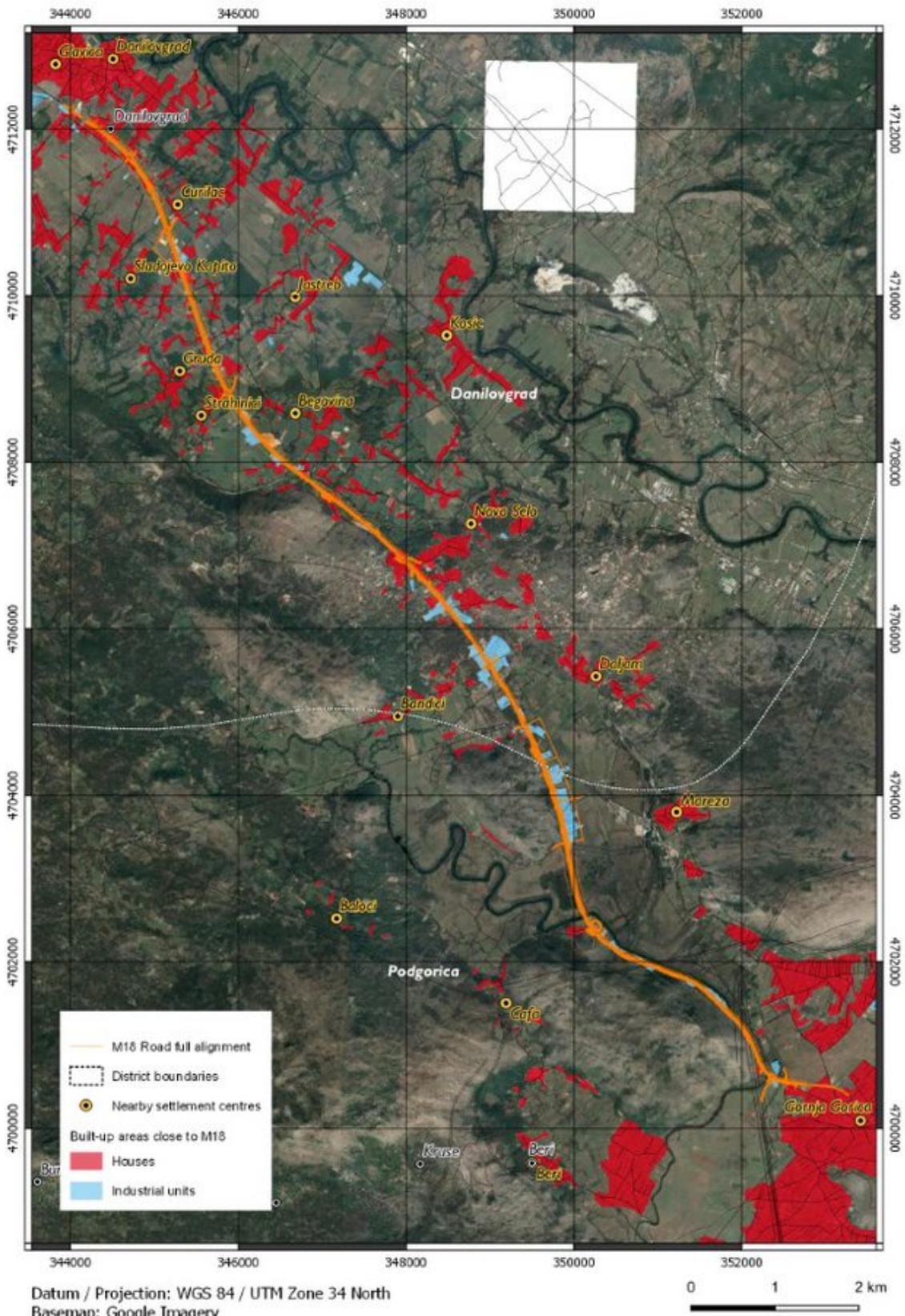
³³ *Labour market transitions of young women and men in Montenegro*. ILO, Geneva, 2016

³⁴ *Labour market transitions of young women and men in Montenegro*. ILO, Geneva, 2016

³⁵ *Main Design (Technical Description) for the Main Roads Reconstruction Project M18 Podgorica-Danilovgrad Section*. Government of Montenegro, Montenegrin Transportation Administration, 2018.

³⁶ *Expropriation study for the Main Roads Reconstruction Project M18 Podgorica-Danilovgrad Section*. "Građevinski nadzor i laboratorijska ispitivanja a.d. Podgorica", 2017.

Figure 12.5.2b: Local Settlements in the Project Area



Source: Earth Active (2019)

Note: Distances are taken from the centre of each settlement but houses often reach up to the side of the road.

Demographics along the Right of Way (RoW)

The socio-economic survey determined that the average (mean) household size was 3.5 people (see Table 12.5.2a with properties ranging from 30 to 450m² in size (see Figure 12.5.2c for examples of houses along the M-18 road).

Table 12.5.2a: Number of People per Household

Number of People per HH	Frequency	Percentage
1	12	13.6
2	18	20.5
3	12	13.6
4	15	17.0
5	21	23.9
6	7	8.0
7	1	1.1
8	2	2.3
Total	88	100.0

Source: Socio-economic survey, E3 Consulting.

Figure 12.5.2c: Houses in the Project Area



The gender ratio amongst surveyed households was 51.1% males and 48.9% females.³⁷ The age profile of those surveyed is presented in Table 12.5.2b and indicates an aging population. Around 20% of those surveyed were retired (see Section 5.3: Economy and Livelihoods).

Table 12.5.2b: Age Profile and Gender Ratios of Households Surveyed

Age	All members of HH's surveyed			
	Male	Female	Total Number	Age Group (%)
>5	12	6	18	5.7
6-17	26	16	42	13.3
18-29	22	30	52	16.5
30-39	24	21	45	14.3
40-49	21	25	46	14.6
50-59	17	15	32	10.2
60-69	25	30	55	17.5
>70	14	11	25	7.9
Total	161	154	315	100.0

Source: Socio-economic survey, E3 Consulting.

Ethnicity, Religion and Language

Montenegrins and Serbians make up about 75% of the total population in Montenegro.³⁸ Table 12.5.2c presents the MONSTAT data for main ethnic groups in Podgorica and Danilovgrad municipalities and Table 12.5.2d presents the ethnicity of those interviewed (the respondents) in the household survey. Approximately 55% of respondents stated they were Montenegrin, 8% said they were Serbian and 30% preferred not to answer the question. The official language in Montenegro is Montenegrin, with Serbian, Bosnian, Albanian and Croatian also spoken.

Table 12.5.2c: Ethnic Groups in Podgorica and Danilovgrad

Municipality	Montenegrin	Serbian	Bosniak	Albanian	Muslim	Croatian	Bosnian	Bosnia Muslim
Podgorica	106,642	43,248	3,687	9,535	4,122	664	105	28
Danilovgrad	11,857	5,001	16	81	38	55	13	0

Source: MONSTAT (2011).

Table 12.5.2d: Ethnic Background of Householders Interviewed

Ethnic Background	No. of APs surveyed	%
Montenegrin	49	55.7
Serbian	7	8.0
Yugoslav	1	1.1
Macedonian	1	1.1
Prefer not to provide response	30	34.1

³⁷ Out of the total Montenegrin population, 50.6 per cent or 313,793 are women and 49.4 per cent or 306,236 are men. *Labour market transitions of young women and men in Montenegro*. ILO, Geneva, 2016

³⁸ MONSTAT, Census 2011

Total	88	100.0
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Source: Socio-economic survey, E3 Consulting.

Educational Attainment

Literacy levels in Montenegro are high with 99.5% of men and 98% of women (over the age of 15) able to read and write.³⁹ 54.9% of households surveyed had completed high school education and 11.7% had graduated from university (see Table 12.5.2e)..

While the country benefits from a highly educated population, the large number of graduates emerging from higher education institutions is not easily absorbed into the limited number of available jobs. Youth unemployment is high at around 41 per cent.⁴⁰ Information collected during the household survey found that 25% of those identified as unemployed, were between 18 and 29 years of age. It has not, however, been possible to determine whether there is a trend of high youth unemployment in the Project Area.

Table 12.5.2e: Education Level of APs in AHs Surveyed

Education	No. of APs surveyed	%
Uncompleted or elementary only	50	15.9
High school	173	54.9
College	28	8.9
University graduate	37	11.7
Postgraduate/Doctorate	3	1.0
Pre-school age child	19	6.0
Prefer not to provide response	5	1.6
Total	315	100.0

Source: Socio-economic survey, E3 Consulting.

Table 12.5.2f: Primary Livelihoods in Households Surveyed

Age of HH member	% Employed	% Business Owners	% Pensioner	% Farmer	% Housewife	% Unemployed	% Student/pupil	% Under six years	% Prefer to not answer
< 6	0	0	0	0	0	0	13.6	84.4	0
7 to 17	0	0	0	0	0	2.6	94.7	0	2.6
18 to 29	32.7	1.9	0	0	0	25.0	38.5	0	1.9
30 to 39	62.2	2.2	0	0	8.9	17.8	0	0	8.9
40 to 49	76.1	4.3	0	0	17.4	0	0	0	2.2
50 to 59	68.8	3.1	18.8	0	9.4	0	0	0	0
60 to 69	23.6	0	61.8	0	7.3	7.3	0	0	0
> 70	0	0	88.0	0	8.0	0	0	0	4.0
Total	36.5	1.6	19.7	0	6.7	8.3	18.7	6.0	2.5

Source: Socio-economic survey, E3 Consulting.

³⁹ <https://www.cia.gov/library/publications/the-world-factbook/geos/mj.html>

⁴⁰ *Labour market transitions of young women and men in Montenegro*. ILO, Geneva, 2016.

Vulnerability Associated with Demographics

Analysis of poverty in Montenegro, published by MONSTAT, shows that in 2013, 8.6 per cent of the population lived below the absolute poverty line. The poverty profile in Montenegro shows that the rate of poverty is significantly higher in the northern region, that the poor usually live in large households, and that poverty is strongly associated with labour market status. The poverty rate is highest among persons who are self-employed or unemployed. Also, the status of poverty is strongly influenced by the level of education, with the highest poverty rate (17.1 per cent) found among persons that have only primary level education.⁴¹

No vulnerable groups were identified in the Project area by the socio-economic survey team. However, this will continue to be assessed during the supplemental socio-economic survey being undertaken for the Land Acquisition and Resettlement Plan (LARP). Roma groups are present adjacent to the RoW and it will be important to understand any areas of sensitivity/vulnerability that may make them differentially or disproportionately affected by Project impacts or less able to take advantage of any benefits. Discrimination remains prevalent in access to employment (particularly for Roma women) and to social care and healthcare in Montenegro. This has been recognised in Montenegro's *Strategy for Social Inclusion of Roma and Egyptians in Montenegro 2016-2020*²⁷

12.5.3. Economy and Livelihoods

National and Regional Economy Overview

Montenegro's economy is transitioning to a market system. Around 90% of Montenegrin state-owned companies have been privatized, including 100% of banking, telecommunications, and oil distribution. Tourism, which accounts for more than 20% of Montenegro's GDP, brings in three times as many visitors as Montenegro's total population every year. Energy and agriculture are considered two distinct pillars of the economy.⁴²

Employment data for 2017 indicates that unemployment is decreasing at a national level, from 22.1% in 2017 to 17.8% in 2018.⁴³ Based on 2017 data, the unemployment rate for Podgorica municipality is 22.89% (11,732 people) and Danilovgrad is 2.84% (1,457 inhabitants).⁴⁴

Local Economy

In addition to tourism, agriculture represents a key sector for the municipality of Danilovgrad. Local residents are engaged in livestock breeding, and fruit and vegetable production, often in greenhouses. However, the results of the socio-economic survey determined that whilst the Project runs through some areas of agricultural land, including vineyards, the majority of houses closest to the road (within 150m) have garden plots which are only utilised for subsistence agriculture. No-one surveyed stated their primary occupation as 'farmer' (see Table 12.5.3a) although two (2) respondents did state this as their secondary occupation. One household also had a winery, but it was not within the

⁴¹ Government of Montenegro, Employment Strategy 2016–2020. Cited in: *Labour market transitions of young women and men in Montenegro*. ILO, Geneva, 2016.

⁴² *Labour market transitions of young women and men in Montenegro*. ILO, Geneva, 2016.

⁴³ Employment Agency of Montenegro, 2018.

⁴⁴ Employment Agency of Montenegro.

area to be acquired by the Project. Additionally, there was an area of cherry orchard falling within the area of land to be acquired by the Project, but the owner did not live in the area, and was not available to participate in the socio-economic survey. The cadastral data for the area is outdated regarding current land-use with many plots that are registered as meadow, pasture, vineyard and orchard etc. having been converted to an alternative land-use or left as scrub/rocky land.

Table 12.5.3a: Current Occupation of APs in AHs Surveyed

Current Occupation	No. of APs surveyed	%
Business owner	5	1.6
Employed	115	36.5
Pensioner	62	19.7
Farmer	0	0
Housekeeper (Housewife)	21	6.7
Unemployed	26	8.3
Student/Pupil	59	18.7
Pre-school age child	19	6.0
Prefer not to answer	8	2.5
Total	315	100

Source: Socio-economic survey, E3 Consulting.

The socio-economic survey identified that around 37% of household members were employed, 20% were retired and 8% were unemployed. Approx. 74% of those that were employed worked in the private sector and 26% worked in state owned companies (see Table 12.5.3b).

Table 12.5.3b: Current Occupation of APs in AHs Surveyed

Type of Employment	No. of APs surveyed	%
Employed by private company	85	73.9
Employed by state owned company	30	26.1
Total	115	100.0

Source: Socio-economic survey, E3 Consulting.

Along the M-18 road itself, there are various small-scale family businesses, including car sales and garages, general retail, restaurants, furniture production and various other workshops or warehouses (see Figure 12.5.3a). It was not possible to determine how many of these businesses were run by local members of the community. Further information about these businesses will be collected during the supplemental assessment undertaken for the LARP.

Figure 12.5.3a: Images of Businesses Along the M-18 Road Route

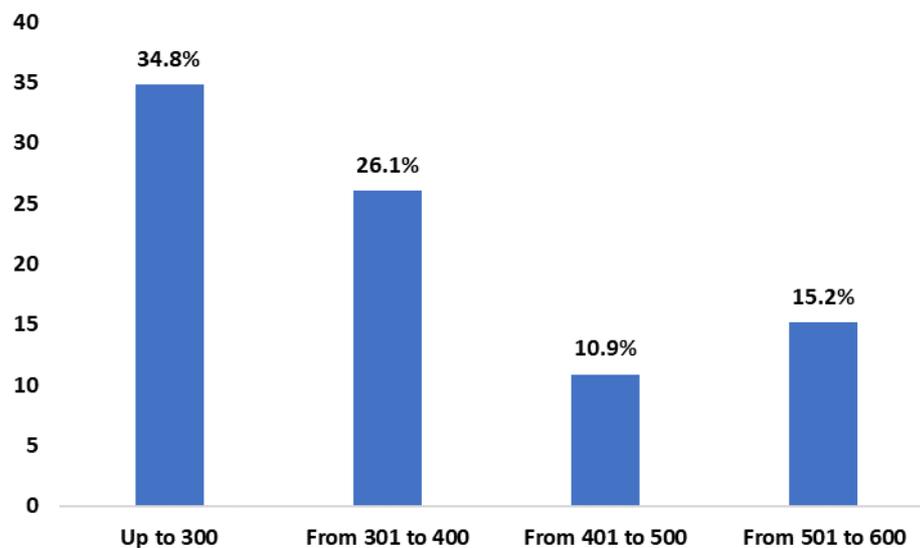


Household Income and Expenditure

According to the socio-economic survey, the average individual monthly salary of households was 485 EUR, which is slightly lower than the national average of 512 EUR (see Table 12.5.3c). 35% of household members had a monthly income up to 300 euros and 26% of household members had a monthly income of between 301 to 400 euros.⁴⁵

⁴⁵ Note that this is self-declared income for individual members of the household.

Figure 12.5.3b: Monthly Income of Household Members Surveyed



Source: Socio-economic survey, E3 Consulting.

The main source of regular income for households were reported as salaries (66%) and pensions (52%). The average income within the household earned from salaries was 578 EUR and that from pensions was 327 EUR.⁴⁶ Only one (1) household reported to have regular income from renting.

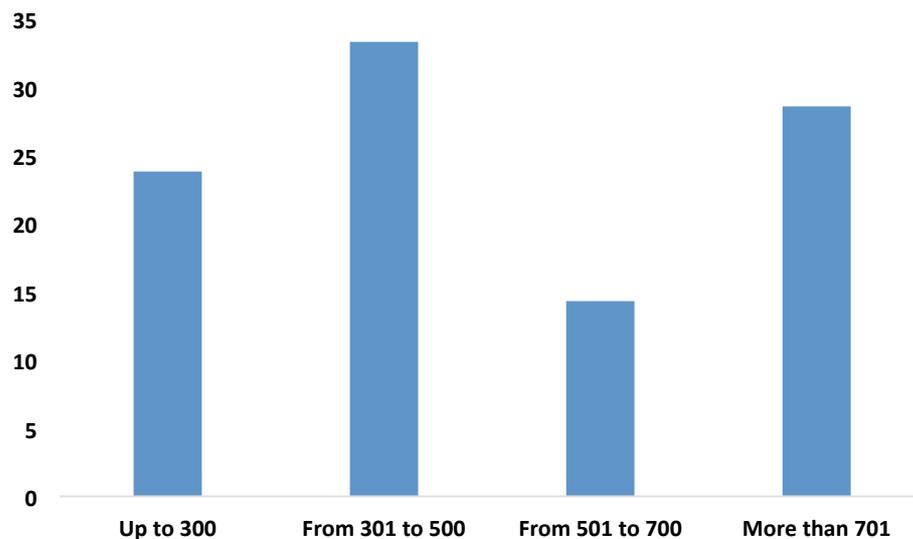
Table 12.5.3c: Average Monthly Income from Household Members Surveyed

Current Occupation	Average (Mean) Monthly Income (EUR)
Employed	485
Business Owner	550
Pensioner	314

Source: Socio-economic survey, E3 Consulting.

⁴⁶ Note that this self-declared income is for the entire household.

Figure 12.5.3c: Monthly Income of Households Surveyed



Source: Socio-economic survey, E3 Consulting.

No information was collected on expenditure at the household level, but this will be collected as part of the supplemental socio-economic survey work being undertaken for the Land Acquisition and Resettlement Plan (LARP).

Vulnerability Associated with Economy and Livelihoods

No specific vulnerabilities associated with livelihoods were identified during the socio-economic survey. Two houses received agricultural subsidies, but it is understood that these were based on the household's livestock and plant production levels, not income or other vulnerability criteria. More information on support available to households will be obtained during the supplementary social survey.

12.5.4 Infrastructure

Governance Overview

The municipalities of Podgorica and Danilovgrad are part of Montenegro's Central Region, which also contains Niksic and Cetinje. Together, these municipalities make up 36% of the total surface area of Montenegro.

National roads fall under the jurisdiction of the Transport Administration of Montenegro (TA). The TA is responsible for inter-municipal roads (main roads), while the local and connecting roads are under the jurisdiction of the relevant council/municipality.

Construction, maintenance, protection, use and management of municipal roads, falls under the responsibility of the municipality.

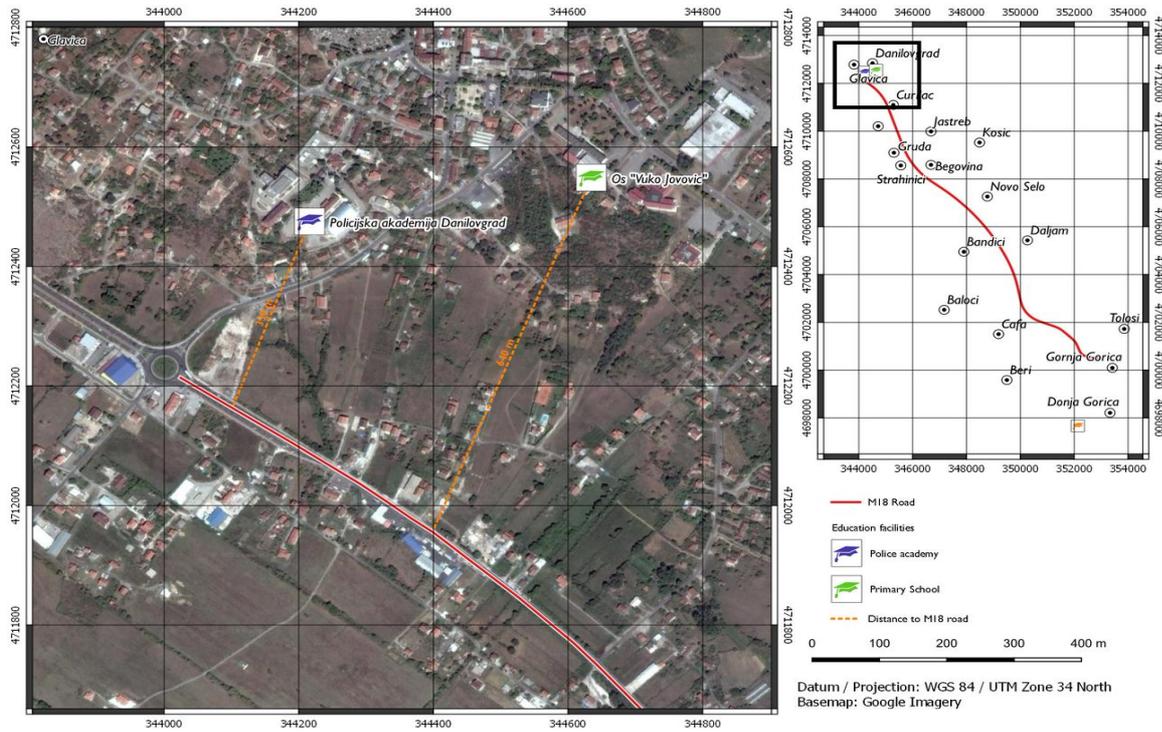
Each municipality has its own local authorities which are responsible for providing municipal services, including water supply and sanitation. Healthcare provision is governed by the Ministry of Health and education by the Ministry of Education, both at the national level.

Educational Facilities

Educational facilities in the municipalities of Danilovgrad and Podgorica consist of pre-schools, primary schools and senior (high) schools. The nearest higher education facilities (universities) are located in the capital city.

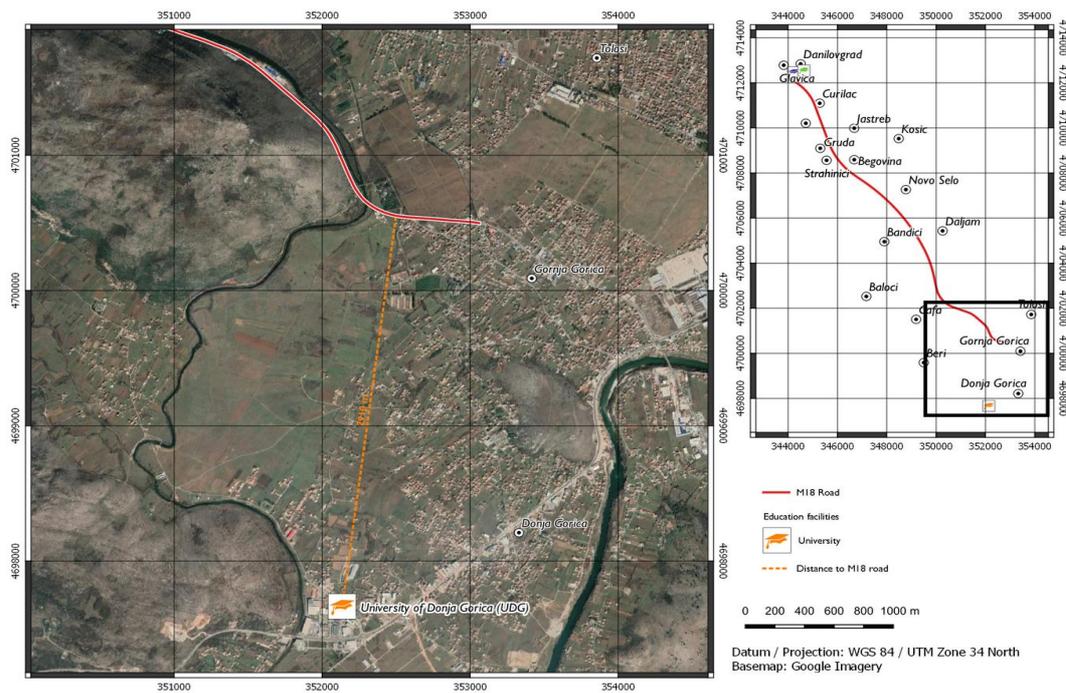
Figures 11.5.4a and 11.5.4b present those educational facilities closest to the M-18 road, namely a police training academy and the 'Vuko Jovovic' primary school, at 360m and 680m respectively. The closest university buildings are over 1km away from the road.

Figure 12.5.4a: Education Facilities Closest to the M-18 Road



Source: Earth Active (2019)

Figure 12.5.4b: Universities UDG and the M18



Source: Earth Active (2019)

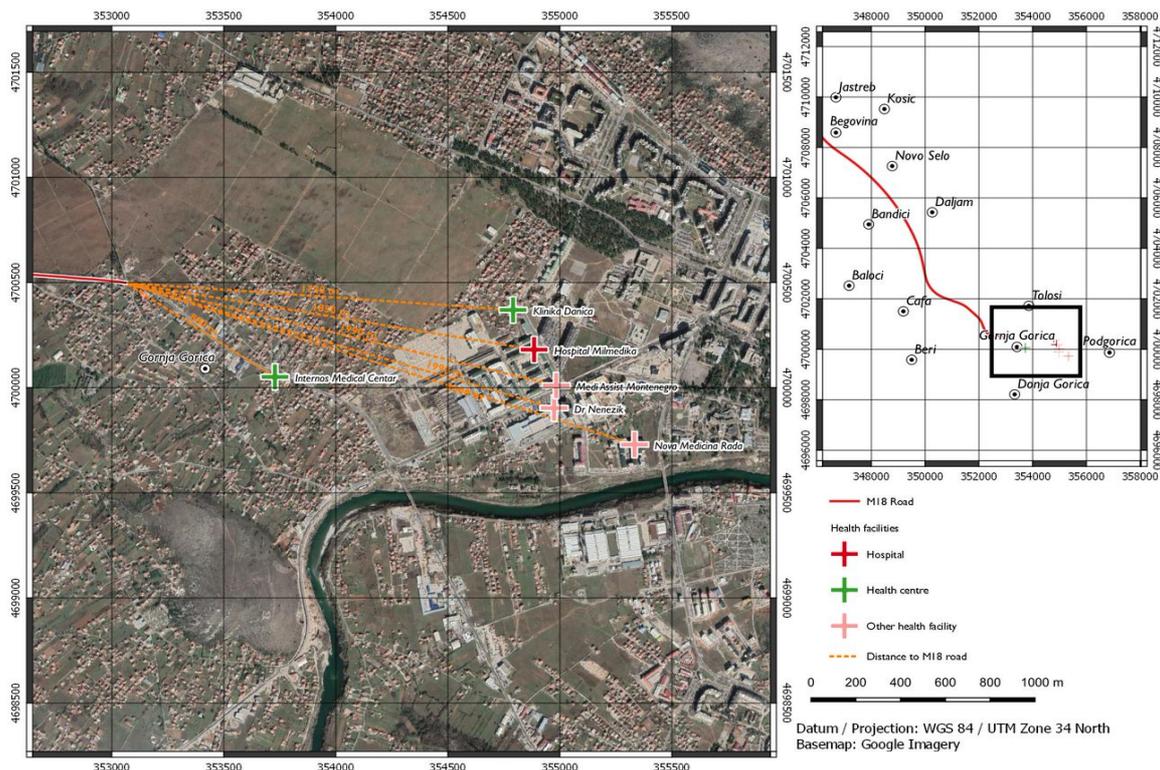
Health Facilities

The health care system in Montenegro consists of state-run and privately-owned institutions. Data from 2012 indicates that there are 11 state run facilities registered in the municipality of Podgorica, along with 75 private pharmacies and 27 private medical clinics. Healthcare in Danilovgrad is organised under the public Danilovgrad Health Centre, which runs several health centres, ambulances and pharmacies.⁴⁷ There are also many private facilities, but specific data was not available.

There are no health facilities close to the M-18 road. The nearest is the Internos Medical Centre in Gornja Gorica, located 450m away. It provides general medical examinations and services.

Figure 12.5.4c: Health Care Facilities and the M18

⁴⁷ Spatial Urban Plan of Danilovgrad 2011-2020, Municipality Danilovgrad, 2014



Source: Earth Active (2019)

Power Supply

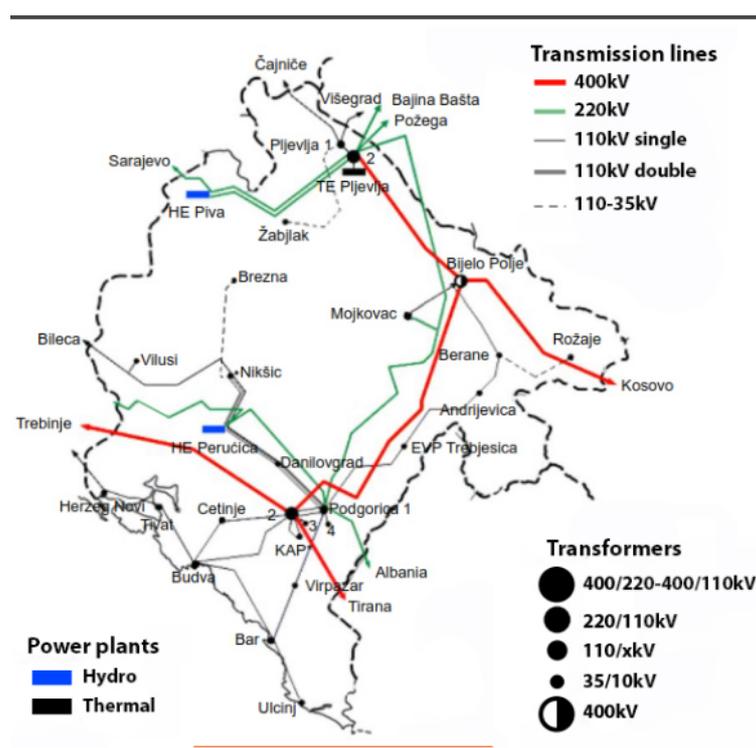
Electricity provision in Montenegro is mostly supplied by hydroelectric and thermal power plants. All households included in the household survey were connected to the national electricity grid. Figure 12.5.4a presents the source of heating in the households surveyed. Some 16% use electricity for heating, while 84% used other sources of power, such as wood, and briquettes/pellets.

Table 12.5.4a: Source of heating in Surveyed Households

Source	Count	Percentage
Electricity	13	14.8
Wood/ Briquette/ Pellets	67	76.1
Other (Central Heating)	1	1.1
Total	81	92.0
Do not want to answer	7	8.0
Total	88	100.0

Source: Socio-economic survey, E3 Consulting.

Figure 12.5.4d: Electricity Transmission System, Montenegro



Source: Montenegrin transmission system a.d. (www.cges.me)

Water Supply and Sanitation

Table 12.5.4b presents the results of the socio-economic survey and provision of water and sanitation services in the households surveyed.

The public network in the settlements surveyed (from Podgorica) is largely sourced from Mareza water supply system⁴⁸, which supplies approximately 60% of the municipality of Podgorica. It is a system of pumps that have a capacity of 550-960 litres/second.⁴⁹

For those settlements within the municipality of Danilovgrad, there are several sources for the municipal supply. The main one is the Oraška Cave which consists of two pump stations linked to three wells, with an installed capacity of 160 litres/second⁵⁰.

All households surveyed were connected to the mains water supply.

Table 12.5.4b: Water and Wastewater System of Surveyed Households

Source	Count	Percentage	Valid Percent
Water Supply			
Public network	82	93.2	100
Water pump	0	0	
Well	0	0	

⁴⁸ Reportedly over 1km away from the Project.

⁴⁹ "Spatial Urban Plan of Podgorica until 2025.", Capital city of Podgorica, 2014.

⁵⁰ "Spatial Urban Plan of Danilovgrad 2011-2020", Municipality of Danilovgrad, 2014

Total	82	93.2	
Do not want to answer	6	6.8	
Total	88	100	
Sewage			
Public network	17	19.3	20.7
Septic Tank	65	73.9	79.3
Outlet to ravine/stream	0	0	0
Total	82	93.2	100
Do not want to answer	6	6.8	
Total	88	100	
Toilet			
Indoor	80	90.9	97.6
Outdoor	2	2.3	2.4
No toilet	0	0	0
Total	82	93.2	100
Do not want to answer	6	6.8	
Total	88	100	

Source: Socio-economic survey, E3 Consulting.

Community Facilities

There are numerous sports facilities available to the local communities living in the Project area. These include clubs for ball sports (tennis, football, basketball, volleyball, handball), athletics tracks, basketball, sailing and kayaking, amongst others.

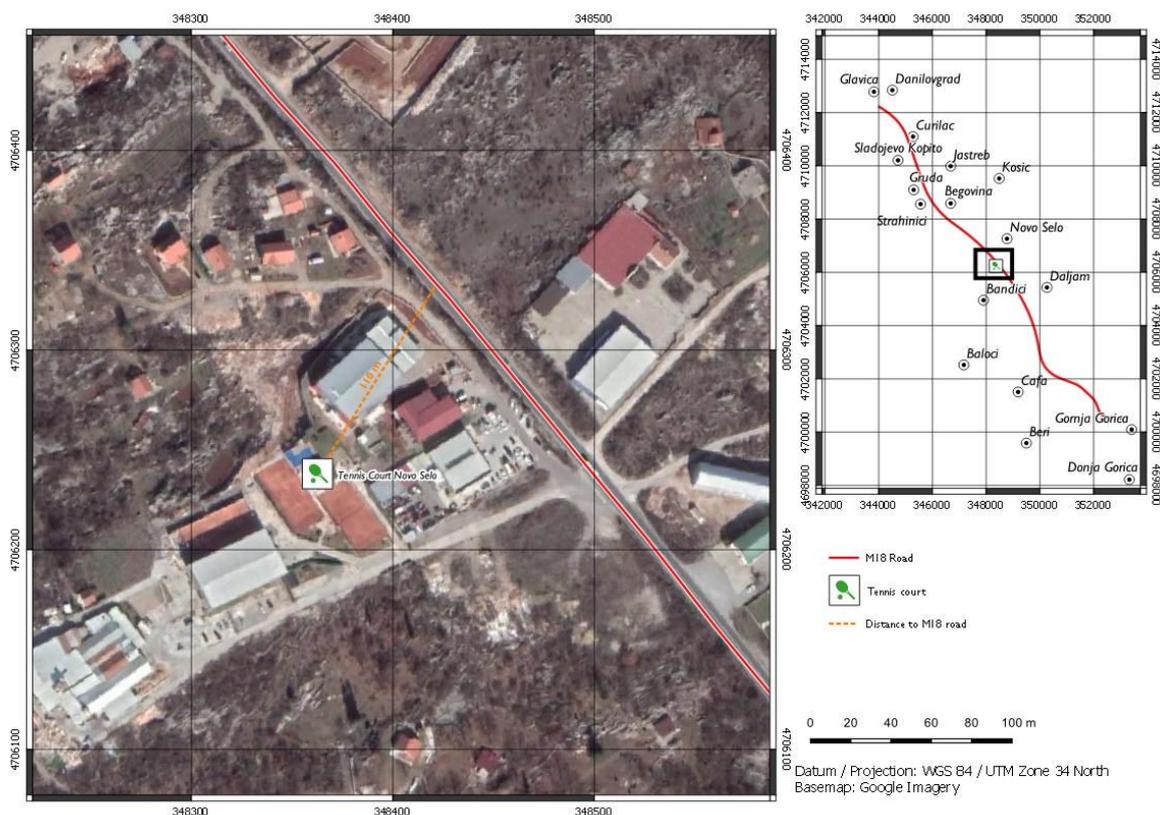
There are no facilities directly adjacent to the M-18 road. The closest is a tennis court in Novo Selo (see Figure 12.5.4e). Table 12.5.4c lists the other main sports/recreational facilities identified during the socio-economic survey.

Table 12.5.4c: Distance of Closest Sports Facilities to the M-18 Road

Sports Facility	Location	Distance from Road
Sports hall Danilovgrad	Danilovgrad	939.5m
Stadium „Braća Velašević“ Danilovgrad	Danilovgrad	816.7m
Stadium in Spuž	Spuž	4.50km
Small football stadium "San Sir"	Spuž	5.50 km
Tennis courts Lazine	Lazine	1.60 km
Sport facilities within the "Milovan Šaranović" barracks	Danilovgrad (above roundabout)	696.50
A sports hall within the Police Academy	Danilovgrad (above roundabout)	359.50m
Hall for Physical Education	Danilovgrad i Spuž	1.20 km
Tennis courts - Novo Selo	Novo Selo	100m

Source: Socio-economic survey, E3 Consulting.

Figure 12.5.4e: Distance of Tennis Court to the M-18 Road



Source: Earth Active (2019)

Cultural Resources

There are no known cultural resources along the RoW that may be impacted by the Project. However, this will be verified during the supplemental socio-economic survey work being undertaken for the Land Acquisition and Resettlement Plan (LARP).

Socioeconomic Impacts

12.6.1 Introduction

This section presents the assessment of potential socio-economic impacts associated with the construction and operation of the Project. Aspects that are likely to result in significant impacts on socio-economic resources or receptors during construction and/or operation are identified; and appropriate mitigation and /or enhancement measures detailed to manage these impacts. These are then captured as commitments in the Project's Framework Environmental and Social Management Plan (ESMP).

The assessment considers impacts on the following social aspects: land and livelihoods, the local economy, local communities and workers.

12.6.2 Potential Impacts on Land

It has been calculated that a total of 186,935.00 m² of land will be subject to land take for the required widening of the road, the safety zone, and associated new infrastructure.

According to the cadastre, the land is owned by a total of 551 owners, 474 private owners and 77 companies. An additional 5 informally-built houses have been identified during fieldwork, so the overall number of affected households (HH) identified so far is 556. The overall amount of land that will be acquired will be slightly larger, because Montenegrin law permits land owners to request expropriation of larger areas to avoid leaving orphaned land, and because one of the informally-built houses had been legalised.

Initial information from the TA suggests that laydown areas, borrow pits, access roads and construction sites will be within the expropriated area, or on government land that is not currently used for other purposes. This needs to be confirmed during additional LARP studies.

Temporary Loss of Land (Construction Phase)

The amount of temporary land required during construction is not currently known. Three (3) construction sites have been identified and it is anticipated that these areas, along with the land expropriated prior to construction, will be sufficient for material and equipment storage, temporary disposal areas and site offices. Locations of access roads, batching plants and borrow pits have yet to be identified. While the majority of workers will be housed in existing accommodation and private homes in cities, especially Danilovgrad, there will be some temporary worker camps at three locations in the RoW (see figure 10.5.2).

Based on the TA assertion that no additional land will be acquired for temporary use, the initial significance of temporary land loss impacts, without mitigation measures, is **low**.

Permanent Loss of Land (Construction and Operation)

The alignment of the M-18 road passes through the two municipalities of Danilovgrad and Podgorica. It traverses 11 settlements/cadastral zones (Grlic, Glavica, Bandic, Donji Zagoric, Novo Selo, Jastreb, Curlovac, Berio, Baloći, Donja Gorica and Tolosi). Table 12.6.2a summarises the total land area to be acquired in each cadastral zone, and the landowners to be affected. Information has been sourced from the Census and compiled by the Transport Directorate. Verification of this data in the field is being undertaken.

Table 12.6.2a – Overview of land area to be expropriated and ownership structure

Ownership status	Number of parcels	Affected area (m ²)
Total amount of land	551	186,935
Private individuals	474*	154,198
Legal entities (Private Companies)	77	32,737
* This is the total number of private plots according to the cadastre, although it appears that some plots have more than one owner and information regarding land use (as opposed to ownership) has not yet been collected.		

Land use studies by certified valuers indicate that the predominant land uses are meadow 73,505 m², forest 61,441 m², pasture 20,384 m² and fields 13,786 m². Smaller areas are dedicated to orchards 2931 m², vineyards 761 m², and backyards 2541 m², roads 394 m² and company infrastructure 1995 m². Some of the land is classified as infertile land, or rocky

land. Table 12.6.2b summarizes the land losses by land use type and ownership (private or business).

Table 12.6.2b: Overview of Landuse and Ownership Structure

Type of land	Total		Private Individuals		Legal Entities	
	Number of parcels	Affected area (m ²)	Number of parcels	Affected area (m ²)	Number of parcels	Affected area (m ²)
Backyard	27	2,541	23	2,393	4	148
Meadow	237	73,505	197	52,205	40	21,300
Field	63	13,786	57	11,799	6	1,987
Orchard	16	2,931	16	2,931	0	0
Pasture	85	20,384	80	19,601	5	783
Infertile land	22	5,208	17	5,098	5	110
Uncharted road	7	394	4	216	3	178
Forest	81	61,441	72	54,784	9	6,657
Vineyard	4	761	3	756	1	5
Business backyard	6	1,995	2	426	4	1,569
Rocky land	3	3,989	3	3,989	0	0

Private land and asset owner and user impacts

While most permanent land acquisition from private owners is expected to be of small roadside land parcels, that are a relatively small proportion of larger land parcels, where landowners will experience more significant losses. For example, one orchard owner will lose a more significant portion, because the orchard has been selected as a location for a roundabout. In addition, the socio-economic survey indicated that a small proportion of landowners interviewed (3/84) rely on agriculture for at least part of their income. Owners and land users, who have yet to be identified, may experience significant livelihood impacts. A small number of private owners will also lose their homes and will experience physical resettlement. Some of the houses to be acquired are informal structures.

The Montenegrin expropriation process requires payment of compensation for lost land and land assets at local market costs, determined by certified valuation experts. Informally held or used land or informal buildings are not eligible for compensation.

Compensation can be reduced to account for an amount deemed by valuers to represent the increase in value of the land due to the project.

1. For private owners who will not experience livelihood impacts the loss of land under the Montenegrin expropriation process is expected to be a **low** impact.
2. For those private landowners and land users who will experience livelihood impacts, the loss of land under the Montenegrin expropriation process, without additional mitigation is expected to be a **medium to high** impact.
3. For those private landowners and land users who will lose their house to the Project under the Montenegrin expropriation process, without additional mitigation is expected to be a **medium to high** impact.
4. For those private landowners and land users who will lose their informally built houses to the Project under the Montenegrin expropriation process, without additional mitigation is expected to be a **very high** impact.

Overall the number of HH in category 3 and 4 is expected to be 5 or less. The number of HH in category 2 is expected to be no more than 10% of affected HH, with at least 90% in category 1.

The two HH in category 4 are Roma HH and assessed as sensitive. Other HH may also be sensitive, as differential impacts data has yet to be collected. Due to sensitivity the impact level for the category 4 impacts is expected to increase to an **extremely high** impact.

Business land and asset acquisition impacts

As with the acquisition of household land, business land to be acquired will mainly be as small roadside parcels. The majority of businesses along the road are retail or restaurant businesses and most are set back from the road. These properties will lose dedicated parking areas, low walls and hedges and some subsidiary business structures. Three businesses will need to have the main business building removed.

One of these, a hotel that houses two HH (the owner and the manager's family), will not be rebuilt. The other two buildings, both petrol stations, will be rebuilt further from the road. A small number of the businesses are situated closer to the road, but not close enough for the main business building to be removed. These businesses may no longer be viable once the new M-18 is built, because they will lose most of their parking lot and the remaining shop or restaurant will be very close to the road. These impacts have not yet been fully assessed.

Under Montenegrin law, formally owned businesses are eligible for compensation for lost land and assets at local market costs, determined by certified valuation experts. Informally held or used land or informal buildings are not eligible for compensation. Compensation can be reduced to account for an amount deemed by valuers to represent the increase in value of the land due to the project.

1. For businesses set back from the road, which will be minimally disrupted, the loss of land under the Montenegrin expropriation process is expected to be a **low** impact.
2. For those businesses that may be left in an unviable situation, the loss of land under the Montenegrin expropriation process, without additional mitigation is expected to be a **medium to high** impact.
3. For those businesses that will lose their business structures to the Project and will either rebuild or retire on the compensation money, the loss under the Montenegrin expropriation process, without additional mitigation is expected to be a **medium** impact.

4. For the only known informal business that will lose land to the Project the loss under the Montenegrin expropriation process, without additional mitigation is expected to be a **low** impact, as the business assets impacted appear to be movable, though no engagement has yet occurred.

The category 4 business is a Roma metal recycling business and is assessed as sensitive. Other businesses may also be sensitive, as differential impacts data has yet to be collected. Due to sensitivity the impact level for the category 4 business impacts is expected to increase to a **medium** impact.

Employees

Employees of businesses to lose land will also experience impacts from the land acquisition:

1. For the vast majority, impacts are expected to be insignificant, as businesses close for one or two days, while parking areas etc are rebuilt.
2. For the employees of businesses that become unviable, impacts, without mitigation would be **high**.
3. Finally, the hotel manager will lose his job and without additional mitigation this impact would be **high**.

There are several hundred employees overall and there is no information about their sensitivity.

A Land Acquisition and Resettlement Framework (LARF) has been prepared for the Project and the Project is developing the more detailed Land Acquisition and Resettlement Plan (LARP). A summary of the impacts on land is presented below.

Table 12.6.2c: Summary of Impacts on Land According to the LARF

Land acquisition impact	# affected HH / businesses	Significance without mitigation	Sensitivity	Overall significance with sensitivity without mitigation
Private HH				
Land acquisition alone	At least 430	Low	Unknown	Low +
Land acquisition with livelihood impacts	Less than 47	Medium	Unknown	Medium +
Land acquisition with physical displacement (formal house)	At least 1	Medium	Unknown	Medium to High +
Land acquisition with physical displacement (informal)	At least 2	Very High	Roma - sensitive	Extremely High
Businesses				
Distant from road	At least 65	Low	Unknown	Low
Will lose buildings (formal)	3	Medium	Unknown	Medium+
Close to road	Under 10	Medium to High	Unknown	Medium to High+
Close to road (informal)	At least 1	Low	Roma - sensitive	Medium
Employees				
Employees who will lose a day or two of work	At least 100	Low (insignificant)	Unknown	Low+
Employees who will lose their job	At least 1	High	Unknown	High+
Employees whose employer's business would be unviable	Unknown	High	Unknown	High+

Management and Mitigation Measures

The key mitigation for land use impacts is implementation of the LARP. The LARP aims to create a comprehensive understanding of all land acquisition and resettlement impacts and risks, with the participation of affected HH and businesses. It then aims to identify a series of entitlement options for each impact that are capable of fully mitigating the impacts of the resettlement, in collaboration with the affected HH. It also aims to create an efficient feedback system to identify emerging issues and implement timely course corrections through an effective grievance management process and appropriate monitoring and reporting. The LARP will include the following broad actions:

- Identify a qualified TA social manager to guide PR compliant consultation, disclosure, data collection, impact identification, design of entitlements, implementation of resettlement plan, monitoring and grievance management.
- With appropriate consultant support:
 - Develop and implement a compliant engagement process with affected HH;
 - Develop and implement an effective resettlement grievance process;
 - Design and implement a census-level asset verification and supplementary Socio-Economic Surveys (SES) with affected HHs;
 - Design and implement an effective approach for verifying asset losses and impacts with affected businesses;

- Development of a complete understanding of resettlement impacts and differentially impacted groups;
- Development of a complete entitlement framework, in consultation with affected HHs;
- Implement additional compensation and support measures to mitigate resettlement impacts effectively, including support for livelihood restoration and support for differentially impacted groups;
- Continue engagement with affected HHs throughout the resettlement compensation and support processes;
- Monitor and report on implementation of resettlement compensation and support measures;
- Contract an independent third party to carry out an external completion audit of the LARP for all phases of the road improvement project;
- Implement any corrective measures identified in the external completion audit.

Residual Impacts

Following effective implementation of the LARP, impacts on land and land-based livelihoods are assessed as **low**.

12.6.3 Potential Impacts on the Local Economy and Local Employment

Construction and Operation Phases

An estimate of jobs to be generated by the Project is not yet known, as hiring will be undertaken by the Construction Contractor and its subcontractors, once commissioned. It is anticipated, however, that direct jobs will be available locally (through local contractors) over the 24-month construction period, with different levels of qualification required at different stages of the construction process e.g. land clearance, earthworks, civil works (construction of bridges, culverts, drainage structures), utility and electrical installations, landscaping etc.,

Indirect employment opportunities are also expected during this phase, through the provision of goods and services (construction material supplies, transportation services, catering, cleaning, security, etc.). The International Finance Corporation IFC (2015) reports from a number of sources that the employment multiplier (number of direct, indirect and induced jobs for each direct job created) for infrastructure projects often exceeds two.⁵¹ Those who secure jobs will have access to regular income during their employment and the opportunity to develop new skills.

At the end of the construction phase there will be a significant reduction in the workforce, but it is expected that terms of employment (including length of contract) will be clearly communicated to Project workers to carefully manage this.

Employment during the operation phase of the Project will be minimal, mainly related to maintenance activities. Indirect job creation is however expected as a result of increased road capacity and improved connectivity, with increased demand for services such as food

⁵¹ Pfeifenberger, et al. (2010); Labovitz School (2010); IFC (2012); CH2MHILL (2009); Estache et al.; Atkinson et al (2009); Bekhet, H.A. (2011) cited in IFC:
<http://www.ifc.org/wps/wcm/connect/83affa004f7ce00bb812fe0098cb14b9/chapter6.pdf?MOD=AJPERES>

and fuel provision. Jobs secured during the operational phase will offer longer-term employment opportunities and income generation.

The skills base in the project affected area is high and the local population is mostly employed or retired. However, 8% of those surveyed in the local area stated they were unemployed and there is high (about 40%) youth unemployment in Montenegro. Jobs (direct or indirect) generated by the Project will therefore provide additional opportunities to local communities for employment, income, skills enhancement and work experience. The presence of a construction workforce and demand for local goods and services will also boost the local economy. This is a **positive** impact of the Project.

Employment – related Measures

- The Project will implement a Human Resources Policy, outlining the Project's commitment to working conditions and good management of worker relationship, referencing non-discrimination and equal opportunity, prevention of child labour, and prevention of forced labour, in accordance with Performance Requirement (PR) 2.
- The Project commits to ensuring competitive and fair remuneration. Terms of employment and working conditions will be clearly communicated to employees, including length of contracts, hours of work, overtime, wages and benefits, compensation, breaks, and provisions for leave.
- The Project's HR policy will have clear details about workers' contract periods so that they (particularly construction workers) can prepare appropriately for termination of their employment. Contracts will clearly detail workers' rights and they will be made aware of how to access the grievance mechanism.
- The Project will take commercially reasonable measures to ensure that contractors are reputable enterprises, with management systems in place to ensure they operate in line with the Project's HR Policy.
- The Project will develop a Labour and Working Conditions Management Plan which will include the contractor's local content policy, local procurement and hiring policies along with requirements and targets around the hiring of workers from within the local area, to maximise local recruitment. Opportunities to source goods and services from local businesses will also be required under the policy.
- Local communities will be kept informed of upcoming recruitment for the Project and this will be captured in the Project's Stakeholder Engagement Plan (SEP).

Residual Impacts

Following effective implementation of the prescribed enhancement measures, the overall impact on the local economy and local employment is considered to be **positive** but it is difficult to quantify this at present.

12.6.4 Potential Impacts on Local Communities from an Influx of Workers

Construction Phase

Influx of construction workers and opportunists seeking economic opportunities may lead to demographic change and reduce social cohesion in the Project area. There may also be

tension if there is not deemed to be an appropriate level of local recruitment. Whilst the Project will have targets for local hiring, it is expected that most of the workforce will be employed from outside of the project area. Considering the suburban location of the Project site, and close proximity to the capital city, the Construction Contractor and its subcontractors are expected to have well-established workforces available for this work.

It is likely there will be gender imbalance as male workers are predominantly engaged in civil construction work. This has the potential for increased grievances and tension within communities. There is also the potential for harassment of residents, particularly women, if construction workers do not behave appropriately.

There is also the potential for increased pressure on local infrastructure, community facilities and health services if these aspects are not well managed by the Contractor.

There are no plans to erect long term worker accommodation for the Project though there will be some temporary camps in the RoW. Workers are mainly expected to be housed in the local towns and cities close to the site, with buses in place to transport workers to site.

The Contractor will be guided by:

- The World Bank Guidance Notes on 'Managing the Risks of Adverse Impacts on Communities from Temporary Project Induced Labour Influx' 2016.
- Good Practice Note on 'Addressing Gender Based Violence in Investment Project Financing Involving Major Civil Works WB, 2018'
- Good Practice Note on 'Managing Contractors Environmental and Social Performance , ICF 2017'.

Operation Phase

No significant impacts on local communities from an influx of workers are predicted to occur during the operation of the Project.

Impact Assessment

The effect is adverse in nature. The sensitivity of receptors is assessed as low due to the suburban location of the Project; retired or more elderly people living in the project affected area may be more sensitive to the impacts, as they are more likely to be home during the day when construction is underway. The magnitude of the impact is rated as small – the impact is local, short-term and affects a small proportion of households. Without any controls, there is a low-medium likelihood of occurrence. This results in a significance level of **low** to **medium** during construction, prior to the application of any mitigation or management measures.

Mitigation Measures

- There will be a Code of Conduct, training and a disciplinary procedure for workers, governing their behaviour and interactions with local communities.
- The grievance mechanism will ensure the Project is aware of any complaints, so that appropriate mitigation and management measures can be put in place, as necessary.
- The Project will implement a local content policy and hiring process to maximise local employment.

- The Construction Contractor will ensure all relevant permits are in place for water and power supply, to ensure there is no interruption to local supplies.
- The Construction Contractor will undertake an assessment of local health care facilities and (in coordination with the relevant health authorities to ensure no exceedances in capacity) develop a plan for their use in the event of an accident/emergency. These details will be captured in the Project's Emergency Preparedness and Response Plan (EPRP).

Residual Impacts

Following effective implementation of the prescribed mitigation measures, the impacts on local communities from an influx of workers are assessed as **low** during construction and therefore **not significant**.

12.6.5 Potential Impacts on Local Communities' Health and Safety from Increased Traffic

Construction Phase

An increase in construction-related traffic increases the risk of traffic-related accidents and injury. There may also be disturbance to local communities through the generation of dust, air quality and noise impacts. Receptors include households adjacent to the RoW and the main haulage roads.⁵² Impacts on air quality, dust, noise and vibration are assessed in Chapter 7 and Chapter 8 with this assessment only focusing on the risk of traffic-related accidents.

Whilst no calculations have yet been made, there will be an increase in traffic during construction as materials and workers are transported to, and around, the site. There will also be an increased presence of Heavy Goods Vehicles (HGVs). Accordingly, there is the potential for congestion and traffic accidents to occur, which could result in injuries or fatalities of other road users or pedestrians.

We do not anticipate any significant impact based on the data available to date on traffic movements, however this needs to be clarified with additional traffic prediction modelling and subsequent impact analysis.

Operation Phase

We expect there to be a traffic increase as a consequence of the road works but predictive modelling has not been completed. Whilst traffic loads will increase, the provision of additional lanes and road surface upgrades, will improve road conditions and safety for road users. Pedestrian crossings have also been carefully planned into the design so that there are designated crossing points where vehicles are required to give way to pedestrians, to improve safety.

Impact Assessment

This effect is adverse in nature. Considering the potential severity and irreversibility of traffic-related accidents, the magnitude of this impact is considered **large**. The sensitivity of local receptors is assessed as **medium**, due to the relatively high number of retired residents along the route. School children would also be assessed as sensitive receptors, but no details are currently available on whether school children use the bus services on the

⁵² The details of the main haulage routes are not currently known.

road to reach school.⁵³ This results in a significance level of **high**, prior to the application of any mitigation or management measures.

Mitigation Measures

- The Project will implement a Construction Traffic Management Plan (TMP). The plan will cover vehicle safety, driver and passenger behaviour, hours of operation and accident reporting and investigation etc. All drivers will be trained, and strict speed limits will be enforced.
- Local stakeholders will also be engaged to discuss road safety and incident reporting. This will be particularly important for any school children using the buses on the road to reach school. Details will be contained in the Project's Stakeholder Engagement Plan (SEP).
- The grievance mechanism for the Project will capture any concerns or complaints about Project-related traffic.
- An Emergency Preparedness and Response Plan (EPRP) will be in place for the Project, prior to construction. This will include measures and procedures to manage any traffic and transport related emergencies. Appropriate details will be shared and discussed with local communities and local service providers, as appropriate.
- The Project will ensure that there is adequate provision for road crossings close to bus stops for the safety of bus users, particularly school children.
- The Project will implement a programme of awareness raising with the local community; especially schools. Details will be captured in the Project's SEP, once the most appropriate method(s) has been defined.

Residual Impacts

Considering the severity of impacts associated with accidents, and the mitigation measures to be put in place, the significance of this impact following mitigation is assessed as **medium to high** during construction (**significant**) and **medium** during operation (**not significant**).

12.6.6 Potential Impacts on Accessibility and Connectivity

Construction Phase

The expansion of the M-18 road will result in temporary disruption to road users over the 24-month construction period. Construction of additional lanes, junctions, underpasses, roundabouts and bridges, will also result in reduced access around the works. Effects will include extended travel times and subsequent impacts on livelihoods, if not well managed.

Those people living in settlements closest to the road will likely have reduced accessibility and connectivity during the construction works. Local businesses may also be impacted by the potential congestion caused, with potential delays in supplies and reduced access for suppliers and clients. Disruption to the existing lanes will be minimised as far as possible;

⁵³ The supplementary social surveys will aim to collect additional information on sensitive receptors in the project area.

construction will be undertaken adjacent to the existing road/bridges, before transferring traffic across to the newly constructed lanes whilst the existing road is upgraded. There are also not expected to be any disruptions to utilities provision, including water and electricity supply.⁵⁴ It will be important for them to remain operational throughout the construction period.

Impact Assessment

This effect is adverse in nature. The magnitude is considered **low** as the impact is reversible, localised and short-term during the construction period. The sensitivity of local receptors is considered **low**, as there are alternative route options available and no known receptors that would be unable to adapt to these road changes during the construction period. This results in a significance level of **low** to **medium**, prior to the application of any mitigation or management measures.

Mitigation Measures

- The Project will develop and implement a Construction Traffic (CTMP), providing a clear plan for traffic movements during each stage of construction. Routes for construction vehicles will be carefully planned to minimise disruption to local residents and any damage to local roads (further impacting connectivity). The movement of construction vehicles on local roads will be minimised. All necessary detours for road users will also be carefully planned and detailed in the TMP.
- All drivers will be trained on the details of the TMP, which will include specified routes, working hours and speed limits, etc.
- Relevant details of the TMP will be shared with local stakeholders, the process of which will be detailed in the Stakeholder Engagement Plan (SEP). This will include advance details of construction works, and any road closures/diversions etc. Notices will be erected in local towns and posted on the TAs website, so that road users can plan their travel appropriately.
- Grievances will be carefully monitored, and where necessary, additional traffic management measures implemented in response to issues raised by stakeholders.

Following effective implementation of the prescribed mitigation measures, the impact on access and connectivity is assessed as **low** and therefore **not significant**.

Operation Phase

The expansion of the road is expected to result in improved connectivity for the transport of goods, services and people in the region, during operation. Travel times will be significantly reduced, and public transport links improved through the addition of 23 new bus stops. The road improvements will facilitate better access to medical and educational infrastructure in other parts of the region, with safer and faster access.

Local companies will potentially have better access to markets; and local residents better access to social and educational services within the municipalities, and more broadly within Montenegro.

⁵⁴ As per discussions with TA and experience on other similar road upgrades.

Impact Assessment

This is a **positive** impact of the Project.

Enhancement Measures

- The Project will continue to engage with local communities, businesses and other key road users to ensure that the design is appropriately tailored to maximise accessibility for local and regional stakeholders. This will include consultation regarding the appropriateness of crossing point locations, to maximise safety of pedestrians wishing to cross the road. Specific attention will be given to school children accessing the new bus stops. This will be captured in the Project's SEP.

Residual Impacts

Following effective implementation of the prescribed enhancement measures, the impact on accessibility is **positive**.

12.6.7 Potential Impact Associated with Security Personnel

Construction Phase (only)

Security personnel are to be employed throughout the construction period, to ensure the security of staff and equipment at the construction sites and worker accommodation. The use of disproportionate force by security personnel in the event of any incident or the inappropriate behaviour of security personnel towards local residents may lead to grievances or injury if there is any physical confrontation. The inappropriate use of force to secure the sites in the event of an incident could compromise the safety and security of local communities or workers.

Impact Assessment

The effect is adverse in nature, short-term during construction and likely small in scale. Security is also well regulated in Montenegro, through Law on the Protection of Property and Persons (Official Gazette of Montenegro No. 24-9/18-2/18 and there is no real history of violence or negative interactions between security and local populations in the project area. therefore the magnitude is considered **low**. The sensitivity of local receptors is considered to be **low**, as there has been minimal vulnerability identified within the Project area. This results in a significance level of **low**, prior to the application of any mitigation or management measures.

Mitigation Measures

- Within the Labour and Working Conditions Management Plan security will be addressed. Whilst the details of security planning have not yet been defined (it will be the responsibility of the Construction Contractor) and will require the recruitment and management of security personnel to be carefully planned. The Project will align with the requirements of EBRD PR2 and agree to a standard of practice and behaviour for the security personnel, guided by the principal of proportionality. All security providers will need to align with the Voluntary Principles on Security and Human Rights (2000). The Project will make reasonable inquiries to satisfy itself that those providing security services are not implicated in past abuses, will ensure they are trained adequately in the use of force, and appropriate conduct towards workers and the local community, and require them

to act within the applicable law. The Project will not sanction any use of force except when used for preventive and defensive purposes in proportion to the nature and extent of the threat.

- The grievance mechanism (as detailed in the SEP) will also be an important mechanism for local stakeholders to report any complaints about security personnel and for the Project to develop resolutions.

Residual Impacts

Following effective implementation of the prescribed mitigation measures, the impacts associated with security personnel are assessed as very low and therefore **not significant**.

12.6.8 Potential Impacts Associated with Occupational Health and Safety of Workers

Construction Phase

Construction activities associated with the Project have the potential to put the workforce (including contractors and subcontractors) at risk of exposure to health and safety risks. These include working at height, manual handling, vehicles and driving, contact with hazardous materials, and noise and vibration exposure, amongst others. In the absence of appropriate standards, the health and safety of workers would not be adequately protected. Impacts could be of major significance with the potential for injury or fatalities.

Impact Assessment

The effect is adverse in nature. The magnitude of this impact is assessed as **medium to large** due to the likelihood of accidents on large construction sites, and the potential severity of any incidents. The vulnerability of workers is assessed as **low** as the workforce is likely to be well-established and appropriately skilled for the work. This results in a significance level of **medium to high**, prior to the application of any mitigation or management measures.

Mitigation Measures

- The Project will comply with all national labour, social and occupational health and safety laws, as well as the requirements of EBRD PR2. The contractor will prepare a Labour Management Plan to action this. Emphasis will also be placed on measures to ensure that workers are free of any discrimination, regardless of race, religion or belief, gender, disability, age, nationality, sexual orientation or ethnicity.
- The construction contractor will prepare and implement an Occupational Health and Safety (OHS) Plan for the works, based on the identification of key hazards, and ensure appropriate emergency preparedness and response planning.
- There will be clear OHS terms and conditions in subcontractor and worker contracts.
- All workers will be appropriately trained.
- Regular audits will be undertaken of all construction sites and accommodation area, to verify the effectiveness of prevention and control strategies. There will also include the contractors and sub-contractors.

- Workers will all be provided with appropriate personal protective equipment (PPE) for their job.
- A formal grievance mechanism will be established for workers to raise any concerns for resolution.

Residual Impacts

Following effective implementation of the prescribed mitigation measures, the impacts associated with occupational health and safety of workers are assessed as **low to medium** and therefore **not significant**.

Project Commitments

To summarise, the implementation of all of the above listed mitigation (and enhancement) measures constitute the following list of 'Project Commitments' which should be accepted:

Socio-Economic Impact Commitments

The key mitigation for land use impacts is implementation of the LARP. The LARP will include the following broad actions:

- Identify and hire a qualified TA social manager to guide PR compliant consultation, disclosure, data collection, impact identification, design of entitlements, implementation of resettlement plan, monitoring and grievance management.
 - With appropriate consultant support:
 - Develop and implement a compliant engagement process with affected HH;
 - Develop and implement an effective resettlement grievance process;
 - Design and implement a census-level asset verification and supplementary SES with affected HHs;
 - Design and implement an effective approach for verifying asset losses and impacts with affected businesses;
 - Development of a complete understanding of resettlement impacts and differentially impacted groups;
 - Development of a complete entitlement framework, in consultation with affected HHs;
 - Implement additional compensation and support measures to mitigate resettlement impacts effectively, including support for livelihood restoration and support for differentially impacted groups;
 - Continue engagement with affected HHs throughout the resettlement compensation and support processes;
 - Monitor and report on implementation of resettlement compensation and support measures;
 - Contract an independent third party to carry out an external completion audit of the LARP for all phases of the road improvement project;

- Implement any corrective measures identified in the external completion audit.
- Labour and Working Conditions Management Plan which will include the contract's local procurement policy and hiring process
- Project's Stakeholder Engagement Plan
- Construction and Operation Emergency Preparedness and Response Plan.
- Construction Traffic Management Plan

Potential Impacts on Local Communities' Health and Safety from Increased Traffic

- The need to strengthen preconstruction baseline info on noise and air quality is addressed in chapters 7 and 8
- The Project will implement a Construction Traffic Management Plan (CTMP). The plan will cover vehicle safety, driver and passenger behaviour, hours of operation and accident reporting and investigation etc. All drivers will be trained, and strict speed limits will be enforced.
- Local stakeholders will also be engaged to discuss road safety and incident reporting. This will be particularly important for any school children using the buses on the road to reach school. Details will be contained in the Project's Stakeholder Engagement Plan (SEP).
- The grievance mechanism for the Project will capture any concerns or complaints about Project-related traffic.
- An Emergency Preparedness and Response Plan (EPRP) will be in place for the Project, prior to construction. This will include measures and procedures to manage any traffic and transport related emergencies. Appropriate details will be shared and discussed with local communities and local service providers, as appropriate.
- The Project will ensure that there is adequate provision for road crossings close to bus stops, to protect the safety of bus users, particularly school children.

Potential Impacts on Accessibility and Connectivity – Construction Phase

- The Project will develop and implement a robust Construction Traffic Management Plan (CTMP), providing a clear plan for traffic movements during each stage of construction. Routes for construction vehicles will be carefully planned to minimise disruption to local residents and any damage to local roads (further impacting connectivity). The movement of construction vehicles on local roads will be minimised. All necessary detours for road users will also be carefully planned and detailed in the TMP.
- All drivers will be trained on the details of the TMP, which will include specified routes, working hours and speed limits, etc.
- Relevant details of the TMP will be shared with local stakeholders, the process of which will be detailed in the Stakeholder Engagement Plan (SEP). This will include advance details of construction works, and any road closures/diversions etc. Notices will be erected in local towns and posted on the TAs website, so that road users can plan their travel appropriately.

- Grievances will be carefully monitored, and where necessary, additional traffic management measures implemented in response to issues raised by stakeholders.

Potential Impacts on Accessibility and Connectivity – Operation Phase (*Enhancement*)

- The Project will continue to engage with local communities, businesses and other key road users to ensure that the design is appropriately tailored to maximise accessibility for local and regional stakeholders. This will include consultation regarding the appropriateness of crossing point locations, to maximise safety of pedestrians wishing to cross the road. Specific attention will be given to school children accessing the new bus stops. This will be captured in the Project's SEP.

Potential Impacts Associated with Security Personnel

- Within the Labour and Working Conditions Management Plan security will be addressed.. The Project will align with the requirements of EBRD PR2 and agree to a standard of practice and behaviour for the security personnel, guided by the principal of proportionality. All security providers will need to align with the Voluntary Principles on Security and Human Rights (2000). The Project will make reasonable inquiries to satisfy itself that those providing security services are not implicated in past abuses, will ensure they are trained adequately in the use of force, and appropriate conduct towards workers and the local community, and require them to act within the applicable law. The Project will not sanction any use of force except when used for preventive and defensive purposes in proportion to the nature and extent of the threat.
- The grievance mechanism (as detailed in the SEP) will also be an important mechanism for local stakeholders to report any complaints about security personnel and for the Project to develop resolutions.

Cumulative Impacts

Due to the levels of uncertainty about other existing or future developments in the project area, the extent of any cumulative social impacts is not possible to assess at this time. It is anticipated that the measures to be put in place to manage the social impacts predicted for this Project, will to some extent respond to potential cumulative impacts resulting from further developments. However, should other developments commence, the extent of socio-economic impacts to local residents will need to be assessed, monitored and managed appropriately.

13. List of Annexes

- A) Framework Construction –Environmental and Social Management Plan
- B) Commitments Register
- C) Calculation of the emission of air pollutants:– description of methodology
- D) Greenhouse Gas Emission Calculations
- E) Critical Habitat Assessment (CHA)
- F) Construction Traffic Management Plan: Key Issues and Minimum Requirements.
- G) Traffic Survey Report
- H) Noise Survey Report
- I) Habitat Survey Report
- J) Bat Survey Report
- K) Aquatic Invertebrate Report