

DIE OESTERREICHISCHE ENTWICKLUNGSBANK AG AND METITO
UTILITIES LTD

ZRENJANIN WASTEWATER TREATMENT PLANT

ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT

14 OCTOBER 2021





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ENTWICKLUNGSBANK AG AND METITO
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NON-TECHNICAL ESIA REPORT SUMMARY

INTRODUCTION

The Serbian Ministry of Agriculture, Forestry and Water Management and Metito Utilities Ltd. (Metito) have signed an agreement for the development and management of a 25 000 m³/day wastewater treatment plant (WWTP). The contract will be implemented as a public-private partnership (PPP). The WWTP is to be located in the Zrenjanin Southeast Industrial Zone, east of the Begej River between Zrenjanin City (~3km North West) and Ecka (~2.5km South East).

The lender, Die Oesterreichische Entwicklungsbank AG (OeEB), observes the ecological and social standards agreed upon by the EDFI. These include the International Finance Corporation (IFC) Performance Standards (PS) on Social and Environmental Sustainability" (IFC Standards) which have become the established market benchmark, as well as the "Environmental, Health and Safety Guidelines" of the World Bank Group, and international conventions of ILO (International Labour Organization). The IFC standards are therefore the primary set of standards for this Environmental and Social Impact Assessment (ESIA).

As part of OeEB's investment process, each investment is subject to environmental and social responsibility categorisation based on the guidelines agreed by the EDFI, in accordance with the Harmonised EDFI Environmental and Social Standards, to determine the nature and level of environmental and social investigations, information disclosure and stakeholder engagement required. The OeEB has categorised the Project as Category B+ (medium high risk): Activities with potential adverse social or environmental impacts that are generally beyond the site boundaries, largely reversible and can be addressed through relevant mitigation measures.

A local standards EIA that is compliant with national EIA requirements and processes, is being prepared in parallel to this ESIA, using all relevant data and studies.

DESCRIPTION OF THE PROJECT

REGIONAL WATER QUALITY CONTEXT

The levels of wastewater management within Serbia are significantly lower than the average levels within the EU, with only 10% of wastewater being treated prior to discharge. These discharges are significant sources of water pollution in the river systems; and, related to this Project, the Begej River is generally considered one of the most polluted water courses in the province of Vojvodina. As a transboundary river, coming from Romania, the Begej River enters Serbia being already under pressure from various upstream industrial, domestic and agricultural pollution sources. The current pollution levels in the Begej River are a severe threat to public health and aesthetics for the inhabitants of the Municipality of Zrenjanin and downstream water users, as well as to the natural ecosystems.

TREATMENT TECHNOLOGY / PROCESS DESIGN

The aim of the project is to treat untreated wastewater currently flowing through the Aleksandrovački canal into the Begej River. The treatment is expected to improve the quality of water in the Begej River. The design of the WWTP incorporates the following treatment stages:

Primary Treatment: This is the first step in the treatment process and is intended to separate the suspended solids and grit from the wastewater. In the proposed WWTP, wastewater will be initially passed through an Inlet Works Unit consisting of screens the removal of suspended and floating solids, and a grit removal unit which perform the screening and grit and grease removal operations.

Biological Treatment: In the proposed WWTP the biological treatment is achieved in three zones: anaerobic, anoxic, and aeration. The treatment processes which take place in each zone is summarised below:

The anaerobic treatment process stresses the bacteria, resulting in increased uptake of phosphorous in the latter, aerobic, stage. This achieves the removal of bio-phosphorous from the wastewater.

The anoxic treatment process is a biological process where in the absence of oxygen, biological organisms convert nitrates contained in the wastewater to nitrogen.

The aeration process is a biological process where in an oxygen-rich environment microorganisms are used to remove the remaining dissolved organic matter contained in the wastewater. Planned technology at this WWTP

is a state of the art Integrated Fixed Activated Sludge (IFAS) process. This is a combination of an Activated sludge process where the microbial growth is suspended in an aerated water mixture, and a Moving Bed Biofilm Reactor (MBBR) where the microbial growth occurs on fixed films.

Secondary Treatment and Disinfection: Biological treatment is followed by settling where big particles or flocs will settle at the bottom of clarifier tanks. The remaining clear water overflows from the top of the tanks into the disinfection stage. In the disinfection stage ultra violet (UV) light is radiated through the treated effluent which inactivates microscopic organisms such as bacteria, viruses, protozoa and other pathogens. Following UV treatment, the water will be discharged to the Aleksandrovacki Canal in accordance with environmental discharge standards.

Sludge Management: Settled organic matter generated in the WWTP is partially recirculated in order to maintain the biological mass in the process; however, the WWTP will generate surplus sludge requiring management. Initially, filter presses will be used to reduce the volume of sludge and increase solids concentration from 1-2% to around 20%.

WASTE DISPOSAL

All waste generated by the WWTP will be required to be disposed at a permitted waste disposal facility. Metito is currently considering the Sremska Mitrovica disposal facility in Serbia operated by ISTEP. The company provides sludge treatment and final disposal in its own landfill. The landfill is permitted in terms of the Serbian legislation and includes provision for disposal of all wastes that will be generated by the WWTP as per waste codes corresponding with the European Waste Catalogue (EWC).

ALIGNMENT TO BEST AVAILABLE TECHNIQUES (BAT)

The ESIA includes a high level review of the WWTP design in terms of the Best Available Techniques (BAT) Reference Document on Waste Treatment (WT BREF) published According to article 15(2) of the EU Industrial Emissions Directive (IED) (2010/75/EU) / section 6: BAT Conclusions. It is noted that this BREF is considered good international industrial practice (GIIP) and is not legally binding on the proposed WWTP as it is covered by Council Directive 91/271/EEC of 21 May 1991 concerning urban waste-water treatment: [...] i) biological treatment.

All of the proposed treatment techniques are aligned with BAT, including: i) inlet works for equalisation and physical separation of solids, suspended solids, oil/grease; ii) secondary biological treatment process including *inter alia* activated sludge process and IFAS+MBBR biological treatment; iii) an anoxic phase for denitrification, and iii) polishing processes including coagulation and flocculation, sedimentation in clarifiers.

The design of the facility addresses air pollution and odour emissions and incorporates noise abatement techniques that are generally aligned with BAT.

Potential for loss of containment is mitigated by the design of the WWTP for hydraulic flow of average and peak conditions. If an incoming flow exceeds the peak flow, the untreated effluent will discharge via an overflow back into the Aleksandrovacki Canal.

In terms of water discharges, the proposed treated effluent quality will conform to the Urban Waste Water Treatment Directive (full title "Council Directive 91/271/EEC of 21 May 1991 concerning urban waste-water treatment") which is referenced in the BREF.

CONSIDERATION OF ALTERNATIVES

In accordance with the IFC PS1 the ESIA considered technically and financially feasible alternatives that could potentially result in differing environmental and social impacts.

The 'no project' option is a fundamental development concept that was considered as part of the ESIA evaluation of alternatives. In this scenario the Municipality of Zrenjanin will continue to discharge untreated wastewater into the Begej River, continuing to be a source of pollution. The 'no project' option has been considered within the impact assessment as a baseline against which the impacts of the Project were assessed.

Studies into alternative site locations were undertaken during a prefeasibility study (C.R.E.A.M., 2015) - predating the involvement of Metito. This study included technical and environmental comparisons of three options which identified the Zrenjanin site as the preferred location. The ESIA did not provide further assessment of the dismissed site options.

Alternative technologies may be considered within an ESIA; however, as the proposed techniques are aligned with BAT there was no justification for an evaluation of alternative technologies for the purposes of the ESIA.

AREA OF INFLUENCE

The ESIA includes a definition of the ecological and social areas of influence (AoI) of the project i.e. the features of the environment around the proposed WWTP that could be affected by it directly, or indirectly, in a positive or adverse manner.

The ecological AoI was determined primarily based on the relevant watershed and analysis of current land cover. The area of influence measures approximately 32,000 ha. Features and aspects that were considered as being ecologically significant within the AoI included Carska Bara protected area located south of the project area, and the adjacent lake system comprising of Mika Jezero, Koca Jezero and Belo Jezero; the Begej River which is the receiving system for the WWTP, flowing into Tisa River system; and, forest area and grasslands.

Critical habitat (CH) identification is required by the IFC PS to manage risks and avoid, mitigate and offset impacts to areas with high biodiversity value; it is also a key criterion in the definition of the AoI. No CH was identified for the terrestrial biodiversity of the project. CH is confirmed with the downstream reach of the Begej River which is associated with the Carska Bara Nature Reserve.

The social AoI was defined as the area within a 2km radius from the proposed WWTP. Features and aspects that were considered as being socially significant within the AoI included the residential neighbourhood of Mužlja situated on the west bank of the Begej River; the “weekend zone” – a small settlement of weekend houses situated north of the site; a local holiday, recreation and touristic zone, namely Lakes’; and, the settlement of Ečka known for its landscape, touristic and historic sites (e.g. Kaštel Ečka).

For the purposes of the ESIA, ecological and social field-based baseline assessments prioritised the AoI, while areas falling outside of the AoI were considered, where necessary, at a desktop level only.

IMPACT ASSESSMENT

Potential environmental impacts were identified through detailed analysis of the proposed project activities and the associated impact sources. The pre- and post-mitigation (residual) significance of impacts was assessed using a semi-quantitative risk assessment methodology.

AIR QUALITY

An emissions inventory was developed using documented emission factors, except for hydrogen sulphide, for which emissions were provided by the client, Metito. Emission rates of hydrogen sulphide, benzene, toluene, ethylbenzene, xylene, chloroform, dichloromethane, trichloroethylene, vinyl chloride, formaldehyde and styrene were inputted to a Level 2 (AERMOD) dispersion model to calculate ambient concentrations. Simulated pollutant dispersion outputs were compared with Serbian maximum allowable concentrations (MAC) or relevant international guidelines (in the absence of local standards) to assess the degree of impact.

The study focussed on the impacts to sensitive receptors based on their proximity to the study site (i.e. the closest sensitive receptors identified). Three receptors comprised residential dwellings / houses, and a third comprised a public retailer (petrol station). Ambient concentrations of pollutants from low-level area sources tend to decrease radially outwards from the source. As such, the closest receptors along key wind trajectories provide insight on worst case potential impacts. Findings were as follows:

Health

- None of the modelled pollutants are predicted to exceed health relevant standards / guidelines at any of the sensitive receptors for any of the averaging periods assessed.
- For pollutants with no specified criterion values (e.g. genotoxic and/or carcinogenic pollutants), predicted concentrations fell within guidelines of insignificant to reasonable excess risk.
- From a cumulative emission perspective (assuming measured pollutants represents consistent background levels across averaging periods), the above finding holds for pollutants for which measured data is available.

Nuisance

- P99 1-hour H₂S concentrations at three of the four proximate sensitive receptors exceed the WHO 30-minute nuisance guideline (applied in the absence of local H₂S nuisance/1-hr average criterion).

- The frequency of exceedance of the nuisance guideline is predicted to occur between 0.9% - 4.4% of the time for proximate receptors – in other words in a typical year the nuisance would be experienced between 3.2 – 16 days for proximate receptors.
- P98 1-hour odour concentrations (based on predicted H₂S levels only) exceed the Netherlands odour criteria limit (applied in the absence of local odour criteria) at the four proximate sensitive receptors. As such, odour nuisance at these proximate receptors is expected. However, ambient concentrations will decrease steadily with distance from the proposed facility and this assessment of the proximate receptors represents worst case receptor impacts.

To reduce potential odour nuisance impacts, WSP has recommended the following:

- Cover emission points and vent emissions to control systems (e.g., compost beds, bio-filters, chemical scrubbers, etc.) as applicable. More than 70% of H₂S emissions are predicted to be emitted from the grit and grease removal tank. This should be the focus of emission mitigation.
- Develop a vegetative environmental buffer (VEB) along the perimeter of the development. WSP recommends the use of indigenous leafy trees that extend to height and that maintain their leaves throughout the year. Multiple rows of trees (with taller and shorter but bushier species alternating) will increase effectiveness of the barrier. Planting established trees will allow for more immediate protection. Additional value of the VEB is protection from bioaerosols, noise mitigation and improved aesthetics.
- Masking agents offer an additional odour neutralisation option should complaints arise despite the above recommendations. The effectiveness of commercial additives varies significantly, and local options can be investigated.
- Fenceline monitoring of H₂S to provide real-time indicator of potential odour impact.
- Warning communities of potential odour events during upset conditions (or as soon as fenceline monitors show increased concentrations) can generate increased trust and facilitate communication between parties.

AMBIENT NOISE

A detailed noise impact assessment was undertaken as part of the ESIA. The assessment included the development of an acoustic inventory; acoustic modelling; monitoring of baseline noise levels at sensitive receptor locations; and, comparison of the cumulative noise levels at these locations with the Law on Environmental Noise Protection (“Official Gazette of Republic of Serbia”, no. 36/2009, 88/2010), World Health Organisation Guidelines for Community Noise, and the World Bank Group EHS Guidelines.

During construction changes in noise levels at the modelled receptor locations were all predicted to be above the IFC 3 dB(A) threshold for annoyance as per the IFC EHS Guidelines for noise. However, such a situation represents a worst-case scenario, which is unlikely to occur. Additionally, the construction phase is transient in nature and will only endure for eighteen months.

During the operational phase noise levels at the modelled receptor locations were predicted to increase by between 0.2 dB(A) and 0.6 dB(A) at receptor locations during the day, and by between 0.4 dB(A) and 2.3 dB(A) at night. These are below the IFC 3 dB(A) threshold for annoyance as per the IFC EHS Guidelines for noise.

In conclusion, with such minimal increases in noise levels at neighbouring receptors during the operational phase, it is envisaged that the operation of the WWTP can be authorised without any major impacts or complaints.

WORKER HEALTH AND SAFETY

Worker health and safety impacts during the construction and decommissioning of the WWTP include a significant range of physical and chemical hazards and are assessed broadly within this ESIA. Impacts associated with the operational phase are general in nature and include over-exertion, slips and falls, work at heights, strikes by objects, moving machinery, and confined spaces and excavations. Impacts associated with the operational phase of water and sanitation projects are both general and facility specific and include accidents and injuries, chemical exposure, hazardous atmosphere, exposure to pathogens and vectors, and noise.

Whilst there is the potential for construction and operation workers to be exposed to such risks, it is assumed that any incidents causing death or injury are preventable through the implementation of and adherence to appropriate H&S management systems including hazard identification and risk assessment (HIRA). It is essential for a H&S culture to be embedded in the workers. In addition, it is expected that many workers associated with the project, and those within site management roles, will be familiar with the appropriate H&S measures for such construction projects.

COMMUNITY HEALTH AND SAFETY

The construction phase of the project has the potential to generate significant traffic volumes associated with the transportation of equipment and materials to the site, most notably the import of fill material that may be required to raise the development platform. Whilst the project is located within an industrial district there is potential for construction related road traffic to pass through more sensitive areas outside of the immediate project area, increasing the risk to pedestrians and other road users. This impact can be mitigated by adoption of best transport safety practices across all aspects of construction and project operations with the goal of preventing traffic accidents and minimizing injuries suffered by project personnel and the public.

There is potential for community exposure to hazardous waste generated by the WWTP if it is not disposed or managed appropriately; therefore this waste may only be transferred to a sanitary waste management or disposal facility that is permitted in accordance with National legislation (Serbian, or other countries) where the applicable legislation is substantively aligned with EU legislation.

The development of the proposed WWTP will have a positive community health and safety impact by improving the quality of water in the Begej River downstream of the Aleksandrovački canal discharge point. However, it is recommended that a communication system is developed to inform residents of a potential situation where the WWTP is bypassed resulting in the discharge of untreated sewage into the Begej River via the Aleksandrovački canal.

BIODIVERSITY

The project area has been classified as transformed habitat and represents a disturbed landscape with a general low sensitivity. The impacts of the project pertain predominantly to the project footprint area and include the Begej River. The riparian habitat adjacent to the Begej River has been considered for the impacts posed to the habitat.

No flora species of international conservation concern were recorded for the project area. Internationally protected faunal species were recorded for the project area. The transformed status has allowed for some fauna and flora species to re-establish in the area, but these are adaptable species. Despite the presence of an altered landscape housing a modified biotic community, the project area does present sensitivity to further degradation.

The loss of habitat and potential impacts on habitat, and associated fauna and flora occurring on the site due to construction activities are not significant impacts attributed to the transformed state of the area.

The key operational phase impacts on ecology relate to potential leaks, discharges and/or pollutant from the treatment system leaching into the surrounding environment and water sources; and, continued encroachment and displacement of the natural vegetation community due to alien invasive plant species and erosion. Provided that mitigation measures are implemented the significance of these impacts is very low.

The project will not result in any significant effects on environmental flows of both the channel and the Begej River.

The most significant ecological impact of the project is positive in nature relating to the improvement of water quality in the Begej River downstream of the discharge point. This will result in improved instream and marginal habitat conditions, as well as improved water quality for biota using the water, and an associated increase in biodiversity should the water quality improve in the Begej River. This is also likely to benefit the water quality of the Carska Bara Nature Reserve.

SOCIO-ECONOMIC

The ESIA considered effects on communities and individuals, as well as their social and economic assets, associated with land use, employment and procurement opportunities, livelihoods, community health, safety and security, revenue generation for municipality, increased costs for local communities and improved infrastructure.

During construction, the proposed development will have limited negative effects in terms of loss of agricultural land or access to land, as well as limited negative impacts on existing infrastructure in the project area. All negative impacts can be successfully mitigated through implementation of appropriate measures, including provision of timely information to affected people, grievance management, etc.

On the other hand, the project will also have some positive impacts related to creation of direct and indirect employment opportunities and associated positive impacts on livelihoods. To further enhance these impacts, it will be important to foster local hiring and local procurement of goods and services.

During operations positive impacts include creation of employment opportunities, however; local communities (especially vulnerable groups), will feel the negative impact of increased tariffs. Mitigation recommendations have been provided and are essential to reduce the significance of these impacts.

The proposed development will result in generation of revenue for the local government for operation and maintenance of broader service infrastructure, and with it the potential for improvements to the surrounding sewerage infrastructure system to connect areas / settlements not yet serviced to the WWTP network -providing these local communities with access to formal sanitation infrastructure. In addition, emergency incidents associated with blockages and upstream impacts will be less frequent.

The associated improvement of Begej River and surrounding environment may also result in possible recreational and tourism enhancement opportunities, while the improved wastewater management infrastructure may also attract new investments, which will contribute to further economic development in the municipality.

On-going communication and consultation with local communities will be key in enhancing positive impacts.

CULTURAL HERITAGE

No culturally important sites or artefacts are known to occur within the project footprint. There however has been recent reporting of artefacts from the Celtic period being unearthed at the Linglong site, approximately 1km from the WWTP site.

During construction, earthworks may accidentally expose unidentified subsurface remains / artefacts. This will result in a lost opportunity to preserve local cultural heritage and historical records should appropriate management measures not be in place. Care therefore needs to be given when planning excavation activities; and if a cultural resource is unearthed.

The improved quality of the environment within and around the Begej River may result in improved tourism in the area (e.g. Kastel Ečka). The AoI has certain tourist facilities that have the potential for further development if the quality the environment improves. For the purposes of the ESIA it is difficult to assess whether the WWTP alone will stimulate tourism in the area, thereby further contributing to local economic development, however it is considered a significant contributor to facilitating the promotion of the area for recreational use and tourist development.

VISUAL AND LANDSCAPE

A desk-based review was undertaken to determine existing landscape features, landscape character, and potential visual receptors. The baseline data was obtained through a combination of the site visits, and desk-based review of third party / consultation information. Several factors were considered when determining the potential visual and landscape impact of the project including the field of view; viewing distance; visual absorption capacity of the surrounding landscape; and viewpoint, elevation.

The review considered potential sensitive receptors including residential areas, areas of ecological importance and protected areas, and touristic and recreational areas. Of these, residential areas were the only relevant receptor to the project.

The change in aesthetic of the site during construction and during operation is not anticipated to have a significant impact on views on three of the four residential areas in the viewshed due to the relatively small footprint of the WWTP, the viewing distance, and the high absorptive capacity of the landscape (including the presence of existing commercial properties in the viewshed).

There could be a more noticeable change in aesthetics viewed from a small residential cluster 200m north of the WWTP (200m). The overall impact significance is very low during construction as the impact duration will be short term. The permanent presence of the WWTP could however have a greater impact on this receptor location due to its permanence. Mitigation measures have been proposed including landscaping of the facility and periphery, planting of vegetative screening, the judicious use of lighting at night.

EFFECTS OF CLIMATE CHANGE

The ESIA identifies the potential for increased flooding in Serbia due to climate change. Whilst the design of the WWTP includes a freeboard of 2.86m it has not been confirmed that this takes into consideration the potential for climate change related flood risk. It is a key recommendation of the ESIA that this confirmation is obtained.

GROUNDWATER POLLUTION RISK

The WWTP includes various containment structures for wastewater at various stages of the treatment process. Leaks from the containment structures and due to potential overflows on non-hard-standing areas have the potential to permeate into the sub-soil environment resulting in potential ground and groundwater contamination. Mitigation measures include the development and implementation of an Infrastructure Maintenance and Monitoring and Service Plan and a Groundwater Monitoring Plan.

CONCLUSION

Whilst the ESIA has identified a significant number of potential detrimental environmental and social impacts these can largely be reduced in significance to low status. Detailed measures have been developed to mitigate the full scope of impacts identified in the ESIA including an Environmental and Social Management Plan (ESMP).

The following key recommendations are made as an outcome of the ESIA:

- 1) Begej Water should consider and implement as far as is reasonably possible the recommendations contained in the ESIA Report (Section 7 [Impact Assessment]).
- 2) Begej Water should implement the ESMP during the construction and operational phases; this applies to the main contractor and all subcontractors involved in the construction and O&M phases of the project.
- 3) The ESIA recommendations and ESMP are critical environmental management tools to be implemented during the construction phase; however, their effectiveness is underpinned by the level of adoption by the construction contractor. To this end, these documents should be made available to the contractor for inclusion in its own environmental and social management system.
- 4) Begej Water should implement an Environmental and Social Management System (ESMS) in line with the requirements of IFC Performance Standard 1 and guided by the Environmental and Social Management System (ESMS) Implementation Handbook (General, 2015). A guideline is provided within the ESMS.
- 5) Begej Water should develop a legal register as part of the ESMS which identifies all legal compliance requirements and obligations in terms of Serbian and EU legislation relating to EHS aspects.
- 6) Begej Water should develop the following plans as recommended in the Best Available Techniques (BAT) Reference Document on Waste Treatment (WT BREF)
 - i) Odour management plan.
 - ii) Noise management plan
 - iii) Accident management plan.
 - iv) WWTP Sludges and Residues Management Plan.
- 7) Begej Water should develop the following plans as recommended in the ESIA report / by WSP's ESIA specialists:
 - i) Storm water and erosion control management plan
 - ii) Alien plant management plan
 - iii) Fire management plan
 - iv) Plan for the prevention of spills and leaks of hazardous materials
 - v) Infrastructure monitoring and service plan
 - vi) Traffic and transportation safety management plan
 - vii) Groundwater Monitoring Plan
- 8) It is recommended that Begej Water undertakes the following environmental monitoring as a minimum. Additional monitoring requirements that are required in terms of the pending Serbian EIA approval must also be undertaken as specified.

- i) Noise: Since noise impacts may result during the construction phase, it is recommended that at least one noise monitoring campaign is initiated during this phase. Additionally, annual noise monitoring in the first year of the operational phase should be implemented to confirm any impacts on receptors and assess the need for any additional mitigation measures.
- 9) The following general (non-mandatory) recommendations have been provided to enhance the positive environmental and impacts identified within the ESIA:
- ii) A biannual aquatic biomonitoring programme is recommended to determine the efficacy of the treatment facility to achieve National biodiversity goals in the downstream reaches. An aquatic biomonitoring programme is an essential management tool. The monitoring programme should be designed to enable the detection of potential negative/ positive impacts brought about by the treated effluent discharges. Table 7 11 highlights some important aspects to monitor in reference to aquatic biota for the life of the WWTP facility.
 - iii) A recommendation of the ESIA that could lead to ecological enhancement of the site is to rehabilitate the embankments of the Begej River adjacent to the WWTP. This could improve the phytoremediation (biological cleaning of water) capacity of the riverbanks to further improve water conditions related to the proposed project activities.
- 10) The ESIA is limited to the project description as contained in this report. Any changes in the project description that have potential to materially affect the findings of the ESIA should be evaluated by Begej Water, as appropriate, in accordance with its own ESMS.
- 11) The ESIA identifies the potential for increased flooding in Serbia due to climate change. Whilst the design of the WWTP includes a freeboard of 2.86m it has not been confirmed that this takes into consideration the potential for climate change related flood risk. It is a key recommendation of the ESIA that this confirmation is obtained by a suitably qualified person within the design team prior to finalisation.
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ACRONYMS AND ABBREVIATIONS

Abbreviation	Definition
AOH	Adsorbing Organic Halogens
AOI	Area of Influence
AP	Autonomous Province
AIDS	Acquired Immunodeficiency Syndrome
AP Vojvodina	Autonomous Province of Vojvodina
AQP	Air Quality Plans
AZE	Alliance for Zero Extinction
BAT	Best Available Techniques
BOD	Biochemical Oxygen Demand
BREF	Best Available Techniques Reference
BSI	British Standards Institution
CCZ	City Council Zrenjanin
CEO	Chief Executive Officer
CH	Critical Habitat
COD	Chemical Oxygen Demand
CR	Critically Endangered
dB	Decibel
dB(A)	A-weighted sound measurement
dB(C)	C-weighted sound measurement
dB(Z)	Z-weighted sound measurement
END	Environmental Noise Directive
DTD	Danube-Tisa-Danube
EBA	Endemic Bird Areas
EBRD	European Bank for Reconstruction and Development
EC	European Commission
EDFI	European Development Finance Institutions
EEA	European Environment Agency
EHIS	European Health Interview Survey
EHS	Environmental Health and Safety
EIA	Environmental Impact Assessment
ELC	European Landscape Convention
EMEP	European Monitoring and Evaluation Programme
EMPr	Environmental Management Programme
EN	Endangered
END	Environmental Noise Directive
EPA	[United States] Environmental Protection Agency
EPRP,	Emergency Preparedness and Response Procedure
ESCP	Environmental and Social Commitment Plan
ESIA	Environmental and Social Impact Assessment
ESL	Effects Screening Levels
ESMP	Environmental and Social Management Plan
ESMS	Environmental and Social Management System

ETF	European Training Foundation
EU	European Union
EWG	European Waste Catalogue
FEED	Front End Engineering and Design
FOG	Fat, Oil, & Grease
GDP	Gross Domestic Product
GHG	Greenhouse Gas
GN	Guidance Note
GPS	Global Positioning System
GV	Guideline Value
Hz	Hertz
H1N1	Hemagglutinin Type 1 and Neuraminidase Type 1
HIRA	Hazard Identification and Risk Assessment
HIV	Human Immunodeficiency Virus
HR	Human Resources
HSE	Health, Safety, and The Environment
IBA	Important Bird and Biodiversity Area
ICCPR	International Covenant on Civil and Political Rights
IDU	Intravenous Drug User
IFAS	Integrated Fixed Activated Sludge
IFC	International Finance Corporation
ILO	International Labour Organisation
IPPC	Integrated Pollution Prevention and Control
ISO	International Organization for Standardization
ICCPR	International Covenant on Civil and Political Rights
IUC	International Urban Cooperation
IUCN	International Union for Conservation of Nature and The International Union for Conservation of Nature and Natural Resources
IUPAC	International Union of Pure and Applied Chemistry
KBA	Key Biodiversity Area
L_{Aeq}	Equivalent continuous sound pressure level
$L_{R,dn}$	Equivalent continuous day/night rating level
$L_{Req,d}$	Equivalent continuous rating level for day-time
$L_{Req,n}$	Equivalent continuous rating level for night-time
$L_{Req,T}$	Typical noise rating levels
LC	Least Concern
LSG	Local Self-Government
LTD	Limited Company
MAC	Maximum Allowable Concentration
MBBR	Moving Bed Biofilm Reactor
MPCN	Most probable number causing cytopathogenic effect
MPN	Most Probable Number
NATO	North Atlantic Treaty Organization
NGO	Non-Governmental Organisation
NH ₄	Ammonium
NO	Nitric Oxide

NO ₂	Nitrogen Dioxide
NO ₃	Nitrate
NPV	Net Present Value
NT	Near Threatened
NTU	Nephelometric Turbidity Units
O ₂	Oxygen
OC	Organized Crime
OECD	Organisation for Economic Co-Operation and Development
ODT	Odour detection limits
OHS	Occupational Health and Safety
OSAC	Overseas Security Advisory Council
P	Phosphorus
PAH	Polycyclic Aromatic Hydrocarbons
PAOR	Activists network for: peace, human rights, ecology, social justice, sport activism, education-science
PCB	Polychlorinated Biphenyls
PCCD / F	Polychlorinated Dibenzo-P-Dioxins and Furans
PE	Population Equivalent
PES	Present Ecological Status
PFD	Personal Flotation Device
PGR	Plant Growth Regulator
PHC	Primary Health Care
PM	Particulate Matter
PPE	Personal Protective Equipment
PPP	Public-Private Partnership
PR	Performance Requirements
PS	Performance Standards
PUC	Public Utility Company
PWL	Sound Power Level
QHSE	Quality, Health, Safety and Environment
RAS	Return Activated Sludge
RIS	Ramsar Information Sheets
RS	Republic of Serbia
RSD	Average Salary
SARS	Severe Acute Respiratory Syndrome
SEA	Strategic Environmental Assessment
SEP	Stakeholder Engagement Plan
SFRY	Socialist Federal Republic of Yugoslavia
SNS	Serbian Progressive Party
SOC	State Owned Company
SRPS	Institute for Standardization of Serbia
STP	Short Term Plans
TCEQ	Texas Commission on Environmental Quality
TDS	Total Dissolved Solids
TDS	Total Dissolved Solids
TKN	Total Kjeldahl Nitrogen

TSP	Total Suspended Particulates
TN	Total Nitrogen
TO	Total Oxygen
TOC	Total Organic Carbon
TOP	Total Phosphorus
TSS	Total Suspended Solids
TVOC	Total volatile organic compounds
UAE	United Arab Emirates
UN	United Nations
UNEP	United Nations Environment Programme
US	United States
UV	Ultraviolet
UWWTD	Urban Waste Water Treatment Directive
VEC	Valued Ecosystem Components
VET	Vocational Education and Training
VG	Vulnerable
VOC	Volatile Organic Compound
VSS	Volatile Suspended Solid
VU	Vulnerable
WAS	Waste Activated Sludge
WBG	World Bank Group
WCMC	World Conservation Monitoring Centre
WFD	Water Framework Directive
WHO	World Health Organization
WRF	Weather Research and Forecasting
WWF	World Wide Fund for Nature
WWII	World War II
WWTP	Wastewater Treatment Plant

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APPENDICES

A MONITORING DATA / REPORTS

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A-2 Soil Analysis Report (Anahem Laboratorija, 2021)

A-3 Water ANALYSIS REPORT (ANAHM LABORATORIJA, 2021)

A-4 GROUNDWATER ANALYSIS REPORT (ANAHM LABORATORIJA, 2021)

A-5 Air Quality ANALYSIS REPORT (ANAHM LABORATORIJA, 2021)

B STAKEHOLDER ENGAGEMENT PLAN

C ENVIRONMENTAL AND SOCIAL MANAGEMENT PLAN (ESMP)

D ENVIROMENTAL AND SOCIAL COMMITMENT PLAN (ESCP)

1 INTRODUCTION

1.1 THE PROJECT

The Serbian Ministry of Agriculture, Forestry and Water Management and Metito Utilities Ltd. (Metito) have signed an agreement for the development and management of a 25 000 m³/day wastewater treatment plant (WWTP). The contract will be implemented as a public-private partnership (PPP). The WWTP is to be located in the Zrenjanin Southeast Industrial Zone, east of the Begej River between Zrenjanin City (~3km North West) and Ečka (~2.5km South East).

The construction of the WWTP is planned to commence in November 2021 and has an 18-month construction timeline. Construction activities will commence with site preparation, which will entail land clearance of vacant state-owned land, site establishment, levelling, and delivery of materials and plant/equipment, followed by the construction of the physical infrastructure and installation of various mechanical and electrical components.

The development is herein referred to as the 'Project'. The land upon which the Project will be developed is herein referred to as the 'Site'.

1.2 THE COMPANY

The Project will be implemented by Begej Water as the Private Limited Liability Company in Serbia. The shareholder in Begej Water consist of EmSrb Water, a privately held company established by Metito in the United Arab Emirates (UAE).

1.3 PROJECT NEED AND JUSTIFICATION

At a regional level, within the European Union (EU), wastewater generated by large populations and industry is a major source of pollution of the natural water resources. This pollution can result in significant environmental and social impacts, affecting ecological systems as well as the health and safety of the various water users, including use of the resource for drinking, recreation and irrigation uses. The Urban Wastewater Treatment Directive (91/271/EEC) has clear and binding objectives for the protection of water resources and provides flexibility on the means to achieve such objectives, allowing alternative solutions and encouraging innovations both in wastewater collection and treatment.

The levels of wastewater management within Serbia are significantly lower than the average levels within the EU, with only 10% of wastewater being treated prior to discharge. These discharges are significant sources of water pollution in the river systems; and, related to this Project, the Begej River is generally considered one of the most polluted water courses in the province of Vojvodina. As a transboundary river, coming from Romania, the Begej River enters Serbia being already under pressure from various upstream industrial, domestic and agricultural pollution sources. The current pollution levels in the Begej River are a severe threat to public health and aesthetics for the inhabitants of the Municipality of Zrenjanin and downstream water users, as well as to the natural ecosystems.

Currently untreated wastewater from the Municipality of Zrenjanin and surrounding settlements is discharged into the Begej River, via the Aleksandrovacki canal, contributing to the already elevated pollution levels of the Begej River impacting water users and natural ecosystems. The justification for the Project is therefore to establish a WWTP to treat the wastewater prior to discharge into the Begej River, via the Aleksandrovacki canal, thereby reducing the level of pollution/contaminants entering the river system.

The Project is aligned with the Serbian national goals in environmental protection, which correspond to European Union (EU) objectives, primarily those set in the Urban Wastewater Treatment Directive (European Council Directive 91/271/EEC). The Directive, which was adopted on 21 May 1991 and amended by the Commission Directive 98/15/EC, aims *"to protect the environment from the adverse effects of urban waste water discharges and discharges from certain industrial sectors"* by mandating waste water collection and

1.4 PROJECT SETTING

The developed WWTP will receive wastewater generated from citizens and various industries within the Municipality of Zrenjanin administrative area, as well as the surrounding settlements (i.e. Aradac, Elemir, Ecka, Jankov Most, Klek, Lazarevo, Lukicevo, and Mihajlovo). The sewerage infrastructure is existing and not included within the remit of the project or the ESIA.



1.5 REFERENCE FRAMEWORK

- International Finance Corporation (IFC) Environmental and Social Performance Standards
- World Bank Group (WBG) General Environmental Health and Safety (EHS) Guidelines, the industry sector EHS Guidelines for Water and Sanitation

- International Labour Organisation (ILO) Core Conventions, all other ILO Conventions ratified by Serbia and the Basic Terms and Conditions of Employment¹
- EDFI (the Association of European Development Finance Institutions) Exclusion List (Annexure 4 – Harmonized EDFI Exclusion List)

In addition to the above, the Project will be structured to comply with European Union (EU) legislation applicable to water treatment, inclusive of:

- EU EIA Directive's (2014/52/EU)
- EU Waste Framework Directive (2008/98/EC) (generally applicable to the management of sludge generated by the WWTP)
- EU Sewage Sludge Directive (86/278/EEC)
- Urban Waste Water Treatment Directive (91/271/EEC)
- EU Water Framework Directive (2000/60/EC)
- EU Groundwater Directive (2006/118/EC)

Where Serbian regulations differ from EU / international environmental and social standards, the Project will be expected to meet whichever is the more stringent. General details on the legislative and policy requirements are outlined in the ESIA Report Section on Environmental and Social Governance Framework Analysis and topic specific details are provided in the environmental and social impact assessment Section (**Section 8**).

1.6 PROJECT CATEGORISATION (IFC)

The lender, Die Oesterreichische Entwicklungsbank AG (OeEB), observes the ecological and social standards agreed upon by the EDFI. These include the "IFC Performance Standards on Social and Environmental Sustainability" (IFC Standards) developed by the IFC, a World Bank subsidiary, which have become the established market benchmark, as well as the "Environmental, Health and Safety Guidelines" of the World Bank Group, and international conventions of ILO (International Labour Organization). The IFC standards are therefore the primary set of standards for the ESIA.

As part of OeEB's investment process, each investment is subject to environmental and social responsibility categorisation based on the guidelines agreed by the EDFI, in accordance with the Harmonised EDFI Environmental and Social Standards, to determine the nature and level of environmental and social investigations, information disclosure and stakeholder engagement required. The OeEB has categorised the Project as:

- Category B+ (medium high risk): Activities with potential adverse social or environmental impacts that are generally beyond the site boundaries, largely reversible and can be addressed through relevant mitigation measures.

This category can be generally considered a median of Categories A and B as defined in the IFC's Environmental and Social Review Procedures Manual (2016):

- Category A: Business activities with potential significant adverse environmental or social risks and/or impacts that are diverse, irreversible, or unprecedented.
- Category B: Business activities with potential limited adverse environmental or social risks and/or impacts that are few in number, generally site-specific, largely reversible, and readily addressed through mitigation measures.

¹ This refers to the requirements on wage, working hours, labour contracts and occupational health & safety issues, stemming from ILO conventions 26 and 131 (on remuneration), 1 (on working hours) and 155 (on health & safety).

1.7 TECHNICAL STUDIES

The following independent technical Project information has been referred to as part of the preparation of the ESIA.

Table 1-1 Key Technical Project Reference Documents

#	DOCUMENT REFERENCE	COMMENTS
1	Municipal Infrastructure Support Programme (EU Funded) – ‘Zrenjanin Wastewater Management, Volume 2: Feasibility Study’ (2015).	This study was commissioned prior to the involvement of MUL and has not been used as the design basis. The document is referenced in providing background on the need for the project.
2	Metito - Wastewater Treatment Project, Zrenjanin City, Serbia - Process Description and associated technical information. – Process Description (Document Ref: 130201500-09-403, 30.12.21) – Process and Instrumentation (Drawing No. 130201500-01-002, Rev 1-16.06.21) – Process Design Calculations (130201500-09-401, Rev1-13.06.21) – General Layout for Waste Water Treatment Plant (Drawing No. 130201500-01-101, Rev C-16.06.21) – Updated Layout Plan as per the Urban Design Conditions (15/07/2021)	-

1.8 OBJECTIVES OF THE ESIA

The key objectives of the ESIA are as follows:

- Concisely describe the main parameters of the proposed Project;
- Set the legal framework;
- Document the consultation process;
- Consider the alternatives to the Project;
- Establish baseline environmental conditions at the Project Site and within the surrounding area;
- Identify likely significant effects during the design process so that some effects can be avoided, prevented, reduced or, if possible, offset prior to the assessments within the ESIA;
- Identify, predict, and assess the environmental effects associated with the Project: beneficial and adverse; permanent and temporary; direct and indirect and short / medium / long term; significant or not significant;
- Identify, predict, and qualitatively assess the cumulative effects of the Project, including those associated with the other developments;
- Identify suitable mitigation measures to prevent, reduce or, if possible, offset likely significant adverse effects on the environment and identify the likely significant residual effects following the implementation of these measures; and
- Identify monitoring measures where likely significant residual effects are identified.

1.9 STRUCTURE OF THE ESIA REPORT

The ESIA report is structured as follows:

- **Section 1:** Introduces the Project and provides detail on the relevant parties, reference framework and structure of the report.
- **Section 2:** Provides information on technologies that are being considered for the proposed design. Includes description of the Project construction and operational activities.

- **Section 3:** Identifies and evaluates potential Project alternatives.
- **Section 4:** Environmental and social legal, policy and institutional context within which the Project will be managed.
- **Section 5:** Description of the existing baseline environmental conditions for physical, biological and social parameters.
- **Section 6:** Provides a summary of the stakeholder engagement process.
- **Section 7:** Scoping process to identify potential significant interactions between Project activities and key resource/receptors, which are investigated in more detail in the Impact Assessment Section (Section 7).
- **Section 8:** Approach to ESIA, details the ESIA methodology for the environmental assessment, and results of the impact assessment for construction and operational impacts. Included within this section are the results of specialist studies, mitigation measures, and the rapid cumulative impact assessment.
- **Section 9:** Provides a conclusion to the report.

The following appendices are attached to the ESIA Report.

- **Appendix A:** Baseline monitoring and analytical reports for soil, water, groundwater, and noise
- **Appendix B:** Stakeholder Engagement Plan (SEP) describing and containing records of measures applied during the ESIA to allow the effective participation stakeholders, including those identified as disadvantaged or vulnerable.
- **Appendix C:** Environmental and Social Management Plan (ESMP) constituting a framework for ensuring that all appropriate legislation and international environmental and social standards as well as best practice guidelines are considered in the implementation of mitigation measures during construction and operation.
- **Appendix D:** Environmental and Social Commitment Plan (ESCP) defining the broader set of commitments to manage EHS aspects over the life of the project, including aspects that are beyond the remit of the ESIA/ESMP. The plan is fundamentally structured according to the 8 thematic areas of the IFC Performance Standards and includes actions, timeframes and responsibilities for actions, and cost estimates for implementation of actions.

1.10 STUDY ASSUMPTIONS AND LIMITATIONS

TOPIC / CATEGORY ASSUMPTIONS AND LIMITATIONS

a) Reliance on third party information	i) Due to travel restrictions on WSP staff all field data collection, including stakeholder engagement, was undertaken by separate independent companies contracted directly to the Client namely: - Dvoper Ltd (Serbia) – soil, water, groundwater, air quality, and ambient noise sampling / monitoring data. - Eco-Vok 2017 – stakeholder engagement, socio-economic surveys. Whilst WSP considers these firms and their quality management processes to be reliable, WSP accepts no responsibility for the accuracy of the information that was used in preparation of the ESIA.
b) Noise Impact Assessment (Section 8.3)	In the Environmental Acoustic Impact Assessment, various assumptions were made, and limitations experienced, that may impact on the results obtained. These include: i) The information provided regarding the operational activities is assumed to be representative of what will occur in reality; ii) Locations of equipment as provided in “130201500-01-101-RC_General Layout.pdf” are assumed to be representative of reality; iii) Mechanical and manual screens have been excluded in the noise source inventory as noise will be minimal from such machinery; iv) Submersible mixers and pumps are deemed to be inaudible when submersed, as per research conducted (Sinclair Knight Merz, 2005); v) A worst-case operational assessment was undertaken with none of the noise sources enclosed within buildings or acoustic enclosures; vi) All operational sources were assumed to operate simultaneously in order to determine a worst-case assessment of impacts; and,

	vii) Sludge skip trucks were assumed to only frequent the facility during daytime hours.
c) Biodiversity Impact Assessment (Section 8.6)	i) Survey Frequency and Duration: According to the “Good Practices for the Collection of Biodiversity Baseline Data” (Harder et al., 2015) guideline, multiple surveys across the different seasons may be required. This is required due to the fact that detectability and abundance of biodiversity values may vary temporally, including time of day, time of month, time of year, seasonally, annually, and over periods of multiple years. Due to the size of the project area, measuring less than 10 ha, and the adjacent reach of the Begej River, the several survey days for a single seasonal survey that were achieved for the project would allow for more than adequate coverage of the area. The timing of the survey, mid-May would also allow for fauna (including ichthyofauna) and flora to be effectively sampled and assessed. The disturbed nature of the project footprint area and surrounds would also deem multiple surveys across different seasons unnecessary, largely due to the associated low sensitivity of the area. ii) The biodiversity baseline information for the Project has been obtained from a review of existing information, site walkover observations, riverine sampling and anecdotal information obtained during the site visit. Given the level of degradation already present at the site, and the lack of features of increased biodiversity interest, this limitation is not considered to represent a constraint to the integrity of the assessment.
d) Air Quality Impact Assessment (Section 8.2)	Various assumptions were made in the compilation of the atmospheric impact assessment. When possible, an environmentally conservative approach was taken to ensure emission rate calculations and model predictions represent a worst-case scenario. The assumptions and limitations underlying the study methodology are as follows: i) Unless otherwise stated, operational information for the proposed facility was provided by Metito in the form of engineering documentation. Any errors, limitations or assumptions inherent in these extend to this study. ii) H₂S emissions from the unit processes were provided by the client, Metito. Any errors, limitations or assumptions inherent in these calculations extend to this study. Result validation is the responsibility of the Client's / Lender's technical advisor. iii) The facility was simulated in AERMOD as an area source with surface level emissions. This is considered the most appropriate approach at the design stage of such a facility when exact locations and heights of emission sources/points are to be established. iv) Odour is not additive (due to masking of synergistic effects) and as such, the calculated odour potentials of various pollutants cannot be combined for a cumulative odour assessment. In this study, estimations of odour potential were based on H₂S concentrations only. In the absence of dynamic olfactometry results, this is considered the most appropriate approach but only offers a tentative assessment. It may be an underestimate of odour impact due to the presence of other odorous compounds, e.g. mercaptans.

2 PROJECT DESCRIPTION

2.1 PROJECT DETAIL

2.1.1 FLOW PARAMETERS

The volumetric design capacity of the WWTP is shown in **Table 2-1**:

Table 2-1 WWTP Volumetric Design Parameters

PARAMETER	DESIGN CAPACITY
Average Daily Flow	25,000 m ³ /day
Hourly Peak Flow Factor	2
Average Hourly Flow	1,042 m ³ /h
Maximum Peak Hourly Flow	2,083 m ³ /h

2.1.2 TREATMENT OBJECTIVES

DETERMINANTS WITHIN THE DESIGN BASIS OF THE PROJECT

Influent is the untreated wastewater currently flowing through the Aleksandrovacki canal that will be redirected into the WWTP for treatment prior to discharge.

The institute of public health for the City of Zrenjanin analysed water in the Aleksandrovački canal on 29 July 2020. The results of the analyses indicated that water in the canal did not meet the requirements prescribed in the Decree for limit values of pollutants in surface, groundwater and sediment (Official Gazette RS No. 50/2012) (**Table 2-2**).

Table 2-2 Summary of Influent Quality

PARAMETER	SUMMARY OF RESULTS
Bacteriological	The water did not meet the requirements for total number of coliform bacteria, faecal coliform bacteria and intestinal enterococci. The associated water quality did not meet the requirements for the purpose of irrigation, industrial use, bathing and recreation.
Physico-chemical	The water quality does not meet the limit values for moderate ecological status i.e. represents poor ecological status (class V) according to above mentioned Decree. The water in the canal is opaque and has very strong odour and is dark yellowish-grey colour. The values of Biochemical oxygen demand (BOD) and Chemical oxygen demand (COD) far surpass the limit values for class V (BOD 190 mg O₂/l against > 25 and COD 1465 mg O₂/l against > 125). Orthophosphates and total phosphorus also exceed limit values for class V (orthophosphates 4.48 mg P/l against > 0.5 and total phosphorus 7.3 mg P/l against > 1).

The aim of the project is to treat wastewater and to discharge processed water. The treatment is expected to improve the quality of water in the Begej River. This will in turn improve the ecological status of the system according to the Rulebook on Reference Conditions for Surface Water Types (Official Gazette RS No. 67/2011) and the Rulebook on parameters for ecological and chemical status of surface waters and parameters of chemical and quantitative status of groundwater (Official Gazette RS No. 74/2011).

Table 2-3 provides the design basis concentrations of each of the above determinants in the influent and the target concentration following treatment (design specification). The table includes discharge standards based on the Serbian legislation (harmonised with EU legislation) and the WBG guidelines. In all cases the design specification achieves the discharge standards.

Table 2-3 Influent and Treated Effluent Quality vs. Normative Standards

PARAMETER	INCOMING WASTEWATER VALUES	DESIGN SPECIFICATION	NORMATIVE STANDARDS	
			Serbian Discharge Standard ²³	World Bank Group General EHS Guidelines ⁴
Biological Oxygen Demand (BOD)	500 mg/l	20 mg/l	See: (II, VI, VII) 25 mg O ₂ /l 40 mg O ₂ /l (III)	30 mg/l
Turbidity	N/A (see endnote B)	5 NTU	Not specified	Not specified
Total Suspended Solids (TSS)	450 mg/l	30 mg/l	See: (IV, VIII) 35 mg/l (> 10 000 Population Equivalent (PE))	50 mg/l
Total Organic Carbon (TOC)	N/A (see endnote B)	8 mg/l	Not specified	Not specified
Chemical Oxygen Demand (COD)	1000 mg/l	125 mg/l	125 mg O ₂ /l	125 mg/l
Volatile Suspended Solid (VSS)	360 mg/l	N/A (see endnote B)	Not specified	Not specified
Total Kjeldahl Nitrogen (TKN)	40 mg/l	8 mg/l	See: (V) 15 mg/l (1000 - 100 000 PE)	10 mg/l
Organic Nitrogen	8 mg/l	3 mg/l	Not specified	Not specified
Nitrate (NO ₃)	N/A (see endnote B)	7 mg/l	Not specified	Not specified
Ammonium (NH ₄ -N)	32 mg/l	5 mg/l	Not specified	Not specified
Phosphorus (P)	8 mg/l	1 mg/l	2 mg/l P (1000 - 100 000 PE)	2 mg/l
Alkalinity	200 mg/l	N/A (see endnote B)	Not specified	Not specified
Total Dissolved Solids (TDS)	1000 mg/l	N/A (see endnote B)	Not specified	Not specified
Fat, Oil, & Grease (FOG)	50 mg/l	5 mg/l	Not specified	10 mg/l
Phenol	0 mg/l	N/A (see endnote B)	Not specified	Not specified
Wastewater Temperature Maximum / Minimum	10 °C / 32 °C	N/A	Not specified	Not specified
pH	6 – 8	6 – 9	Not specified	6 - 9
Faecal Coliform	No data	14 MPN/100 ml	2000	N/A ⁵
Total Coliform	No data	100 MPN/100 ml	10000	Not specified
Endnote A:				
(I) Reduction in comparison with raw wastewater load.				

² The Decree on emission limit values of polluting substances discharged into water and deadlines for compliance ("Official Gazette of RS", No. 67/2011, 48/2012 and 1/2016) - Table 2. Emission limit values for municipal wastewater discharged into the recipient. Harmonised with the Urban Wastewater Directive 91/271/EEC

³ Limit values are determined by the population equivalent (PE) serviced by the plant. Metito has confirmed that the population catered will be approximately 88,500 - in the range of 10,000–100,000

⁴ Environmental, Health, and Safety (EHS) Guidelines General HS Guidelines: Environmental Wastewater and Ambient Water Quality / Table 1.3.1 Indicative Values for Treated Sanitary Sewage Discharges /

⁵ Not applicable to centralized, municipal, wastewater treatment systems which are included in EHS Guidelines for Water and Sanitation

PARAMETER	INCOMING WASTEWATER VALUES	DESIGN SPECIFICATION	NORMATIVE STANDARDS	
			Serbian Discharge Standard ²³	World Bank Group General EHS Guidelines ⁴
(II)	This parameter may be substitute by other, such as total organic carbon (TOC) or COD if the ratio between BOD and COD can be maintained.			
(III)	In case that after purification discharged wastewater do not affect water quality of the recipient.			
(IV)	Suspended solids are not mandatory.			
(V)	Total nitrogen: organic N + NH ₄ -N + NO ₃ -N + NO ₂ -N.			
(VI)	Homogenized sample, before filtration or decanting.			
(VII)	With addition of nitrification inhibitor.			
(VIII)	Filtration of representative sample through 45 μ filter, drying at 105 °C and weighing.			
Endnote B:				
The determinant is not part of the designed inlet parameters or influent quality parameters in the Project Agreement between the developer and the Municipality				

DETERMINANTS FALLING OUTSIDE OF THE DESIGN BASIS OF THE PROJECT

Due to the industrial effluent component present within the influent, a diverse suite of physical determinants (pollutant) is expected to be present. All industries discharging into the sewer system will be required to comply with the 'Regulation on Limit Values for Emissions of Pollutants into Water and Deadlines for Reaching Them - ("Official Gazette of RS", No. 67/2011d 1/2016'. The Regulation specifies limits based on an extensive list of industry types e.g. metal processing and fine processing, production of coating materials and glazes, etc. Industries that cannot meet the standard would be required to pre-treat the effluent prior to discharge. This Regulation will be enforced by the Municipality of Zrenjanin.

2.1.3 TREATMENT PROCESS

The goal of the WWTP is to reduce or remove organic matter, solids, nutrients, disease-causing organisms, and other various forms of pollutants from the wastewater before discharging it to the natural environment. Wastewater entering the WWTP contains suspended and soluble contaminants, which are classified into organic, and non-organic groups.

Organic solids come from animals or plants and include the waste products of plant and animal life. These solids will decompose. Inorganic solids will not usually decompose and comprise of sand, silt, salts, etc. Both organic and inorganic solids can be broken down further into Suspended Solids and Dissolved Solids. Suspended solids are mainly organic in nature, are visible and can be removed from the wastewater by physical/ mechanical means (e.g. screening and sedimentation). Dissolved solids are present in solution and generally pass through the system unaffected.

The typical processes involved in wastewater treatment are preliminary treatment, biological treatment, secondary treatment, and final treatment and sludge treatment. This is the basis of design of the Zrenjanin WWTP. Each of the process steps are illustrated in **Figure 2-1** and described in the following subsections.

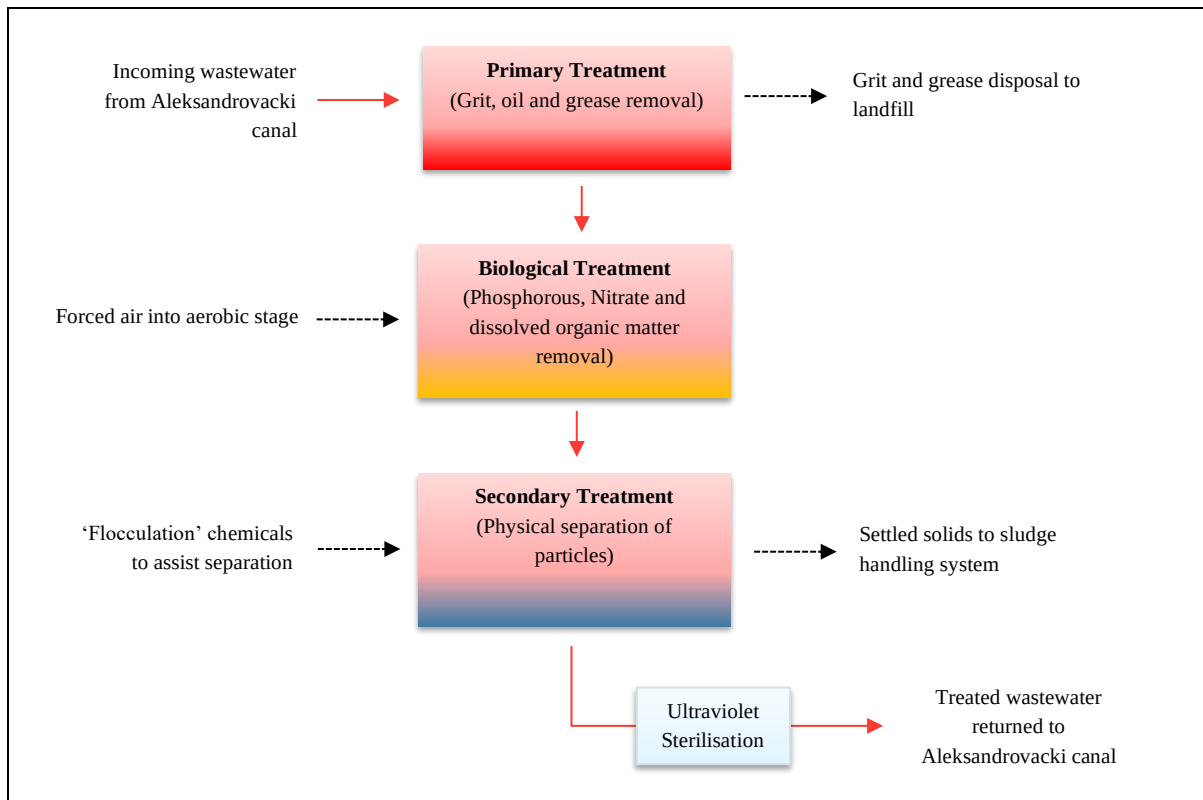


Figure 2-1 Outline of the Wastewater Treatment Process Flow

PRIMARY TREATMENT

This is the first step in the treatment process and is intended to separate the suspended solids and grit from the incoming wastewater. In the proposed WWTP, wastewater will initially be passed through an Inlet Works Unit consisting of a series of screens for the removal of suspended and floating solids, and grit and grease removal tanks which performs the grit and grease removal operations.

BIOLOGICAL TREATMENT

In the proposed WWTP the biological treatment is achieved in three zones: anaerobic, anoxic, and aeration. The treatment processes which take place in each zone is summarised below:

- The anaerobic treatment process removes of bio-phosphorous from the wastewater. This is achieved through a biological process where biological organisms consume the phosphorous which is metabolised for energy and growth.
- The anoxic treatment process is a biological process where in the absence of oxygen, biological organisms convert nitrates contained in the wastewater to nitrogen.
- The aeration process is a biological process where, in an oxygen-rich environment, microorganisms are used to remove the remaining dissolved organic matter contained in the wastewater. Planned technology at this WWTP is a state-of-the-art Integrated Fixed Activated Sludge (IFAS) process. This is a combination of an activated sludge process where the microbial growth is suspended in an aerated water mixture, and a Moving Bed Biofilm Reactor (MBBR) where the microbial growth occurs on fixed films.

SECONDARY TREATMENT AND DISINFECTION

Biological treatment is followed by settling where big particles or flocs will settle at the bottom of clarifier tanks. The remaining clear water overflows from the top of the tanks into the disinfection stage. In the disinfection stage ultraviolet (UV) light is radiated through the treated effluent which inactivates microscopic organisms such as bacteria, viruses, protozoa and other pathogens. Following UV treatment, the treated wastewater will be discharged to the Aleksandrovacki Canal, in accordance with environmental discharge standards **WSP provide link to standards in final document.**

SLUDGE MANAGEMENT

Settled organic matter generated in the WWTP is partially recirculated in order to maintain the biological mass in the treatment process, however; the WWTP will generate surplus sludge requiring management and disposal thereof. Initially, filter presses will be used to dewater the sludge, thereby reducing the volume of sludge and increasing the solids concentration from 1-2% to around 20%.

2.1.4 WASTE GENERATION AND MANAGEMENT

WASTE STREAMS FROM THE CONSTRUCTION AND OPERATION OF THE WWTP

According to the WBG EHS Guidelines (Water and Sanitation, 2007) solids removed from wastewater collection and treatment systems may include sludge and solids from cleaning of drainage and sewer collection systems (including **septage systems**), screening solids, and sludge from various unit operations used for wastewater treatment.

The proposed Zrenjanin WWTP will generate the following waste streams which will be transported for off-site disposal at a permitted waste facility.

Table 2-4 WWTP Waste Streams

WASTE CATEGORY (SOURCE)	TYPICAL CONSTITUENTS	GENERATION RATE (AVERAGE)
Coarse Screening Material	Material with diameter above 20mm including Rags, paper, plastics, metals, and other gross solids	1,25m ³ /day
Fine Screening Material	As above, with diameter ranging from 6 - 20mm	0,44m ³ /day
Grit	Sand, gravel, cinder, or other heavy solid materials that are “heavier” (higher specific gravity) than the organic biodegradable solids in the wastewater. Grit also includes eggshells, bone chips, seeds, coffee grounds, and large organic particles, such as food waste ⁶ .	Approx. 1 ton/day * (0.6 m ³ /day at 80-90% dry solids content) *(specific gravity of 2.65 assumed)
Grease (grease removal system)	Fat, oils, and grease (FOG)	0,87m ³ /day
Dewatered Excess Sludge (Filter Press)	Mixture of dry solids (20%) and water (80%). Composition of the sludge depends on the treatment process and the characteristics of the source water, and may include arsenic and other metals, radionuclides, lime, polymers and other organic compounds, microorganisms, etc.	65m ³ /day 13.1 tons/day

WASTE MANAGEMENT

All waste generated by the WWTP will be required to be disposed at a permitted waste disposal facility. Metito is currently considering the Sremska Mitrovica disposal facility in Serbia operated by ISTEP. The company provides sludge treatment and final disposal in its own landfill. The landfill is permitted in terms of the Serbian legislation and includes provision for disposal of the following waste codes as per the European Waste Catalogue (EWC) **.

- **19:** Wastes from waste management facilities, off-site waste water treatment plants and the preparation of water intended for human consumption and water for industrial use.
 - **19 08** wastes from waste water treatment plants not otherwise specified
 - **19 08 01** screenings
 - **19 08 02** waste from desanding
 - **19 08 05** sludges from treatment of urban waste water

⁶ United States Environmental Protection Agency. Wastewater Technology Fact Sheet Screening and Grit Removal (1999)

** The Law on Waste Management (Official Gazette of RS, no. 36/2009) refers to the Serbian Waste Catalogue, which is completely in accordance with the European List of Waste/European Waste Catalogue, which is an important prerequisite in the continuation of the EU membership negotiations. According to the Catalogue, waste is categorised into 20 groups, in terms of the source and origin, and this Catalogue is the basis for all national and international obligations on waste reporting.

In addition, the sludge will be required to conform to the Serbian legislation on the emission limit values for municipal wastewater treatment residues (Table 2-5).

Table 2-5 Emission limit values for municipal wastewater treatment residues (Official Gazette No. 67/2011, 48/2012 and 1/2016 / Annex 2. Chapter III Municipal Wastewater, Table 7.

PARAMETER	UNIT OF MEASURE ^(I)	EMISSION LIMIT VALUE	
		For use in agriculture ^(II)	For other needs ^(III)
Inorganic matter			
Lead	mg / kg	120	1200
Cadmium	mg / kg	2.5	40
Chrome	mg / kg	100	1000
Nickel	mg / kg	60	400
Alive	mg / kg	1.6	25
Copper	mg / kg	700	1750
Zinc	mg / kg	1500	4000
Arsenic	mg / kg	15	75
Organic matter			
AOH ^(V)	mg / kg	400	500
PCB ^(YOU)	mg / kg	0.1 (per congener)	0.2 (per congener)
PCCD / F ^(VII)	ng / kg SO	30	30
Pathogens ^(IV)			
<i>Salmonella</i>	MPN / 10g SO ^(VIII)	0-10	
<i>Enterovirus</i>	MPCN / 10g SO ^(IX)	3	
(I) Refers to the mass of dry residue from purification (SO). (II) When using residues from purification in agriculture, the production cycle of agricultural crops must be taken into account, provided that the pH of the soil is from 6 to 7. If the residues from purification are used at lower pH than 6, the increase of metal mobility and their adoption must be taken into account, by plants and then lower limit values must be taken. Treatment residues are used in a way that takes into account the needs of plants for nutrients, soil quality and that there is no pollution of surface and groundwater. (III) Residues from purification can be used to cover landfills, in parks for green areas, to improve the quality of land on which agricultural crops and livestock will not be grown for at least a year, to fill depressions (landscape repair). In all these cases, the pH of the soil should range from 6 to 7. (IV) In the case of specific land use, intended for use, e.g. vegetables and grazing, restrictions are set due to the risk to human health from the remaining pathogens. In this case, purification residues are treated before use to reduce the number of pathogens to an acceptable extent. (V) AOH - adsorbing organic halogens. (VI) PCBs - polychlorinated biphenyls, each of 6 individual PCBs (28, 52, 101, 138, 153 and 180). According to the IUPAC nomenclature, they are: 2,4,4'-Trichlorobiphenyl, 2,2', 5,5'-Tetrachlorobiphenyl, 2,2', 4,5,5'-Pentachlorobiphenyl, 2,2', 3,4, 4', 5'-Hexachlorobiphenyl, 2,2', 4,4', 5,5'-Hexachlorobiphenyl, 2,2', 3,4,4', 5,5'-Heptachlorobiphenyl. (VII) PCCD / F-polychlorinated dibenzo-p-dioxins and furans. (VIII) MPN / - the most probable number. (IX) MPCN - the most probable number that cause a cytopathogenic effect.			

WASTE DISPOSAL

2.1.5 BEST AVAILABLE TECHNIQUES EVALUATION

In this section, the proposed WWTP design is been reviewed in terms of general environmental performance guidance contained in the Best Available Techniques (BAT) Reference Document on Waste Treatment (WT BREF) published According to article 15(2) of the EU Industrial Emissions Directive (IED) (2010/75/EU) / section 6: BAT Conclusions.

It is noted that this BREF is not legally binding on the proposed WWTP as it is covered by Council Directive 91/271/EEC of 21 May 1991 concerning urban waste-water treatment: [...] i) biological treatment. However, notwithstanding, the BREF is still considered a useful yardstick of good international industrial practice (GIIP).

ENVIRONMENTAL MANAGEMENT SYSTEM

Begej Water will develop an ESMS that includes:

- Odour Management Plan (where the ESIA identifies and substantiates the potential for odour nuisance at sensitive receptors).
- Noise Management Plan (where the ESIA identifies and substantiates that the potential for noise or vibration nuisance at sensitive receptors).
- Accident Management Plan.
- WWTP Sludges and Residues Management Plan.

TREATMENT TECHNOLOGIES

The applicable BAT consideration for the WWTP is to treat wastewater using an appropriate combination of techniques to reduce pollutants being discharged into natural water resources/systems.

The proposed WWTP includes a combination of treatment techniques that have been developed as the optimal solution by Metito. All the techniques are aligned with BAT, including: i) inlet works for equalisation and physical separation of solids, suspended solids, oil/grease; ii) secondary biological treatment process including *inter alia* activated sludge process and IFAS+MBBR biological treatment; iii) an anoxic phase for denitrification, iv) polishing processes including coagulation and flocculation, sedimentation in clarifiers, and v) disinfection via ultraviolet (UV) light - inactivates microscopic organisms such as bacteria, viruses, protozoa and other pathogens.

Additional available BAT techniques include filtration and flotation. The polishing process of filtration was however not considered applicable in the design, based on the requirement of the TSS being specified as < 30 mg/l for discharge. The required limit can be well met with the proposed secondary clarifier, as the expected TSS during normal operation is around 15-20 mg/l which may spike to 25 mg/l.

MONITORING AND MANAGEMENT OF PROCESS PERFORMANCE

MONITORING OF INFLUENT

Management of influent from the Aleksandrovački Canal is critical for ensuring optimal process conditions for the biological treatment processes. In turn, it also plays a critical role in ensuring that treated wastewater achieves the environmental discharge standards.

The management of influent to the WWTP primarily falls under the control of the Municipality of Zrenjanin, which is responsible for the regulation of industrial discharges into the effluent system. All discharges will be required to comply with Industrial Discharge Consents issued by the City. The City is contractually obliged to take all reasonable steps within its power to prevent any illegal discharge. Discharge into the City sewerage system without an appropriate Industrial Discharge Consents, and/or discharge into the City sewerage system of wastewater containing any of the Consent Substances which exceeds the Consent Influent Concentration Levels, are considered illegal.

The monitoring of influent by Begej Water will be undertaken through the use of an online analyser for COD, pH and electrical conductivity (EC) as primary indicators. The influent will be treated through the WWTP if

COD is within acceptable level. If inlet COD is higher (i.e., off-spec influent), influent will automatically be taken to an 'off-spec tank'. The off-spec influent can be stored up to 500 m³, and subsequently it can be fed back to the inlet of the WWTP for dilution into the system at lower flow. The WWTP design also includes provision to manually bypass the off-spec influent back to the Aleksandrovacki Canal, in case the off-spec quality influent comes continuously for more than 30 minutes.

In addition to the online monitoring, daily on-site laboratory analysis will be conducted for COD, BOD, TSS, TKN, NH₄-N, TP, pH, TDS, Alkalinity, FOG, Conductivity, and Temperature.

TANKERED / SPECIAL LOADS

The discharge of tankered / special loads into the WWTP is not part of the design. The influent source, as per design, is limited to the Aleksandrovacki Canal.

MONITORING OF TREATED EFFLUENT

Treated effluent flow will be measured and monitored on an hourly basis, and effluent quality will be sampled on a daily basis and analysed for COD, BOD, TSS, NH₄-N, TN, TP, pH, Alkalinity and FOG.

PROCESS CONTROLS

The design of the WWTP includes handling and transfer procedures which aim to ensure that effluent being processed through the system is safely handled and transferred to the respective storage or treatment facilities within the plant. These include *inter alia* influent flow and quality monitoring systems, level and flow sensors and transmitters at various stages of the process that are linked to automated process controls and provide online information to the plant operators.

CONTROL OF ODOUR EMISSIONS

The design of the facility addresses air pollution and odour emissions using techniques that are generally aligned with BAT. These include: i) minimising the residence time of the wastewater in stages where it is prone to generating emissions (particularly under anaerobic conditions), and ii) inclusion of aerobic processes that are less conducive to odour formation.

The sludge generated in the treatment process has also been identified as a potential odour source. Metito has included design measures aligned with BAT to limit the release of odour from the sludge handling system including aeration of the sludge holding tank to dilute potential emissions and maintain aerobic conditions, and the enclosure of the sludge handling systems.

CONTROL OF NOISE EMISSIONS

The design of the facility incorporates noise abatement techniques which are recognised as BAT. The use of low-noise equipment (<85dBA) is proposed wherever possible. The only equipment that will have higher noise levels is the air blowers. The air blowers for the aeration tanks and sludge holding tanks are provided with acoustic enclosures to keep noise level below 85 dBA. Further the blowers are mounted inside of a building.

PREVENTION OF LOSS OF CONTAINMENT

The applicable BAT considerations for the WWTP are the use of impermeable surfaces and techniques to reduce the likelihood and impact of overflows and failures from tanks and vessels, as well as appropriate buffer storage capacity.

The biological process is based on gravity flow, which inherently prevents the risk of a loss of containment of effluent within the process vessels. The WWTP has been designed for hydraulic flow of average and peak conditions. In the event that an incoming flow exceeds the peak flow, the untreated effluent would discharge via an overflow back into the Aleksandrovacki Canal. Furthermore, all storage tanks (i.e. offline balance tank, off specification tank, service water tank, etc.) are provided with level switch / transmitters with high level alarms to alert plant operators and trigger control procedures.

The WWTP design also includes effluent buffering capacity. An offline balancing tank of 1500 m³ is provided to hold peak flows which are then gradually transferred to the biological treatment process over an 8 hour period, once influent flows have returned to normal. The 500 m³ off specification tank is also available for flow-buffering if required.

STORMWATER MANAGEMENT

The applicable BAT considerations for the WWTP are the segregation of clean and contaminated water streams generated at the WWTP, and adequate drainage infrastructure.

The WWTP design prevents the ingress of stormwater into the site through the use of a perimeter drain, which collects the stormwater and diverts it around the WWTP and discharges into the Aleksandrovacki Canal.

Stormwater generated within non-contaminated areas of the WWTP (roadways, building roofs etc.) is considered as clean stormwater and will be connected to the permitted channel for discharge into the Aleksandrovacki Canal. Stormwater generated within potentially contaminated areas (chemical area and maintenance area) will be routed to the WWTP for treatment.

2.2 PLANT LAYOUT

The layout of the WWTP is illustrated in **Figure 2-2**.

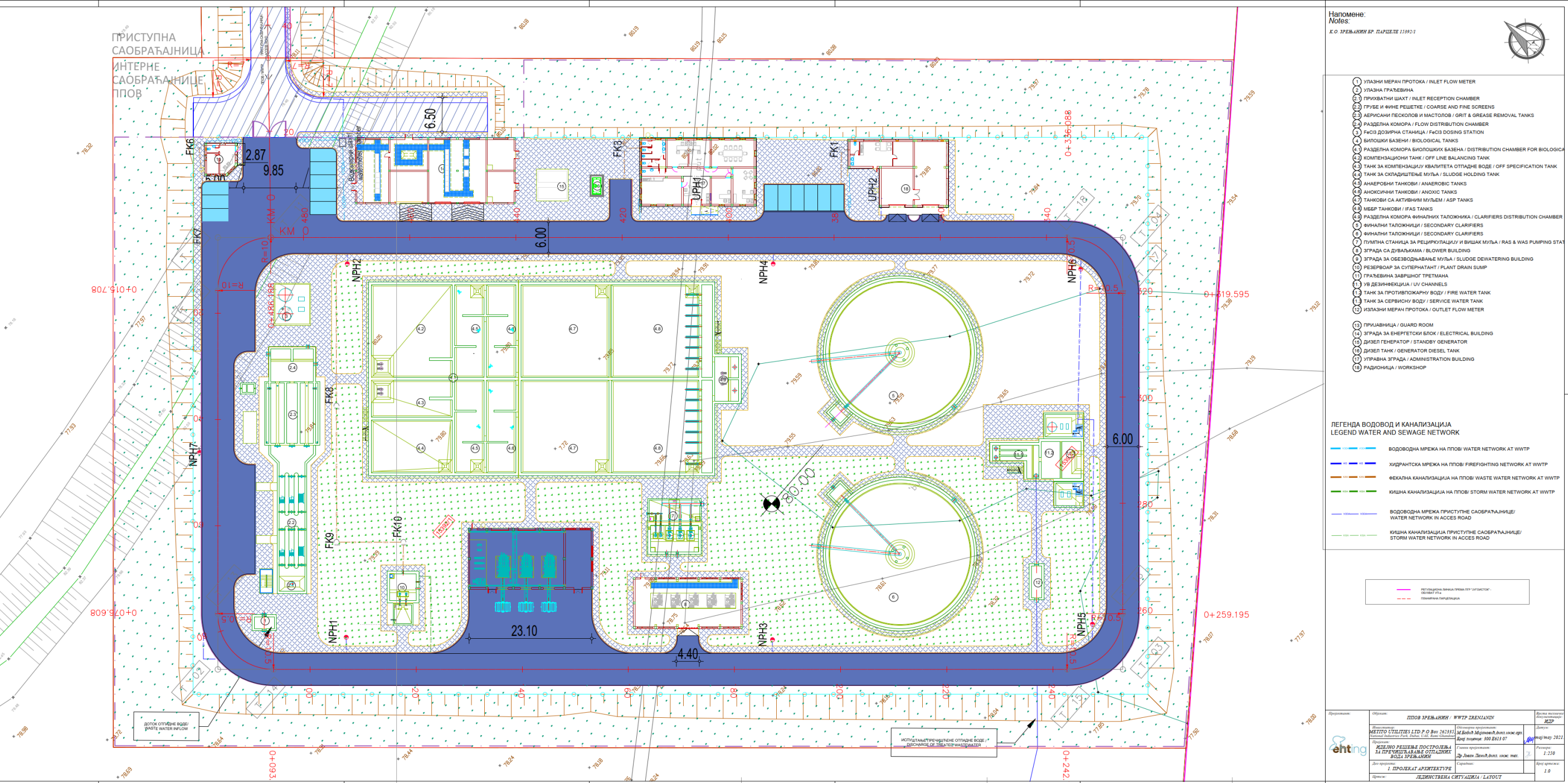


Figure 2-2 WWTP Layout (Metito, 2021)

2.3 UTILITIES AND SERVICES

The power supply to the site will be via an underground cable provided by the municipal electricity supply company. The ring main unit will be installed in a dedicated room inside the WWTP boundary.

The water supply to the site will be piped from the existing municipal water supply system in the area which is located close-by.

2.4 CONSTRUCTION, OPERATION, AND DECOMMISSIONING ACTIVITIES

2.4.1 PROJECT TIMESCALES

The expected Project timelines, subject to acquiring all the requisite approvals, is indicated in **Table 2-6**:

Table 2-6 Project Timescales

MILESTONE	TIMESCALE
Engineering Design	April 2021 – November 2021
Procurement Activities	Procurement and Construction activities to be started by EPC Contractor after issuance of the Construction Permit and achieving the Financial Close for the project. Expected in December 2021.
Construction Activities	
Mechanical, Electrical, Instrumentation, Controls, Automation Installations	December/January 2021 – August 2022
Commissioning	August – September 2022
Decommissioning	Earliest date of 2047 (based on contractual O&M Period of 25 years)

2.4.2 CONSTRUCTION ACTIVITIES

The construction process will follow standard industry methods and techniques. Key activities associated with the construction process are described in **Table 2-7**.

Table 2-7 Construction Activities

ACTIVITY	DESCRIPTION
Construction labour and employment	The project is expected to generate direct employment opportunities during the construction phase; however the number could not be provided within the ESIA. Approximately 25-30 people could be employed during the operational phase. The breakdown of the labour categories (skilled, semi-skilled, and unskilled) that are required for the Project have not been defined at this point. As part of its obligations to the Local Community, local employment will be prioritised in order of Municipality of Zrenjanin, province of Vojvodina, and the country of Serbia.
Workforce accommodation	Local labour will commute to work from their own residences. No workforce accommodation will be provided. Expats will make use of existing accommodation facilities and commercial accommodation options in the area (hotels, lodges, B&Bs etc.)

ACTIVITY	DESCRIPTION
Contractor's facilities and materials lay-down areas	These will be strictly located within laydown areas adjacent to the WWTP development footprint, likely in an area allotted for future expansion sites. Activities within these areas are like likely to include: — Temporary offices and administration facilities (e.g. containers, portable cabins). — General materials storage and laydown areas. — Construction of chemicals storage facilities (oil, grease, solvents etc.) and associated infrastructure (bunds, secured / roofed areas etc.). — Above ground fuel storage (e.g. gasoil/ petrol) for fuelling of plant and equipment – it is unlikely that volumes would be stored in quantities exceeding 9000L which is considered sufficient for normal construction site requirements. — Workshops / areas (e.g. welding, mechanical repair, electrical etc.). — Change-houses, chemical toilets, and showering facilities (linked to conservancy tanks – removal of contents by a vacuum truck / tanker and disposal at permitted facility). — Temporary waste storage areas; these shall be established and managed in accordance with Environmental Management Programme (EMPr) requirements.
Sourcing of construction materials and equipment	Bulk materials (aggregate, cement, steel etc.) will be sourced from existing lawful commercial sources; there will be no direct mining, harvesting or extraction of natural resources. Where possible, equipment will be sourced locally. Equipment will be purchased outside of Serbia where this makes commercial sense.
Site Clearance, excavations, and earthworks	Subject to the determination of founding specifications for the new plant and equipment to be constructed, earthworks will be required. This is likely to entail: — Clearance of vegetation and other surficial matter from the development footprint. — To raise the site above the flood level of the Begej River an earth fill platform will be constructed using imported commercially sourced fill material. — Levelling and compaction using heavy machinery / earthmoving equipment. — Excavations and trenching to prepare foundations and laying of below ground level equipment (cables, pipes, sumps, drainage etc.). — Piling / drilling depending on the identified construction / founding technique.
Use of general mechanical equipment	This will be undertaken within construction areas and includes the use trucks and cranes, generators, cutting and welding equipment, compressors etc.
Working Hours	The Project may require work to be carried out during daytime and night-time hours. Due to the nearby residential areas excessively noisy activities are to be limited to normal daytime working hours as far as reasonably practical.

2.4.3 OPERATIONAL ACTIVITIES

The WWTP is expected to have an operational life of at least 25 years. The facility will operate 24 hours per day, 7 days per week. Operation and maintenance processes and procedures will focus on ensuring proper performance of the WWTP in achieving the treatment objectives.

Operation and maintenance will involve a variety of tasks, including the following:

- Management,
- Provision of manpower,
- Provision of electricity and chemicals, fuels lubricants, consumables, and spare parts
- Provision of replacement (for example diffusers)
- Day-to-day operation of the plant,
- Adjustment of process whenever necessary,
- Preventive and routine maintenance,
- Repair and replacement work,

- Repainting work,
- Monitoring of performance,
- Reporting,
- Data filing and processing,
- Preparation and execution of training

To organize the above tasks and to monitor the proper execution, standard procedures will be developed and implemented including:

- Standard Procedures for Administration/Finance
- Standard Procedures for Regular Operation
- Standard Procedures for Start-up / Shut-down of Operation
- Standard Procedures for Operational Disturbances
- Standard Procedures for Operation of SCADA Systems
- Standard Procedures for Maintenance
- Standard Procedures for Laboratory Works and Laboratory Data Manual
- Standard Procedures for Health and Safety
- Standard Procedures for Emergency Response / ERP
- Standard Procedures for Environmental Management / EMP
- Project Components Damage Prevention / Control Plan and Standard Procedures for Security

ORGANISATION AND PERSONNEL

The organisational structure for the operations and maintenance will include departments for Administration, Operations and Maintenance Department, and Service.

The administrative department would be responsible for the general administration, financial management (accounting, financial controlling, payroll accounting, financial asset management, and procurement), logistics and support. Any sub-contracted services would be administratively and financially managed by this department.

The operation and maintenance department will be responsible for operation of all assets for process monitoring / control / optimization / assessment of function and performance, for regular cleaning of process units / tanks / channels / pipes, execution of surveys, management of chemicals and operating materials, management of collection, transport and disposal of residuals and wastes. Sub-contracted operational works will be technically managed by this department.

The department will also be responsible for all predictive, preventive, and reactive maintenance, for repair, overhaul, replacement, for assessment of asset condition and criticality, housekeeping, touch-up, management of spare and wear parts, lubricants, oils, tools, etc. including store and workshop management. Sub-contracted maintenance works and service contracts for maintenance by the manufacturer are technically managed by this department. The maintenance department is also responsible for operation of the generator sets.

For the analytic works, a laboratory will be established under Service department. In addition to the basic analytical functions, the department will be responsible for the training of the site operators in proper sampling techniques. In case of instances where analytics works needs to be outsourced it be technically managed by this department.

2.4.4 DECOMMISSIONING ACTIVITIES

Following the initial 25-year O&M contractual period, the WWTP will be handed over in working condition to the Municipality of Zrenjanin, who will determine the future of the facility. If deemed viable, the operational life may be extended. If not, the facility will be decommissioned. Standard demolition techniques will be used including the following:

- Manual and mechanical removal of hazardous or regulated materials including tank and vessel inventories.
- Manual dismantling to prevent damage of equipment and structures that are to be reused / relocated.

- Raising of buildings and other above ground infrastructure using hydraulic excavators or loaders fitted with attachments such as rakes. A wrecking ball may be used to demolish structures down to a certain manageable height.
- Lifting and lowering of materials at height using various crane types.
- Dismantling of steel structural elements using excavators with shear attachments.
- Breaking up and crushing of concrete components using hydraulic hammers.
- Earthworks such as excavating and levelling using bulldozers and backhoe loaders.
- Explosives and/or implosion demolition techniques will not be used.

Unusable parts and material (e.g. building rubble) will be disposed of according to local waste management regulations and in accordance with international best practice.

2.5 COMPANY POLICIES ON LABOUR AND WORKING CONDITIONS, HEALTH, SAFETY, AND THE ENVIRONMENT (HSE)

The Project will be implemented by Begej Water as the Private Limited Liability Company in Serbia. The shareholder in Begej Water consist of EmSrb Water, a privately held company established by Metito in the United Arab Emirates (UAE). Begej Water will generally adopt the standards of Metito which are summarised below:

2.5.1 LABOUR AND WORKING CONDITIONS

POLICY

Metito has in place various policies relating to working conditions and management of worker relationships. The working conditions are outlined within the Master Policy Document, and the Employee Handbook. The policies and procedures include, but are not limited to, working hours, equal opportunities, salary review process, expenses, sick pay, maternity cover, and annual leave. The policies are broadly aligned with the IFC PS requirements, although there are some differences between the working conditions policies and the International Labour Organisation (ILO) standards (such as maternity cover). Whilst the risk rating is green, Metito is reminded of the need to ensure that when working in countries that have ratified ILO Conventions (i.e. are incorporated into national law) these are reflected in employee rights and contracts. Furthermore, Metito must be confident that all conditions of employment are fair and pursue employee equality. Serbia has ratified 77 conventions (62 in force), which includes C183 - Maternity Protection Convention, 2000 (No. 183) (maternity entitlement of 16 weeks).

Metito's commitments in relation to child and forced labour are outlined both in the Employee Handbook, and the example of a previous Project HSE Plan that was reviewed as part of the lenders red flag report for this project. These commitments align with the IFC's principles in relation to these topics. The policies and documents reviewed did not clearly confirm that workers have the right to form a union / the right to organise and collective bargaining. An opportunity for improvement exists – for Metito to put policies in place to protect the workers' right to form or join a workers' organisation.

2.5.2 HEALTH AND SAFETY AND ENVIRONMENT

POLICY

Metito manages Health and Safety both at a Group and Project level. At a Group level, Metito has a combined Quality, Health, Safety and Environment (QHSE) policy, clearly defining the QHSE objectives, which is signed by the CEO. Certification for ISO9001:2015 (Quality), ISO 14001:2015 (Environmental), and ISO 45001:2018 (Health and Safety) has been achieved for the group management system.

At a project level, Metito will implement project specific HSE plans in response to the framework Environmental and Social Management Plan (ESMP) developed by WSP as part of the ESIA. Metito Project level HSE plans typically address key management areas as follows:

- Personal Protective Equipment (PPE): Mandatory PPE for all site employees is listed in ESMPs. Supervisors are responsible for checking that all personnel on the project are trained in the use of, are provided with and are wearing all PPE required for the work activity. For specific high-risk activities, further PPE, as identified in a Risk Assessments is mandated.
- Training: ESMPs outline the requirements for a training plan, and specifies the following elements that are considered comprehensive: Induction for new employees; Daily lectures on safety and environment; Management plans training; Safety and environmental education; Induction for drivers; Induction for managers and supervisors; Equipment training and instruction; and Monitoring of training. ESMPs also includes a range other training related procedures to assist in the identifying, developing and implementing required training.

METITO EMERGENCY PREPAREDNESS AND RESPONSE

Metito has a group level Emergency Preparedness and Response procedure (EPRP). The procedure states that it is the responsibility of the QHSE Manager to develop emergency response plans to meet the needs of Metito and its subsidiary businesses. For project specific EPRP, the Project Manager/Plant Manager is responsible for ensuring that all foreseeable emergencies are highlighted, and plans prepared to minimise the effects of the said emergency. Metito ESMPs contains detailed project level EPRPs that meet good international industry requirements.

METITO HSE STATISTICS / KEY PERFORMANCE INDICATORS

HSE performance monitoring is a requirement of Metito ESMPs, along with HSE inspections and QHSE audits. Additionally, non-conformance and corrective action reporting is required. The data captured through the above inspections and reporting mechanisms is summarised, and H&S statistics reported at a group level. HSE Statistics for Metito group for the last 6 years show that no fatalities, permanent total disability, permanent partial disability, lost time injury cases, or restricted workday cases have been recorded. Medical treatment and first aid cases have occurred in relatively low numbers.

3 CONSIDERATION OF ALTERNATIVES

According to the IFC PS1, Guidance Note (GN) 25 for greenfield developments, the ESIA should include an examination of technically and financially feasible alternatives to the source of such impacts, and documentation of the rationale for selecting the particular course of action proposed. In this section the following alternatives are evaluated:

- 1) No-project alternative;
- 2) Alternative project locations; and
- 3) Alternative project layouts.

3.1 NO-PROJECT ALTERNATIVE

The 'no project' option is a fundamental development concept that may be considered as part of the ESIA evaluation of alternatives. The following conditions are likely to remain or occur if the Project does not proceed:

- 1) The Municipality of Zrenjanin will continue to discharge untreated wastewater into the Begej River, continuing to be a source of pollution and a severe threat to public health and aesthetics for the inhabitants of the Municipality of Zrenjanin and downstream water users, as well as the aquatic ecosystem.
- 2) As the Project is aligned with the Serbian national goals in environmental protection, which correspond to EU objectives, primarily those set in the Urban Wastewater Directive, these objectives will not be met.
- 3) The Municipality of Zrenjanin will not be able enhance its promotion of industrial investment into the region, based on access to wastewater treatment infrastructure that aligns with the Urban Wastewater Directive.

The 'no project' alternative will be considered within the impact assessment as a baseline against which the impacts of the Project will be assessed.

3.2 ALTERNATIVE PROJECT LOCATIONS

The options evaluation in the Zrenjanin Wastewater Feasibility Study (C.R.E.A.M., 2015) considered the following three possible locations for the development of the WWTP:

- 1) **Location 1: Zrenjanin** (proposed site within this ESIA on the left bank of the River Begej, downstream from the City centre and upstream from Ečka, in the vicinity of the industrial zone).
- 2) **Location 2: Muzlja** (c. 3km south of proposed Zrenjanin site, on the right bank of the River Begej, downstream from the city centre and Muzlja area, and upstream from Ečka, in the vicinity of the bridge in Ečka).
- 3) **Location 3: Lukićevo** (c. 8km southeast of proposed Zrenjanin site, on the left bank of the River Begej, close to the settlement Lukićevo).

TECHNICAL COMPARISON

The alternative sites were comparatively evaluated in terms of several economic, technical, and environmental criteria resulting in the overall preference for the Zrenjanin site (**Table 3-1**).

Table 3-1 Summary of technical comparison of locations (C.R.E.A.M., 2015)

LOCATION 1 (B) LAND PORTION PROPOSED FOR THE WWTP PLANT IN THE ESIA**				
CRITERION	LOCATION 1 (A)		LOCATION 2	LOCATION 3
Policy and Planning	Included in the General Regulation Plan for Zrenjanin.		Not included in any policy or planning documents.	
Odour and Noise Nuisance	The closest sensitive receptors (residential houses) situated at about 500 m from the site, providing larger buffer zone, and space to implement odour and noise mitigation measures (green barriers, etc.)	The closest sensitive receptors (residential houses) situated at only about 50 m from the site. Risk of nuisance increased due to a small buffer zone.	The closest sensitive receptors (residential houses) situated at about 300 m from the site, at the opposite bank of the Begej River. Risk of nuisance is negligible due to distance involved.	The closest habitations are about 1.7 km north-west of the WWTP site in Lukicevo village. Risk of nuisance is negligible due to distance involved.
	Note: Based on the final siting of the WWTP as presented in this ESIA, the distance from the WWTP boundary to the nearest sensitive (residential) receptor is c. 200m			
Available Space	All of the sites have sufficient space of 5 hectares			
Infrastructure (access roads, water supply, electricity, telecommunications)	Distant connections to infrastructure utilities - about 500 m from the site.	Closer connections to infrastructure utilities - about 50 m from the site, availability of electricity to be verified.	Distant from the closest infrastructure. No detailed information available.	Distant from the closest infrastructure. No detailed information available.
Geological Settings	Unfavourable subsurface settings. Historically marshy and flooded land. Presence of silt and sludge up to 4 m depth providing low stability and might necessitate technical interventions. Groundwater level recorded at 3.5 m below ground surface.	Characterized by presence of marshy and swampy land (silt and mud) with a low stability in the subsurface layers. Location B has slightly better conditions, due to the presence of compact soil layer (alluvial sand), resulting in less soil to be excavated and refilled. Groundwater level recorded at about 6-7 m from the surface.	No investigations carried out, but it is expected to be similar to Location 1.	No investigations carried out.
Land Acquisition	Land not completely state-owned and acquisition more complex.	State-owned (by the PWMCM) and acquisition simpler.	No information available in respect to land ownership.	No information available in respect to land ownership.
Visual Impact	Minor visual impact due to a larger buffer zone to the closest receptors (about 500 m).	Moderate visual impact due to a small available buffer zone to the closest receptors (about 50 m).	Minor visual impact due to a larger buffer zone to the closest receptors.	Minor visual impact due to a larger buffer zone to the closest receptors
Resettlement	No resettlement required.	No resettlement required.	No resettlement required.	No resettlement required.

Based on the initial evaluation of the criteria, all three locations were considered acceptable due to the presence of larger buffer zone to the closest sensitive receptors (residential houses).

Location 1 was preferred in terms of availability of existing infrastructure (access roads, water supply, electricity, and telecommunications). Limited infrastructure at locations 2 and 3 would require this to be developed, increasing Project cost and extent of construction / potential environmental impacts.

Location 1 (B) was least preferred in terms of relatively close proximity to the closest sensitive receptors (residential houses) that could be affected by noise and odour. Location 1 (A), 2, and 3 all had larger buffer distances.

FINANCIAL COMPARISON OF WWTP LOCATIONS

To determine the most cost-efficient option, the capital investment, and incremental operation and maintenance costs were calculated over the Project period using a discounted cash analysis.

The analysis showed that Location 1 has a lower net present value (NPV) and least incremental costs (approximately 20% less than Location 2 and approximately 32% less than Location 3). Operation and Maintenance (O&M) costs are also lower for Location 1 than for Locations 2 or 3. The main cost differences arise in respect of capital investment costs with regards to site preparation and flood protection; sewerage system pipelines (with pumping); and, with two of the options, the length of the main collector to the WWTP.

Table 3-2 Summary of financial comparison of locations (C.R.E.A.M., 2015)

OPTION	TOTAL	NPV (LIFECYCLE)		
	INVESTMENT COST (€)	WWTP and wastewater collection investment cost (€)	O&M cost (€)	Total (€)
Location 1 – Zrenjanin	20,657,000	18,323,000	16,635,000	34,958,000
Location 2 – Muzlja	25,453,000	22,478,000	20,979,000	43,457,000
Location 3 – Lukicevo	29,140,000	25,724,000	23,377,000	49,101,000

MULTI-CRITERIA RANKING

A multi-criteria analysis of the proposed wastewater/sewerage collection and treatment options was undertaken bringing together the technical and cost criteria. The main conclusions of the multi-criteria selection are outlined in **Table 3-3**. This analysis showed that Location 1 was ranked highest and was therefore optimal for further development of the wastewater/sewerage collection and treatment measures.

Table 3-3 Multi-criteria selection of the wastewater/sewerage collection and treatment (C.R.E.A.M., 2015)

NO	CRITERIA DESCRIPTION	LOCATION 1:	LOCATION 2:	LOCATION 3:	COMMENT
		ZRENJANIN	MUZLJA	LUKIČEVO	
1	Incremental costs	5	3	2	-
2	Suitability for phased implementation	5	5	5	-
3	Compliance with urban planning documents	5	1	1	-
4	Operational stability, reliability, and costs	5	4	2	-
5	Dealing with priority environmental factors	5	5	5	-
6	Monitoring and control	5	4	3	-
	Total score	30	22	18	-

3.3 ALTERNATIVE PROJECT LAYOUTS

The WWTP is located within an area comprising previously cultivated land that is highly disturbed as a result. Two versions of the plant layout were evaluated by WSP as the design progressed in parallel with the ESIA, however; the overall placement of the unit processes within the WWTP did not vary significantly across these revisions. Relevant to the assessment of alternatives is that the placement of certain unit processes within the WWTP footprint has a potential bearing on the impact of the facility in terms of noise and odour emissions.

A sensitivity review by WSP's specialists has however indicated that by changing the location of emission points within the emissions model made very little difference on the resultant impact on sensitive receptors.

3.4 ALTERNATIVE TREATMENT TECHNOLOGIES

As previously indicated in the **BAT Review**, the proposed WWTP includes a combination of treatment techniques that has been developed as the optimal solution by Metito. These techniques include i) inlet works for equalisation and physical separation of solids, suspended solids, oil/grease; ii) secondary biological treatment process including inter alia activated sludge process and IFAS+MBBR biological treatment; iii) an anoxic phase for denitrification, and iv) polishing processes including coagulation and flocculation, sedimentation in clarifiers.

As the proposed techniques are aligned with BAT there is no justification for an evaluation of alternative technologies for the purposes of the ESIA.

4 ENVIRONMENTAL AND SOCIAL GOVERNANCE FRAMEWORK ANALYSIS

In this section, relevant legislation, policies, guidelines, and protocols are described and their applicability to the Project determined. The framework establishes well-defined requirements and standards for environmental and social management of industrial and civil infrastructure developments. Different authorities at both national and regional levels carry out environmental and social protection functions.

4.1 STANDARDS, LEGISLATION, AND POLICY CONTEXT

4.1.1 IFC PERFORMANCE STANDARDS

Table 4-1 provides an overview of the IFC Performance Standards (PS) on Environmental and Social Sustainability and their applicability to the Project. The IFC has eight PSs providing guidance on how to identify risks and impacts, to help avoid, mitigate, and manage risks and impacts.

Table 4-1 IFC Performance Standards and their applicability to the Project

STANDARD	OVERVIEW	APPLICABILITY
IFC PS 1: Assessment and Management of Environmental and Social Risk and Impacts	PS1 highlights the importance of managing social and environmental performance throughout the life of a project (any business activity that is subject to assessment and management). This PS details the implementation of an environmental management system from the project's inception. This is to be carried out through the assessment of potential environmental impacts and risks, and ways of mitigating and managing these on an ongoing basis.	The Project is expected to have potential adverse social or environmental impacts that are generally beyond the site boundaries, largely reversible and can be addressed through relevant mitigation measures. The IFC PS 1 (GN 23) states that “<i>the breadth, depth and type of analysis included in an ESIA must be proportionate to the nature and scale of the proposed project's potential impacts as identified during the course of the assessment process</i>”. An environmental and social impact assessment (ESIA) and Environmental and Social Management Plan (ESMP) is considered the appropriate level of environmental and social risk assessment for this Project. The ESIA must focus on key environmental and social risks anticipated for the Project – these are described below under the applicability of PS 2-8.
IFC PS2: Labour and Working Conditions	For any business, its workforce is its most valuable asset. A sound worker-management relationship is key to the success of any enterprise. PS2 asks that companies treat their workers fairly, provide safe and healthy working conditions, avoid the use of child, or forced labour, and identify risks in their primary supply chain.	The construction activities will require contractors for completion. A safe working environment and fair contractual agreements must be in place. The operational phase will have permanent employees for day-to-day activities as well as contractors who will all need a safe working environment and fair contractual agreements. Whilst PS2 will be applicable to the Project, it is not intended to be addressed in detail at the ESIA stage. Recommendations are provided in the Environmental and Social Commitment Plan (ESCP) concerning development of a detailed Human Resources (HR) and Occupational Health and Safety (OHS) system by the developer and its partners (e.g. EPC Contractors) as the Project moves towards implementation. In addition, measures to address the Interim Advice for IFC Clients

STANDARD	OVERVIEW	APPLICABILITY
		on Supporting Workers in the Context of COVID-19 are referenced in the ESCP.
IFC PS3: Resource Efficiency and Pollution Prevention	PS3 focuses on the awareness that development often leads to increased pollution of air, land and water and consumes finite resources. These impacts can affect people and the environment at all scales, local to global, and it is important that these impacts are acknowledged and managed from project inception.	The following topics are relevant to the Project and have been assessed in detail as part of the ESIA: — Air quality and odour; — Environmental noise; — Pre-existing subsurface contamination risk; and — Waste management (including WWTP sludges and residues)
IFC PS4: Community Health, Safety, and Security	Business activities and infrastructure projects may expose local communities to increased risks and adverse impacts related to worksite accidents, hazardous materials, spread of diseases, or interactions with private security personnel. PS4 helps companies adopt responsible practices to reduce such risks including through emergency preparedness and response, security force management, and design safety measures.	During the construction phase there will be a significant increase in vehicular traffic along public roads, largely due to the need for importation of fill material to create the development platform above the river flood-level. Pedestrian and road safety during construction is therefore a key area of assessment and required mitigation. During the operational phase, the community risk relates to the potential emission of hazardous air pollutants from the WWTP. The air quality study (see PS3) is being performed to determine potential human health risks and thus addresses the assessment requirements of PS4. It is noted that the treatment of effluent via the WWTP will have community health benefits related to improvement in water pollution levels (pathogens etc.) in the Begej river.
IFC PS5 – Land Acquisition and Involuntary Resettlement	PS5 recognises that project-related land acquisition and restrictions on land use can have adverse impacts on communities and persons who use this land. PS5 aims to: avoid or at least minimise involuntary resettlement wherever feasible by exploring alternative project designs; mitigate adverse social and economic impacts from land acquisition by (i) providing compensation for loss of assets and (ii) ensuring that resettlement activities are implemented with appropriate consultation and disclosure; and improve or at least restore the livelihoods, standards of living and living conditions of displaced persons.	The site is currently vacant, devoid of any structures, and there is no evidence of the site being used for economic activities. Therefore, there will be no physical displacement and/or economic displacement brought about by this project. Legacy PS5 issues, associated with the prior transfer of the land in 2020 from the Government of Serbia to the Municipality of Zrenjanin, do need to be considered. The land was reportedly expropriated, and adequate compensation provided, and the land user(s) livelihood(s) have not been negatively affected by the expropriation (i.e. access to other land / source of livelihood), no additional measures would likely have been required. This must be confirmed as part of the ESIA.
IFC PS6: Biodiversity Conservation and Sustainable Management of Living Natural Resources	PS6 is concerned with the protection and conservation of biodiversity, that is, the variety of life in all its forms, including genetic, species and ecosystem diversity. The key components of biodiversity include ecosystems and habitats, species and communities. This PS addresses how proponents can avoid or mitigate threats to biodiversity arising from their operations.	A water resources and aquatic ecology assessment will determine the Present Ecological Status (PES) of the aquatic ecosystem in the Begej River, as well as response of various habitat features to changes in flow and quality parameters associated with the current and proposed discharge. Whilst the majority of the development site is entirely transformed due to agriculture, the ESIA must assess areas of potential biodiversity interest (riparian habitat) that occur along the riverbanks. Key biodiversity issues that must be addressed include the presence of protected species, habitat classification, and the potential for critical habitat (CH).

STANDARD	OVERVIEW	APPLICABILITY
IFC PS7: Indigenous Peoples	PS7 aims to: ensure that the development process fosters full respect for Indigenous Peoples; anticipate and avoid, minimise, or compensate adverse impacts of projects on Indigenous Peoples and provide opportunities for development benefits; establish and maintain an ongoing relationship with affected Indigenous Peoples throughout the life of the project; ensure free, prior, and informed consent of Indigenous Peoples; and respect and preserve their culture, knowledge, and practices.	No indigenous peoples are present in the Project area. The Project does not involve land acquisition or displacement. PS7 will not be triggered.
IFC PS8 - Cultural Heritage	PS8 recognises the importance of cultural heritage for current and future generations. PS8 aims to: protect cultural heritage from the adverse impacts of project activities; support its preservation; and promote equitable sharing of benefits from cultural heritage.	The potential for the presence of cultural heritage resources on the development site will be confirmed within the ESIA.

4.1.2 IFC / WBG ENVIRONMENTAL HEALTH AND SAFETY GUIDELINES

In support of the Performance Standards, the IFC / WBG have published a number of Environmental Health and Safety (EHS) Guidelines. The EHS Guidelines are technical reference documents that address IFC's expectations regarding the industrial pollution management performance of its projects. They are designed to assist managers and decision makers with relevant industry background and technical information. This information supports actions aimed at avoiding, minimising, and controlling EHS impacts during the construction, operation, and decommissioning phase of a project or facility. The EHS Guidelines serve as a technical reference source to support the implementation of the IFC Performance Standards, particularly in those aspects related to PS3: Pollution Prevention and Abatement, as well as certain aspects of occupational and community health and safety.

Where host country (Serbia) regulations differ from the levels and measures presented in the EHS Guidelines, projects will be expected to achieve whichever is more stringent. If less stringent levels or measures are appropriate in view of specific project circumstances, a full and detailed justification for any proposed alternatives is required.

The following IFC / WBG EHS Guidelines have been generally consulted during the preparation of the ESIA in order to aid the identification of EHS aspects applicable to the project:

- 1) Water and Sanitation (2007) – this includes a section on wastewater treatment, the associated use of hazardous chemicals, and air emissions, and sludge management.
- 2) General EHS Guidelines – this includes a section on a range of environmental, occupational health and safety, community health and safety, and construction activities that would apply to the project. The guideline also contains recommended guidelines adopted from the World Health Organisation (WHO) for ambient air and water quality, which are referred to in the relevant impact assessment sections in the ESIA report.

4.2 INTERNATIONAL CONVENTIONS AND PROTOCOLS

Table 4-2 identifies the various environmental Conventions that Serbia is signatory to, and their potential applicability to the Project.

Table 4-2 Environmental and Social International Conventions and Protocols that Serbia is signatory to

CATEGORY	NAME	APPLICABILITY
Biodiversity	- Convention on Biological Diversity ("Official Gazette of - International Contracts", no. 11/01) - Convention on International Trade of Endangered Species of Wild Fauna and Flora ("Official Gazette of FRY - International Treaties", No. 11/01) - Cartagena Protocol on Biological Protection with convention on biological diversity, with annexes ("Official Gazette of SCG - International Treaties", no. 16/05) - Convention on conservation of migratory wildlife species, Bonn, 1979 ("Official Gazette of RS – International Treaties", no. 102/07) - Convention on the Preservation of European Wild Flora and Fauna and Natural Habitats of Europe, Bern, 1979 ("Official Gazette of RS – International Treaties", no. 102/07) - International Convention for the Protection of Birds ("Official Gazette of SFRY - International Treaties", no. 6/73) - Convention on wetlands that are of international importance, especially as wetland bird habitats ("Official Gazette of SFRY - International Treaties", no. 9/77)	Wildlife habitats likely to be directly impacted by the footprint of the WWTP, as well as downstream ecological impacts, are investigated in the ESIA.
Surface Water Resources	- Convention on Co-operation for protection and sustainable use of the Danube River ("Official Gazette of FRY - International Contracts", no. 2/03) - Convention on the protection and use of cross-border waterways and international lakes and amendments to article 12 25th and 26th. Convention on the protection and use of cross-border waterways and international lakes ("Official Gazette of RS – International Treaties", no. 1/10) - Protocol on water and health with the Convention on protection and use of cross-border waterways and international lakes ("Official Gazette of RS, No. - International Treaties", No. 1/2013") - Agreement on protection of the waters of the River Tisa and its 50 000 000 from polluting ("Official Gazette of SFRY - International Treaties", no. 1/90)	The Begej River, via the Tisa and Danube Rivers, belongs to the Black Sea catchment basin. Impacts on the river must be considered at the regional and catchment level. The Zrenjanin WWTP is a water improvement initiative within these waterways.
Climate Change	- Amendments to the Montreal Protocol on substances damaging the ozone layer ("Official Gazette of SCG - International Treaties", no. 24/04) - Kyoto Protocol with the UN Framework Convention on Climate Change, 1997 ("Official Gazette of RS – International Treaties", no. 88/07) - Amendments to Annex B of the Kyoto Protocol with the UN Framework Convention on Climate Change ("Official Gazette of RS – International Treaties", no. 38/09) - UN Convention on Combating Desertification in Countries with Severe Sums and/or Desertification, Especially in Africa, ("Official Gazette of RS – International Treaties", no. 102 /07) - Vienna Convention on protection of ozone layer ("Official Gazette of SFRY - International Treaties", no. 1/90) - Montreal Protocol on Substances Damaging Ozone Layer ("Official Gazette of SFRY - International Contracts", no. 16/90) - UN Framework Convention on Climate Change ("Official Gazette of FRY - International Treaties", no. 2/97)	The proposed WWTP technology is not a significant user/emitter of greenhouse gas (GHG) and ozone depleting substances. Climate change impacts are discussed qualitatively within the ESIA.

CATEGORY	NAME	APPLICABILITY
Environmental and Social Impact Assessment	- Convention on Environmental Impact Assessment in a cross-border context, Espo, 1991 ("Official Gazette of RS – International Treaties", no. 102/07) - Amendments to the Convention on Environmental Impact Assessment in a cross-border context (Sofia, 2001) and Cavtat (2004) ("Official Gazette of RS – International Treaties", no. 4/2016) - Convention on information availability, public participation in decision-making and availability of judiciary regarding environmental issues, Aarhus, 1998 ("Official Gazette of RS – International Treaties", no. 38/09) - Protocol on Strategic Environmental Impact Assessment with Convention on Environmental Impact Assessment in a cross-border context ("Official Gazette of RS – International Treaties", no. 1/10) - Protocol on emissions and transmission of pollutants with convention on information availability, public participation with decision-making and the right to protection in environmental issues ("Official Gazette of RS, No. - International Treaties", no.1/2010)	The ESIA including stakeholder engagement is being undertaken in accordance with international best practice, principally the IFC Performance Standards and the Aarhus Convention (EU Best Practice).
Waste, Chemicals and Pollutants	- The Rotterdam Convention on Procedure previously informed consent for some chemicals and pesticides in international trade, in 1998. ("Official Gazette of RS", no. 38/09) - Convention on cross-border effects of industrial accidents ("Official Gazette of RS", no. 42/09) - Stockholm Convention on Long-Lasting Organic Polluting Substances ("Official Gazette of RS", no. 42/09) - Basel Convention on Control of Cross-Border Movement of Hazardous Waste and its disposal ("Official Gazette of FRY - International Treaties", no. 2/99)	The WWTP does not involve the handling and use of internationally regulated chemicals. Cross-boundary transportation of sludge has the potential to trigger authorisation procedures by the Serbian (and destination country) authorities in terms of the Basel Convention requirements.
Air Quality	- A jury of heavy metals with the Convention on Cross-Border Air Pollution on Large Scathings of 1979. ("Official Gazette of RS – International Treaties", no. 1/12) - The Protocol on Long-Term Organic Pollutants with the Convention on Cross-Border Air Pollution on Large-Border Air Pollution in 1979 ("Official Gazette of RS – International Treaties", no. 1/12) - Protocol with the Convention on Cross-Border Air Pollution long-distance on long-term financing of the Cooperation Programme for monitoring and assessment of cross-border transmission of pollutants in the air at long distances in Europe (EMEP)- ("Official Gazette of SFRY - International Contracts", no. 2/87)	The WWTP does not result in significant air pollution with trans-boundary implications. Localised odour and air quality impacts are quantitatively assessed in the ESIA.
Labour	Fundamental Conventions of the International Labour Organisation (ILO): - C029 - Forced Labour Convention, 1930 (No. 29) - C087 - Freedom of Association and Protection of the Right to Organise Convention, 1948 (No. 87) - C098 - Right to Organise and Collective Bargaining Convention, 1949 (No. 98) - C100 - Equal Remuneration Convention, 1951 (No. 100) - C105 - Abolition of Forced Labour Convention, 1957 (No. 105) - C111 - Discrimination (Employment and Occupation) Convention, 1958 (No. 111)	Labour and working conditions associated with the construction and operation of the Zrenjanin WWTP project are required to confirm to the ILO fundamental conventions.

CATEGORY	NAME	APPLICABILITY
	– C138 - Minimum Age Convention, 1973 (No. 138) Minimum age specified: 15 years – C182 - Worst Forms of Child Labour Convention, 1999 (No. 182)	
Other	– European Convention on Landscape ("Official Gazette of RS – International Treaties", No. 4/2011) – Protocol on protection and sustainable use of biological and landscape diversity with the Framework – Convention on protection of world cultural and natural heritage ("Official Gazette of SFRY - International Treaties", no. 8/74);	Landscape and cultural heritage aspects are addressed within the ESIA.

4.2.1 EU ENVIRONMENTAL STANDARDS

EU EIA DIRECTIVE

A review against the EU EIA Directive's (2011/92/EU as amended) requirements has been undertaken to assess whether the Project activities are listed in Annex I or II of the EIA Directive. EU EIA Annex I projects require a project-by-project assessment, using national law to undergo a 'screening process' to determine if an EIA is required. Annex II projects require a full environmental impact assessment (EIA). The following is applicable to the Project:

- Annex I (Projects to be determined if they require an EIA) / 11 (c) Waste-water treatment plants (projects not included in Annex I⁷)

The ESIA is being performed to international standards; and a parallel EIA for local authorisation is being undertaken in parallel to the international standards ESIA. These processes substantively fulfil the potential requirements of the Directive.

EU WASTE FRAMEWORK DIRECTIVE

The objective of the Directive (2008/98/EC) is to prevent or reduce adverse environmental effects associated with the generation and management of waste, in order to reduce the overall effects of resource use and improve the efficiency of said use thereby protecting the environment and human health.

The Directive sets the basic concepts and definitions in relations to waste management, such as defining waste itself and different waste criteria, and establishes the Waste Hierarchy. The Directive defines the elements of the waste hierarchy and requirements in relation to these components of the waste hierarchy (waste prevention, re-use, recycling, recovery and disposal). The following articles within the Directive are of relevance to the Project:

- Article 15 – Responsibility for Waste Management: Details responsibilities for the waste transfer process such as the need to ensure professional waste collection and transport results in delivery to appropriate treatment installations;
- Article 17 – Control of Hazardous Waste: Outlines the need to ensure the production, collection, transportation, storage and treatment of hazardous waste is carried out in conditions protecting the environment and human health;
- Article 18 – Ban on the mixing of hazardous waste: Outlines that hazardous waste must not be mixed with non-hazardous waste, with exceptions that if Best Available Techniques (BAT) is applied at permitted facilities then mixing is allowed.

⁷ Listing in Annex II is for "wastewater treatment plants with a capacity exceeding 150 000 population equivalent, as defined in point 6 of Article 2 of Council Directive 91/271/EEC of 21 May 1991 concerning urban waste-water treatment..

EU SEWAGE SLUDGE DIRECTIVE

The objective of the Directive (86/278/EEC) is to encourage the use of sewage sludge in agriculture, in a way that will not harm the soil, humans, and the environment. A guideline the EU has put into place is that sewage sludge should not be added to fruit and vegetable crops that are in season. In the EU, regulations regarding sewage sludge disposal differ because legislation regarding landfill disposal is not in the national regulations for the EU.

The sludge generated by the Zrenjanin project will initially be disposed at a permitted landfill site. Both the generator of the waste (Begej Water) and the landfill operator are however encouraged to seek alternatives to landfilling in accordance with the general duties set out in the Directive.

URBAN WASTE WATER TREATMENT DIRECTIVE

The Urban Waste Water Treatment Directive (full title "Council Directive 91/271/EEC of 21 May 1991 concerning urban waste-water treatment") is a EU directive regarding urban wastewater collection, wastewater treatment and its discharge, as well as the treatment and discharge of "waste water from certain industrial sectors". It was adopted on 21 May 1991. It aims "to protect the environment from the adverse effects of urban waste water discharges and discharges from certain industrial sectors" by mandating waste water collection and treatment in urban agglomerations with a population equivalent of over 2000, and more advanced treatment in places with a population equivalent above 10,000 in sensitive areas ^(see inset).

***Sensitive Areas as defined in 91/271/EEC:** Serbia has not yet completed its analysis to define sensitive or less sensitive areas as per Annex II of the UWWTD. However, the available monitoring results compared to the criteria set in the "Regulation on parameters of ecological and chemical status of surface water and parameters of chemical and quantitative status of groundwater" (Official Gazette of RS, No. 74/2011) would indicate that the water of River Begej belongs to the 3rd category. However, the River Begej is classified as a Type 2 water body. It is therefore expected that when design conditions are requested for proceeding with the preliminary design of the WWTP, stringent water conditions may be requested to instigate improvement of the water status as required by the Law on Water ("Official Gazette of RS", No.30/2010). Therefore, the design requirements of the WWTP may be proposed as having to meet a sensitive area status. Certainly, by 2025 this would be the case.*

Member states in the EU maintain and operate waste-water treatment plants to conform to the Urban Waste Water Treatment Directive, which sets standards for both treatment and disposal of sewage for communities of more than 2000 person equivalents. Each member state is obliged to enact the requirements of the directive through appropriate local legislation. This directive also links to the Bathing Waters Directive and to the environmental standards set in the Water Framework Directive which are designed to protect all legitimate end uses of the receiving environment.

Harmonised Local Legislation

Serbia is currently in the process of harmonization of its water management legislation with correspondent EU Directives. The Law on Water (Off. Gazette of RS, No. 30/10, 93/2012) is supplemented by a variety of by-law documents stipulating water bodies and their types, overall status of water bodies, emission limit values and environmental quality standards. Effluent discharge standards for both industrial and communal effluents are defined by the Decree on emission limit values of polluting substances discharged into water and deadlines for compliance (Off. Gazette of RS, No. 67/2011). In respect to municipal wastewater, the Decree sets the limit values for the following elements:

- i) Emission limit values for industrial wastewater discharged into a municipal sewer (Chapter 3, Table 1 of the Decree);
- ii) Emission limit values and required percentage of reduction for communal wastewater discharged into a recipient (Chapter 3, Table 2 of the Decree);
- iii) Emission limit values for communal wastewater depending on the capacity of the WWTP (Chapter 3, Table 3 of the Decree);
- iv) Emission limit values for treated communal wastewater discharged into surface water used for recreation, water supply and irrigation (Chapter 3, Table 4 of the Decree);
- v) Sampling regime requirements for treated communal wastewater depending on the capacity of the WWTP (Chapter 3, Table 5 of the Decree); and
- vi) Number of allowed samples of communal wastewater deviating from the limit values (Chapter 3, Table 6 of the Decree).

Regarding item (iv), discharges from the WWTP into the Begej River must comply with the Decree on emission limit values of polluting substances discharged into water and deadlines for compliance (“Official Gazette of RS”, No.67/2011), which is based on the Council Directive 91/271/EEC of 21 May 1991 concerning urban waste water treatment, OJ L 135, 30.5.1991, states. These discharge standards are incorporated in **Table 2-3**.

EU WATER FRAMEWORK DIRECTIVE

Directive 2000/60/EC (EU Water Framework Directive) establishes a framework for the Community action in the field of water policy and streamlines previous EU legislation, expanding protection to all waters, based on the principles of: ensuring ecologically clean water, reduction of water pollution, safe water treatment, combined approach involving control at the river basin and subsequent control, and realistic and fair prices for water consumption. The Water Directive encourages cross-border cooperation alongside rivers and stimulates solidarity in water management within river basins.

EU GROUNDWATER DIRECTIVE

The purpose of the Directive (2006/118/EC) is to prevent and control groundwater pollution, it also aims to support groundwater components of Directive 2000/60/EC. The following articles are of relevance to the Project:

- Article 3 – Outlines the criteria to use when assessing groundwater chemical status, including the determination of threshold values. Annex II of the Directive contains guidelines for the establishment of threshold values, as well as pollutants to assign threshold values for;
- Article 4 – Outlines the procedure to use when assessing groundwater chemical status; and
- Article 6 – Details measures to prevent or limit inputs of pollutants of inputs into groundwater.

4.2.2 SERBIAN ENVIRONMENTAL STANDARDS

This section summaries the key legislation that applies to this ESIA.

ADMINISTRATIVE BODIES IN THE SERBIAN ENVIRONMENT SECTOR

Table 4-3 identifies the institutional actors with influence over the project, which are present at the level of the central administration, regional level, and divisional level and at the level of para-public and private bodies.

Table 4-3 Institutional actors with influence over the project

INSTITUTION	MANDATE	ROLE ON THE PROJECT
Republic Water Directorate - Ministry of Agriculture, Forestry and Water Management	Competencies of the Directorate include water management policies, use of water resources, water supply (excluding distribution), water protection, inspection in area of water management and other water-related activities.	For projects / infrastructure within the Autonomous Province of Vojvodina (AP Vojvodina), certain competencies are transferred to provincial authorities as listed below.
Ministry of Environmental Protection	The Ministry is responsible for environmental protection activities - developing and managing systems for protection and development of environment, inspection, research, information management, protection of air, ozone layer, surface and underground waters; it determines conditions for environmental protection for construction.	
Ministry of Construction, Transport and Infrastructure	Competencies of the Ministry include construction, construction land, construction conditions, urbanism, spatial planning, utility infrastructure and services (except heating), and inspection activities within these fields.	
Environmental Protection Agency	The Agency is responsible for development and management of national environmental protection information system, state monitoring of water and air quality, collection of environmental data and reporting, keep records on best	

INSTITUTION	MANDATE	ROLE ON THE PROJECT
	practices in environmental protection, cooperation with the European Environment Agency (EEA).	
AP Vojvodina, Secretariat for Urbanism and Environmental Protection	Competencies of the Secretariat include spatial and urban planning within AP Vojvodina territory, including measures for implementing the spatial plan of Serbia and regional spatial plans. It provides consent for spatial and urban documents of local self-governments. In area of environmental protection, the Secretariat monitors use and protection of natural resources and supervises the overall environmental status.	Provincial authorities are responsible for managing and monitoring environmental protection activities on its territory. As per the Law on Planning and Construction, provincial authorities define conditions, participate in review of technical documentation, and issue permits for objects of special importance for the Republic (Article 133 of the law), located within the Province boundaries.
AP Vojvodina, Secretariat for Agriculture, Water Management and Forestry	The Secretariat is responsible for water management within the territory of AP Vojvodina, water protection, floods protection, adopting planning documents for integrated water management, and establishes and directs the public water management company "Waters of Vojvodina" ("Vode Vojvodine").	Secretariat for Agriculture, Water Management and Forestry is responsible for issuing water acts foreseen by the Law on Water, with participation of PWMCMC "Waters of Vojvodina".
AP Vojvodina Secretariat for Energy, Construction and Transport	Competencies of the Secretariat include construction of infrastructure, participation in technical review of documentation for projects for which permits are issued by the Provincial authorities, monitoring development of utility infrastructure, participation in working groups and bodies formed by the Ministry of Construction, Transport and Infrastructure.	Provincial Secretariat responsible for Environmental Protection is the competent body for the EIA procedure, for projects for which the permit is issued on the provincial level.
Public water management company "Waters of Vojvodina" ("Vode Vojvodine")	The company is responsible for waterways management, floods protection, water protection, integrated management of water resources and other activities as defined by the law and other regulations.	
Municipality of Zrenjanin	The local self-government (LSG) is responsible for infrastructure and provision of utility services of adequate quality, scope, accessibility and continuity, as well as for monitoring their implementation. Its competencies include management of environmental protection and natural resources within its territory.	The City is managing activities within its territory within the competencies foreseen in the Law on Local Self-government and relevant other regulations.
Public Enterprise for Urbanism Zrenjanin	Competencies include spatial and urban planning, management of city land, issuance of location conditions and consents for construction and other activities as per the Law on Planning and Construction.	
Public Utility Service (PUC) "Vodovod i kanalizacija", Zrenjanin	The activities of the PUC include management and maintenance of water supply and wastewater networks and services, as well as hydrotechnical objects within the Municipality of Zrenjanin territory.	
Institute for Public Health Zrenjanin	Public health institution providing services across several fields, including environment.	In charge for monitoring of the River Begej, in the area of Zrenjanin.

SERBIAN ENVIRONMENTAL AND SOCIAL LEGISLATION

Table 4-4 identifies the various Serbian environmental, social, and labour related Laws, Decrees and Orders and their potential applicability to the Project.

Table 4-4 Environmental, social, and labour related Laws, Decrees and Orders

NAME	SUBJECT MATTER	SUMMARY	APPLICABILITY
Law on Water ("Official Gazette of RS", no. 30/2010, 93/2012, 101/2016, 95/2018 and 95/2018)	Environment	This is the base law for water management. It applies to all surface and ground waters, including sewage waters, and sets the main principles of water management. It regulates the protection of waters, conditions and ways of carrying out water management and inspection over the implementation of regulations of this law. Aside from the Decree on Emission Limit Values of Polluting Substances Discharged into Water and Deadlines for Compliance separately listed below, the following by-laws should also be noted: - Decree on Limit Values of Polluting Substances Discharged in Surface Water, Groundwater and Sediment and Deadlines for Compliance ("Official Gazette of RS", no. 50/2012); - Regulation on Parameters of Ecological and Chemical Status of Surface Water and Parameters of Chemical and Quantitative Status of Groundwater ("Official Gazette of RS", no. 74/2011); - Decree on Limit Values of Priority and Priority Hazardous Substances Polluting Surface Water and Deadlines for Compliance ("Official Gazette of RS", no. 35/2011); - Ordinance on the Method and Conditions for Measuring the Quantity and Testing of Wastewater Quality ("Official Gazette of RS", no. 33/2016). Several relevant rulebooks should be noted: - Rulebook on content and request template for water acts, content of opinion for issuing water conditions and content of report for issuing water permit ("Official Gazette of the RoS" No. 71/2017 and 44/2018); - Rulebook on cases for which the water permit is required ("Official Gazette of the RoS" No. 30/2017); - Rulebook on technical and technological equipment, organisational and human resources needed for performance of the activities in relation to water management and on procedure for registering of the issued and withdrawn licences ("Official Gazette of the RoS" No. 23/12).	The law covers water protection, setting (in the related by-laws) the standards and limit values for pollutants. Defined are obligations to treat wastewater before discharging into public sewer or directly into the 'recipient' (receiving natural water body), as well as sludge management. It sets conditions and procedures for: - Licence for collection, transport and treatment of wastewater in a public sewer system; - Water Conditions, issued as part of preparing technical documents for construction of objects with potential effect on water/environment (inc. WWTPs); - Water consent, issued for objects listed in the law (inc. WWTPs), which confirms that the technical documentation is in line with the water conditions; - Water permit, which sets the method and conditions for water use, discharge of wastewater and other activities that can impact the water regime.
Decree on emission limit values of polluting substances discharged into water and deadlines for	Environment	The Decree sets the emission limit values of polluting substances discharged into water, and compliance deadlines.	For wastewater, it sets the limit values and sampling regime for industrial water discharged into a municipal sewer, for communal wastewater discharged into a 'recipient' (receiving natural water body), for communal wastewater depending on the WWTP capacity, for treated communal

NAME	SUBJECT MATTER	SUMMARY	APPLICABILITY
compliance (“Official Gazette of RS”, no. 67/2011, 48/2012 and 1/2016)			wastewater discharged into surface water used for recreation, water supply and irrigation.
Law on Environmental Protection (“Official Gazette of RS”, no. 135/2004, 36/2009, 43/2011, 14/2016, 76/2018, and 95/2018)	Environment	This Law establishes the overall framework for integrated system of environmental protection, which includes activities, conditions and instruments for sustainable protection of environmental balance, variety and quality. The main objectives are to prevent pollution and reduce or remediate pollution sources, as well as promote use of products, technologies and processes which are more environment-friendly.	For water protection, the law stipulates that waste waters can be discharged with adequate treatment, in a way and amount that does not endanger natural processes and/or quality and amount of water, nor its ability to be used for other purposes. Sludge created during this process must be treated and disposed of in line with the Law on waste management. For projects which might significantly impact the environment and/or affect population health, it is mandatory to prepare an EIA, which becomes integral part of project documentation and pre-requisite for implementation.
Law on Environmental Impact Assessment (“Official Gazette of RS”, no. 135/2004, 36/2009)	Environment	This law sets the procedure for determining potential influences that a project might have on environment. It provides mandatory elements for EIA study and obligations of investors seeking to obtain a permit for construction, reconstruction, expansion or other activity related to facilities which might have an impact on environment. The Government adopts a decision on lists of objects for which the EIA is mandatory (List I) and those for which the EIA can be requested (List II).	List I (objects for which the EIA is mandatory) includes WWTPs for settlements of over 100,000 inhabitants. List II (objects for which EIA can be requested) includes facilities for treatment of communal (if not under List I) and technical wastewater.
Law on Nature Protection (“Official Gazette of RS”, no. 36/2009, 88/2010, 91/2010, 14/2016 and 95/2018)	Environment	The Law is managing protection and safeguarding of biological, geological and spatial diversity as part of overall environmental protection.	Applicable in case the project activities will impact the status of wild species’ population and their habitats. All project promoters and/or physical or legal entities using natural resources or implementing construction or other works in nature are obligated to implement measures to avoid or minimise negative impacts on nature.
Law on Utility Activities (“Official Gazette of RS”, no. 88/2011, 104/2016 and 95/2018)	Utility services	The Law sets the framework for provision of utility services, including their definition and institutional responsibilities, eligible providers and conditions they have to fulfil, responsibilities of utility service providers, relations with the end users, financial aspects (tariffs) and reporting of these services.	The law includes the provisions allowing local self-government to contract private companies for provision of communal activities. It sets the framework for provision of these services and rules for setting and changing tariffs charged to end users. Inspection competencies for monitoring the provision of utility services are also defined.
Law on Planning and Construction (“Official Gazette of RS”,	Planning and construction	The law regulates spatial planning, construction of objects and permitting, urban construction land and legalization of objects. Article 133 of the law determines the list of objects which are	All technical preparation, construction and permitting activities are subject to this law.

NAME	SUBJECT MATTER	SUMMARY	APPLICABILITY
no. 72/2009, 81/2009, 64/2010, 24/2011, 121/2012, 42/2013, 50/2013, 98/2013, 132/2014, 145/2014, 83/2018, 31/2019, 37/2019 and 9/2020)		considered to be of special importance for the Republic of Serbia. For these objects, the licenses are issued by the Ministry (or a relevant body of the Autonomous Province of Vojvodina). Additional requirements are also present during project preparation process, including mandatory preparation of pre-feasibility study (with a general design) and a feasibility study (with a preliminary design), which are subject to a review by a technical commission. By-laws to be noted: - Rulebook on Feasibility Study and Pre-Feasibility Study ("Official Gazette of RS", no. 87/2019); - Rulebook on content, method and procedure of drafting and technical control of technical documentation based on category and use of objects ("Official Gazette of RS", no. 73/2019); - Decree on Location Conditions ("Official Gazette of RS", no. 15/2020); - Rulebook on content and method of undertaking works supervision ("Official Gazette of RS", no. 22/2015 and 24/2017); - Rulebook on methodology and procedure for implementing projects of importance for the Republic of Serbia ("Official Gazette of RS", no. 1/2012).	Wastewater treatment plants with over 200 l/s of capacity are included in Article 133.
Law on Expropriation ("Official Gazette of RS", no. 53/95, 16/2001, 20/2009, 55/2013 and 106/2016)	Land expropriation	The Law defines how land and other construction objects can be expropriated based on established public interest and fair compensation. Public interest is proclaimed by the Government, based on proposal by the entity eligible to be the expropriation beneficiary under the law.	Construction of utility infrastructure is an eligible basis for proclaiming public interest and therefore expropriation.
Law on Public-Private Partnership and Concessions ("Official Gazette of RS", no. 88/2011, 15/2016 and 104/2016)	Public Private Partnerships (PPP)	This law sets the framework for preparation, proposing, approval and implementation of public-private partnership arrangements, including rights and obligations of parties, legal protection, form and content of PPP contracts and all other elements relevant for PPPs and concessions. The law recognizes two main forms of PPP: institutional, which foresees a joint legal entity implementing the partnership; and contractual, defined through a contract whose content is set by Article 46 of the law.	Relevant for all projects implemented through a PPP model (with or without concession elements).
Decree on supervision over implementation of public private partnership contracts ("Official	Public Private Partnerships	This decree sets the responsibilities regarding supervision over PPP contracts, in terms of fulfilment of conditions, costs, service quality and all other provisions of the public contract. Supervision is performed by competent authority of the Republic of Serbia, AP Vojvodina and/or of local self-government. It	Applicable to all PPP agreements.

NAME	SUBJECT MATTER	SUMMARY	APPLICABILITY
Gazette of RS", no. 47/2013)		foresees review of reports by public and private partners, direct inspection of the subject location and the implementing private company, as well as documents review and analysis of the PPP's results.	
Company Law ("Official Gazette of RS", no. 36/2011, 99/2011, 83/2014, 5/2015, 44/2018, 95/2018 and 91/2019)	Companies	The law sets the legal framework for companies (any legal entity undertaking activities for purpose of profit) including procedure for their establishment, internal organisation and management. It defines several legal forms for companies, including provisions regulating limited liability and a joint-stock companies.	All companies established in the country are subject to provisions of this law.
Labour Law ("Official Gazette of RS", no. 24/2005, 61/2005, 54/2009, 32/2013, 75/2014, 13/2017, 113/2017 and 95/2018)	Labour	The provisions of the Labour Law apply to employees of any legal entity or individual. The law sets the rights and obligations of employees and employers, the procedures for establishing employment relations, contract elements, compensation, paid and unpaid leave, and all other aspects of employment. The Law also defined forms of engagement that do not represent an employment relationship (contracts for single term or periodic engagements).	Relevant for all companies operating within the country.
Law on Workplace Safety and Health ("Official Gazette of RS", no. 101/2005, 91/2015 and 113/2017)	Labour	This law regulates health and safety issues for all persons working or present in the workplace.	All employers within the country are subject to the law. Specific areas of workplace protection are covered by more than 40 by-laws.
Law on Public Enterprises ("Official Gazette of RS", no. 15/2016 and 88/2019)	Public companies	A public enterprise is a company undertaking activities of national interest, which is formed by the Republic of Serbia, autonomous province, or a local self-government unit. Public enterprise for undertaking communal activities, which fall under the competencies of the local self-government, is formed by an act adopted by the Municipal Assembly, which includes a number of provisions concerning the company.	Zrenjanin PUC is subject to this law.
Law on Public Health ("Official Gazette of RS", no. 15/2016)	Public health	Subject of this law are rules and procedures for maintaining and improving general health of the population.	Natural environment (e.g. condition of surface waters and groundwater) and working environments (i.e. labour health and safety) are included in areas of public health considerations.
Law on Agricultural Land ("Official Gazette of RS", no. 62/2006, 65/2008, 41/2009, 112/2015,	Environment	Planning, management, protection and use of agricultural land is set by this Law, as a resource of public interest.	The Law forbids discharge of hazardous and polluting materials in channels used for irrigation and how the levels of these materials are to be measured.

NAME	SUBJECT MATTER	SUMMARY	APPLICABILITY
80/2017 and 95/2018)			
Law on Waste Management (“Official Gazette of RS”, no. 36/2009, 88/2010, 14/2016 and 95/2018)	Environment	The law regulates types and classification of waste, waste management subjects and responsibilities, management of special waste streams, permitting and other aspects of waste management.	The law is applicable to sludge from wastewater treatment plants, as well as for all other types of waste (construction waste included).
Law on Air Protection (“Official Gazette of RS”, no. 36/2009, 10/2013 and 26/2021)	Environment	This law sets the framework for air protection and defined measures, organisation and control over protection and improvement of air quality.	All legal entities undertaking activities with potential negative impact on air quality are obligated to provide technical and other measures to prevent or minimise the negative emissions and monitor the ongoing affect of their activity on air quality.
Law on Noise Protection in Environment (“Official Gazette of RS”, no. 36/2009, 88/2010)	Environment	The law defines measures and conditions for noise protection in environment, noise measurements, access to information and other elements relevant for environmental protection and public health in regards to noise.	Legal entities that undertake commercial activities that produce noise are subject to this law. Both the national (and provincial in the case of AP Vojvodina) and local authorities define conditions and measures for noise protection, including those in the process of EIA and (where applicable) integrated permit issuance. Monitoring of noise pollution is performed by environmental protection inspectors on a national/ provincial and local level.
Law on Soil Protection (“Official Gazette of RS”, no. 112/2015)	Environment	The law manages protection of soil, monitoring of its quality, remediation measures and other aspects to protect it as a natural resource of national interest.	Subject to this law are all owners or users of land who are performing activities with adverse effect on its status.
Law on Integrated Pollution Prevention and Control (IPPC) (“Official Gazette of RS”, no. 135/2004 and 25/2015)	Environment	This act sets conditions and procedures for issuing the integrated permit for facilities and activities that can have a negative impact on public health and environment, as well as types of these activities and facilities, their monitoring and pollution control.	Facilities subject to IPPC are listed in Decree on types of activities and facilities for which the integrated permit is issued (“Official Gazette of RS”, no. 84/2005)
Law on Competencies of AP Vojvodina (“Official Gazette of RS”, no. 99/2209, 67/2012 and 18/2020)	Provincial administration	The law sets the framework for competencies of the Autonomous Province of Vojvodina. Within water management, AP Vojvodina undertakes the following transferred activities: management of water resources, water protection, management of waterways, inspection activities and other.	Relevant for projects / activities within the territory of AP Vojvodina.
Law on Local Self-Government (“Official Gazette of RS”,	Local administration	This Law defines the characteristics, responsibilities, organization and other specifications of local self-government (LSG) units in the Republic of Serbia. In order to fulfil	The Law is applicable to all LSGs and therefore also the Municipality of Zrenjanin.

NAME	SUBJECT MATTER	SUMMARY	APPLICABILITY
no. 129/2007, 83/2014, 101/2016 and 47/2018)		their obligations and answer the need of their citizens, LSG can form companies, public institutions and other organizations for undertaking public services. Alternatively, local self-government unit can, following competition and free market principles, engage a private operator for undertaking activities under its competencies.	

5 BASELINE ENVIRONMENTAL AND SOCIAL DESCRIPTIONS

Baseline information (environmental characteristics and conditions) has been collated, based upon desk-based information available at the time of the assessment and site visits undertaken by the following independent environmental and social practitioner appointed by the project Company:

Table 5-1 Third Party Specialists involved in baseline data collection

COMPANY DETAILS	TASKS
EKO-VOK 2017 d.o.o, Albanske Spomenice 12, lokal C-2	– Socio-economic surveys – Waste management baseline assessment
Dvoper d.o.o., 10, Nušićeva str., Belgrade	– Air quality monitoring – Noise monitoring – Surface water monitoring – Soil sampling – Groundwater sampling – Ecological sampling
ANAHM d.o.o, MOCARTOVA 10 11050, Beograd (Zvezdara) Serbia	– Analytical procedures (soil, water, air, groundwater)

Sections 5.1 - 5.4 provide details of the baseline information. The methodology used in the baseline's assessment, any consultation undertaken, the temporal and spatial extent and any limitations establishing the baseline are described within these same sections.

5.1 PHYSICAL ENVIRONMENT

5.1.1 LOCAL METEOROLOGY

TEMPERATURE AND RAINFALL

Ambient air temperature influences plume buoyancy as the higher the plume temperature is above the ambient air temperature, the higher the plume will rise. Further, the rate of change of atmospheric temperature with height influences vertical stability (i.e. formation of mixing or inversion layers). Rainfall is an effective removal mechanism of atmospheric pollutants and thus also relevant in the assessment of pollution potential.

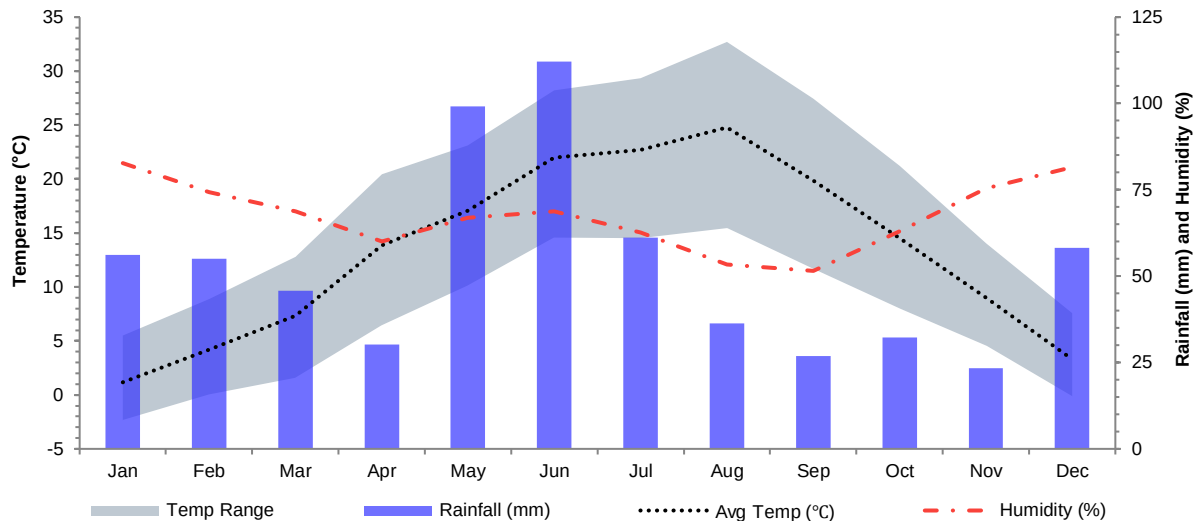


Figure 5-1 presents the average monthly temperature range, humidity and rainfall for the assessment area. The region receives year-round rainfall with slightly drier conditions during autumn months (September, October and November). Summer temperatures for the region average at 23.2°C while winter temperatures average at 2.9°C. Zrenjanin receives on average 637 mm of rainfall per annum, with approximately 33% of that during the summer months (June, July and August) and 13% during autumn (September, October and November). The remainder is evenly split between winter (December, January and February) and spring (March, April and May), receiving 27% each. Average humidity peaks during summer (June, July and August) at 80%.

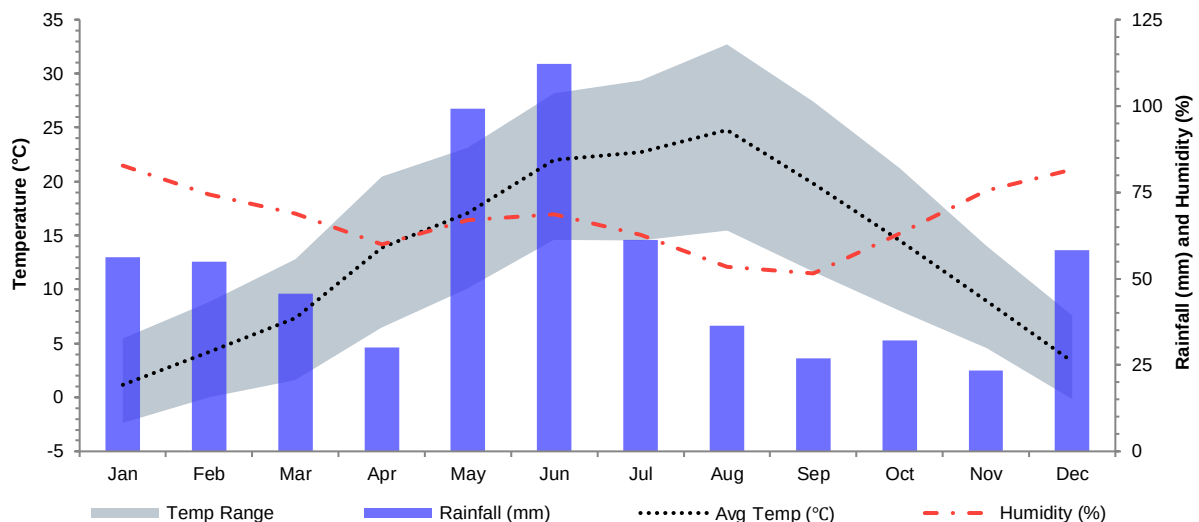


Figure 5-1 Average Temperatures and Precipitation

HUMIDITY

The lowest average monthly relative humidity is 64.2% in August, and the highest in December of 86.6%. Of all the seasons, winter has the highest value of average daily relative humidity of 84.2%, followed by autumn 75.1% and spring 69.9%, while in summer the daily relative humidity is at its lowest of 65.9%.

SOLAR RADIATION

The average number of sunny hours is 2,000 – 2,200 with a maximum amount of 322.4 hours in July, and a minimum amount of 42.5 hours in December. According to the solar atlas of Vojvodina, the Municipality of Zrenjanin is located in a zone with a solar radiation intensity of about 1,450 kWh / m² per year. (Figure 5-2).

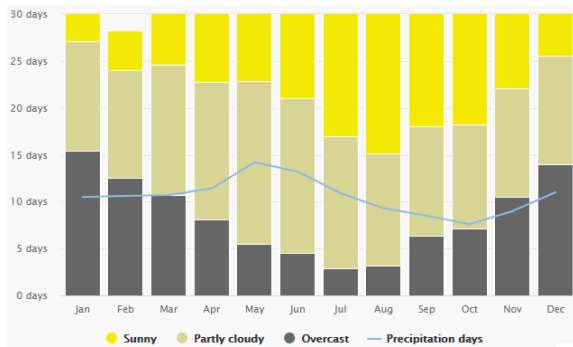


Figure 5-2 Cloudy, Sunny, and Precipitation Days

WIND

Wind roses (**Figure 5-3**) summarize wind speed and directional frequency at a location. Each directional branch on a wind rose represents wind originating from that direction. Each directional branch is divided into segments of colour, representative of different wind speeds. Calm conditions are defined according to the *Beaufort Wind Force Scale* as wind speeds less than 0.5 m/s.

Typical wind fields have been analysed using Lakes Environmental WRPlot Freeware (Version 7.0.0) for the full period (January 2017 – December 2020); diurnally for early morning (00h00 – 06h00), morning (06h00 – 12h00), afternoon (12h00 – 18h00) and night (18h00 – 00h00); and seasonally for summer (December, January and February), autumn (March, April and May), winter (June, July and August) and spring (September, October and November):

- Calm conditions (wind speeds <0.5 m/s) occurred 0.72% of the time;
- Light to fresh southeasterlies and south-southeasterlies prevailed in the region;
- Peak wind speeds occurred from the south-southeast (16.3 m/s) and highest average wind speeds occurred from the southeast (4.6 m/s);
- Winds from the south-southeast and southeast prevailed during the early morning (00h00 – 06h00) and morning (06h00 – 12h00) hours with west-northwesterly components also noted in the early morning;
- Northerly and southeasterly winds prevailed during the afternoon (12h00 – 18h00);
- Southeasterlies prevailed at night however higher directional variability in the wind field is observed between 18h00 – 00h00;
- Diurnal peak (15.4 m/s) and highest average (4.0 m/s) wind speeds occurred during the afternoon;
- Prevailing southeasterly and south-southeasterly winds are noted throughout autumn and winter with some variability in seasonal frequency and strength;
- Winds from the northwesterly quadrant are also relevant during winter and prevail during summer months;
- During spring, northerlies prevail with less frequent westerly and southeasterly components noted. Higher directional variability in the wind field is observed during spring; and
- Seasonal peak (13.8 m/s) wind speeds and highest average (4.4 m/s) wind speeds occur during winter.

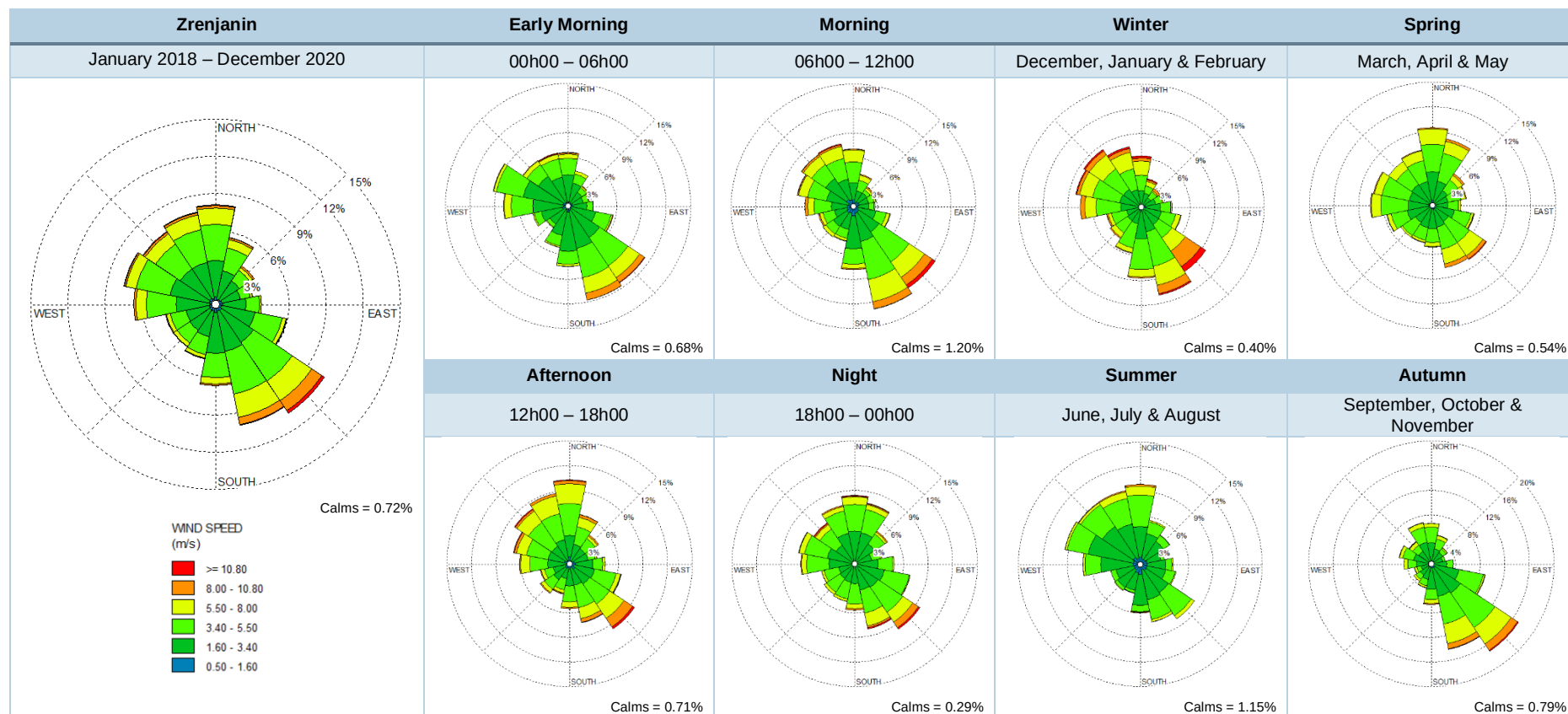


Figure 5-3 Local wind conditions at Zrenjanin

5.1.2 AIR QUALITY

Anahem Laboratory was appointed to undertake an air quality monitoring assessment to determine background ambient pollutant concentrations at sensitive receptors proximate to the proposed development site (**Appendix A-5**). The findings of this monitoring is presented in the sections that follow.

Sensitive receptors (i.e. places where sensitive individuals may be impacted, such as residences) in proximity to the study site, selected for evaluation in this assessment are listed in **Table 5-2** and shown in **Figure 5-4**.

Table 5-2 Sensitive receptors

ID	Description	Receptor type	Latitude (°N)	Longitude (°E)	Distance from site (m)	Cardinal direction from site
MT1	House at Pančevačka bb, Zrenjanin	Residence	45.349510	20.420537	195	N
MT2	House at 149 Hunjadi Janoška Street, Zrenjanin	Residence	45.345635	20.414386	450	W
MT3	House at 169 Hunjadi Janoška Street, Zrenjanin	Residence	45.342168	20.415902	590	SW
MT4	On perimeter of Ečka-Jugoistok Industrial Zone across road from Petrol Station	Public retailer	45.349093	20.423478	230	NE





Figure 5-5 Assembled Radiello® passive sampler (left) and across section of diffusive body and sorbent cartridge tube (right)

Sampling comprised two campaigns spanning 14 days each (i.e. 24 May – 07 June 2021 and 07 June – 21 June 2021) in line with the manufacturer recommended exposure period. Samplers were deployed at four monitoring locations (**Table 5-3**).

Table 5-3 Monitoring locations

ID	Description	Latitude (°N)	Longitude (°E)	Corresponding sensitive receptor
AQ1	House along river Begej	45.348383	20.417336	-
AQ2	Edge of field	45.346719	20.423175	-
AQ3	169 Hunjadi Janoš Street	45.349319	20.419911	-
AQ4	149 Hunjadi Janoš Street	45.345622	20.413911	MT2

Please note: The description provided by *Anahem Laboratory* for AQ3 (169 Hunjadi Janoš Street) does not align with the coordinates for the monitoring location. 169 Hunjadi Janoš Street is a proximate sensitive receptor located on the west bank of the Begej River that was pre-identified for specialist assessment in the ESIA.

Results are presented in **Table 5-5**. No standard or guideline applicable to a 14-day averaging period was found in the literature for any of the assessed pollutants. Where available, national limit values/MAC and international guidelines applicable to different averaging periods have been used in this instance as a reference threshold for assessing the degree of impact.

Table 5-4 Monitoring results

Sample location	Pollutant (µg/m³)					
	Ammonia	Hydrogen sulphide	Benzene	Toluene	Ethyl benzene	Xylene
Detection limit (µg/m³)	Not reported	Not reported	0.01	Not reported	0.01	0.01
Standard / Guideline (µg/m³)	100	150	5	260	570	180
	Serbian MAC (24-hour)	Serbian MAC (24-hour)	Serbian Limit Value (annual)	Serbian MAC (1-week)	TCEQ ESL (annual)	TCEQ ESL (annual)
Campaign 1 (24 May – 07 June 2021)						
AQ1	8.7	1.3	BDL	4.9	BDL	BDL
AQ2	8.9	1.1	BDL	2.6	BDL	BDL
AQ3	8.3	2.4	BDL	1.9	BDL	BDL
AQ4	8.1	2.1	BDL	3.2	BDL	BDL
Campaign 2 (07 – 21 June 2021)						
AQ1	17.1	2.9	0.38	2.6	0.66	0.28
AQ2	16.9	1.5	0.33	1.6	0.78	0.25
AQ3	18.3	2.2	0.022	0.26	0.14	0.053
AQ4	15.9	1.9	0.047	0.32	0.25	0.08

BDL – below detection limit

Key findings are as follows:

- Benzene, ethyl benzene and xylene concentrations at all monitoring locations measured below the detection limit of the analysis method (i.e. <0.01 µg/m³) during Campaign 1.
- With the exception of H₂S concentrations measured at AQ3 and AQ4, all pollutant concentrations measured higher during Campaign 2 compared to Campaign 1. Higher ambient temperatures were noted during Campaign 2 which may have resulted in increased pollutant volatility at the emission source/s.
- Measured concentrations of all pollutants across both campaigns are well below the applicable standard/guidelines. It is highlighted that these results are based on a 14-day monitoring period and should not be viewed as the average concentration for any other averaging period (e.g. annual).
- No wind direction data is provided in the Anahem Laboratory monitoring reports to allow for an assessment of likely emission sources.

5.1.3 NOISE

Continuous 24-hour and short-term (15-minute) sound level measurements were undertaken at four receptor locations (**Table 5-5** and **Figure 5-6**) from 21 to 24 May 2021. All sound level measurement procedures were undertaken in line with ISO 1996-1:2019 (*Acoustics - Description, Measurement and Assessment of Environmental Noise - Part 1: Basic Quantities and Assessment Procedures*) and ISO 1996-2:2019 (*Acoustics - Description, Measurement and Assessment of Environmental Noise - Part 2: Determination of Sound Pressure Levels*) specifications.

As per the *Regulation on Noise Indicators, Limit Values, Assessment Methods for Indicators of Noise, Disturbance and Harmful Effects of Noise in the Environment* (“Official Gazette of Republic of Serbia”, no. 75/2010), the 24-hour time period is divided into three reference time intervals, namely day (06:00 – 18:00), evening (18:00 – 22:00) and night (22:00 – 06:00).

Sensitive receptors are identified as areas that may be impacted negatively due to noise associated with the proposed WWTP. Examples of receptors include, but are not limited to, schools, shopping centres, hospitals, office blocks and residential areas. Sensitive receptors (i.e. places where sensitive individuals may be impacted) within a 1 km radius of the Project site are provided in **Table 5-5** and **Figure 5-6**.

Table 5-5 Sensitive receptors surrounding the Zrenjanin WWTP project site

ID	DESCRIPTION	LATITUDE (°S)	LONGITUDE (°E)	DISTANCE FROM PLANT BOUNDARY (M)	DIRECTION FROM PLANT BOUNDARY
MT1	House at Pančevačka bb, Zrenjanin	45.349510	20.420537	195	N
MT2	House at 149 Hunjadi Janoš a Street, Zrenjanin	45.345635	20.414386	450	W
MT3	House at 169 Hunjadi Janoš a Street, Zrenjanin	45.342168	20.415902	590	SW
MT4	On perimeter of Ečka-Jugoistok Industrial Zone across road from Petrol Station	45.349093	20.423478	230	NE



Figure 5-6 Sensitive receptors surrounding the Project site

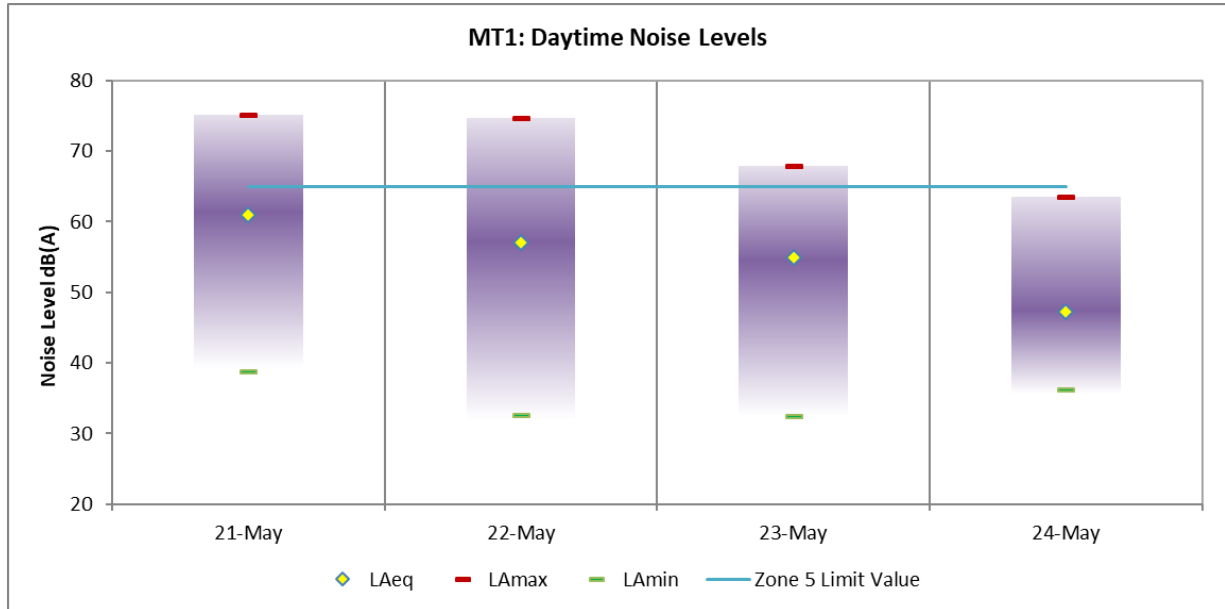
Baseline monitoring indicated current daytime noise levels at three of the four receptor locations were below the applicable Serbian limit values. Noise levels at receptor MT2 (house at 149 Hunjadi Janoš a Street, Zrenjanin) were slightly above the Serbian Zone 3 (residential) limit value of 55 dB(A). Current evening noise levels at all receptor locations were on or below the relevant Serbian limit values. Night-time noise levels at three of the four receptor locations were slightly above their respective limit values. Night-time noise levels at receptor MT3 (house at 169 Hunjadi Janoš a Street, Zrenjanin) were below the Serbian Zone 3 limit value of 45 dB(A).

Detailed results from the monitoring campaign are presented below, with equivalent continuous sound pressure levels (L_{Aeq}) assessed against the limit values of noise indicators in the open for different zones as per the above-mentioned Serbian legislation as presented in the full Environmental Noise Measurement Report (Anahem Laboratorija, 2021) is presented in **Appendix A1**.

LOCATION MT1

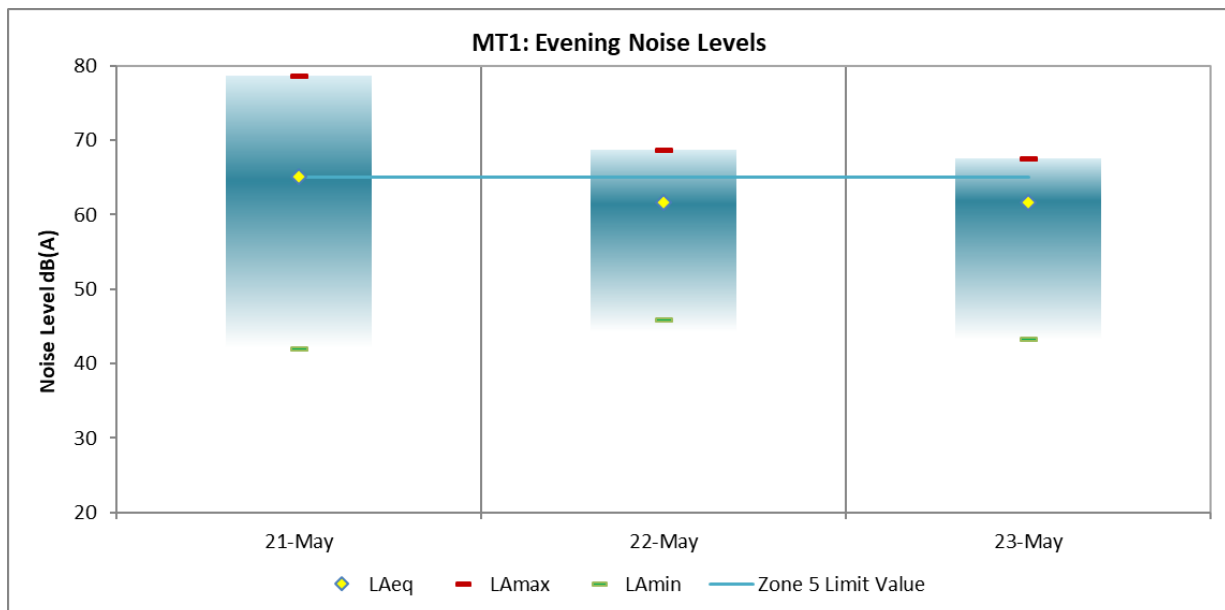
This monitoring location is located on the western side of the Belgrade-Zrenjanin Highway, in the yard of the house owned by Bojan Gavrić. Dominant sources of noise at this location included vehicles travelling on the Belgrade-Zrenjanin Highway, occasional dogs barking, industrial activities in the vicinity of the location and residential activities in the adjacent yard. The average daytime, evening and night-time monitored noise levels during the four-day monitoring period are presented in **Figure 5-7**, **Figure 5-8** and **Figure 5-9** respectively.

Daytime noise levels are below the Zone 5 limit value of 65 dB(A), with an average L_{Aeq} of 57.2 dB(A) recorded over the 4-day period. Noise levels in the evening remained just on or below the Zone 5 limit value of 65 dB(A), with an average evening L_{Aeq} of 63.1 dB(A) over the monitoring period. Night-time noise levels were slightly above the Zone 5 limit value of 55 dB(A), with an average night-time L_{Aeq} of 56.6 dB(A) recorded during the monitoring period.



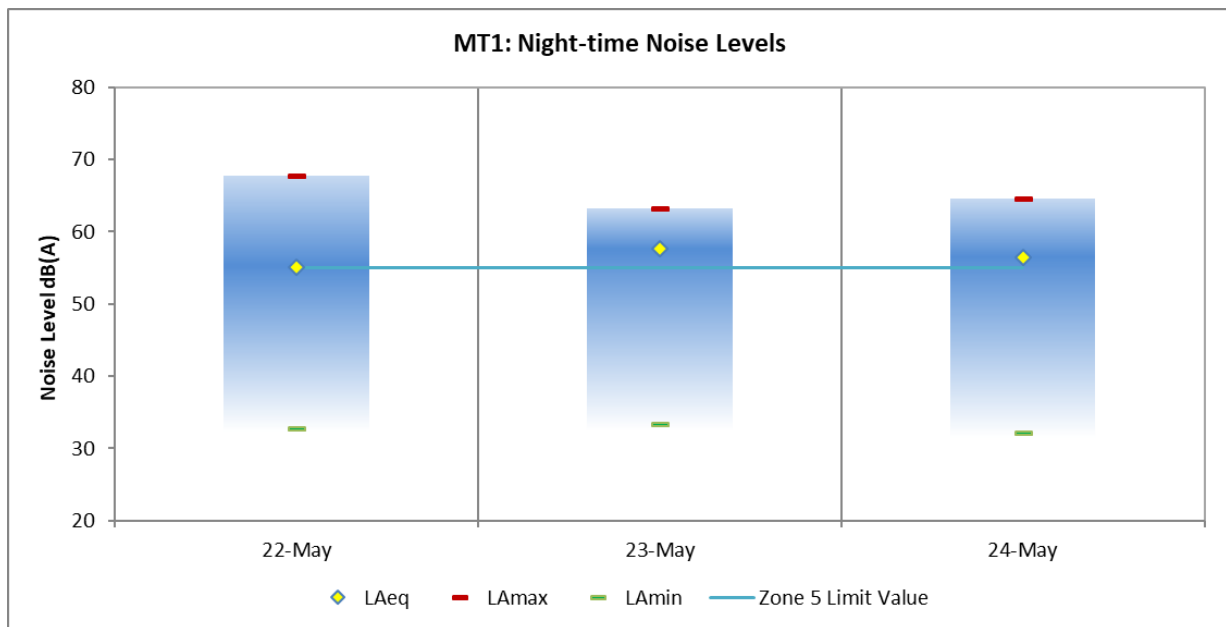
(Note: L_{Aeq} assessed against the limit value)

Figure 5-7: Daytime average noise levels at location MT1



(Note: L_{Aeq} assessed against the limit value)

Figure 5-8: Evening average noise levels at location MT1



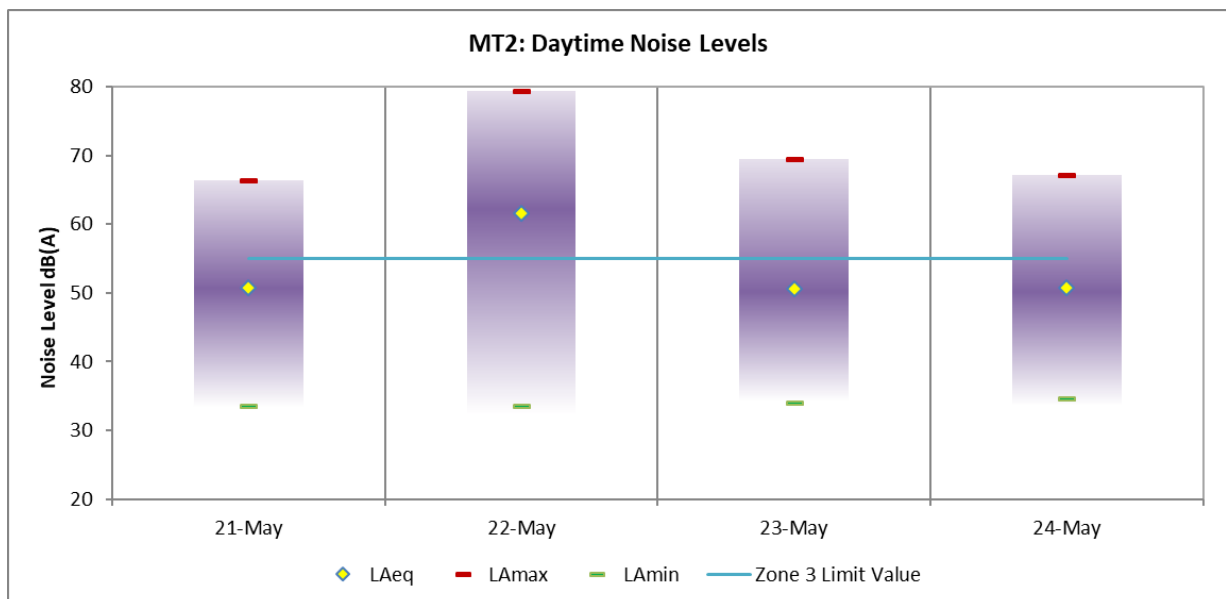
(Note: L_{Aeq} assessed against the limit value)

Figure 5-9: Night-time average noise levels at location MT1

LOCATION MT2

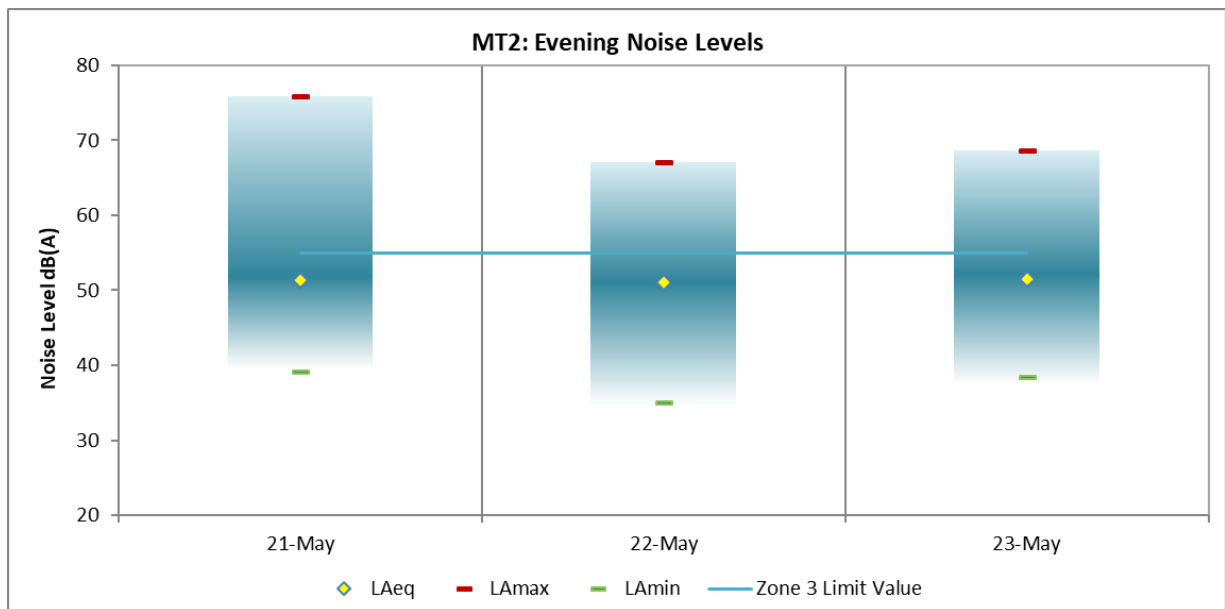
This monitoring location is situated in the yard of the house at 149 Hunjadi Janoš Street, Zrenjanin. Dominant sources of noise at this location included traffic on Hunjadi Janoš Street, trees rustling, birds and occasional influences from dogs and human activities. The average daytime, evening and night-time monitored noise levels during the four-day monitoring period are presented in **Figure 5-10**, **Figure 5-11** and **Figure 5-12** respectively.

Daytime noise levels are generally below the Zone 3 limit value of 55 dB(A) with the exception of noise levels on 22 May which resulted in an average L_{Aeq} of 56.4 dB(A) over the 4-day period. Noise levels in the evening remained just below the Zone 3 limit value of 55 dB(A), with an average evening L_{Aeq} of 51.3 dB(A) over the monitoring period. Night-time noise levels were generally around the Zone 3 limit value of 45 dB(A), with an average night-time L_{Aeq} of 45.1 dB(A) recorded during the monitoring period.



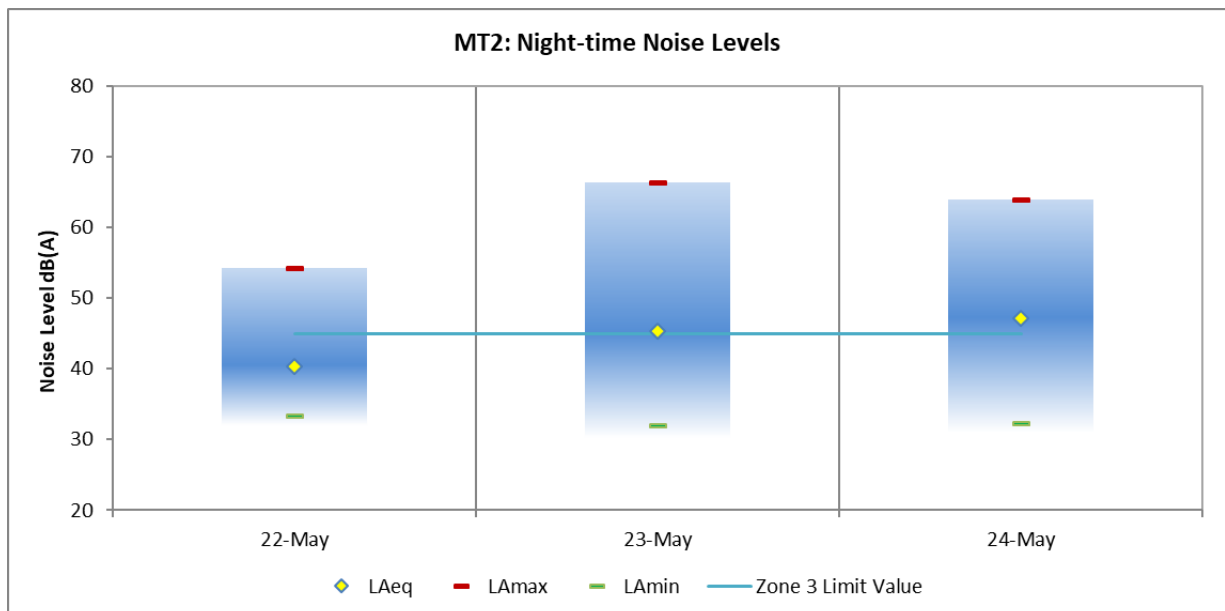
(Note: L_{Aeq} assessed against the limit value)

Figure 5-10: Daytime average noise levels at location MT2



(Note: L_{Aeq} assessed against the limit value)

Figure 5-11: Evening average noise levels at location MT2



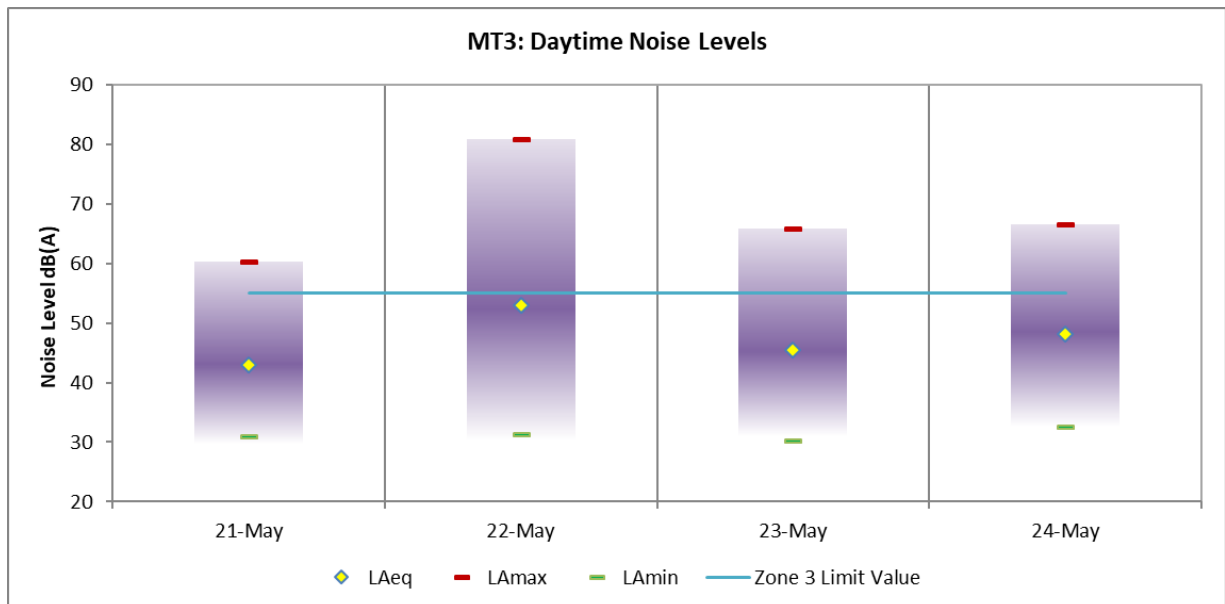
(Note: L_{Aeq} assessed against the limit value)

Figure 5-12: Night-time average noise levels at location MT2

LOCATION MT3

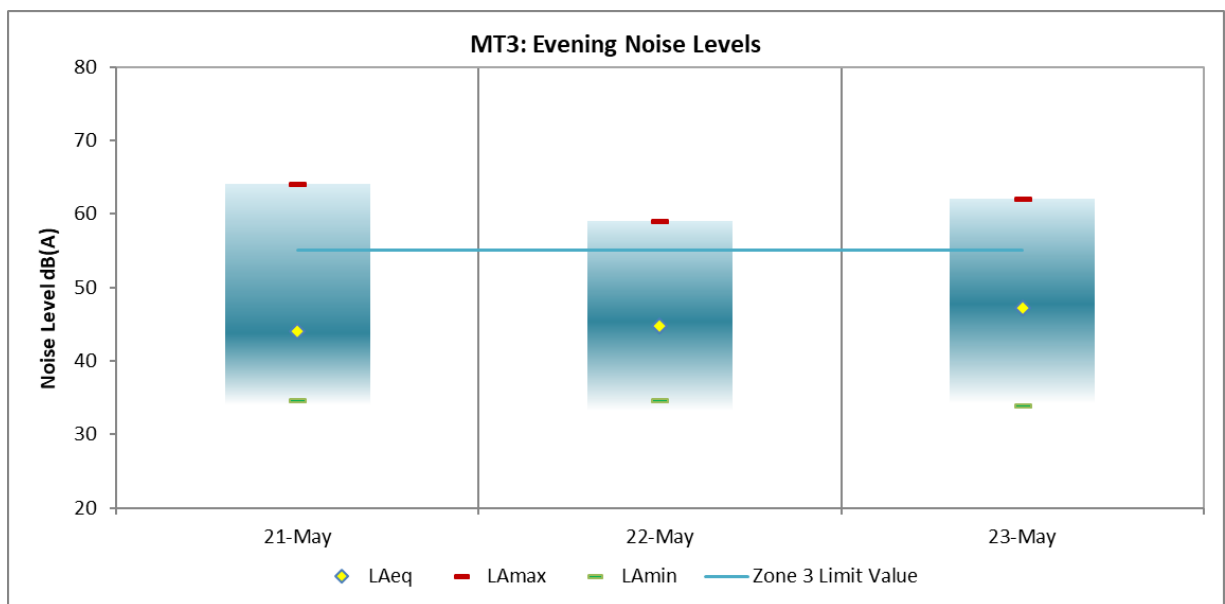
This monitoring location is situated in the yard of the house at 169 Hunjadi Janoša Street, Zrenjanin. Dominant sources of noise at this location included traffic on Hunjadi Janoša Street, trees rustling, birds and occasional influences from dogs and human activities. The average daytime, evening and night-time monitored noise levels during the four-day monitoring period are presented in **Figure 5-13**, **Figure 5-14** and **Figure 5-15** respectively.

Daytime noise levels are below the Zone 3 limit value of 55 dB(A), with an average L_{Aeq} of 49.0 dB(A) recorded over the 4-day period. Noise levels in the evening remained below the Zone 3 limit value of 55 dB(A), with an average evening L_{Aeq} of 45.6 dB(A) over the monitoring period. Night-time noise levels were below the Zone 3 limit value of 45 dB(A), with an average night-time L_{Aeq} of 41.3 dB(A) recorded during the monitoring period.



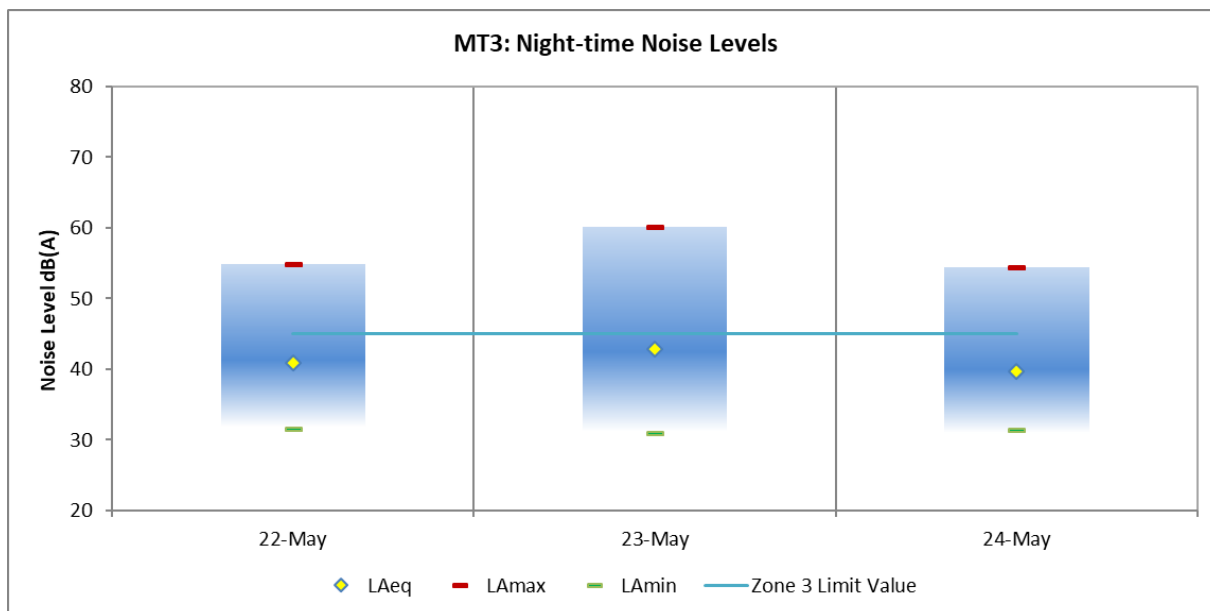
(Note: L_{Aeq} assessed against the limit value)

Figure 5-13: Daytime average noise levels at location MT3



(Note: L_{Aeq} assessed against the limit value)

Figure 5-14: Evening average noise levels at location MT3



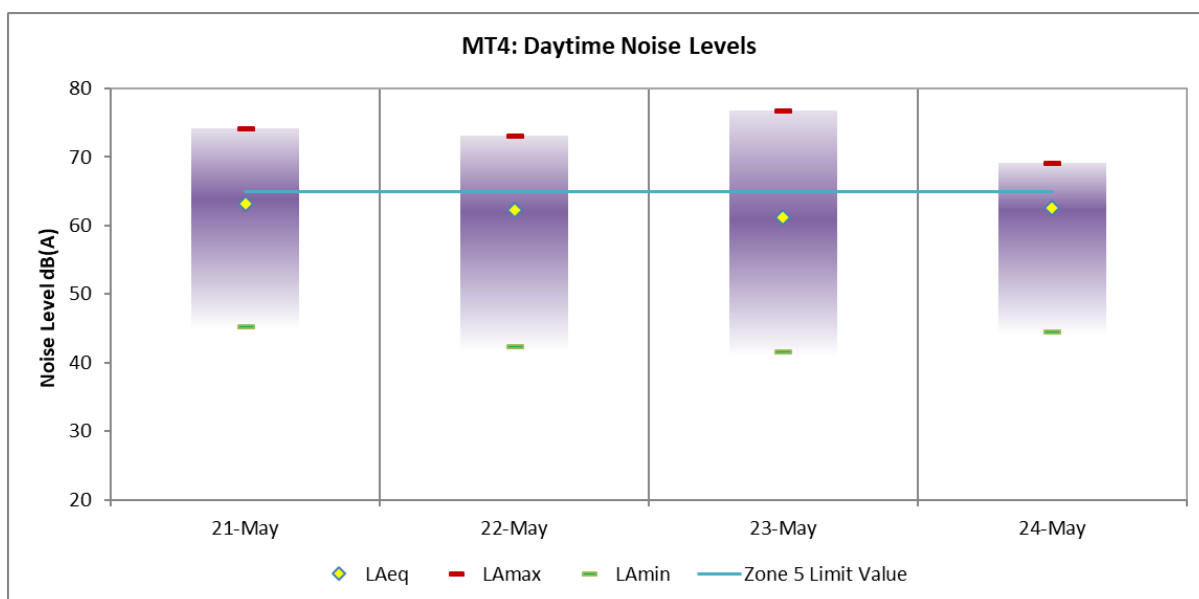
(Note: L_{Aeq} assessed against the limit value)

Figure 5-15: Night-time average noise levels at location MT3

LOCATION MT4

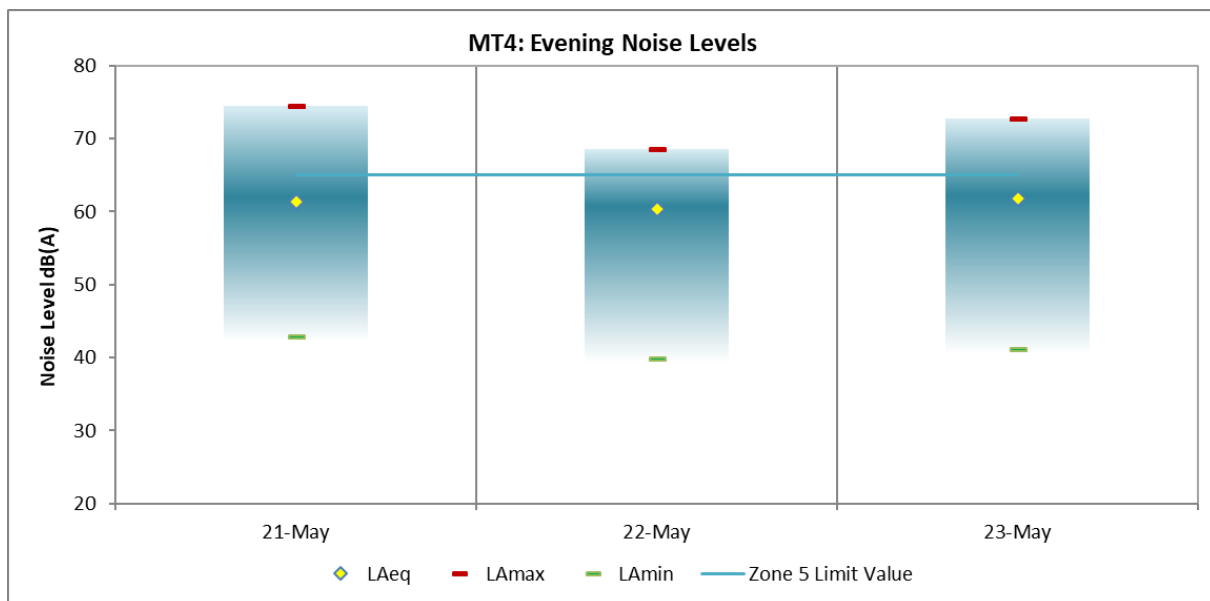
This monitoring location is located on the eastern side of the Belgrade-Zrenjanin Highway, on the perimeter of the Ečka-Jugoistok Industrial Zone, across the road from the petrol station. Dominant sources of noise at this location included vehicles travelling on the Belgrade-Zrenjanin Highway and industrial activities in the vicinity of the location. The average daytime, evening and night-time monitored noise levels during the four-day monitoring period are presented in **Figure 5-16**, **Figure 5-17** and **Figure 5-18** respectively.

Daytime noise levels are below the Zone 5 limit value of 65 dB(A), with an average L_{Aeq} of 62.4 dB(A) recorded over the 4-day period. Noise levels in the evening remained below the Zone 5 limit value of 65 dB(A), with an average evening L_{Aeq} of 61.2 dB(A) over the monitoring period. Night-time noise levels were slightly above the Zone 5 limit value of 55 dB(A), with an average night-time L_{Aeq} of 56.1 dB(A) recorded during the monitoring period.



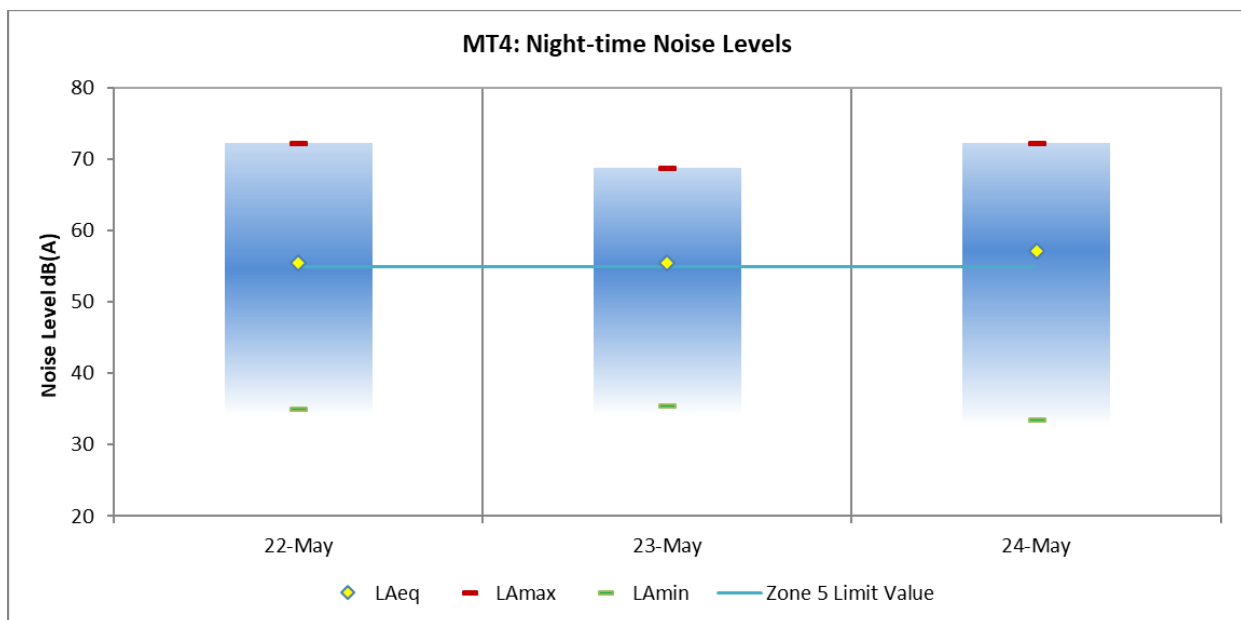
(Note: L_{Aeq} assessed against the limit value)

Figure 5-16: Daytime average noise levels at location MT4



(Note: L_{Aeq} assessed against the limit value)

Figure 5-17: Evening average noise levels at location MT4



(Note: L_{Aeq} assessed against the limit value)

Figure 5-18: Night-time average noise levels at location MT4

5.1.4 GEOLOGY AND SOILS

REGIONAL

According to its seismological – geological characteristics, the area of the town and municipality of Zrenjanin belongs to the region of rare and moderate earthquakes. The whole municipality region belongs to V00 seismic zone. According to the pedological chart of Vojvodina, the town area is macroscopically divided into only two pedological categories: carbonate chernozem in the upper part of “lesna terasa” (loose yellowish soil of rock origin) and “solonjec” – salt-springs in the Begej valley. However, according to some local pedological researches which were conducted for certain detailed urbanistic solutions and according to general acquaintance

with the situation, it is more probable that the areas marked on the mentioned table as “solonjec”, actually represent variation of marshy dark, fertile humus soil “crnica”, and “smonica” (dark soil full of clay).

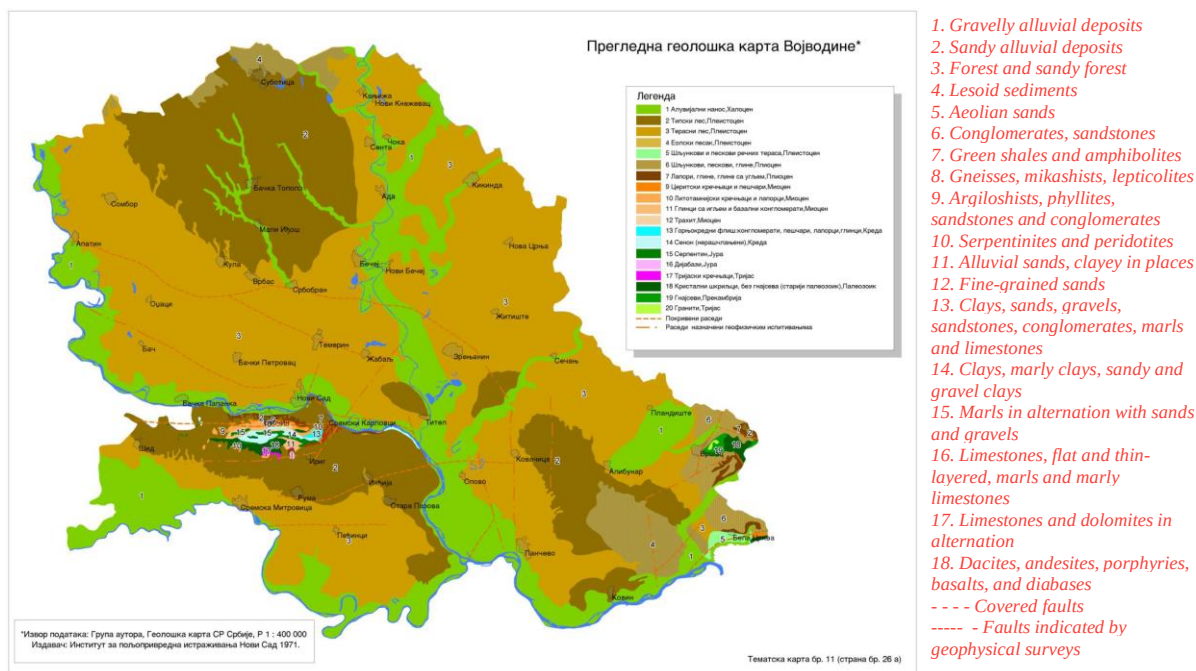


Figure 5-19 Regional Geology

SOIL QUALITY

As part of the ESIA, shallow (0-1m) and deep (2-3m) soil samples were collected by ANAHM d.o.o. on 05/18/2021 at four locations around the proposed WWTP location (Table 5-6 / Figure 5-22).

Table 5-6 Soil Sampling Designations and Locations

REF	SAMPLE LABLE	SAMPLE LABLE - LOCATION	DEPTH	GPS COORDINATES	
SS1	2104051101	Former agricultural land approx. 100m west of the WWTP	0-1m	N 45° 20' 44,01"	E 20° 25' 15,22"
	2104051102		2-3m		
SS2	2104051107	Agricultural land approx. 80m Northwest of the proposed WWRP	0-1m	N 45° 20' 51,98"	E 20° 25' 11,33"
	2104051108		2-3m		
SS3	2104051103	Lawn / former agricultural land approx. 40m east of the WWTP. Currently designated the Nis Pump and Bike Track	0-1m	N 45° 20' 49,69"	E 20° 25' 20,75'
	2104051104		2-3m		
SS4	2104051105	Lawn approx. 125m northeast of the WWTP and 25m west of the commercial fuel filling station. Currently designated the Nis Pump and Bike Track	0-1m	N 45° 20' 54,09"	E 20° 25' 20,98"
	2104051106		2-3m		



Figure 5-20 Soil Sampling Locations

The overall test procedure consisted of consideration of location, introducing an earlier technological processes, sampling, transport of samples to the Anahem laboratory, performing chemical analysis and processing of experimental data. During sampling and testing were used standard or validated accredited methods. Soil sampling was carried out by the ISO 18400:2017 method, and laboratory tests were performed according to the methods detailed in the full analytical report (**Appendix A2**).

The physico-chemical test results recorded nickel in excess of the limit values at SS4 (shallow and deep) and SS2 (deep); and, chromium in excess of the limit values at SS2 (deep).

In all instances, however, the results were below their respective soil remediation values and, with reference to Anahem Laboratory Report No. 11040505-2, dated 03 June 2021, both were recorded below detection ($<10\mu\text{g/l}$) within the underlying groundwater.

On this basis, it is considered unlikely that remedial efforts will be necessary to address impacts relating to chromium and/or nickel within the soils given the intended development.

5.1.5 TOPOGRAPHY

The territory of the town of Zrenjanin is located in the central part of Banat and covers an area of 1,326 km². The whole area of Zrenjanin is predominantly flat terrain (elevation between 70 and 80 m.a.s.l.). Geomorphological settings comprise flat swampy areas, river terraces (alluvial plain of the Tisza, the Danube, the Begej and the Tamis River) and slightly elevated terrains (loess terraces and plateaus).

5.1.6 HYDROLOGY AND WATER QUALITY

HYDROLOGY

The area of Zrenjanin is the densest river and canal hub in Europe. Zrenjanin lies on the banks of the river Begej, and only ten kilometers west of the city flows the river Tisza, the largest tributary of the Danube. The confluence of the Tisza and the Danube, about thirty kilometers southwest of Zrenjanin, represents the administrative border of the territory of the City. The fourth river in the city is the Tamis.

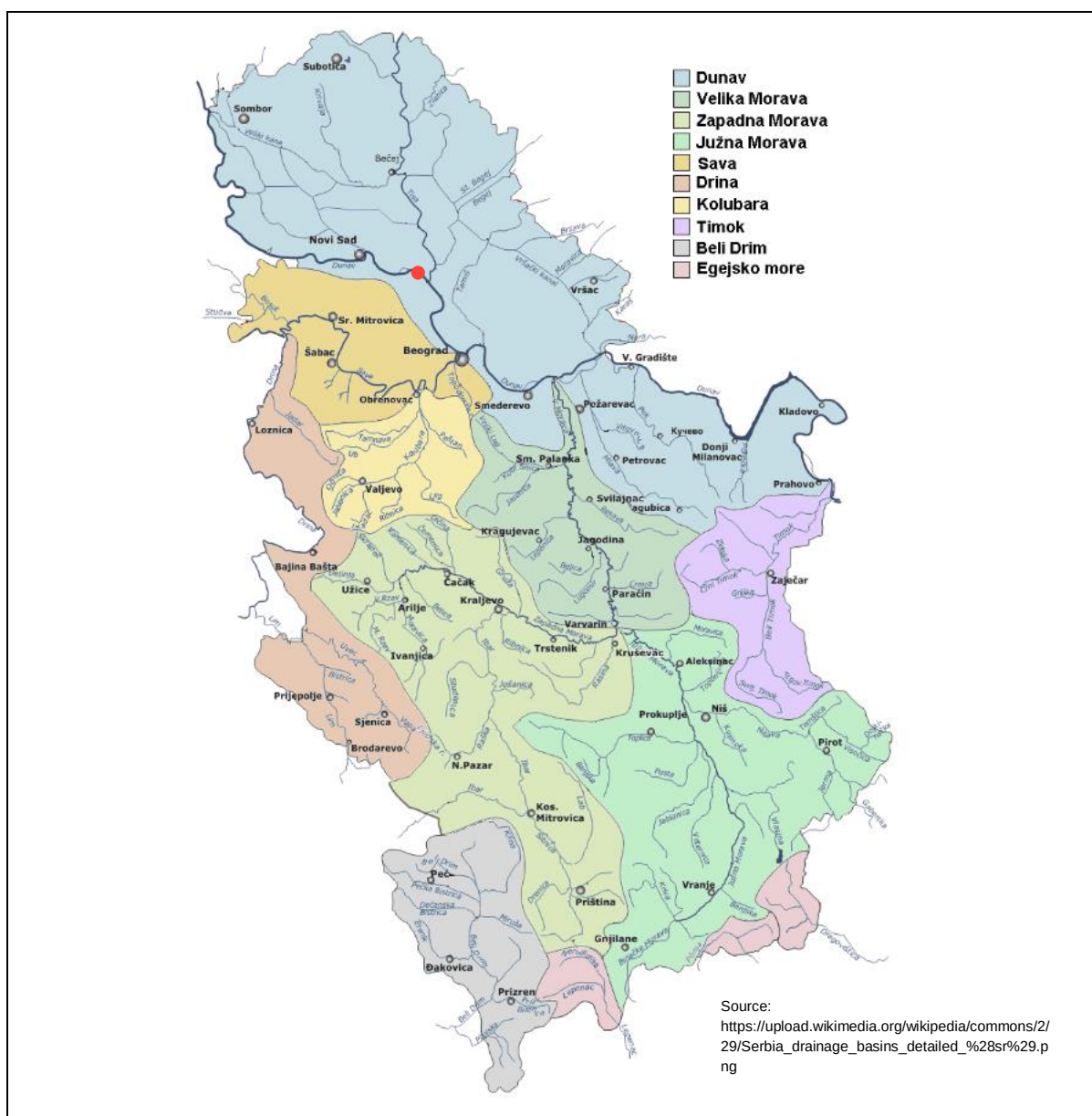


Figure 5-21 Drainage Basins and Rivers of Serbia

The Begej River springs in the Carpathian region of Romania and flows through Banat as a left tributary of the Tisza. It flows into the river Tisza near the settlement of Perlez. The river is 254 km long, of which 76 km is in Serbia. From Timisoara to Zrenjanin and further to the mouth, it was turned into a navigable so-called Begej Canal. The old Begej canal, a canalized riverbed, is 97 km long, and the new one 83 km (to Timisoara).

The Tisza River is the largest tributary of the Danube (966 km, catchment area 157,186 km²). It springs in the Carpathians, in Ukraine, at 1,800 m above sea level and flows through the Pannonian basin - it originates from the White and Black Tisza. Through Serbia it flows in the length of 207 km, to the confluence with the Danube near Slankamen. Tisza River partly forms the administrative border of the town of Zrenjanin and the Central Banat District.

The Tamis River originates in Romania, in the Transylvanian Alps. It flows into the Danube with several tributaries, and the main one flows near Pančevo. The length of the river in Serbia is about 123 km, and the entire course is 352 km. It is navigable at the mouth. The main port is in the Municipality of Pančevo.

The Danube River is an international river. It springs in Germany in the Black Forest, flowing towards the Black Sea. It flows through Germany, Austria, Slovakia, Hungary, Serbia, Bulgaria, Romania and Russia. It enters

Serbia near Mohács, flows in the length of 591 km, and leaves it at the mouth of Timok. It is navigable throughout its course in Serbia.

The Danube-Tisa-Danube canal (DTD) occupies a significant place in the development of the economy of Bačka and Banat, but also of the wider area. DTD hydraulic system has multiple purposes:

- Reception and implementation of waters coming from the territory of other countries around 3.0 billion m³ / year;
- Reception and drainage of water from the drainage system of agricultural and other land whose area is about 1,085,000 ha;
- Supply of water for the needs of irrigation systems, ponds, farms, industry and settlements, about 270 million m³ / year;
- Reception, implementation and dilution of used water from industry, farms and settlements 1.0 billion m³ / year;
- Navigation through canals for vessels with a carrying capacity of 200 to 1,000 t;
- Flood defence;
- Fishing, recreation and tourism.

WATER QUALITY

As part of the ESIA, water quality samples were collected by ANAHEM d.o.o. on 05/27/2021 at two locations upstream and six locations downstream of the current discharge point of the Aleksandrovacki canal (**Table 5-7 / Figure 5-22**).

Table 5-7 Surface Water Sampling Locations

REF	SAMPLE LABLE - LOCATION	GPS COORDINATES	
SW1	1104050501 – Begej River 150m upstream from the outflow channel	N 45°20'46,00"	E 20°25'5,59"
SW2	1104050502 - Begej River 250m upstream from the outflow channel	N 45°20'42,70"	E 20°25'7,93"
SW3	1104050503 – Begej River 25m downstream from the outflow channel	N 45°20'40,54"	E 20°25'9,09"
SW4	1104050504 - Begej River 75m downstream from the outflow channel	N 45°20'38,80"	E 20°25'10,11"
SW5	1104050505 – Begej River 125m downstream from the outflow channel	N 45°20'37,26"	E 20°25'11,56"
SW6	1104050506 - Begej River 175m downstream from the outflow channel	N 45°20'35,13"	E 20°25'13,74"
SW7	1104050507 – Begej River 225m downstream from the outflow channel	N 45°20'33,74"	E 20°25'15,90"
SW8	1104050508 - Begej River 275m downstream from the outflow channel	N 45°20'32,16"	E 20°25'18,03"



Figure 5-22 Surface Water Sampling Locations

Water samples were analysed and compared with the maximum permitted limit values (GV) prescribed by the Rulebook on parameters of ecological and chemical status of surface waters and parameters of chemical and quantitative status of groundwater (Official Gazette of RS, 74/2011) and maximum permitted values according to Regulation on the limit values of pollutants in surface and groundwater and sediment and deadlines for their achievement (Official Gazette of RS 50/2012). See full analytical report in **Appendix A3**.

RS 50/2012 Water Quality Classes

- **Class I** - excellent ecological status. Surface waters belonging to this class provide conditions for the functioning of ecosystems, life and protection of fish (salmonids and cyprinids) based on the limit values of quality elements and can be used for the following purposes: drinking water supply with prior treatment by filtration and disinfection, bathing and recreation, irrigation, industrial use (process and cooling water).
- **Class II** - good ecological status. Surface waters belonging to this class provide conditions for the functioning of ecosystems, life and protection of fish (cyprinids) on the basis of limit values of quality elements and can be used for the same purposes and under the same conditions as surface waters belonging to class I.
- **Class III** - moderate ecological status. Surface waters belonging to this class provide living conditions and protection of cyprinids on the basis of limit values of quality elements and can be used for the following purposes: drinking water supply with prior treatment by coagulation, flocculation, filtration and disinfection, bathing and recreation, irrigation, industrial use (process and cooling water).
- **Class IV** - poor ecological status. Surface waters belonging to this class based on the limit values of quality elements can be used for the following purposes: drinking water supply with a combination of the above treatments and advanced treatment methods, irrigation, industrial use (process and cooling water).
- **Class V** - poor ecological status. Surface waters belonging to this class may not be used for any purpose.

The following can be concluded from the results:

Sample SW1 (1104050501) predominantly corresponds to the class I water quality, except for the TOC and arsenic parameter corresponding to the class II water quality. COD, BOD, total phosphorus, dissolved oxygen,

oxygen saturation and total coliforms belong to class III, the nitrite parameter belongs to class IV surface waters. The value of ammonium ion classifies water as Class V surface water. Regarding the microbiological classification of the quality of this sample, it can be concluded that the Danube waters at the location Belegiš-preliv belong to the total coliform bacteria class II surface water for coliform bacteria and aerobic heterotrophs correspond to class III water, while for intestinal enterococci correspond to class IV water.

Sample SW2 (1104050502) predominantly corresponds to the class I water quality, except for the TOC and BOD parameter which correspond to the class II water quality. COD, total phosphorus, oxygen saturation and total coliforms belong to class III; the dissolved oxygen parameter belongs to class IV surface water. The value of ammonium ion and nitrites correspond to the class V water quality.

Sample SW3 (1104050503) predominantly corresponds to the class I water quality, except for the parameters TOC, BOD and dissolved oxygen which correspond to the class II water quality. The COD parameter belongs to class III; the total coliform parameter belongs to class IV surface waters. The value of ammonium ion and nitrites correspond to the class V water quality.

Sample SW4 (1104050504) predominantly corresponds to the class I water quality, except for the TOC and arsenic parameters that correspond to the class II water quality. COD, BOD and total phosphorus belong to class III, the parameter oxygen saturation and total coliforms belong to class IV surface waters. The value of ammonium ion and nitrites correspond to the class V water quality.

Sample SW5 (1104050505) predominantly corresponds to the class I water quality, except for the TOC and arsenic parameters that correspond to the class II water quality. COD, BOD and total coliforms belong to class III, the parameter oxygen saturation and total phosphorus belong to class IV surface waters. The value of ammonium ion and nitrites correspond to the class V water quality.

Sample SW6 (1104050506) predominantly corresponds to the class I water quality, except for TOC and arsenic parameters that correspond to the class II water quality. COD, BOD and total coliforms belong to class III, the parameter oxygen saturation and total phosphorus belong to class IV surface waters. The value of ammonium ion and nitrites correspond to the class V water quality.

Sample SW7 (1104050507) predominantly corresponds to the class I water quality, except for the TOC parameter which belongs to class II; COD, BOD and total coliforms belonging to class III, parameters dissolved oxygen, oxygen saturation and total phosphorus belong to class IV surface waters. The value of ammonium ion corresponds to the class V water quality.

Sample SW8 (1104050508) predominantly corresponds to the class I water quality, except for the TOC parameter, which belongs to class II; nitrites, COD, BOD, oxygen saturation, dissolved oxygen and total coliforms belong to class III, the parameter total phosphorus belongs to class IV surface waters. The value of ammonium ion corresponds to the class V water quality.

Table 5-8 Water Sample Results - Class according to Official Gazette of RS, No. 50/2012, Annex 1, Tables 1, 2 And 3

TEST PARAMETER	CLASS							
	Upstream		Downstream					
Relation to Aleksandrovački canal discharge point into the Begej River	WS1	WS 2	WS 3	WS 4	WS 5	WS 6	WS 7	WS 8
Sample Ref:								
pH	I	I	I	I	I	I	I	I
Electrical conductivity, µS/cm	I	I	I	I	I	I	I	I
Ammonium ion, expressed as N (NH ₄ -N) mgN/l	V	V	V	V	V	V	V	V
Total organic carbon (TOC) mg/l	II	II	II	II	II	II	II	II
Suspended solids, mg/l	I/II	I/II	I/II	I/II	I/II	I/II	I/II	I/II
Nitrates mgN/l	IV	V	V	I	I	I	I	V
Nitrites mgN/l	I	I	I	I	I	I	I	I
Chlorides, mg/l	I	I	I	I	I	I	I	I

Chemical oxygen	III	III	III	III	III	III	III	III
Biochemical oxygen consumption (BOD) mg/l	III	II	II	III	III	III	II	II
Arsenic, µg/l	II	I	I	II	II	II	I	I
Copper µg/l	I	I	I	I	I	I	I	I
Zinc µg/l	I	I	I	I	I	I	I	I
Total iron, µg/l	I	I	I	I	I	I	I	I
Total phosphorus, mg P/l	IV	IV	V	IV	IV	IV	IV	IV
Oxygen saturation, %	III	III	I	II	IV	IV	IV	III
Dissolved oxygen mg/l	II	III	II	I	V	V	IV	III
Total coliform bacteria in 100 ml	III	III	IV	IV	III	III	III	III

5.1.7 HYDROGEOLOGY

REGIONAL

In terms of hydrogeological properties, in the Zrenjanin area there is a compact type issued formed within:

- Quaternary sediments of Holocene age (compacted type issued with a free level that depends on the surface of the terrain to a depth of about 30 m);
- Quaternary sediments of Pleistocene age (compacted type issued under pressure that lies in the interval from 40 to 70 m depth - the first subarterial issued);
- Neogene sediments of Pliocene age (compacted type issued under pressure that lies in the interval from 100 to 130 m depth - other subarter issued).

The compacted type issued with a free level was formed within the clayey sands of Quaternary sediments of Holocene age. The groundwater level varies from 3 to 7 m depth.

From the first subartesian issued within the sediments of Pleistocene age, waters in the area of Zrenjanin within the city spring are captured. The lower limit of this issue is at a depth of about 70 m. Sediments are represented by siltstone sands, sandy siltstones and medium-grained sands. The waters of this release have a mineralization of 800 mg / l, a pH of about 8 while the chloride content is 8 mg / l. The waters of this release have an increased content of ammonium ions, iron and manganese ions and an increased content of organic matter.

The second subartesian issue was formed within the sediments of Pliocene age. Sediments are represented by sands, sandy siltstones in the interval from 100 to 126 m depth. It is released in the uplift and bottom limited by clay sediments with a variable amount of sand fraction.

The waters of this issue have a mineralization of about 850 mg / l, pH about 8.1, chloride content of 6.5 mg / l, sodium 266 mg / l, calcium 14.8 mg / l and magnesium 12.1 mg / l.

In the low coastal area, groundwater levels are directly affected by river levels. In areas away from rivers (light terrace), the groundwater level is more uniform, and the changes depend on the characteristics of the hydrological year, season and phase in the multi-year cycle of the groundwater regime.

GROUDWATER QUALITY

As part of the ESIA, piezometers were installed to a depth of 8-10m at two locations on the project site (**Table 5-9/ Figure 5-24**). Groundwater quality samples were collected from these piezometers by ANAHEM d.o.o. on 05/27/2021.

Table 5-9 Groundwater Sampling Locations

REF	SAMPLE LABLE - LOCATION	GPS COORDINATES	
BH1	1104050509 - PZ-1 – Down-hydraulic gradient of the proposed WWTP site	N 45°20'45.10"	E 20°25'10.26"
BH2	1104050510 - PZ-2 – Up-hydraulic gradient of the proposed WWTP	N 45°20'52,44"	E 20°25'20,73"



Figure 5-23 Surface Water Sampling Locations

Groundwater samples were analysed and compared with the Limit Values of Polluting, Harmful and Hazardous Substances in Soil ("Official Gazette Of RS", No. 30/2018 and 64/2019, Annex 2: Remediation Values of Pollutants, Harmful and Dangerous Substances in the Aquifer); and, Maximum Permitted Values according to the Regulation on Limit Values Of Pollutants in Surface and Groundwater and Sediment and Deadlines for their Achievement (Official Gazette of RS 50/2012).

The physico-chemical test results recorded arsenic above its published remediation value (60µg/l - Official Gazette Of RS", No. 30/2018 And 64/2019, Annex 2) within both groundwater samples collected (90µg/l and 110µg/l). See full analytical report in **Appendix A4**.

Providing Context to Arsenic Exceedences in Groundwater Samples

Regarding the exceedences of Arsenic in both groundwater samples, it is must be acknowledged that the project area forms part of the southern portion of the Pannonian Basin, a sediment-filled geological basin that centres on Hungary but that extends across northern Serbia and the Vojvodina Province in which Zrenjanin is situated.

Rowland *et al.*, 2009, acknowledge that groundwater in the Pannonian Basin is known to contain naturally elevated levels of arsenic, and such have been reported in the Vojvodina Province (Vidovic *et al.*, 2006; Stauder, 2007; Djuric and Jevtic, 2008). Papic *et al.*, 2012, report a recorded maximum arsenic concentration in groundwater of 217µg/l within the Central Banat District, of which Zrenjanin is the administrative centre, which compares well with earlier reported arsenic concentrations ranging from 5–349µg/l within Serbian groundwater (Jovanovic *et al.*, 2011). The two values recorded within the collected groundwater samples fall well within this range and, therefore, are almost certainly related to the regional groundwater signature. Whilst expectedly of a much lower magnitude, this regional signature is supported by the arsenic concentrations recorded within eight surface water samples collected from up- and downstream locations along the adjacent Begej River that ranged from 4.0–6.6µg/l (Anahem Laboratory Report No. 11040505-1, dated 03 June 2021). Moreover, arsenic was consistently recorded below its dry matter converted limit values within the soil samples collected across the site

and, therefore, there's no evidence to suggest an origin relating to either historical site activities or infilling materials.

With respect to arsenic within the Pannonian Basin, it is notable that “published estimates suggest nearly 500,000 people are exposed to levels greater than the EU maximum admissible concentration of 10 µg/l in their drinking water, making it the largest area so affected in Europe” (Rowland *et al.* 2009).

5.2 BIOLOGICAL ENVIRONMENT (DESKTOP)

5.2.1 BIODIVERSITY & CONSERVATION

A variety of datasets have been considered and reviewed in order to provide a suitable description of the project area, whilst also considering the surrounding areas. **Table 5-10** presents an overview of datasets, which were considered for this assessment. A comment has been provided for each dataset to describe the data and the relevance in the context of the project.

Table 5-10 Datasets considered for the description of the project area and corresponding comments

DATASET	COMMENT
Global Critical Habitat Screening Layer (UNEP-WCMC (2017)) This screening layer presents the global spatial distribution of likely or potential Critical Habitat (CH), as defined by the IFC PS6 criteria.	Based on this dataset no CH is expected for the project area. CH is expected downstream within the Carska Bara Nature Reserve.
Protected Areas (IUCN and UNEP-WCMC (2016)) This dataset displays areas that are legally protected according to various designations and managed to achieve conservation objectives.	The World Database on Protected Areas indicates the Carska Bara Nature Reserve (IUC N Category IV) is located approximately 6 km (off channel) downstream of the discharge area. This Reserves occupies 1 767 ha.
RAMSAR (IUCN and UNEP-WCMC (2016))	Stari Begej / Carska Bara Special Nature Reserve is located approximately 6 km (of channel) downstream of the discharge area (45°15'N 020°23'E). Special Nature Reserve, the site is a remnant of the once flooded area in the lower Begej River
Biodiversity Hotspots A biodiversity hotspot is a biogeographic region that is both a significant reservoir of biodiversity and is threatened with destruction.	No hotspots are close to the project area.
Key Biodiversity Area (KBA) (BirdLife International, 2020) Boundaries of Key Biodiversity Areas are defined as 'sites contributing significantly to the global persistence of biodiversity'.	The Carska Bara Key Biodiversity Area is located approximately 6 km downstream of the discharge location.
Alliance for Zero Extinction (AZE) sites (2010) This dataset displays critical sites for conservation that contain endangered species with limited ranges and populations found nowhere else on the planet.	No AZE sites are close to the project area.

Endemic Bird Areas (EBA) (Stattersfield <i>et al.</i>, 1998) This dataset displays areas where the geographic range of two or more endemic bird species overlaps.	No EBAs are close to the project area.
Biodiversity intactness (UNEP-WCMC and Natural History Museum) This dataset displays the impacts of forest change on local biodiversity intactness.	The intactness of the project footprint area is low, with higher intactness associated with the marginal and riparian greenbelt of the Begej River.
Biodiversity significance (IUCN, BirdLife International, and UNEP-WCMC (2016)) This dataset displays the relative importance of each pixel in terms of its aggregate contribution to the distribution of forest-dependent species of mammals, birds, amphibians, and conifers.	The significance of the project area is classified as low (the lowest classification).

5.2.2 PROTECTED / DESIGNATED AREAS

CARSKA BARA SPECIAL NATURE RESERVE

The project area is located approximately 6 km upstream of the Carska Bara Special Nature Reserve (134953WDPA ID), with the reserve situated off (channel) from the Begej River. The designation for the reserve is a Ramsar Site, which is a Wetland of International Importance that is protected for conservation. Details of the nearest designated areas are listed within **Table 5-11** below and presented in **Figure 5-24** and **Figure 5-25** presents a list of IBA trigger species. The following have been selected (from amongst others) to indicate the sub-regional criteria for the designation of the Carska Bara IBA (RS013):

- **C2. Concentrations of a species threatened at the European Union level.** Criterion: The site is known to regularly hold at least 1% of a flyway population or of the EU population of a species threatened at the EU level.
- **C3. Congregations of migratory species not threatened at the EU level.** Criterion: The site is known to regularly hold at least 1% of a flyway population of a migratory species not considered threatened at the EU level.
- **C6. Species threatened at the European Union level.** Criterion: The site is one of the five most important in the European region (NUTS region) in question for a species or subspecies considered threatened in the European Union.

Table 5-11 Protected Areas Summary

SITE NAME	DESIGNATION (AND IUCN CATEGORY)	APPROXIMATE DISTANCE & DIRECTION FROM PROJECT SITE	SITE SUMMARY
Carska Bara	Important Bird Area (IV)	6 km south	Stari Begej River and Carska Bara represents an authentic splice of water and terrestrial habitats of Pannonian plane. The entire area of Carska Bara administratively belongs to the Zrenjanin municipality (west central part of Banat district) situated near the mouth of the Begej River into the Tisa River. Habitat includes pools, fish-ponds, reedbeds, alkaline meadows and softwood forests. Ecka fishpond represents largest inland fishpond in Europe (BirdLife International, 2021).

Stari Begej-Carska bara	Ramsar Site, Wetland of International Importance	6 km south	Approximately 1 767 ha of this special nature reserve overlaps with the IBA. According to Ramsar the following is applicable, “The site, a remnant of the once flooded area in the lower Begej River, is a mosaic of fishponds, swamp, marsh, forest, meadow, and steppe intersected by rivers, canals, and embankments. Vegetation consists of salt-tolerant communities, a rich aquatic flowering plant community, and steppe vegetation. Of the 250 recorded bird species, 140 species nest at the site and 100 pass through on migration. Notably, all eight European heron species and <i>Anser anser</i> nest at the site. The diversity of biotopes gives rise to high species diversity at the site and includes various rare, endangered, or vulnerable fish, birds, plants, amphibians, reptiles and mammals. Human activities include recreation, birdwatching, sport fishing, and some traditional agricultural. There is an important commercial fishery nearby. Ramsar site no. 819. Most recent RIS information: 1994”.
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Table 5-12 Populations of IBA trigger species

SPECIES	CURRENT IUCN RED LIST CATEGORY	YEAR(S) OF ESTIMATE	IBA CRITERIA TRIGGERED
Ferruginous Duck <i>Aythya nyroca</i>	NT	2019	B1a, B1b, C6
Western Water Rail <i>Rallus aquaticus</i>	LC	2013-2019	B2a
Eurasian Bittern <i>Botaurus stellaris</i>	LC	2013	C6
Common Little Bittern <i>Ixobrychus minutus</i>	LC	2019	B1b, C6
Purple Heron <i>Ardea purpurea</i>	LC	2008-2013	B1b, C6
Great White Egret <i>Ardea alba</i>	LC	2013	C6
Pygmy Cormorant <i>Microcarbo pygmaeus</i>	LC	2013	A4, B2a, B3a, C2, C6
Black-headed Gull <i>Larus ridibundus</i>	LC	2013-2019	B3a, C3
Whiskered Tern <i>Chlidonias hybrida</i>	LC	2013-2019	B3a
Western Marsh-harrier <i>Circus aeruginosus</i>	LC	2019	C6
Hen Harrier <i>Circus cyaneus</i>	LC	2019	B1b, C6
Eurasian Penduline-tit <i>Remiz pendulinus</i>	LC	2010-2019	B2a
Savi's Warbler <i>Locustella luscinioides</i>	LC	2013-2019	B2a
Bluethroat <i>Cyanecula svecica</i>	LC	2010-2019	C6

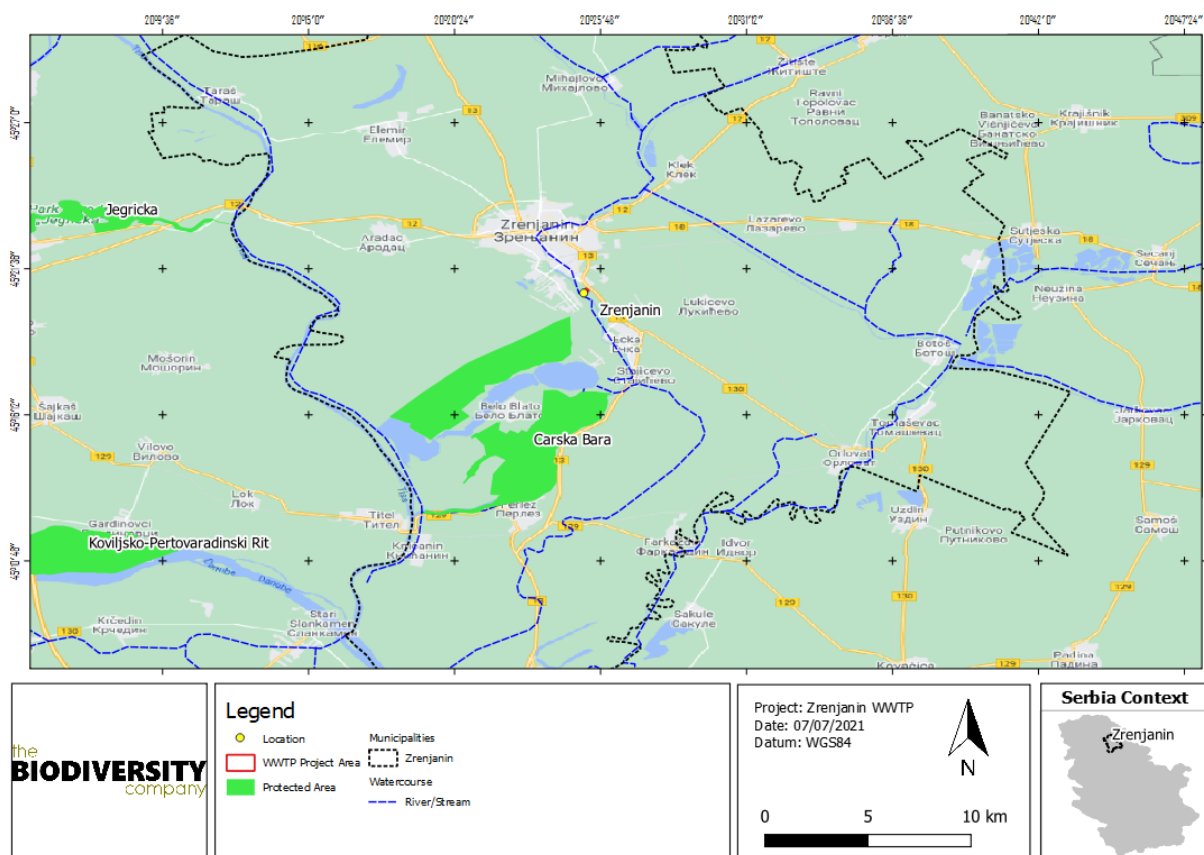


Figure 5-24 Location of the project area in relation to the Carska Bara Protected Area

5.2.3 TERRESTRIAL ECOREGION

The project area is located in the Pannonian Mixed Forests (PA0431) ecoregion (**Figure 5-25**) which is classified as critical or endangered. According to World Wide Fund for Nature (WWF) the ecoregion is described as follows:

Pannonian Mixed Forests (PA0431) Ecoregion

“This ecoregion consists of the depression surrounded by the Carpathian Mountains, Alps, and Dinaric Mountains. Avifauna diversity is high; there are fifty Important Bird Areas in this ecoregion. Lake Neusiedel with Seewinkel National Park, and other important wetlands are renowned for their bird life (Heath and Evans 2000). Resident mammals are of the widespread throughout Europe including the European rabbit (*Oryctolagus cuniculus*), wolf (*Canis lupus*), and the endangered European mink (*Mustela lutreola*). There are a number of endangered reptiles including Orsini’s viper and Balkan wall lizard. Recreation and tourism, unsustainable exploitation, development and fragmentation, agricultural abandonment, and disturbance of wildlife, are other important threats (Heath & Evans 2000). There are a number of natural parks in this ecoregion, but much of the natural habitat has been lost to agriculture.”

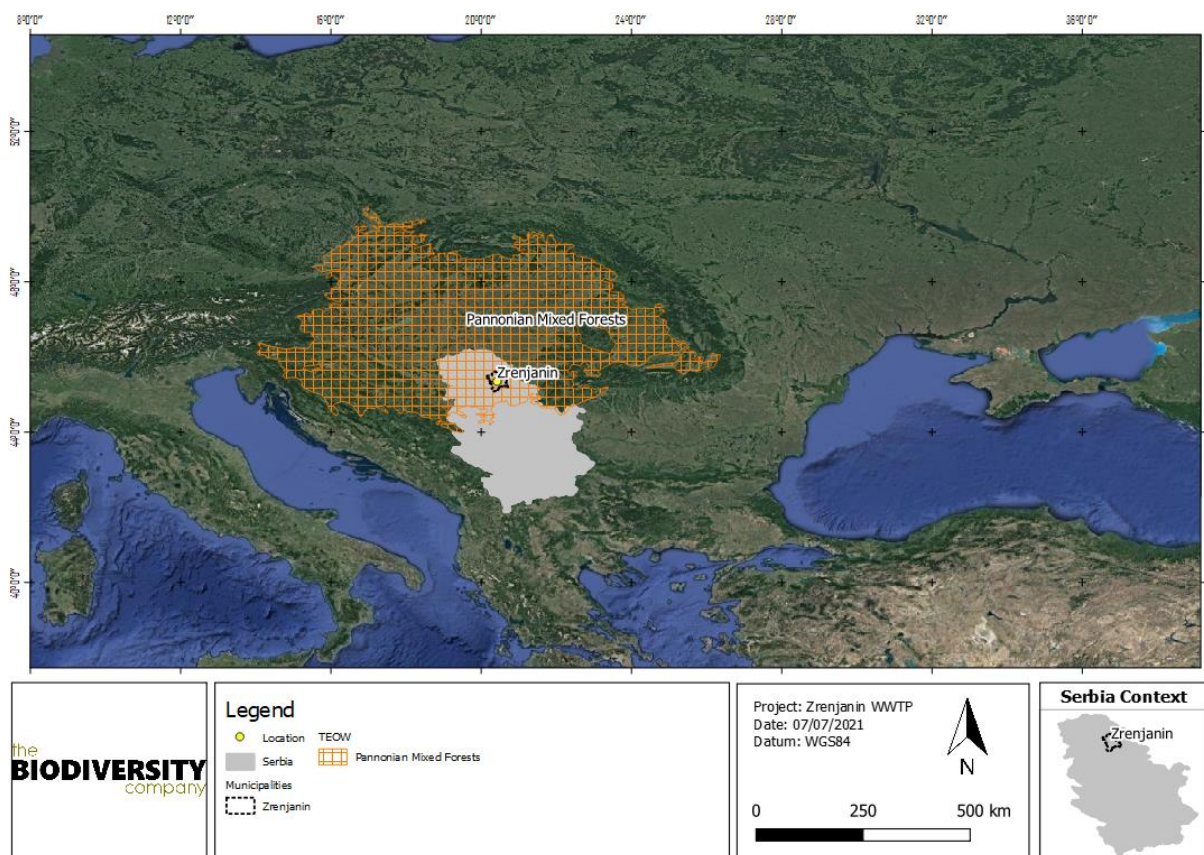


Figure 5-25 The location of the project area within the Pannonian Mixed Forests ecoregion

5.2.4 FRESHWATER ECOREGION

The project area falls within the Dniester – Lower Danube (ID: 418) ecoregion (**Figure 5-26**). According to the Freshwater Ecoregions of the World organisation, the boundaries of the ecoregion comprise the following:

“This ecoregion encompasses basins of the Dniester and Danube rivers. It shares its western and southern borders with the following ecoregions: Upper Danube, Dalmatia, Albania, Vardar, and Thrace. The ecoregion also shares borders with Central and Western Europe and Dnieper (South Bug) to the north. The northeastern border runs along the Dniester-Dnieper divide and the Podolskaya Vozvyshennost Hills, whereas the northwestern border touches the Ceski Les and Shumava ridges. The ecoregion also encompasses the Stara Planina Mountains, the main divide between the Danube drainage area (in former Yugoslavia) and the nearby rivers flowing into the Adriatic Sea, and the Danube deltaic area and coastal lakes at Konstanza (Romania).”

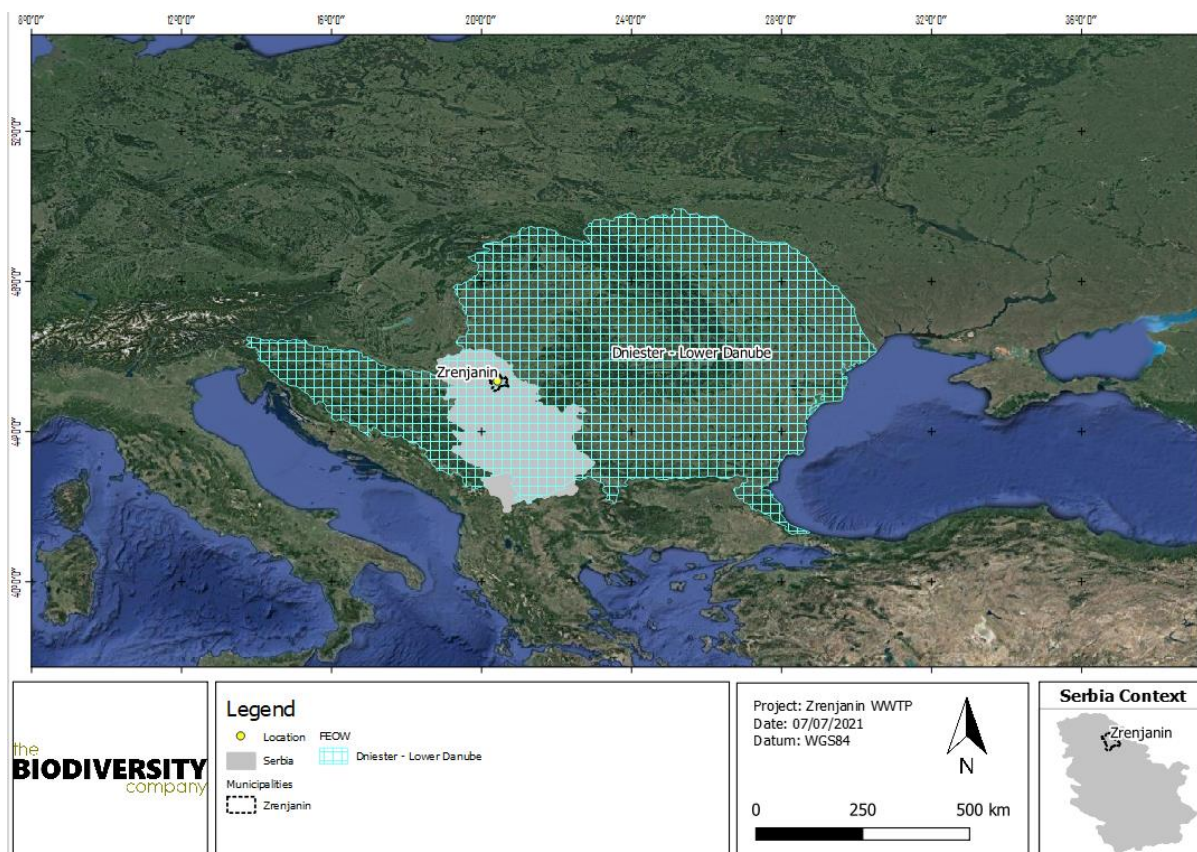


Figure 5-26 The project area falls within the Dniester Lower Danube ecoregion

5.2.5 TREE COVER

To define the status of the land use and identify areas of natural vegetation or disturbance tree cover is considered. According to Hansen *et al.* (2013) “tree cover” is defined as all vegetation taller than 5 meters (m) in height. “Tree cover” is the biophysical presence of trees and also structure which can take the form of natural forests or plantations existing over a range of canopy densities. **Figure 5-27** depicts the relatively low tree cover in the project area, especially when compared pockets of dense vegetation associated with the Begej River. This dataset (dated 2010) clearly indicates the clearing of vegetation for the proximity to the project area, this is attributed to the agricultural land uses.

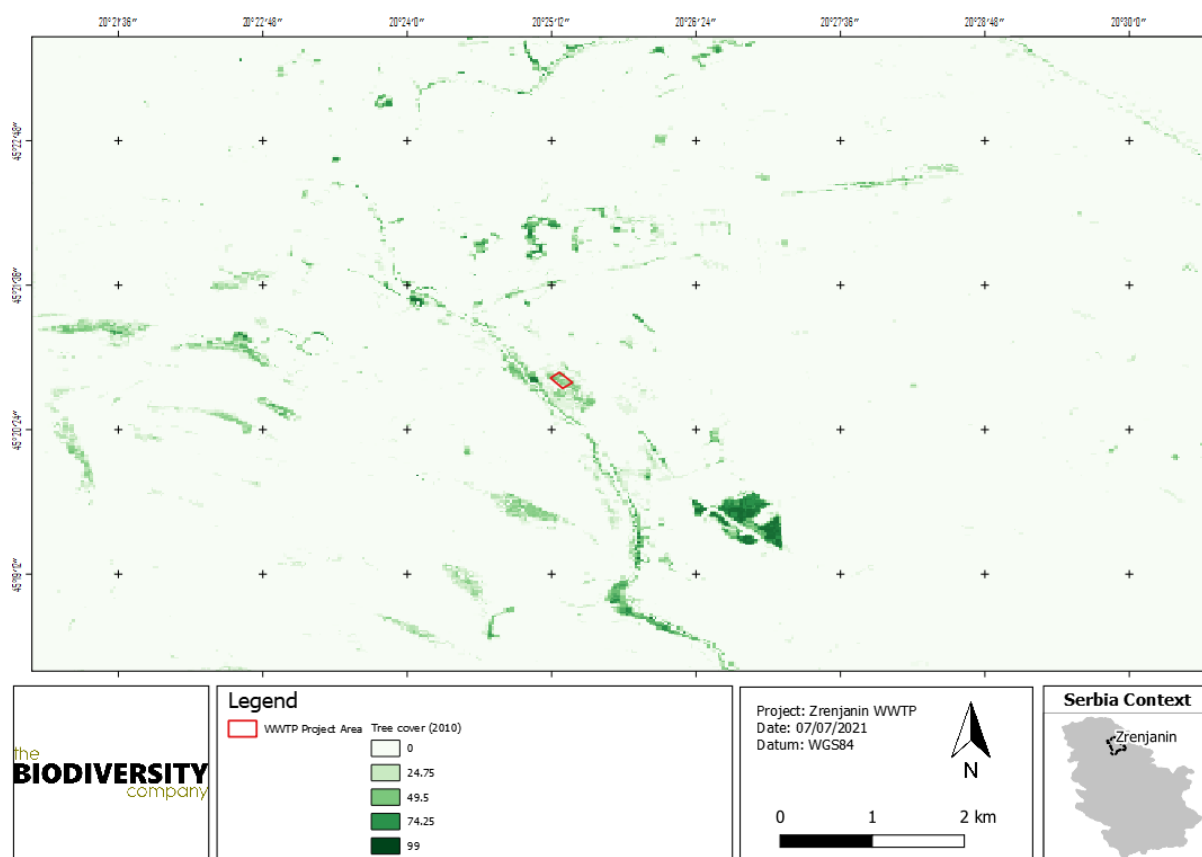


Figure 5-27 The extent of tree cover associated with the project area (Hansen *et al.*, 2013)

5.2.6 LAND COVER

To define land-use in the project area, the Global Landcover (2009) dataset was considered as a land cover spatial representation for the project area. The dataset provides a total of 22 global land cover classes, which have been summarised for the requirements of this assessment. The land cover classes include agriculture, forest, grassland, wetland, settlement, shrubland, sparse vegetation, bare area, water and permanent ice (and snow).

According to this dataset the land cover associated with the project area is dominated by a form of cropland as presented in **Figure 5-28**. It is evident from the dataset that the land cover for the larger area has been modified and does not represent natural conditions.

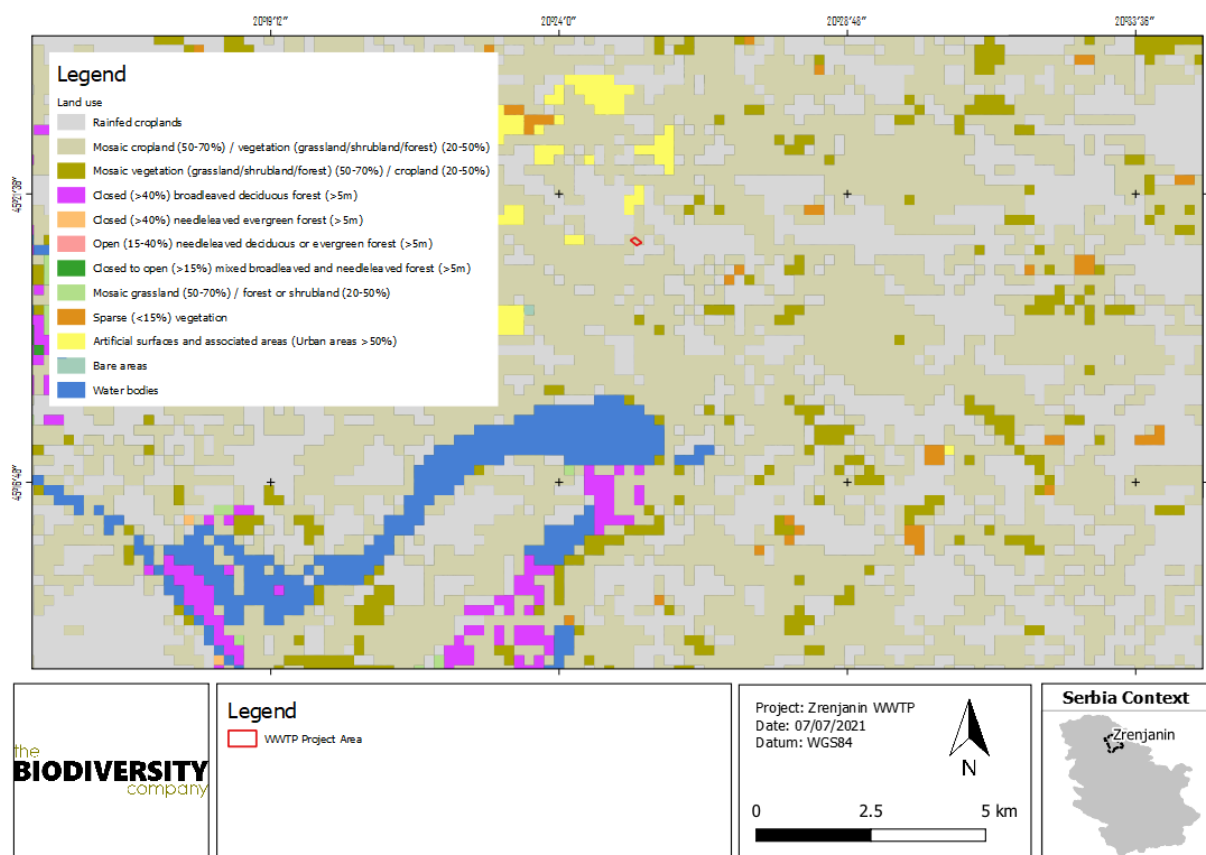


Figure 5-28 The land cover for the project area (Global Landcover, 2009)

5.2.7 THREATENED FAUNA AND FLORA

According to the IUCN (2021), a total of 90 threatened species (**Table 5-13**) are expected for Serbia. This table presents the number of species known to be threatened within those species that have been assessed to date, and not as the overall total number of threatened species for each group.

Table 5-14 presents the IUCN red list category summary totals for fauna and flora in Serbia. Listed national species listed for species of conservation concern are present in Table 5-15 to Table 5-17.

Table 5-13 IUCN threatened species by taxonomic group for Serbia (IUCN, 2021)

TOTAL	MAMMALS	BIRDS	REPTILES	AMPHIBIANS	FISHES	MOLLUSCS	OTHER INVERTS	PLANTS	FUNGI
90	10	13	1	1	15	8	26	9	7

Table 5-14 Number of fauna and flora species in each IUCN Red List category for Serbia (IUCN, 2021)

	EX	EW	CR	EN	VU	NT	LC	DD	TOTAL
Flora	0	0	0	6	3	10	416	37	472
Fauna	0	0	10	12	49	65	827	29	992

IUCN Red List Categories: EX - Extinct, EW - Extinct in the Wild, CR - Critically Endangered, EN - Endangered, VU - Vulnerable, LR/cd - Lower Risk/conservation dependent, NT - Near Threatened (includes LR/nt - Lower Risk/near threatened), DD - Data Deficient, LC - Least Concern (includes LR/lc - Lower Risk, least concern).

The conservation status of the indigenous species was assessed in terms of the IUCN Red List of Threatened Species (IUCN, 2021). A summary of the evaluation for Red list categories is provided in **Figure 5-29**. According to IUCN (2012),

“Listing in the categories of Not Evaluated and Data Deficient indicates that no assessment of extinction risk has been made, though for different reasons. Until such time as an assessment is made, taxa listed in these categories should not be treated as if they were non-threatened. It may be appropriate (especially for Data Deficient forms) to give them the same degree of attention as threatened taxa, at least until their status can be assessed”.

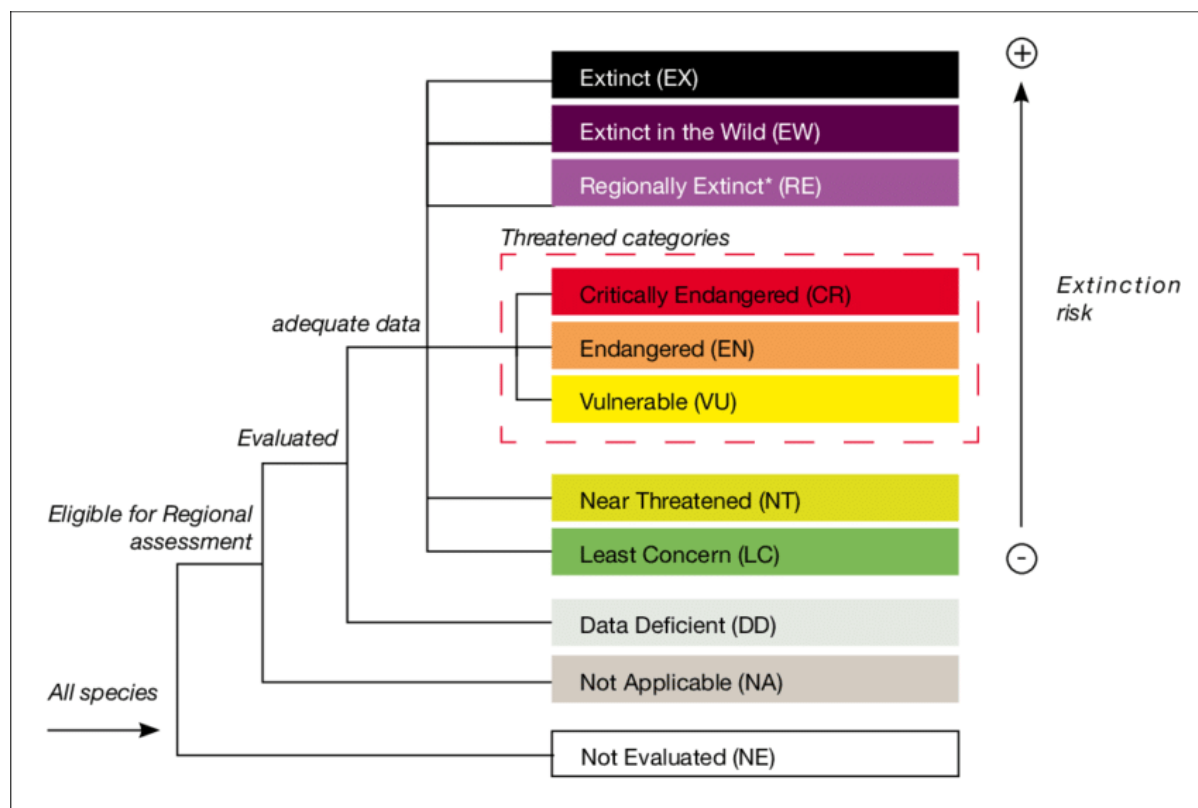


Figure 5-29 Structure for Red list categories (IUCN, 2012)

Table 5-15 Listed mammals of national conservation concern

FAMILY	GENUS	SCIENTIFIC	IUCN CATEGORY
CANIDAE	Vulpes	<i>Vulpes vulpes</i>	LC
CANIDAE	Nyctereutes	<i>Nyctereutes procyonoides</i>	LC
CERVIDAE	Dama	<i>Dama dama</i>	LC
CERVIDAE	Capreolus	<i>Capreolus capreolus</i>	LC
CERVIDAE	Cervus	<i>Cervus elaphus</i>	LC
CRICETIDAE	Arvicola	<i>Arvicola amphibius</i>	LC
CRICETIDAE	Ondatra	<i>Ondatra zibethicus</i>	LC
CRICETIDAE	Cricetus	<i>Cricetus cricetus</i>	LC
CRICETIDAE	Microtus	<i>Microtus subterraneus</i>	LC
CRICETIDAE	Microtus	<i>Microtus arvalis</i>	LC

FAMILY	GENUS	SCIENTIFIC	IUCN CATEGORY
ERINACEIDAE	Erinaceus	<i>Erinaceus roumanicus</i>	LC
GLIRIDAE	Muscardinus	<i>Muscardinus avellanarius</i>	LC
GLIRIDAE	Dryomys	<i>Dryomys nitedula</i>	LC
GLIRIDAE	Glis	<i>Glis glis</i>	LC
LEPORIDAE	Lepus	<i>Lepus europaeus</i>	LC
MURIDAE	Apodemus	<i>Apodemus agrarius</i>	LC
MURIDAE	Apodemus	<i>Apodemus uralensis</i>	LC
MURIDAE	Apodemus	<i>Apodemus sylvaticus</i>	LC
MURIDAE	Rattus	<i>Rattus rattus</i>	LC
MURIDAE	Rattus	<i>Rattus rattus</i>	LC
MURIDAE	Micromys	<i>Micromys minutus</i>	LC
MURIDAE	Mus	<i>Mus spicilegus</i>	LC
MURIDAE	Rattus	<i>Rattus norvegicus</i>	LC
MURIDAE	Rattus	<i>Rattus norvegicus</i>	LC
MURIDAE	Rattus	<i>Rattus norvegicus</i>	LC
MURIDAE	Apodemus	<i>Apodemus flavicollis</i>	LC
MUSTELIDAE	Mustela	<i>Mustela eversmanii</i>	LC
MUSTELIDAE	Mustela	<i>Mustela putorius</i>	LC
MUSTELIDAE	Mustela	<i>Mustela lutreola</i>	CR
MUSTELIDAE	Lutra	<i>Lutra lutra</i>	NT
MUSTELIDAE	Meles	<i>Meles meles</i>	LC
MUSTELIDAE	Martes	<i>Martes martes</i>	LC
MUSTELIDAE	Martes	<i>Martes foina</i>	LC
MUSTELIDAE	Mustela	<i>Mustela erminea</i>	LC
MUSTELIDAE	Mustela	<i>Mustela nivalis</i>	LC
RHINOLOPHIDAE	Rhinolophus	<i>Rhinolophus ferrumequinum</i>	LC
RHINOLOPHIDAE	Rhinolophus	<i>Rhinolophus hipposideros</i>	LC
SCIURIDAE	Sciurus	<i>Sciurus vulgaris</i>	LC
SCIURIDAE	Spermophilus	<i>Spermophilus citellus</i>	VU
SORICIDAE	Neomys	<i>Neomys anomalus</i>	LC
SORICIDAE	Crocidura	<i>Crocidura leucodon</i>	LC
SORICIDAE	Sorex	<i>Sorex araneus</i>	LC
SORICIDAE	Neomys	<i>Neomys fodiens</i>	LC
SORICIDAE	Sorex	<i>Sorex minutus</i>	LC

FAMILY	GENUS	SCIENTIFIC	IUCN CATEGORY
SORICIDAE	Crocidura	<i>Crocidura suaveolens</i>	LC
SPALACIDAE	Spalax	<i>Spalax leucodon</i>	DD
SUIDAE	Sus	<i>Sus scrofa</i>	LC
TALPIDAE	Talpa	<i>Talpa europaea</i>	LC
URSIDAE	Helarctos	<i>Helarctos malayanus</i>	VU
URSIDAE	Helarctos	<i>Helarctos malayanus</i>	VU
URSIDAE	Helarctos	<i>Helarctos malayanus</i>	VU
URSIDAE	Helarctos	<i>Helarctos malayanus</i>	VU
VESPERTILIONIDAE	Myotis	<i>Myotis nattereri</i>	LC
VESPERTILIONIDAE	Plecotus	<i>Plecotus auritus</i>	LC
VESPERTILIONIDAE	Pipistrellus	<i>Pipistrellus pipistrellus</i>	LC
VESPERTILIONIDAE	Plecotus	<i>Plecotus austriacus</i>	LC
VESPERTILIONIDAE	Myotis	<i>Myotis brandtii</i>	LC
VESPERTILIONIDAE	Nyctalus	<i>Nyctalus leisleri</i>	LC
VESPERTILIONIDAE	Eptesicus	<i>Eptesicus serotinus</i>	LC
VESPERTILIONIDAE	Pipistrellus	<i>Pipistrellus kuhlii</i>	LC
VESPERTILIONIDAE	Myotis	<i>Myotis bechsteinii</i>	NT
VESPERTILIONIDAE	Myotis	<i>Myotis dasycneme</i>	NT
VESPERTILIONIDAE	Myotis	<i>Myotis blythii</i>	LC
VESPERTILIONIDAE	Myotis	<i>Myotis myotis</i>	LC
VESPERTILIONIDAE	Myotis	<i>Myotis emarginatus</i>	LC
VESPERTILIONIDAE	Pipistrellus	<i>Pipistrellus nathusii</i>	LC
VESPERTILIONIDAE	Myotis	<i>Myotis mystacinus</i>	LC
VESPERTILIONIDAE	Myotis	<i>Myotis alcathoe</i>	DD
VESPERTILIONIDAE	Nyctalus	<i>Nyctalus noctula</i>	LC
VESPERTILIONIDAE	Barbastella	<i>Barbastella barbastellus</i>	NT
VESPERTILIONIDAE	Vespertilio	<i>Vespertilio murinus</i>	LC
VESPERTILIONIDAE	Myotis	<i>Myotis daubentonii</i>	LC

Table 5-16 Listed amphibians of national conservation concern

FAMILY	GENUS	SCIENTIFIC	IUCN CATEGORY
COLUBRIDAE	Zamenis	<i>Zamenis longissimus</i>	LC
EMYDIDAE	Emys	<i>Emys orbicularis</i>	LR/nt
LACERTIDAE	Lacerta	<i>Lacerta viridis</i>	LC

FAMILY	GENUS	SCIENTIFIC	IUCN CATEGORY
LACERTIDAE	Podarcis	<i>Podarcis muralis</i>	LC
LACERTIDAE	Lacerta	<i>Lacerta agilis</i>	LC
NATRICIDAE	Natrix	<i>Natrix tessellata</i>	LC
SCINCIDAE	Ablepharus	<i>Ablepharus kitaibelii</i>	LC

Table 5-17 Listed reptiles of national conservation concern

FAMILY	SPECIES	IUCN CATEGORY
BOMBINATORIDAE	<i>Bombina bombina</i>	LC
BUFONIDAE	<i>Bufo bufo</i>	LC
BUFONIDAE	<i>Bufo viridis</i>	LC
HYLIDAE	<i>Hyla arborea</i>	LC
PELOBATIDAE	<i>Pelobates fuscus</i>	LC
RANIDAE	<i>Pelophylax ridibundus</i>	LC
RANIDAE	<i>Pelophylax lessonae</i>	LC
RANIDAE	<i>Rana dalmatina</i>	LC
SALAMANDRIDAE	<i>Triturus dobrogicus</i>	NT
SALAMANDRIDAE	<i>Lissotriton vulgaris</i>	LC

Expected fish species (**Table 5-18**) for the project area was generated from the IUCN (2021). A review of fish species expected for the immediate Pannonian River Basin associated with the project area indicated a total of 49 fish species expected for the Begej River and associated basin. The expected species list is viewed with medium confidence. Due to individual species sensitivity to water quality and habitat modification in the project area, not all the expected species are likely to occur.

Table 5-18 Expected species of fish for the project areas

FAMILY	SCIENTIFIC NAME	CONSERVATION STATUS (IUCN)
CYPRINIDAE	<i>Abramis brama</i>	LC
ACIPENSERIDAE	<i>Acipenser ruthenus</i>	VU
CYPRINIDAE	<i>Alburnus alburnus</i>	LC
GOBIIDAE	<i>Babka gymnotrachelus</i>	LC
CYPRINIDAE	<i>Ballerus ballerus</i>	LC
CYPRINIDAE	<i>Ballerus sapa</i>	LC
BALITORIDAE	<i>Barbatula barbatula</i>	LC
CYPRINIDAE	<i>Barbus balcanicus</i>	LC
CYPRINIDAE	<i>Barbus barbus</i>	LC
CYPRINIDAE	<i>Blicca bjoerkna</i>	LC
CYPRINIDAE	<i>Chondrostoma nasus</i>	LC

FAMILY	SCIENTIFIC NAME	CONSERVATION STATUS (IUCN)
COBITIDAE	<i>Cobitis elongatoides</i>	LC
COTTIDAE	<i>Cottus gobio</i>	LC
CYPRINIDAE	<i>Cyprinus carpio</i>	VU in Native country. Exotic and invasive elsewhere
CYPRINIDAE	<i>Gobio obtusirostris</i>	LC
PERCIDAE	<i>Gymnocephalus baloni</i>	LC
PERCIDAE	<i>Gymnocephalus cernua</i>	LC
PERCIDAE	<i>Gymnocephalus schraetser</i>	LC
CYPRINIDAE	<i>Leucaspis delineatus</i>	LC
CYPRINIDAE	<i>Leuciscus aspius</i>	LC
CYPRINIDAE	<i>Leuciscus leuciscus</i>	LC
COBITIDAE	<i>Misgurnus fossilis</i>	LC
GOBIIDAE	<i>Neogobius fluviatilis</i>	LC
GOBIIDAE	<i>Neogobius melanostomus</i>	LC
CYPRINIDAE	<i>Pelecus cultratus</i>	LC
CYPRINIDAE	<i>Phoxinus phoxinus</i>	LC
GOBIIDAE	<i>Ponticola kessleri</i>	LC
GOBIIDAE	<i>Proterorhinus semilunaris</i>	LC
GASTEROSTEIDAE	<i>Pungitius platygaster</i>	LC
CYPRINIDAE	<i>Rhodeus amarus</i>	LC
CYPRINIDAE	<i>Romanogobio kesslerii</i>	LC
CYPRINIDAE	<i>Romanogobio uranoscopus</i>	LC
CYPRINIDAE	<i>Romanogobio vladkovi</i>	LC
CYPRINIDAE	<i>Rutilus rutilus</i>	LC
CYPRINIDAE	<i>Rutilus virgo</i>	LC
COBITIDAE	<i>Sabanejewia balcanica</i>	LC
COBITIDAE	<i>Sabanejewia bulgarica</i>	LC
SALMONIDAE	<i>Salmo labrax</i>	LC
SALMONIDAE	<i>Salmo trutta</i>	LC
PERCIDAE	<i>Sander lucioperca</i>	LC
PERCIDAE	<i>Sander volgensis</i>	LC
CYPRINIDAE	<i>Scardinius erythrophthalmus</i>	LC
SILURIDAE	<i>Silurus glanis</i>	LC

FAMILY	SCIENTIFIC NAME	CONSERVATION STATUS (IUCN)
CYPRINIDAE	<i>Squalius cephalus</i>	LC
SYNGNATHIDAE	<i>Syngnathus abaster</i>	LC
SALMONIDAE	<i>Thymallus thymallus</i>	LC
CYPRINIDAE	<i>Vimba vimba</i>	LC
PERCIDAE	<i>Zingel streber</i>	LC
PERCIDAE	<i>Zingel zingel</i>	LC

5.3 BIOLOGICAL ENVIRONMENT (FIELD ASSESSMENT)

5.3.1 METHODOLOGY

The following methodology was adopted for the aspects / components considered for the assessment:

Terrestrial fauna

- mammals – observations, active searching for holes, burrows and shelters;
- birds – observations, viewing in trees and birds in flight;
- reptiles – observations, active searching for in cryptic places, under rocks and fallen branches;
- insects – observations, primarily for Lepidoptera, Diptera, some Coleoptera, Neuroptera, Hemiptera, Hymenoptera and Mecoptera, observation of land, primarily for Apterygota, Coleoptera and other groups; and
- other invertebrates – observations, active searching.

Terrestrial vascular macrophytes

- observation of species for the extent of the project area.

Mosses and lichens

- observations of rocks and tree branches.

Aquatic fauna

- fishes – sampling in the Begej River at three locations: 1 - upstream of location, at the Municipal heating plant, 2 – adjacent to the project area, near the inflow of the wastewater into the Begej River, 3 – approximately 100 m downstream of location;
- mammals – observation of shallow water and river banks;
- birds – observation of branches in the water, river banks, trees and birds in flight;
- amphibians – observation in the shallow water near the river bank;
- reptiles – observation of water column and river bank; and
- benthos – turning over stones and using a hand excavator for extraction of river sediment from the bed and bank.

Macrophytes

- observation of river banks and extraction of some (semi)submerged plant individuals.

5.3.2 AREA OF INFLUENCE (AOI)

In order to manage risks associated with the project, the IFC's PS6 (GN17 & GN58) is crucial for the identification of natural and Critical Habitat, and must also consider project-related impacts across the potentially affected landscape. For the purposes of this project, the extent of the landscape considered was determined primarily based on the relevant watershed and current land cover (Figure 5-30). The AoI measures approximately 32,000 ha. The following aspects were considered for the determination of the AoI:

- The initial extent of the AoI was defined by the local catchment area, which was then refined taking into account the project requirements, existing infrastructure and the local developments and activities;
- The Carska Bara protected area is located south of the project area, which is adjacent to the lake system comprising of Mika Jezero, Koca Jezero and Belo Jezero
- The Begej River will be the receiving system for the WWTP, flowing into Tisa River system;
- The AoI was also determined to include forest area and grasslands.

It is evident from the land cover data that crops dominate the extent of the AoI (Table 5-19). A total of 41.1% of the area is comprised of rainfed crops, with almost half of the AoI comprised of a mosaic of cropland and vegetation (grassland/shrubland/forest). The extent of water bodies for the AoI comprise 6.5% of the area.

For the purposes of this assessment, fieldwork prioritised the extent of the project area, and a read of the Begej River adjacent to the proposed WWTP. The remaining extent of the AoI has been considered at a desktop level only.

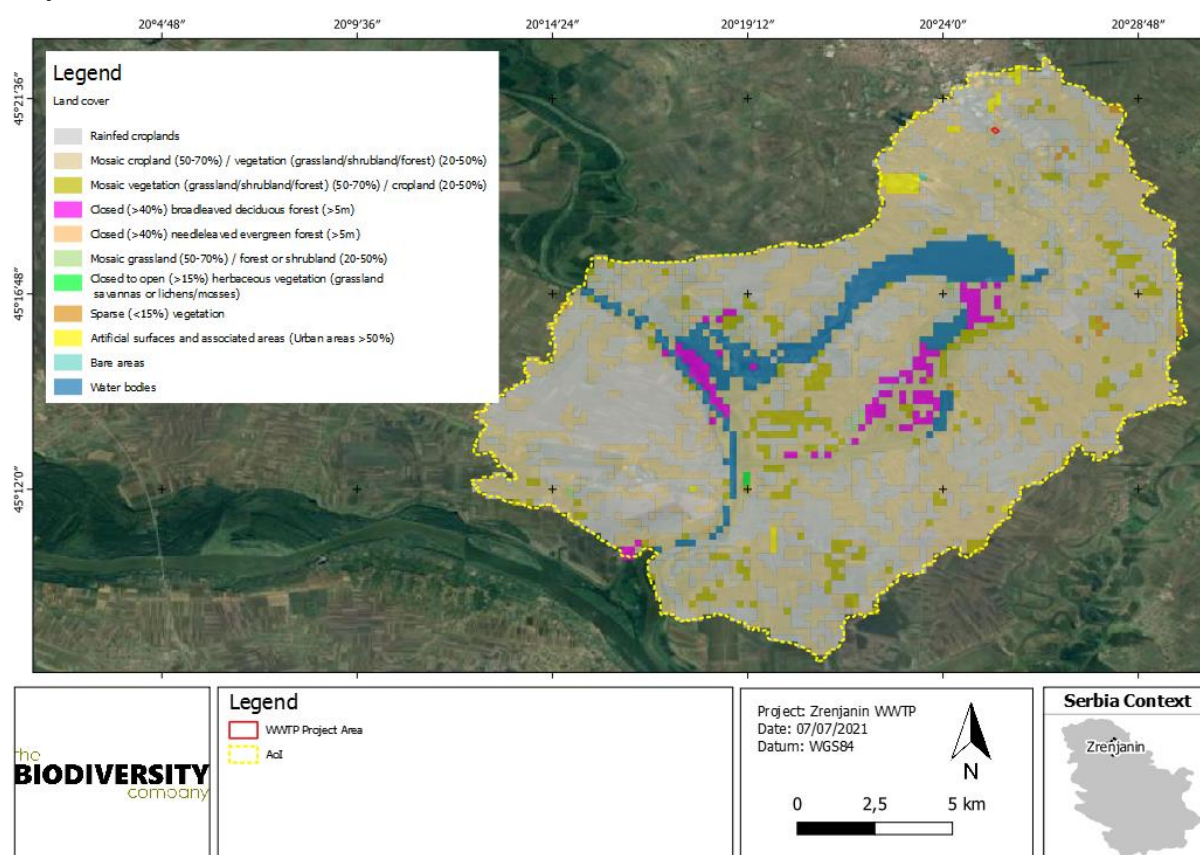


Figure 5-30 The land cover classes and extent for the AoI

Table 5-19 The land cover classes and extent for the AoI

LAND COVER	AREA (HA)	PERCENTAGE (%)
Rainfed croplands	13084,47	41,1%

Mosaic cropland (50-70%) / vegetation (grassland/shrubland/forest) (20-50%)	16569,09	52,0%
Mosaic vegetation (grassland/shrubland/forest) (50-70%) / cropland (20-50%)	1727,085	5,4%
Closed (>40%) broadleaved deciduous forest (>5m)	27,1063	0,1%
Closed (>40%) needleleaved evergreen forest (>5m)	27,10321	0,1%
Mosaic grassland (50-70%) / forest or shrubland (20-50%)	0,0462	0,0%
Closed to open (>15%) herbaceous vegetation (grassland, savannas or lichens/mosses)	87,95726	0,3%
Sparse (<15%) vegetation	87,95726	0,3%
Artificial surfaces and associated areas (Urban areas >50%)	229,9726	0,7%
Bare areas	0,0589	0,0%
Water bodies	2085,039	6,5%
Total	31840,85	100,0%

5.3.3 HABITATS

The project area is located on a larger site previously comprising a series of ponds (dated 2006) which have been backfilled and historically used for crop agriculture (Figure 5-31). The larger extent of the area is located on a plain (< 20%), which is consistent with the region of Vojvodina in which the City of Zrenjanin is located. A directional view of the project area is presented in Figure 5-32. The project area is situated between the Zrenjanin-Belgrade Road and the Begej River. The elevation of the project area ranges from 50 m to 100 m, forming a mild depression. The central portion of the project area comprises of cultivated agricultural fields separated by stands of shrub plants forming two cultivated area of similar sizes. The western portion of the project area (adjacent to the Begej River), the eastern portion close to the local road and petrol station, and the northern portion are all uncultivated. These three areas are covered by perennial vegetation and appear to be abandoned. Some herbaceous plants in these areas have a height of up to 1 m. Woody plant species were recorded on the border, with the exception of the southern border.



Figure 5-31 A Google Earth time series depicting land use changes for the project area



Figure 5-32 Directional view of the project area

Two preliminary habitat types were delineated for the project footprint area, these are discussed below. Photographs of the two dominant habitat types and other features are presented in **Figure 5-33**.

PERENNIAL RIVER

The perennial river (Begej River) habitat is adjacent to the project area and includes flowing open water with reedbeds for fringe vegetation. Plant species associated with this habitat unit include *Calystegia sepium*, *Cicuta virosa*, *Hydrocharis morsus-ranae*, *Lepidium didymum*, *Myosotis sp.* and *Phragmites australis*. Some alien and/or invasive plant species occurred along the habitat due to the dispersal of seeds via water. Due to the crucial role that this habitat plays as a water source for the area, this area has been infringed upon, and utilized extensively. This habitat, even though somewhat degraded, is still important as a movement corridor for several faunal species, especially birds and fish, and plays a vital role as a water resource not only for the biodiversity but also the local industry. This habitat unit can be regarded as highly important, not only within the local landscape, but also regionally. The habitat sensitivity is considered high.

TRANSFORMED

The transformed habitat is the largest habitat for the area. This habitat is characterised by areas cleared of natural vegetation mainly for agriculture and also comprised of roads and channels. Vegetation structure consist of rows of trees, herbaceous and short shrubland. Species include *Conium maculatum*, *Galium aparine*, *Ballota nigra*, *Malva sylvestris* and *Lamium maculatum*. Woody and shrubby plants are dominant on the eastern and northern borders and these include *Juglans regia*, *Fraxinus ornus*, *Populus alba*, *Salix alba*, *Morus nigra*, *Prunus cerasifera*, *Prunus cerasus*, *Sambucus nigra* and *Rosa canina*. The Common orange lichen (*Xanthoria*

parietina was recorded on tree branches, with some branches totally covered. The habitat sensitivity is considered low.



Figure 5-33 The identified habitat types and features for the project area.



Figure 5-34 The delineated habitat unit and features for the project area

The Begej River has been subject to severe instream and riparian modification associated with land use alterations within its catchment with the city of Zrenjanin developed on the banks of the Begej. Over time, the river's course through the city has constantly been influenced, with most influence stemming from man who depend greatly on this river and water supplies. This altered catchment and heavy reliance on the river has resulted in pollution and degraded water quality and habitat conditions, which is no longer able to sustain its original biotic communities it retained before modification. Many publications have highlighted the contamination status and assessed the origin and type of pollutants within the river system. According to Popić (2010), the Begej system is referred to as the most polluted watercourse in Serbia. The Begej River is a heavily

utilised multicounty canal system receiving pollution from both scattered point sources (industrial and urban effluent and spills, untreated domestic wastewaters and hydrocarbons in stormwater runoff) and diffuse sources along the entire length of the canal (agricultural activity and return waters from informal residential areas) (Dalmacija *et al.*, 2006; Popić, 2010; Dubovina *et al.*, 2018).

A portion of contamination inflow stems from landuse upstream of Serbia and the quality of sediments in the canal in Serbia are highly contaminated near the border. There is limited inflow of anthropogenic and natural sediment into the Serbian section of the canal (Dalmacija *et al.*, 2006).

The Begej River canal was an important transnational navigable route between the Danube River in the north-eastern part of Serbia and the city of Temisvar. Following the innovation and installation of hydroelectric complexes and shipping locks and 1958 suspension of navigation, sediment began to accumulate rapidly with an associated increase in sediment and water contamination (Dubovina *et al.*, 2018). Studies by Dalmacija *et al.*, (2006) indicated the sediment is heavily contaminated with cadmium, copper, zinc, and chromium, and was classed as unacceptable quality falling into class 4 or extremely polluted, requiring remediation (responsible dredging and land based disposal). The study highlighted that no elevated metal levels were present in the reference sediment sample, indicating anthropogenic input of pollution in the canal. There was mention of potential remnant contamination from the Chernobyl accident in 1986 as presented by increased levels of ¹³⁷Cs. Studies by Dubovina *et al.* (2018) indicated significant ecological impacts associated with pollution near the near-border region, with frequently detected harmful heavy metals Hg, Cr, Pb, Cu and Zn, and the carcinogenic PAH dibenzo[a,h]anthracene in this and the wider Pannonia region. For more than a decade, there has been mention of various projects to dealing with pollution in the Begej River (Popić, 2010)

5.3.4 TERRESTRIAL FAUNA

General notes: The project area is in an industrial zone, and faunal activity in the area is not expected to be high. Due to the land use and associated disturbances fauna, except for birds (for feeding) have vacated the area.

MAMMALS

The extent of the project area was investigated for the presence of mammals. Two species were found, namely the European hare (*Lepus europaeus* Pallas, 1778) (Table 5-20) and a field mouse (*Apodemus uralensis* Pallas, 1811) (



Figure 5-35). The duration of the fieldwork was three (3) days, and three (3) sightings of the European hare were recorded. These sightings were located in shrubby and woody vegetation, and it is uncertain of the number of different individuals of hare sighted. Due to the presence of shelter provided by shrubs in the open fields, the probability of *L. europaeus* being resident here is high. A single dead individual of a field mouse (*Apodemus uralensis* Pallas, 1811) was found on the north-eastern border of the project area.

Table 5-20 Recorded species of mammals

SPECIES	ESTIMATED NUMBER OF INDIVIDUALS	SERBIAN STATUS OF PROTECTION IUCN CATEGORY
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<i>Lepus europaeus</i>	1 High probability of several individuals being present	Protected Hunting species whose status and protection regime are regulated for hunting	LC
<i>Apodemus uralensis</i>	1	Protected The species is protected as a wild species, except in the territory of Vojvodina, where it is not protected	LC



Figure 5-35 Photographs of recorded mammals

BIRDS

Birds were observed on the ground and in vegetation in the project area, with birds in flights over the area also recorded. Predominantly common bird species were recorded, this is attributed to vegetation structure and relatively flat / open terrain associated with the area. A list of recorded bird species is presented in Table 5-21. The Common raven (*Corvus corax* L. 1758) and Hooded crow (*Corvus cornix* L. 1758) were dominant in number. The number of individuals can be estimated to be approximately 8-10 and 3-5 for the Common raven and Hooded crow respectively. The Eurasian magpie (*Pica pica* L. 1758) was recorded both in trees and in flight, with approximately 5-8 individuals being recorded. Three Western jackdaw (*Corvus monedula* L. 1758) (Figure 5-36) and Rook (*Corvus frugilegus* L. 1758) (Figure 5-37) were recorded on the land, with three (3) and two (2) individuals being recorded respectively. The Great tit (*Parus major* L. 1758), Common cuckoo (*Cuculus canorus* L. 1758) and Eurasian collared dove (*Streptopelia decaocto* Frivaldszky, 1838) were identified by their calls. The number of individuals for these three species is estimated to be 2-4 each. Two male individuals of the Common pheasant (*Phasianus colchicus* L. 1758) were recorded in low grass. Common species recorded for the project area and also expected for urban areas included the Eurasian tree sparrow (*Passer montanus* L. 1758) and Rock dove (*Columba livia* Gmelin, 1789) with five (5) and three (3) individuals respectively being recorded. Water birds such as the Grey heron (*Ardea cinerea* L. 1758) was recorded in flight, and in immediate proximity of the Begej River. No bird nests were recorded for the project area.

Table 5-21 Recorded species of birds

SPECIES	ESTIMATED NUMBER OF INDIVIDUALS	SERBIAN STATUS OF PROTECTION	IUCN CATEGORY
<i>Corvus corax</i>	8-10	Protected	LC
<i>Corvus cornix</i>	3-5	Protected	Not listed

		Hunting species whose status and protection regime are regulated for hunting	
<i>Corvus monedula</i>	3	Protected	LC
<i>Corvus frugilegus</i>	2	Protected Hunting species whose status and protection regime are regulated for hunting	LC
<i>Pica pica</i>	5-8	Protected	LC
<i>Parus major</i>	1	Strictly protected	LC
<i>Cuculus canorus</i>	1	Strictly protected	LC
<i>Passer montanus</i>	5	Protected	LC
<i>Phasianus colchicus</i>	2	Protected Hunting species whose status and protection regime are regulated for hunting	LC
<i>Columba livia</i>	3	Strictly protected	LC
<i>Streptopelia decaocto</i>	1	Protected Hunting species whose status and protection regime are regulated for hunting	LC



Figure 5-36 Western jackdaw (*Corvus monedula*)



Figure 5-37 Rook (*Corvus frugilegus*)

INVERTEBRATES

Vegetation, ground cover areas and beneath rocks and debris were inspected for the presence of invertebrates, with recorded invertebrates listed in Table 5-22. All of the recorded species of invertebrates belong to insects (Pterygota) and snails. The diversity of herbaceous and woody plants species does allow for considerable insect diversity in qualitative sense. Pollinators were present on flowers, with other species recorded on leaves, branches or in flight. The identified species are mostly dependent on or associated with vegetation, with fewer insects recorded for the groundcover areas. Aphididae were numerous on selected plant species. Snails were also recorded on vegetation. No Apterygota nor other invertebrate species were recorded. Photographs of some of the recorded invertebrates are presented in

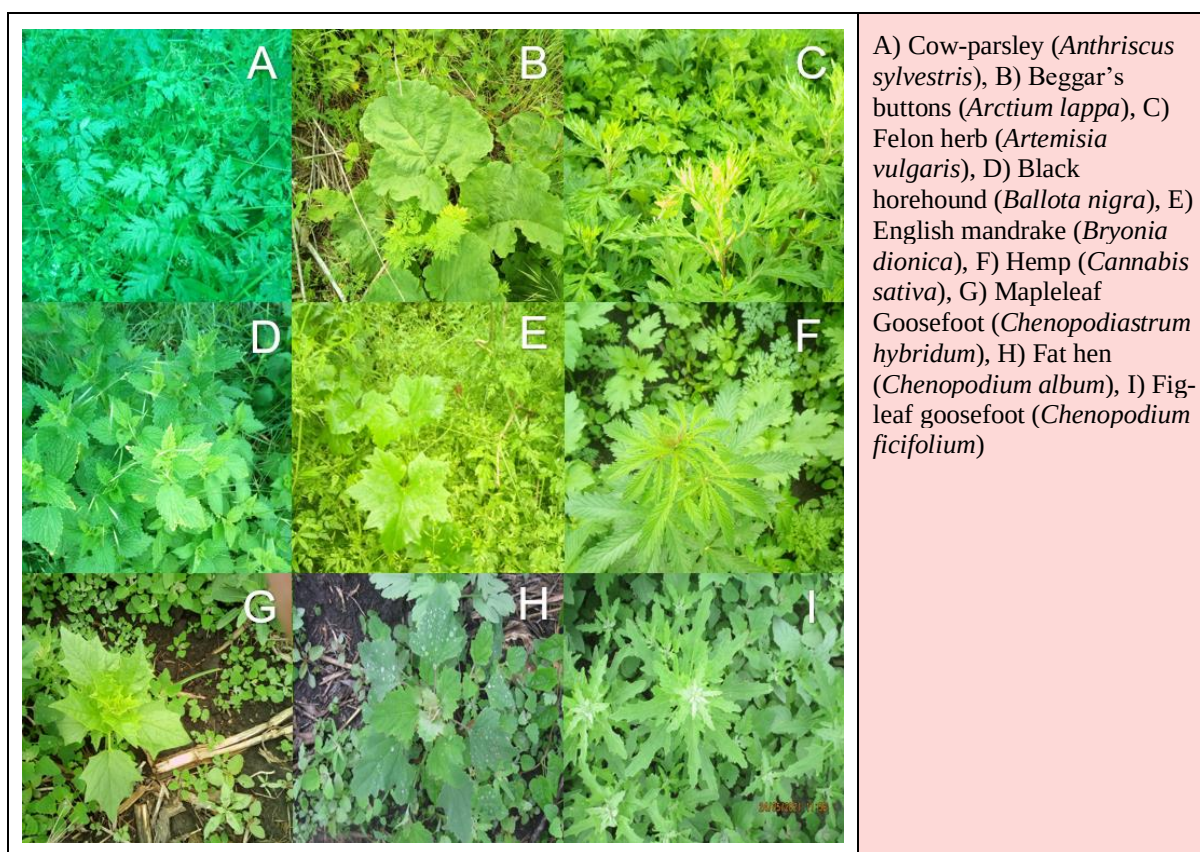


Figure 5-39.

Table 5-22 Recorded species of invertebrates

SPECIES	ESTIMATED NUMBER OF INDIVIDUALS	SERBIAN STATUS OF PROTECTION	IUCN CATEGORY
<i>Panorpa communis</i>	1	Not listed	Not listed
<i>Euschistus sp.</i>	3	Not listed	Not listed
<i>Chrysolina graminis</i>	2	Not listed	Not listed
<i>Chrysolina sp.</i>	3	Not listed	Not listed
<i>Coccinella septempunctata</i>	10	Not listed	Not listed
<i>Larinus sp.</i>	1	Not listed	Not listed
<i>Graphosoma italicum</i>	30-40	Not listed	Not listed
<i>Pyrrhocoris apterus</i>	200	Not listed	Not listed
<i>Hippodamia sp.</i>	2	Not listed	Not listed
<i>Lampyrus sp.</i>	1	Not listed	Not listed

<i>Tipula sp.</i>	5-10	Not listed	Not listed
<i>Culex sp.</i>	10	Not listed	Not listed
<i>Calosoma sycophanta</i>	1	Not listed	Not listed
<i>Ocypus olens</i>	1	Not listed	Not listed
<i>Blaps mortisaga</i>	2	Not listed	Not listed
<i>Vespa sp.</i>	10	Not listed	Not listed
<i>Xylocopa violacea</i>	1	Not listed	Not listed
<i>Apis mellifera</i>	10	Not listed	Not listed
<i>Gonepteryx rhamni</i>	1	Not listed	Not listed
<i>Colias croceus</i>	1	Not listed	Not listed
<i>Argynnis paphia</i>	2	Not listed	Not listed
<i>Chrysopa sp.</i>	1	Not listed	Not listed
<i>Dichrostigma flavipes</i>	1	Not listed	Not listed
<i>Aphis sp.</i>	few hundreds-one thousand	Not listed	Not listed
<i>Syrphus sp.</i>	10	Not listed	Not listed
<i>Ichneumonidae</i>	5-10	Not listed	-
<i>Cepaea vindobonensis</i>	20-30	Not listed	Not listed
<i>Helix pomatia</i>	15-20	Protected	Not listed

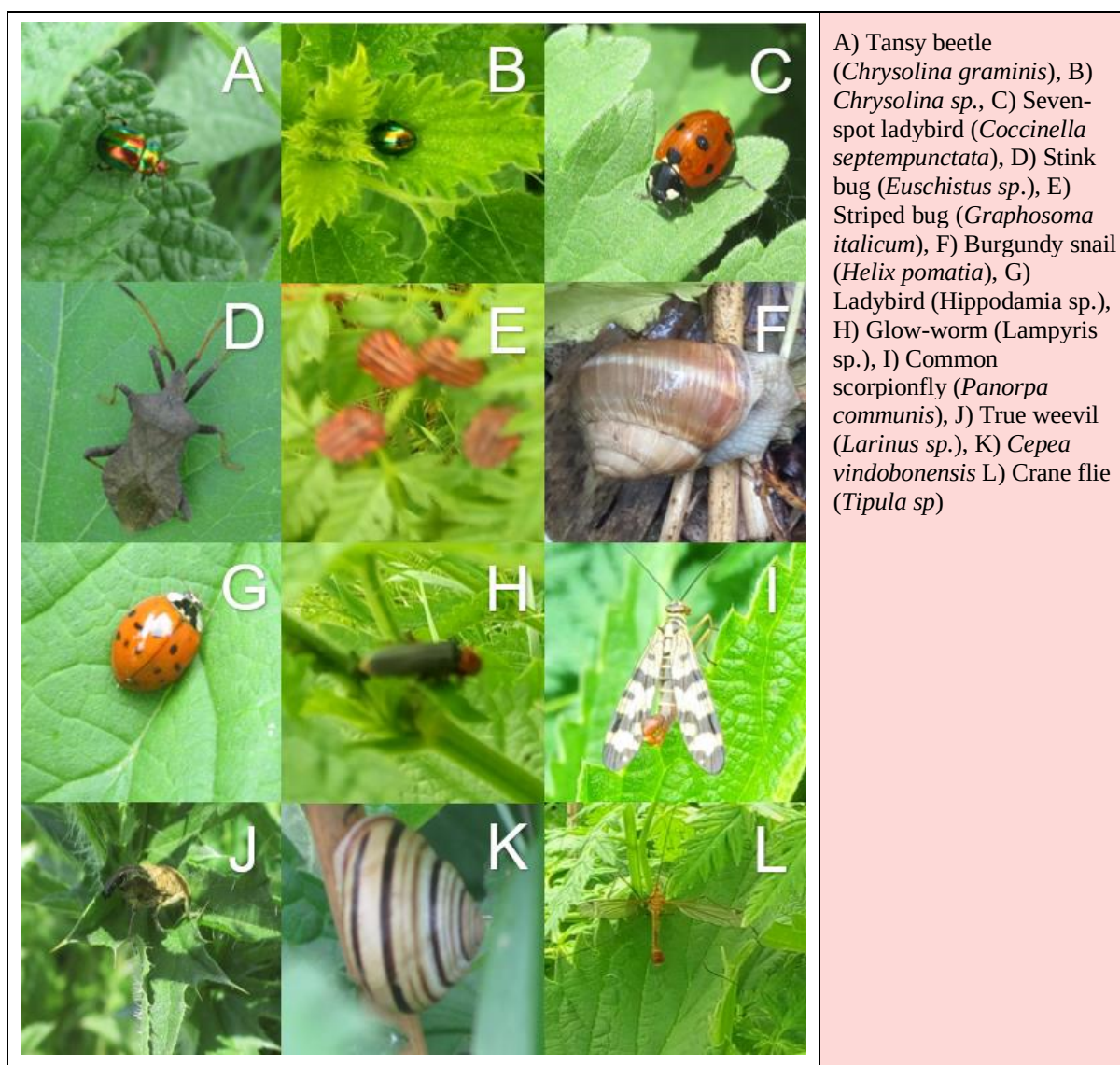


Figure 5-38 Photographs of recorded invertebrates

5.3.5 TERRESTRIAL FLORA

VASCULAR MACROPHYTES

Herbaceous and woody plants were recorded across the floor area (Table 5-23). Photographs of some of the recorded species are presented from

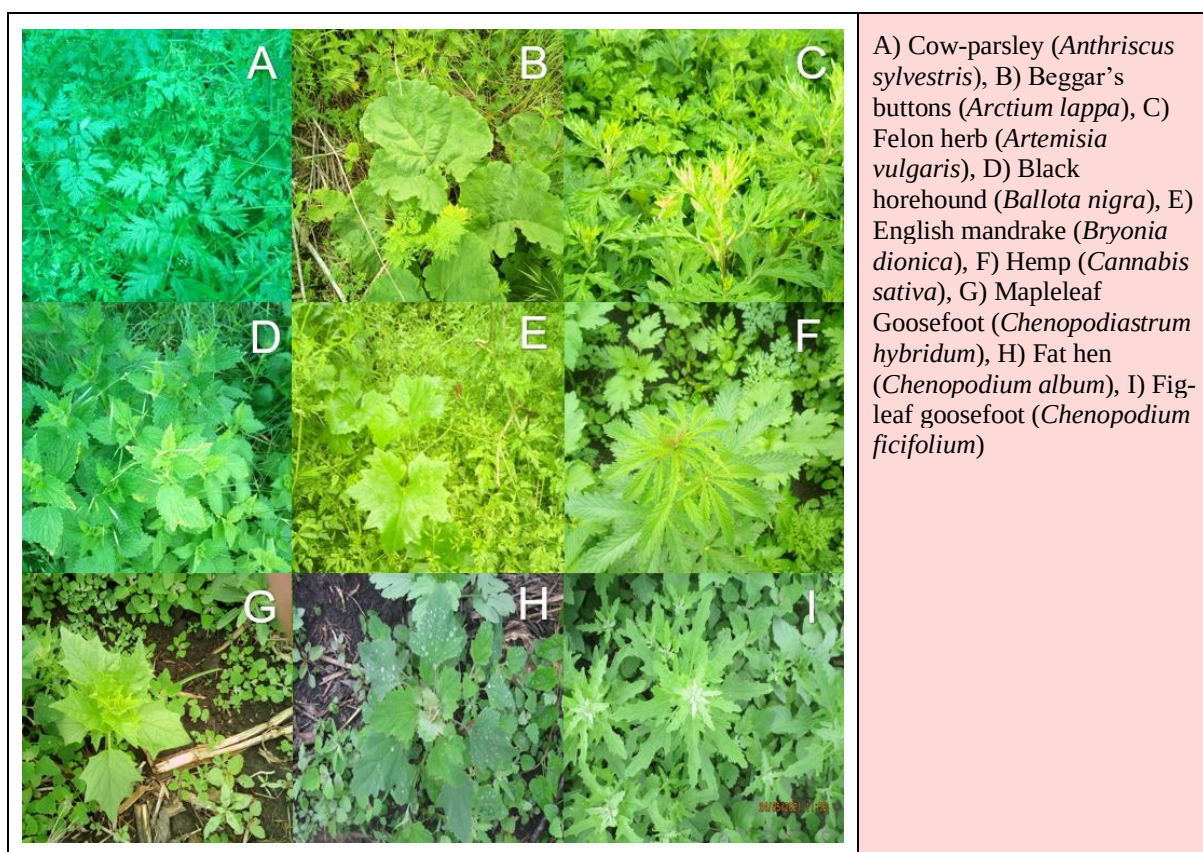


Figure 5-39 to

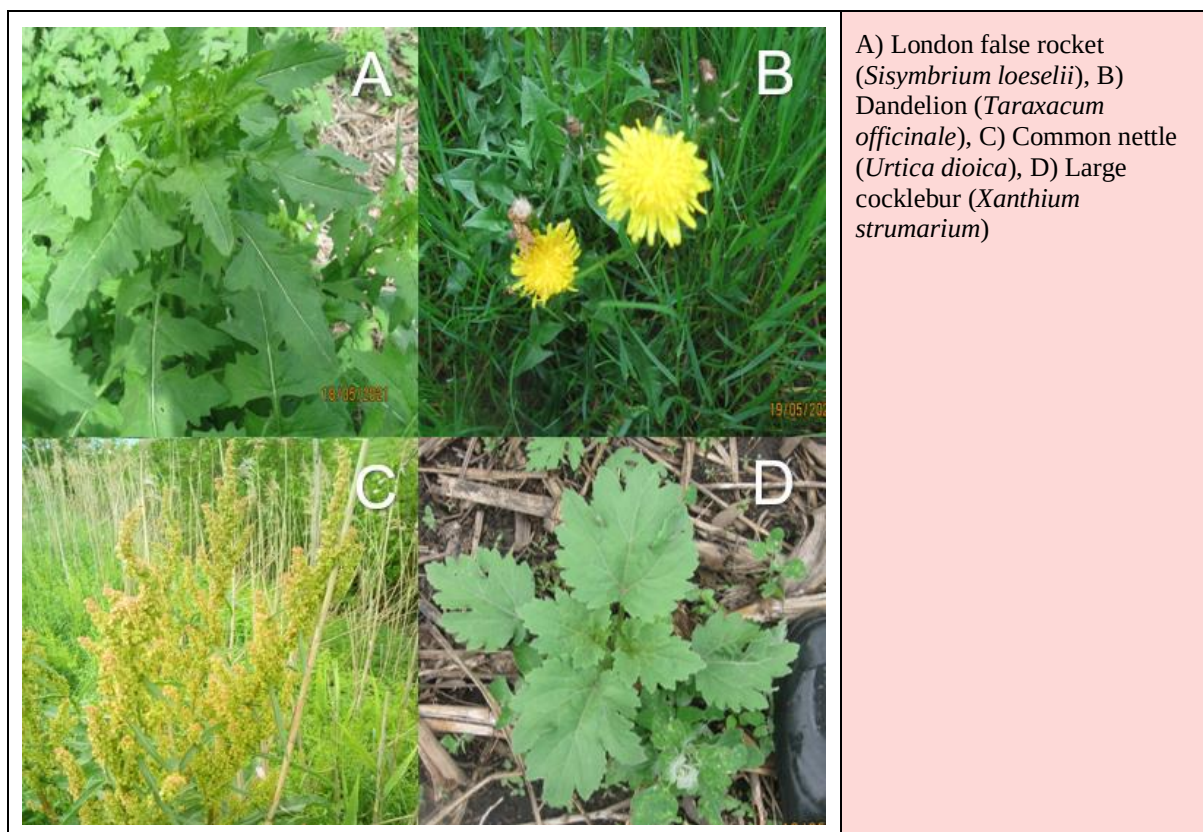


Figure 5-43. The floor of woody plants within the project area is characterized by presence of the following species:

- *Juglans regia* are present on the eastern and northern border of the project area, with up to ten (10) trees on each border. Trees are limited towards the river bank;
- *Fraxinus ornus* is present on the eastern border;
- *Prunus cerasifera* is also present on the eastern side of the project area but with limited numbers;
- The *Morus* is also present and recorded for the project area;
- *Robinia pseudoacacia* is limited for the project area and located on the eastern border; and
- *Populus alba* and *Salix alba* are both present only towards the river bank.

The floor of shrubs is characterized by presence of *Sambucus nigra*, which is present on all four of the borders by a few dozen of trees. *Rosa canina* is present on the eastern border in limited numbers but was in flowering during the fieldwork.

A variety of species were recorded for the ground floor, with some frequent species such as *Conium maculatum*, *Galium aparine*, *Ballota nigra*, *Malva sylvestris* and *Lamium maculatum* in the center of the project area. *Urtica dioica* was recorded towards the eastern border and a stand of *Phragmites australis* was recorded closer to the river bank.

Table 5-23 Recorded species of vascular flora

SPECIES	ABUNDANCY	SERBIAN STATUS OF PROTECTION	IUCN CATEGORY
<i>Anthriscus sylvestris</i>	Occasionally	Not listed	Not listed
<i>Arctium lappa</i>	Limited	Subspecies <i>lappa</i> is protected. The species is commercial and is subject to the provisions of the Regulation on bringing under control the use and trade of wild flora and fauna	LC
<i>Artemisia vulgaris</i>	Occasionally	Not listed	LC
<i>Ballota nigra</i>	Occasionally	Not listed	LC
<i>Bryonia dioica</i>	Limited	Not listed	Not listed
<i>Cannabis sativa</i>	Limited	Not listed	Not listed
<i>Chenopodiastrum hybridum</i>	Limited	Not listed	Not listed
<i>Chenopodium album</i>	Occasionally	Not listed	Not listed
<i>Chenopodium ficifolium</i>	Limited	Not listed	Not listed
<i>Conium maculatum</i>	Occasionally	Not listed	Not listed
<i>Dactylis glomerata</i>	Occasionally	Not listed	Not listed
<i>Fraxinus ornus</i>	Limited, on the eastern border	Not listed	LC

<i>Galium aparine</i>	Frequent	Not listed	LC
<i>Hordeum murinum</i>	Occasionally	Not listed	LC
<i>Juglans regia</i>	Limited, on the eastern and northern border	Not listed	LC
<i>Lamium maculatum</i>	Frequent	Not listed	Not listed
<i>Lamium purpureum</i>	Frequent	Not listed	Not listed
<i>Leonurus cardiaca</i>	Occasionally	Subspecies <i>cardiaca</i> is protected The species is commercial and is subject to the provisions of the Regulation on bringing under control the use and trade of wild flora and fauna	LC
<i>Malva sylvestris</i>	Frequent	Not listed	LC
<i>Morus alba</i>	Limited, only on the eastern border	Not listed	Not listed
<i>Morus nigra</i>	Limited, only on the eastern border	Not listed	Not listed
<i>Onopordum acanthium</i>	Occasionally	Not listed	Not listed
<i>Papaver rhoeas</i>	Limited, only on the eastern border	Not listed	LC
<i>Phragmites australis</i>	Frequent on the western border	Not listed	LC
<i>Prunus cerasifera</i>	Limited, only on the eastern border	Not listed	DD
<i>Prunus cerasus</i>	Limited, only on the eastern border	Not listed	Not listed
<i>Prunus mahaleb</i>	Limited	Not listed	LC
<i>Ranunculus acris</i>	Limited	Not listed	Not listed
<i>Robinia pseudoacacia</i>	Limited, only on the eastern border	Not listed	LC
<i>Rosa canina</i>	Limited, only on the eastern border	Protected The species is commercial and is subject	LC

		to the provisions of the Regulation on bringing under control the use and trade of wild flora and fauna	
<i>Rubus caesius</i>	Limited	Not listed	LC
<i>Rumex longifolius</i>	Occasionally	Not listed	Not listed
<i>Sambucus nigra</i>	Frequent on all border lines	Not listed	LC
<i>Senecio squalidus</i>	Limited	Not listed	Not listed
<i>Silene latifolia</i>	Occasionally	Not listed	Not listed
<i>Silene vulgaris</i>	Occasionally	Not listed	LC
<i>Sinapis alba</i>	Limited	Not listed	LC
<i>Sisymbrium loeselii</i>	Occasionally	Not listed	Not listed
<i>Taraxacum officinale</i>	Occasionally	Not listed	LC
<i>Urtica dioica</i>	Abundant on the western border	Not listed	LC
<i>Xanthium strumarium</i>	Occasionally	Not listed	Not listed

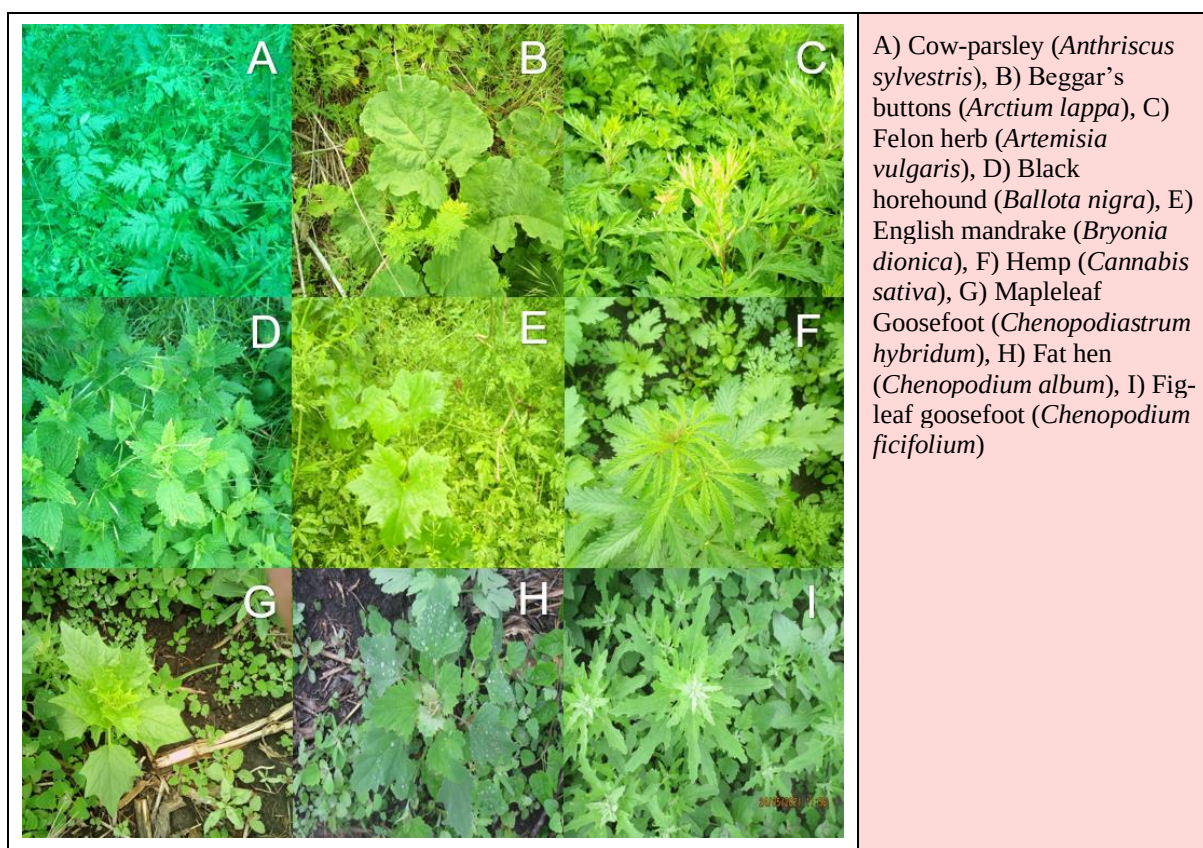


Figure 5-39 Photographs of recorded flora.

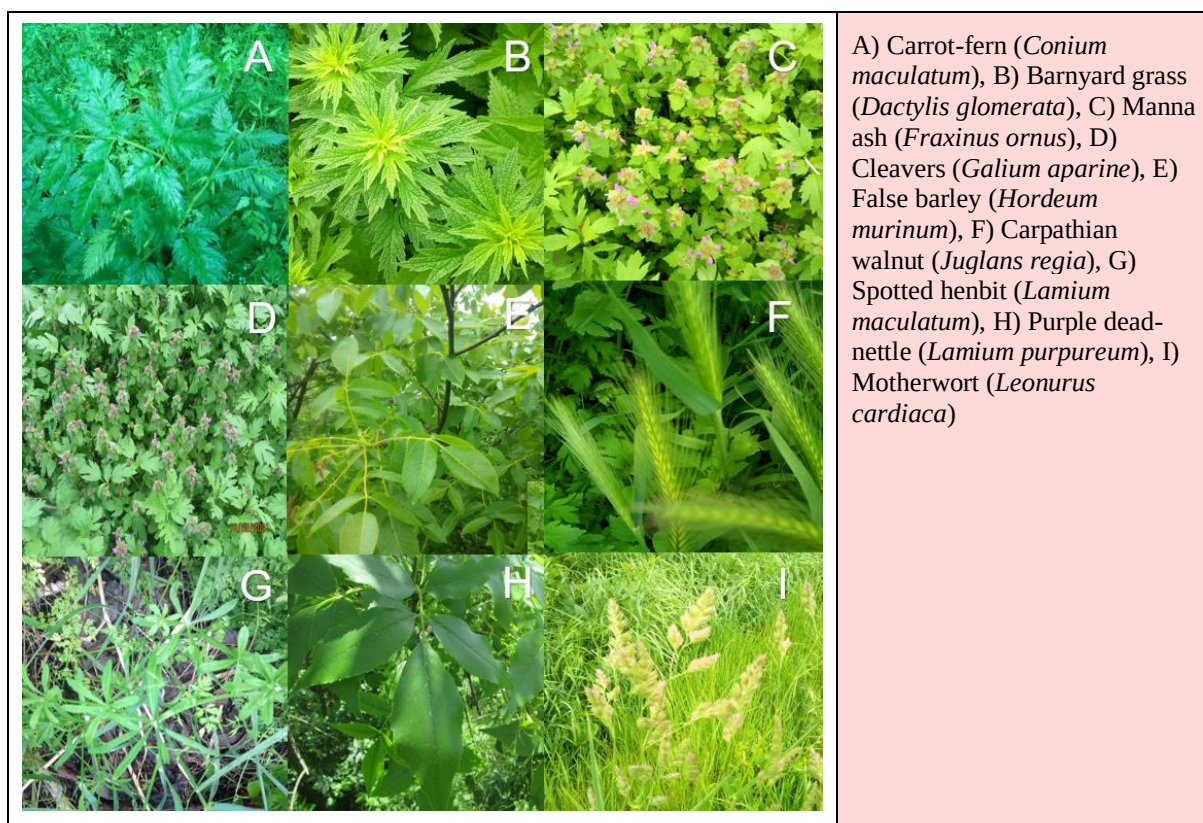


Figure 5-40 Photographs of recorded flora.

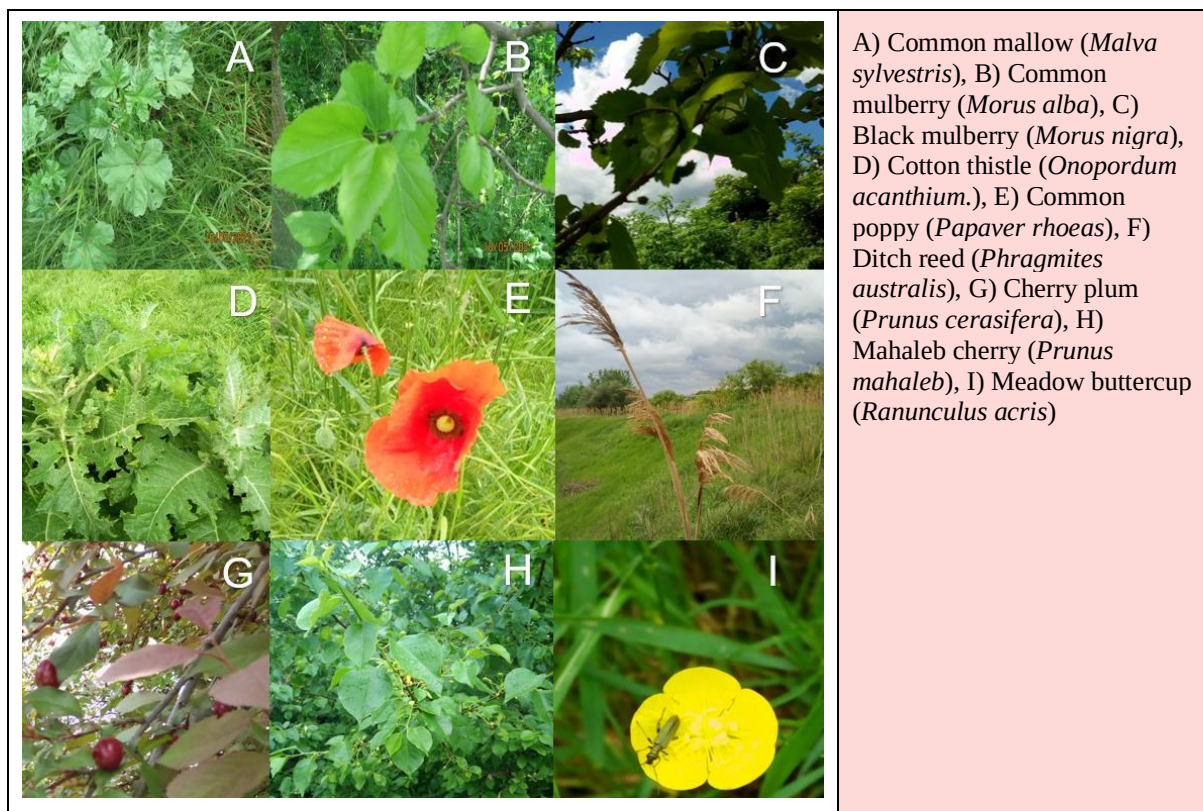


Figure 5-41 Photographs of recorded flora.

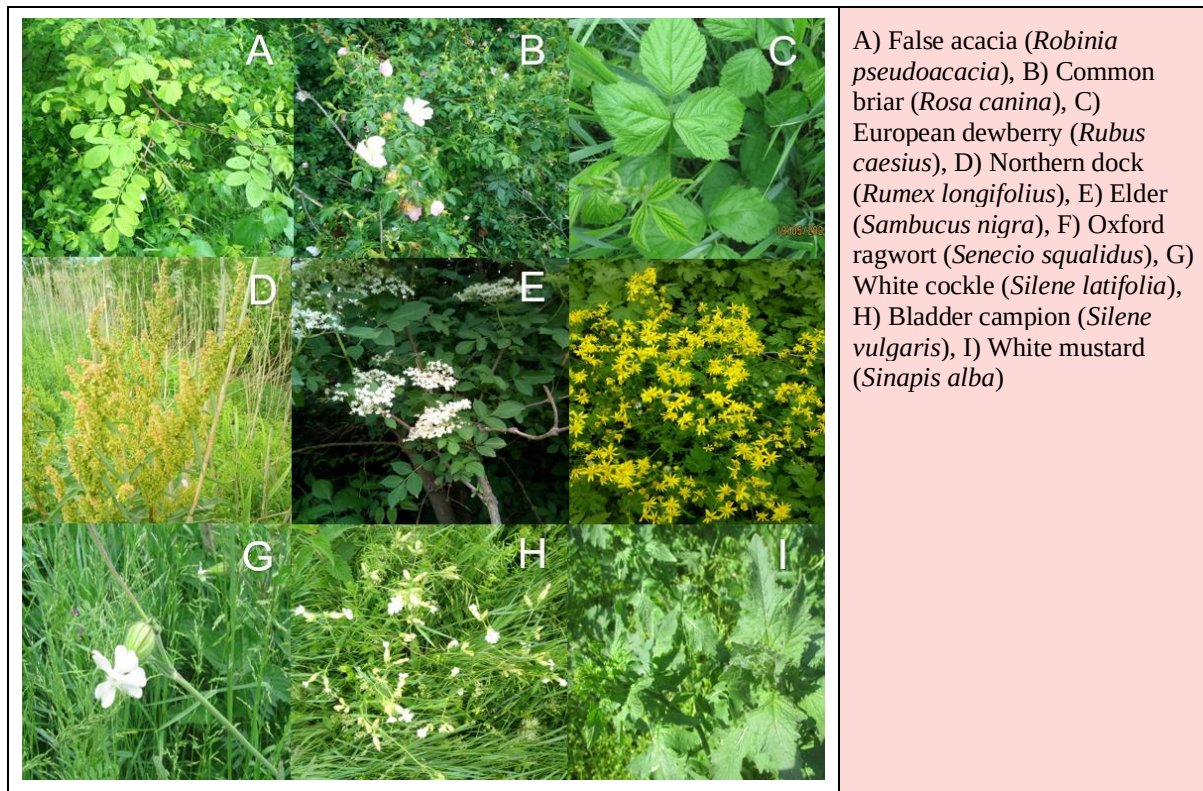


Figure 5-42 Photographs of recorded flora.

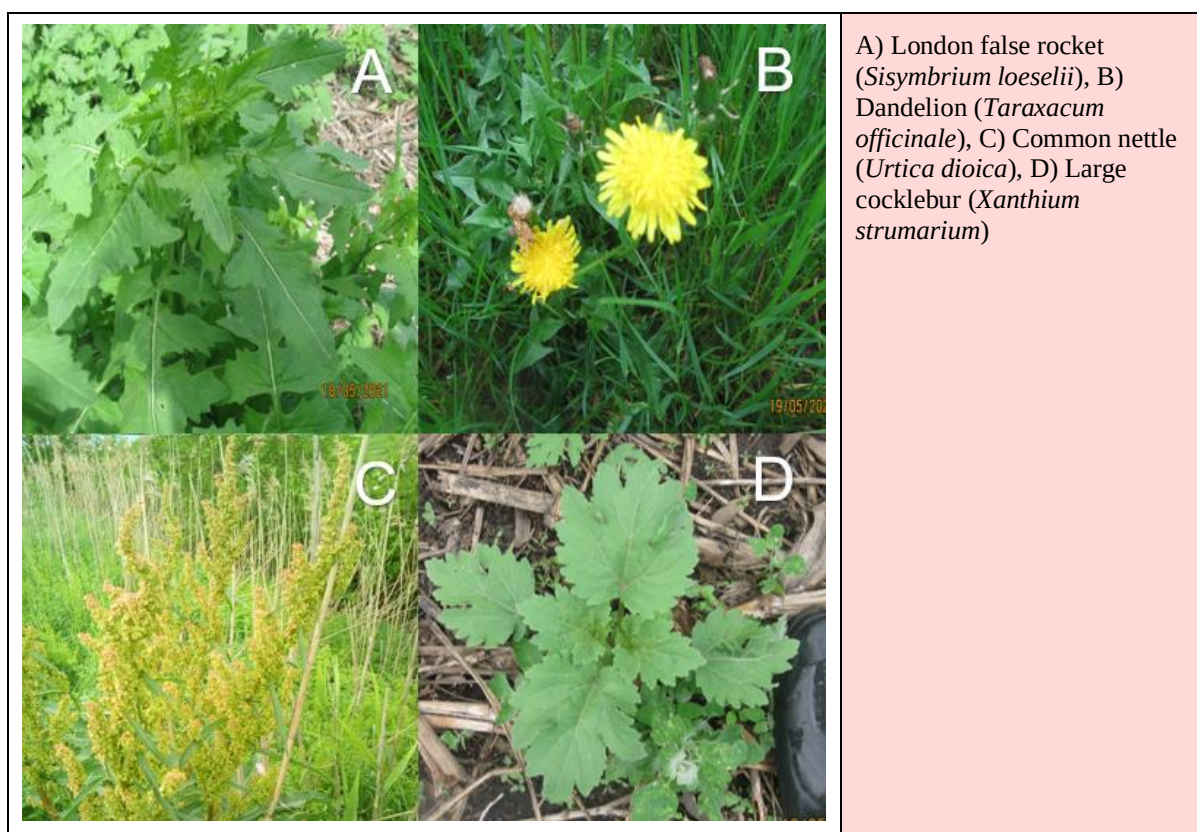


Figure 5-43 Photographs of recorded flora.

MOSESSES AND LICHENS

Mosses were rare / limited for the project area. One species was recorded on the northern border of the project area, at several locations. Lichens were present with one species being recorded, namely *Xanthoria parietina*. This species is common / frequent on tree bark. The recorded species are presented in Table 5-24 and



Figure 5-44.

Table 5-24 Recorded species of mosses and lichens

SPECIES	ABUNDANCY	SERBIAN STATUS OF PROTECTION	IUCN CATEGORY
<i>Dicranum sp.</i>	Limited	Species <i>viride</i> is protected	Some species are LC or NT

<i>Xanthoria parietina</i>	Limited	Not listed	Not listed
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Figure 5-44 Photographs of recorded mosses and lichen.

5.3.6 AQUATIC FAUNA

The adjacent water resource was sampled for approximately 6 hours, with overall good conditions. Temperature of water ranged between 17,2-20,1°C, and the air temperature ranged from 26,0-29,6°C. The average depth of the Begej River is 2,5 m, with an average water flow 10-25 m³/s.

FISH

Fishes were collected from the three locations on the Begej River. Two species were caught: one individual of Common carp (*Cyprinus carpio*) and one individual of Asp (*Leuciscus aspius*). The two species were sampled upstream of the project area and adjacent to the project area respectively. One dead individual of the alien Silver carp (*Hypophthalmichthys molitrix* Valenciennes, 1844) was found approximately 300 m upstream of the project area. A listed of the recorded species is presented in Table 5-25, with supporting photographs presented in



Figure 5-45.

Table 5-25 Recorded species of fish

SPECIES	NUMBER OF INDIVIDUALS	LENGTH	SERBIAN STATUS OF PROTECTION	IUCN CATEGORY
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<i>Cyprinus carpio</i>	1	Standard – 29,5 cm Total – 35 cm	Protected Fishing species whose status and protection regime are regulated by fisheries regulations	VU
<i>Leuciscus aspius</i>	1	Standard – 42 cm Total – 50 cm	Protected Fishing species whose status and protection regime are regulated by fisheries regulations	LC
<i>Hypophthalmichthys molitrix</i>	1	Not measured, approximately 40 cm in total	Not listed	NT in native lands LC in introduced areas

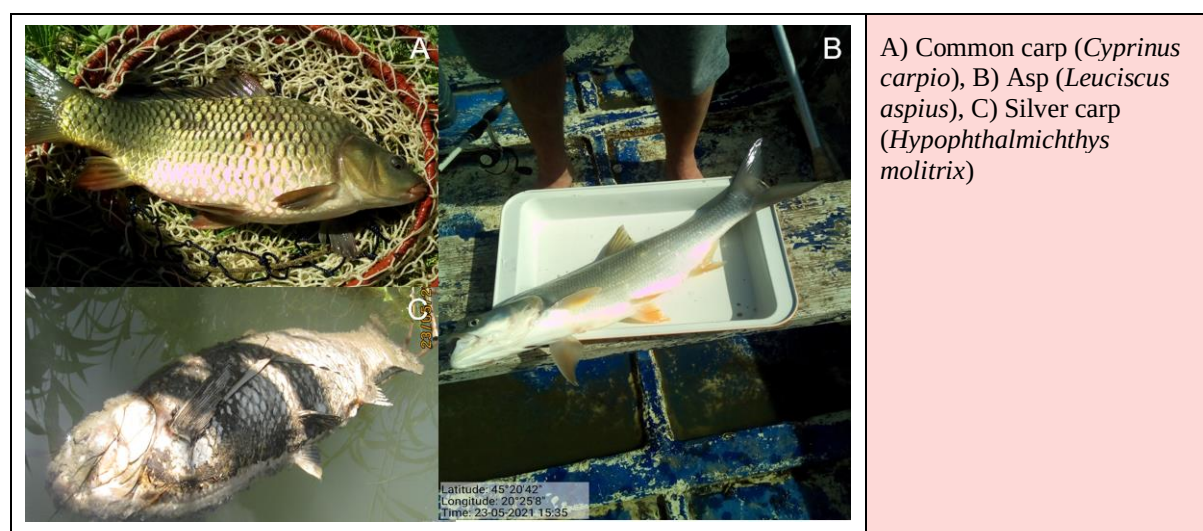


Figure 5-45 Photographs of recorded fish species.

MAMMALS

A single aquatic mammal species was recorded during the assessment, namely a European water vole (*Arvicola amphibius* L. 1758). The mammal was recorded on the right-hand embankment of the river, in the vicinity of the project area.

Table 5-26 Recorded species of mammals

SPECIES	NUMBER OF INDIVIDUALS	SERBIAN STATUS OF PROTECTION	IUCN CATEGORY
<i>Arvicola amphibius</i>	1	Protected	LC

BIRDS

The diversity of water (or aquatic) birds was determined to be moderate, with a total of six (6) species being recorded (Table 5-27). The Mallard (*Anas platyrhynchos* L. 1758) and Black-headed gull (*Larus ridibundus* L. 1766) were the most abundant, with approximately 20 individuals recorded for both species. The Black-headed gull was recorded in flight across the Begej River. A single individual of the following species was recorded, namely Grey heron (*Ardea cinerea* L. 1758), Purple heron (*Ardea purpurea* L. 1766, Little egret (*Egretta*

garzetta L. 1766), Great egret (*Ardea alba* L. 1758) and Squacco heron (*Ardeola ralloides* Scopoli, 1769). The Grey heron, Great egret and Purple heron were in flight across the Begej River (

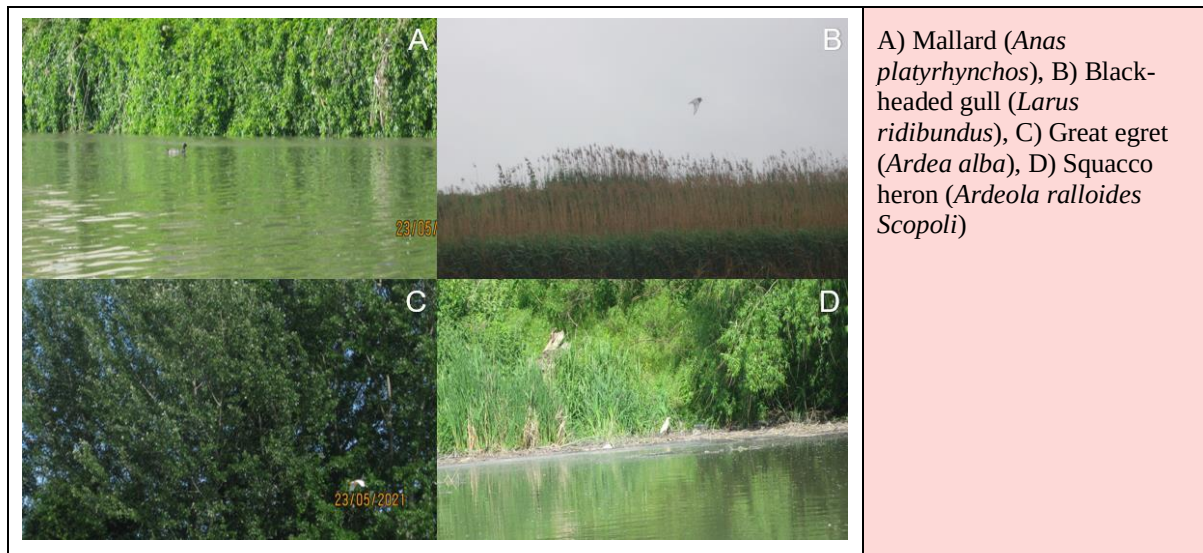


Figure 5-46). The Little egret was also in flight and the Squacco heron was on the river bank.

Table 5-27 Recorded species of birds

SPECIES	NUMBER OF INDIVIDUALS	SERBIAN STATUS OF PROTECTION	IUCN CATEGORY
<i>Larus ridibundus</i>	Approximately 20	Protected	LC
<i>Anas platyrhynchos</i>	Approximately 20	Protected Hunting species whose status and protection regime are regulated by regulations in the field of hunting	Not listed
<i>Ardea purpurea</i>	1	Strictly protected	LC
<i>Ardea cinerea</i>	1	Protected Hunting species whose status and protection regime are regulated by regulations in the field of hunting	LC
<i>Egretta garzetta</i>	1	Strictly protected	LC
<i>Ardea alba</i>	1	Strictly protected	LC
<i>Ardeola ralloides</i>	1	Strictly protected	LC

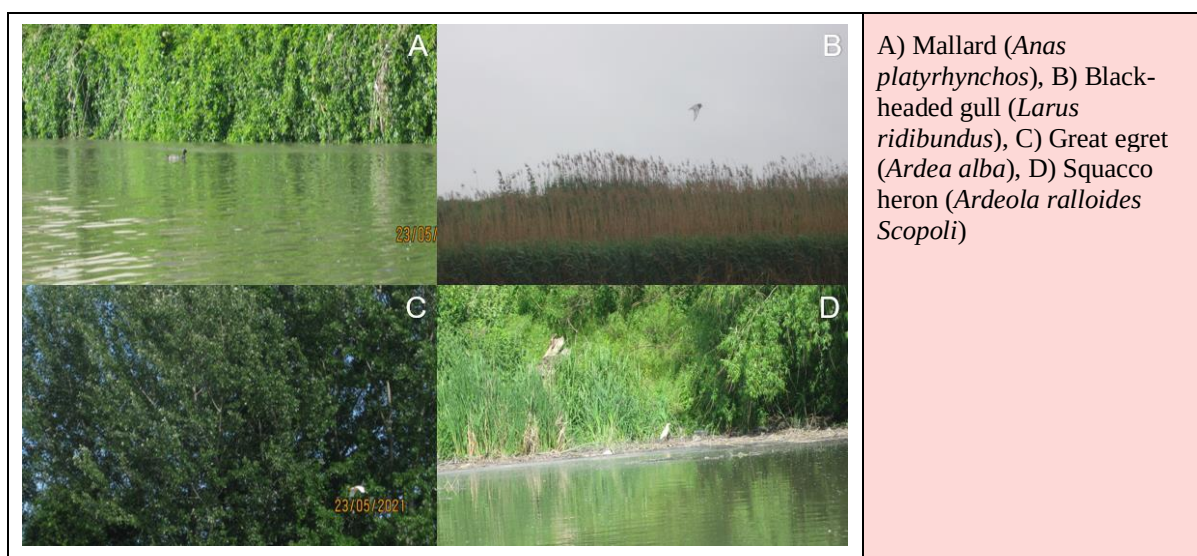


Figure 5-46 Photographs of the recorded water birds.

AMPHIBIANS

Only one (1) species of amphibian was recorded during the survey (Table 5-28), namely the Marsh frog (*Pelophylax ridibundus* Pallas, 1771). The estimated number of individuals for the project area is thought to be between 100-200. A photograph of the Marsh frog recorded for the project is presented in



Figure 5-47.

Table 5-28 Recorded species of amphibians

SPECIES	NUMBER OF INDIVIDUALS	SERBIAN STATUS OF PROTECTION	IUCN CATEGORY
<i>Pelophylax ridibundus</i>	100-200	Protected The species is commercial and is subject to the provisions of the Regulation on bringing under control the use and trade of wild flora and fauna	LC



Marsh frog (*Pelophylax ridibundus*)

Figure 5-47 Photographs of the recorded frog species

REPTILES

Two species of reptiles were found during the survey, these include the Grass snake (*Natrix natrix* L. 1758) and European pond turtle (*Emys orbicularis* L. 1758). Table 5-29 presents a table for the recorded species, with photographs presented in



A) Grass snake (*Natrix natrix*), B) European pond turtle (*Emys orbicularis*)

Figure 5-48. Snakes were present by two or three individuals, while recorded turtles were seven, but is high probability that on the river bank and in the water, in the zone of location, can be 30-40 individuals of that species.

Table 5-29 Recorded species of reptiles

SPECIES	NUMBER OF INDIVIDUALS	SERBIAN STATUS OF PROTECTION	IUCN CATEGORY
<i>Natrix natrix</i>	2-3	Strictly protected	LC
<i>Emys orbicularis</i>	20-30	Strictly protected	NT



Figure 5-48 Photographs of the recorded reptile species

INVERTEBRATES

Sampling for invertebrates comprised of overturning rocks and searching vegetation on the embankments. This yielded no results. Sediment retrieved by grab samples from various locations in the Begej River also yielded no results. The river bed substrate of the Begej River (particularly towards the middle) is not comprised of sand or gravel, but with black sludge / waste material (Figure 5-49). The sludge was present at all sample locations in the Begej River.

Sediment along the embankments was sampled for the presence of invertebrates, with low abundances and diversities being recorded. The sediment was dominated by insects, snails and a single leech was recorded. Five species were recorded, these included the Damselfly (*Lestes sponsa* Hanseemann, 1823), several individuals of Water scorpion (*Nepa cinerea* L. 1758), one (1) individual of Common backswimmer (*Notonecta glauca* L. 1758), one (1) individual of Leeches (*Hirudo* sp. L. 1758) and several individuals of *Cepaea vindobonensis* Pfeiffer, 1828. Photographs of some of the recorded invertebrates are presented in



Figure 5-50.



Figure 5-49 Structure of river sediment

Table 5-30 Recorded species of invertebrates

SPECIES	NUMBER OF INDIVIDUALS	SERBIAN STATUS OF PROTECTION	IUCN CATEGORY
<i>Lestes sponsa</i>	Several	Not listed	LC
<i>Nepa cinerea</i>	Several	Not listed	Not listed
<i>Hirudo sp.</i>	One	Species <i>medicinalis</i> is protected The species is commercial and is subject to the provisions of the Regulation on bringing under control the use and trade of wild flora and fauna	<i>Hirudo medicinalis</i> is NT
<i>Notonecta glauca</i>	One	Not listed	Not listed
<i>Cepaea vindobonensis</i>	Several	Not listed	LC



Figure 5-50 Photographs of sampled invertebrates.

MACROPHYTES

The diversity of macrophytes recorded for the Begej River is low.

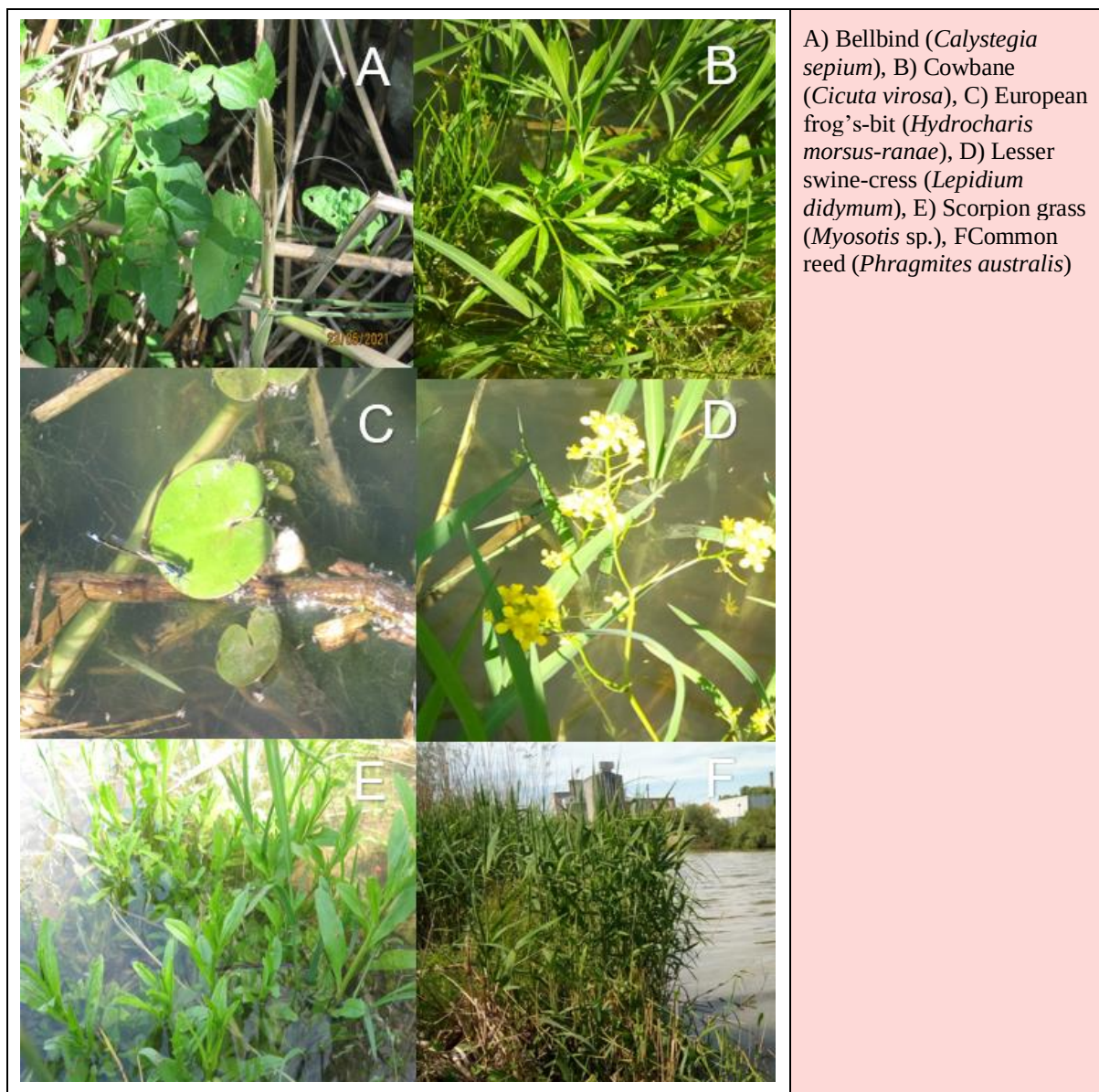


Figure 5-51 and

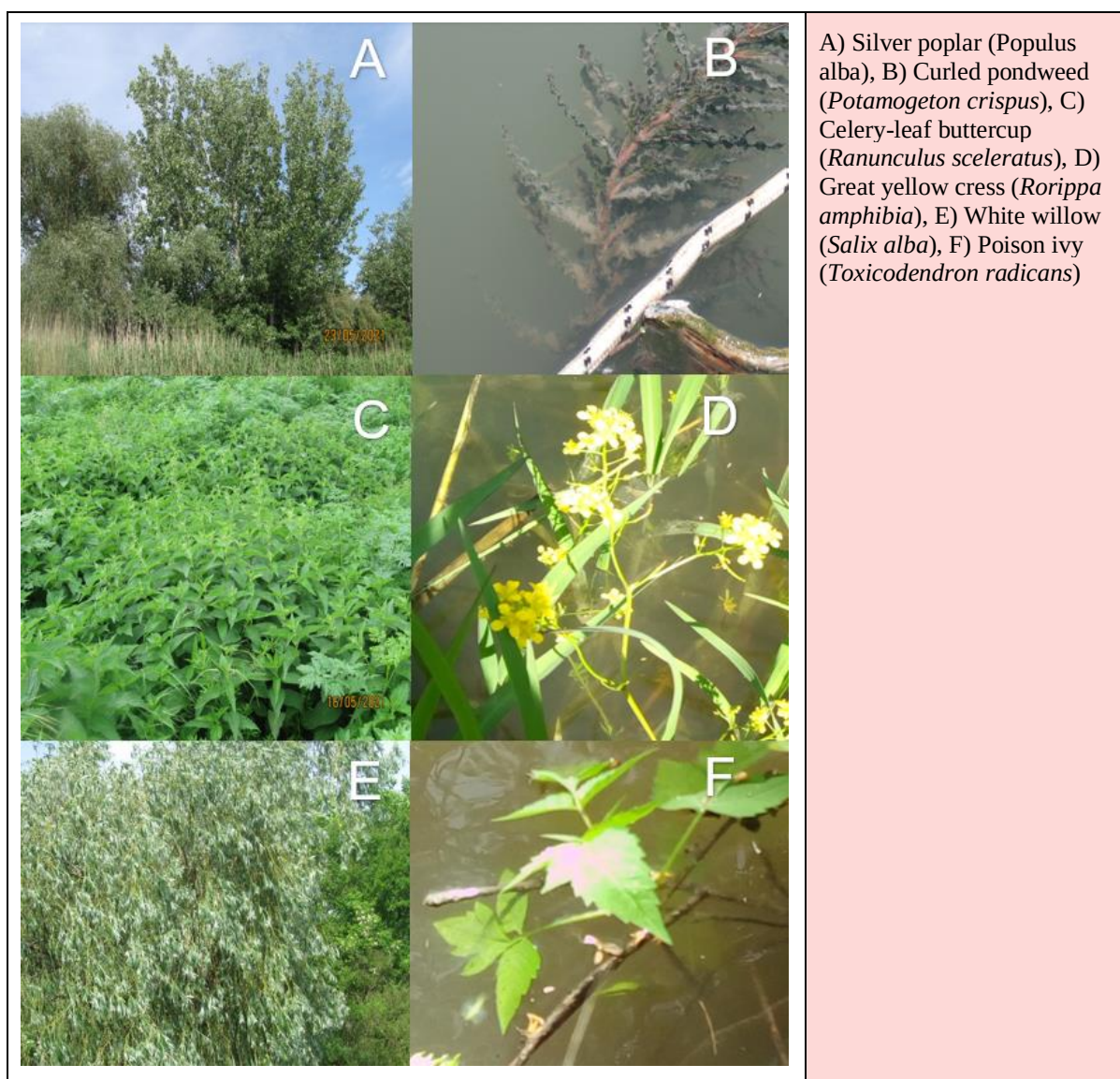


Figure 5-52). *Salix alba* is dominant in the area and is well adapted for semi-aquatic conditions. *Phragmites australis* dominates the river banks, and large stands have formed. Other herbaceous plants, biannuals and perennials were recorded but in are low abundance (Table 5-31).

Table 5-31 Recorded species of macrophytes

SPECIES	ABUNDANCE	SERBIAN STATUS OF PROTECTION	IUCN CATEGORY
<i>Calystegia sepium</i>	Occasionally	Not listed	Not listed
<i>Cicuta virosa</i>	Rare	Strictly protected	LC
<i>Hydrocharis morsus-ranae</i>	Occasionally	Not listed	LC
<i>Lepidium didymum</i>	Occasionally	Not listed	Not listed
<i>Myosotis sp.</i>	Occasionally	Not listed	LC
<i>Phragmites australis</i>	Dominant	Not listed	LC
<i>Populus alba</i>	Rare, on the river bank	Not listed	LC
<i>Potamogeton crispus</i>	Frequent	Not listed	LC
<i>Ranunculus sceleratus</i>	Rare	Not listed	LC

<i>Rorippa amphibia</i>	Occasionally	Not listed	LC
<i>Salix alba</i>	Rare, on the river bank	Not listed	LC
<i>Toxicodendron radicans</i>	Rare	Not listed	Not listed

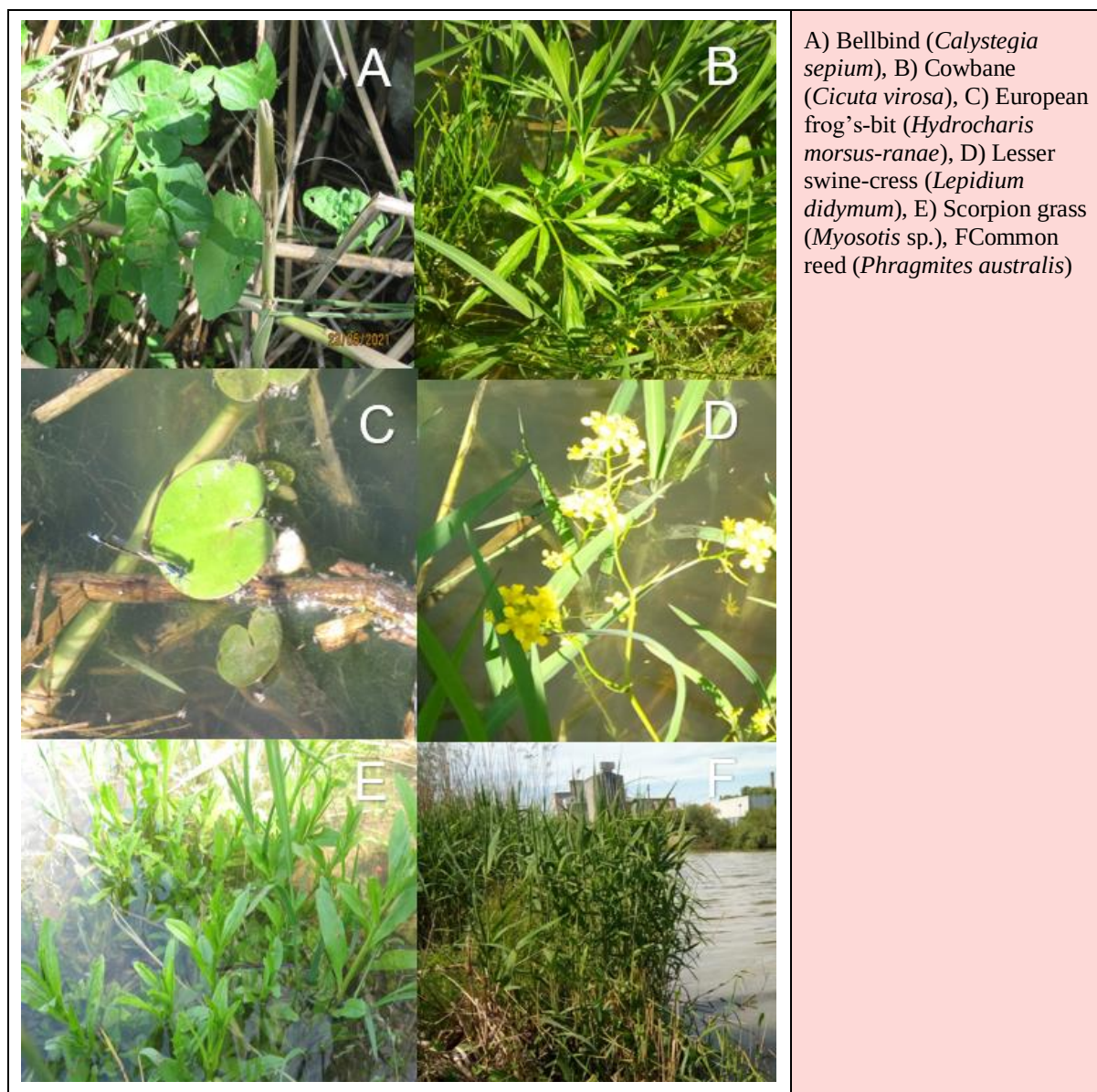


Figure 5-51 Photographs of recorded macrophytes.

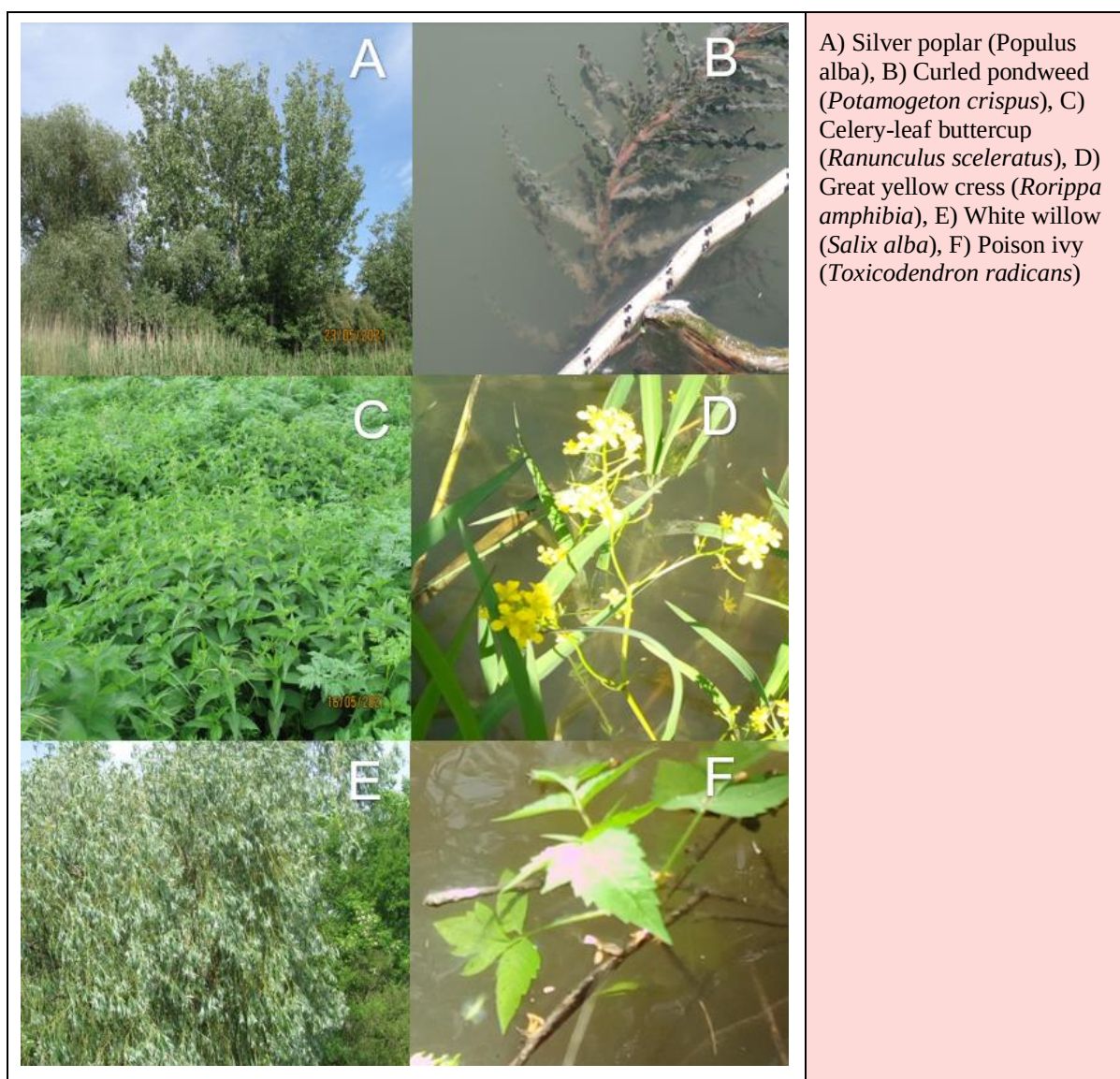


Figure 5-52 Photographs of recorded macrophytes.

5.3.7 CRITICAL HABITAT

Performance Standard 6 (PS6; IFC 2012a) and the associated Guidance Note 6 (GN6; IFC 2019) focuses on the protection and conservation of biodiversity. In most cases, the required conservation outcome under PS6 is no-net-loss of biodiversity value achieved using the “like-for-like” or better principle of biodiversity offsets. However, when a project occurs in critical habitat (CH) supporting exceptional biodiversity value, a net gain in biodiversity value is required. According to the EBRD PR6 the criteria used by the EBRD’s PR6 to define critical habitat build on and are closely aligned with those used by the IFC PS6.

CH identification is required by PS6 to manage risks and avoid, mitigate and offset impacts to areas with high biodiversity value including: 1) habitat of significant importance to Critically Endangered (CR) and/or Endangered (EN) species; 2) habitat of significant importance to endemic and/or restricted-range species; 3) habitat supporting significant global concentrations of migratory species and/or congregator species; 4) highly threatened and/or unique ecosystems; and/or 5) areas associated with key evolutionary processes. CH exists independent of a project and can be identified without reference to a project; a project may be proposed in CH, but the CH is present under baseline conditions and is not defined by the size of the project footprint, or other project effects. CH should be determined on a case-by-case basis according to the concepts of irreplaceability and vulnerability.

The CH assessment for both the terrestrial is shown in Table 5-32 and aquatic biodiversity (for the Begej River) in Table 5-33. Based on this, no CH was identified for the terrestrial biodiversity of the project. CH is confirmed with the downstream reach of the Begej River which is associated with the Carska Bara Nature Reserve. Further to this, the improvement in water quality entering the Begej River via the Aleksandrovački channel is expected to improve instream conditions supporting downstream fauna and flora communities, which includes the protected nature reserve.

Table 5-32: Critical habitat assessment of terrestrial biodiversity

CRITERION	DESCRIPTION	TERRESTRIAL BIODIVERSITY
1	The occurrence of critically endangered or endangered species.	Tier 1 critical habitat is considered as unlikely - it is unlikely that the project area will support 10% or more of the global population of any floral or faunal species. No CR or EN species were recorded for the Project. No CR or EN species were recorded for the Project. The Pond Turtle (<i>Emys orbicularis</i>) were observed, 20-30 individuals of this Near Threatened species were observed. This does still not meet the requirements for this criterion.
2	Habitat types sustain any endemic species with >95% or ≥1% but <95% of its global population restricted to this habitat. And/or, taxa are restricted-range species with an extent of occurrence of 50,000 km ² or less.	None of the floral or fauna taxa in the project area were restricted-range species with an extent of occurrence of 50,000 km ² or less.
3	Migratory or congregator species are present on the site, with abundance values exceeding 1% of the global population size.	Two avifauna migratory species; Common Cuckoo (<i>Cuculus canorus</i>) and Black Headed Gull (<i>Larus ridibundus</i>) were observed. They were however observed in low numbers as such they do not meet the requirement of more than 1% of the global population. No congregatory species were observed.
4	This criterion has relevance to highly threatened or unique ecosystems containing unique assemblages of species, including concentrations of biome-restricted species.	None of the ecosystems potentially affected by the project can be unique to the area. Based on the historical imagery provided in the report it can clearly be seen that the area has been altered for more than 15 years.
5	This criterion has relevance to areas associated with key evolutionary processes (i.e. important landscape level features, which allow for key evolutionary processes to take place).	The perennial river habitat is considered under Criterion 5, but no key evolutionary processes were identified.

Table 5-33: Critical habitat assessment of aquatic biodiversity

CRITERION	DESCRIPTION	AQUATIC BIODIVERSITY
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1	The occurrence of critically endangered or endangered species.	Tier 1 critical habitat is considered as unlikely - it is unlikely that the project area will support 10% or more of the global population of any fish species. Common Carp (<i>Cyprinus carpio</i>) were observed in the project area. This species is Vulnerable and inhabits a vast range of habitat types. This does still not meet the requirements for this criterion.
2	Habitat types sustain any endemic species with >95% or ≥1% but <95% of its global population restricted to this habitat. And/or, taxa are restricted-range species with an extent of occurrence of 50,000 km ² or less.	None of the collected fish species in the project area were restricted-range species with an extent of occurrence of 50,000 km ² or less.
3	Migratory or congregator species are present on the site, with abundance values exceeding 1% of the global population size.	Three migratory fish species namely; Common carp (<i>Cyprinus carpio</i>), Asp (<i>Leuciscus aspius</i>) and Silver carp (<i>Hypophthalmichthys molitrix</i>) were observed. They were however observed in low numbers as such they do not meet the requirement of more than 1% of the global population. No congregatory species were observed.
4	This criterion has relevance to highly threatened or unique ecosystems containing unique assemblages of species, including concentrations of biome-restricted species.	The Carska Bara Nature Reserve (IUCN Category IV) is located approximately 6 km (off channel) downstream of the discharge point. According to the Ramsar evaluation this reserve “is a mosaic of fishponds, swamp, marsh, forest, meadow, and steppe intersected by rivers, canals, and embankments. Vegetation consists of salt-tolerant communities, a rich aquatic flowering plant community, and steppe vegetation. The diversity of biotopes gives rise to high species diversity at the site and includes various rare, endangered, or vulnerable fish, birds, plants, amphibians, reptiles and mammals”. The cleaned water is expected to support and assist in maintaining this downstream biodiversity area.
5	This criterion has relevance to areas associated with key evolutionary processes (i.e. important landscape level features, which allow for key evolutionary processes to take place).	The perennial river habitat is considered under Criterion 5, but no key evolutionary processes were identified.

Whilst no CH is associated with the project area, the Carska Bara Nature Reserve which is in the AoI is classified as CH (Figure 5-53). It is specified by GN56 of the IFC’s Guidance Note 6, the determination of critical habitat can include four critical habitat criteria (i.e., CR/EN species; endemic/restricted-range species; migratory/congregatory species; threatened and unique ecosystems). The Carska Bara Nature Reserve is regarded as a catchment area with relatively high levels of species (avifauna and fish) diversity and is necessary for the survival of these species. GN54 species that projects located within internationally and/or nationally recognized areas of high biodiversity value may require a critical habitat assessment. These would include areas that meet the criteria of the IUCN’s Protected Area Categories Ia, Ib and II, KBAs and IBAs. The Carska Bara Nature Reserve is a KBA and IBA, and has a protected area category rating IV, and this category is unique in that provides a management approach used in areas that have already undergone substantial modification, necessitating protection of remaining fragments, with or without intervention.

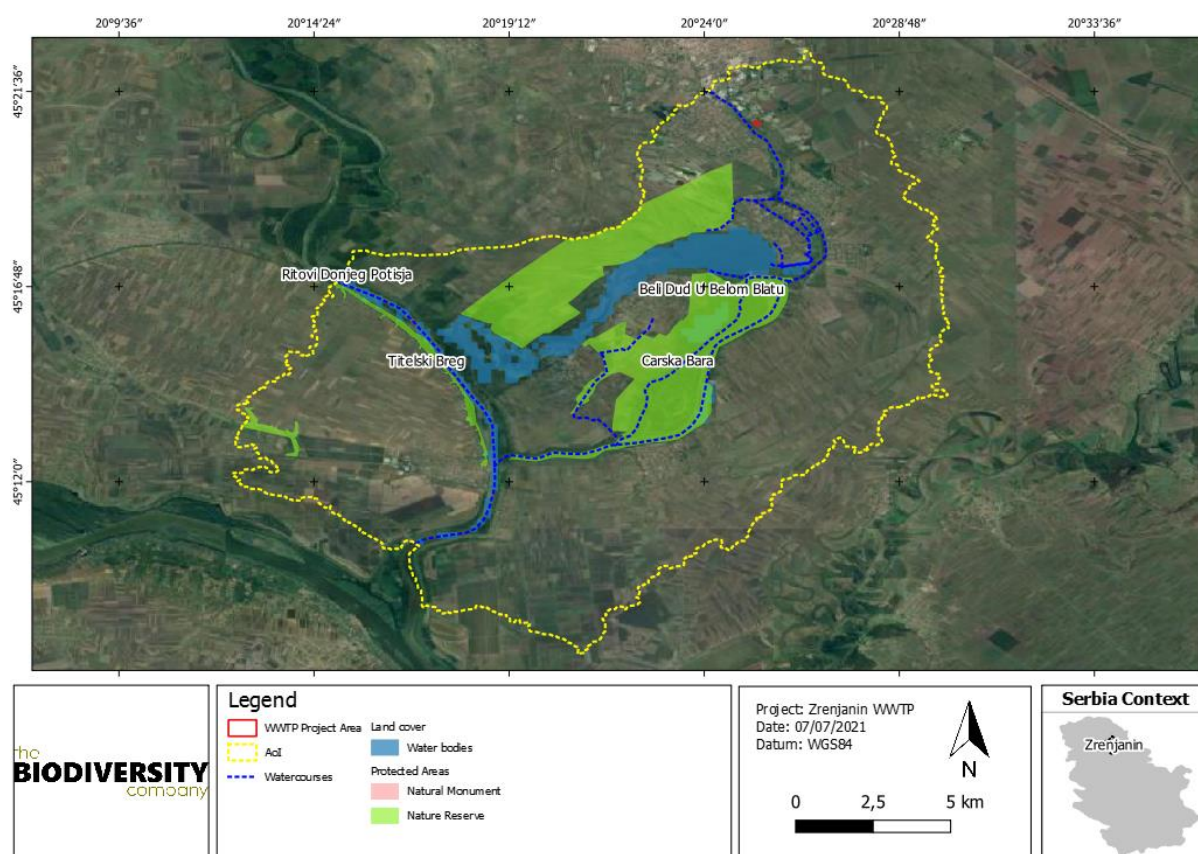


Figure 5-53 Critical Habitat for the Aol

5.4 SOCIAL ENVIRONMENT

5.4.1 METHODOLOGY

The following methodology was adopted for the aspects / components considered for the social baseline:

SITE RECONNAISSANCE

Initial site reconnaissance was undertaken to identify potential social risks to the Project and inform the planning of assessment fieldwork. Where appropriate, local stakeholders were consulted. During site reconnaissance the following was undertaken:

- Site Observations during Zrenjanin walkover (8-9 May 2021).
- Informal engagement by stakeholder team with people in Zrenjanin (residents and rivers users) (23-24 May 2021).
- Meeting with Saša Santovac, Deputy Mayor (Zrenjanin Municipality) (25 May 2021).

DESKTOP REVIEW

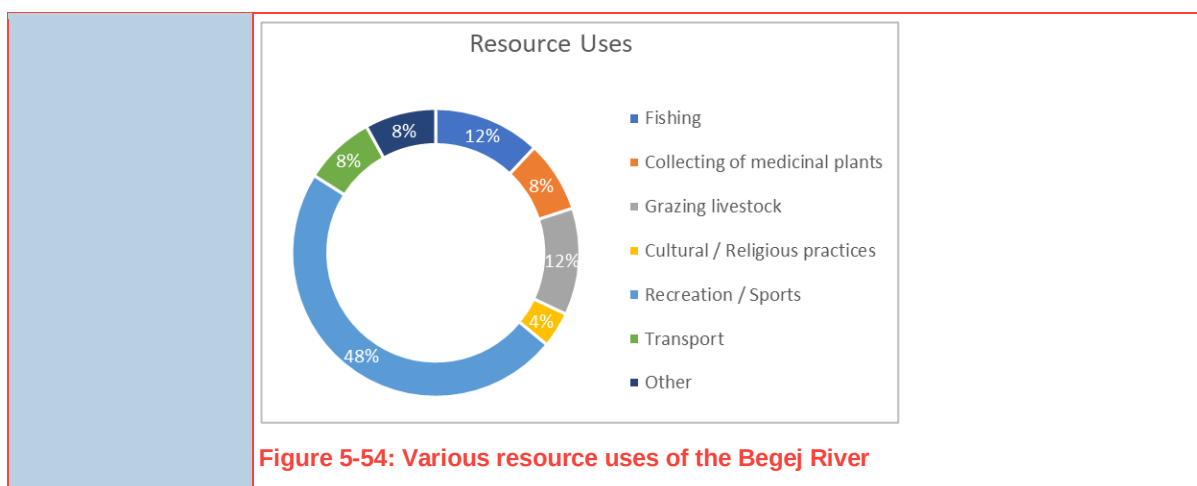
Desk top study to obtain socio-economic baseline data (disaggregated information by age and gender on population, education, employment, etc.) for the region and local area.

SOCIAL SURVEYS

Social surveys were undertaken to secure both quantitative and qualitative information relevant to the social baseline. Surveys, with use of questionnaire, were undertaken with the groups outlined in **Table 5-34**.

Table 5-34 Social Survey Groups

SURVEY GROUP	DESCRIPTION
General households (17 households)	The social team undertook a household survey to gather socio-economic data of the community in the project area. Structured questionnaires were administered by trained social surveyors to collect both quantitative and qualitative data. Some of the quantitative data collected included, but were not limited to land ownership, household composition, household water and sanitation infrastructure and disposal methods, river usage, income and expenditure, among others. The qualitative data included livelihood information, perceptions of the proposed project, and ability/willingness to pay for improved sanitation, among others. The data were analysed using Microsoft Excel to acquire graphic representation of the information obtained from the household survey. The survey obtained appropriate diversity and representation according to location, demographics and economic activity within the identified groups.
Vulnerable groups representatives (15 households)	Communities are not homogeneous, and there can be differentiated impacts within groups, including vulnerable groups, of women, men, the young, the elderly, and persons with disabilities. Vulnerable or “at-risk” groups include people who, by virtue of gender, ethnicity, age, physical or mental disability, economic disadvantage or social status. Such vulnerable or disadvantaged groups could experience adverse impacts from the proposed project more severely than others, and therefore may require additional support or management measures to mitigate such impacts. Such groups that are expected to be present within the Project area include: — Elderly (+65), women, single parent households, households with multiple members, or those living below the poverty line; — Unemployed, socially, and medically excluded — People of Roma and Hungarian ethnicity — Small local agricultural producers A survey of households identified as vulnerable, in line with the above criteria, was undertaken in the Project area to gather relevant baseline information and to get a better understanding of how the proposed Project will potentially affect them. The surveyed households were identified through discussions with relevant figures in the community and the city of Zrenjanin as well as institutions of the Centre for Social Work, National Employment Service, local community “Mužlja” and associations PAOR and ROZA (which deal with mapping and assistance of these vulnerable groups). The survey covered vulnerable households in Mužlja, Ečka and Zrenjanin, focusing on households in close proximity to the Begej River, as well on households with multiple vulnerabilities. The survey obtained appropriate diversity and representation according to location, demographics and economic activity within the identified groups.
Resource users of the Begej River (18 individuals)	A sample survey of individuals that make use of the Begej River (i.e. resource users) was undertaken to gain a better understanding these uses and potential concerns and perceptions of the proposed project. A total of 18 river users from the project area were surveyed. Of the 18 respondents 7 (39%) indicated that they no longer make use of the Begej River. The main reasons cited for not using the river were odour (41%) and pollution (41%), other reasons noted included lack of security, lack of cycling tracks and mosquitos. Of the respondents that still utilise the river 70% access the river within the project area. The results of the survey showed that the main reason for accessing the river was for recreational purposes, identified by 46% of the respondents. While 12% of respondents utilise the river for fishing, 12% for grazing livestock, 8% for collecting medical plants, 8% for transport and 4% for cultural / religious practices. Other uses were noted as growing flowers and having beehives in close proximity to the river. Recreational / sporting activities noted included walking dogs, barbeques with friends and sailing. The various resource uses and percentage distribution by users is shown in Figure 5-54.



FIELD OBSERVATIONS

Apart from the information gathering tools discussed above, ongoing field observation accompanied all work in the field. Such observation was non-invasive, and it can add texture and detail to socio-economic findings in a variety of contexts. Among these are livelihoods and production systems, land use, housing and settlement patterns, social and infrastructural facilities and natural resources. Where appropriate a photographic record was assembled.

COVID-19 PROACTIVE MEASURES

Coronaviruses are a large family of viruses typically associated with illnesses such as the common cold and influenza. A novel coronavirus is a new strain that has not been previously identified in humans. In December, 2019 a new coronavirus was identified in China (Wuhan City), and was initially known as the 2019 Novel Coronavirus (2019-nCoV). It has been now formally named COVID-19. Its identification was confirmed on 07 January 2020.

The World Health Organization (WHO) recommended regular hand washing with soap/alcohol-based sanitizers, wearing face masks while in public and practising social distancing. The International Finance Organisation (IFC, 2020) produced and distributed an interim guidance document on stakeholder engagement under COVID-19 for clients wishing to pursue key engagements, which were adopted in an effort to protect both those conducting social surveys and discussions, and those participating therein.

5.4.2 AREA OF INFLUENCE (AOI)

The primary AoI for the socio-economic assessment is defined as a 2km radius from proposed WWTP. Affected areas / parties within the area include: residential neighbourhoods; informal settlement; agricultural sector; local industries, and river users (i.e. water supply; and tourism, sports and recreation). Potential exists for those affected to experience both negative and positive impacts from the proposal WWTP.

As indicated in **Figure 5-55**, the residential neighbourhood of Mužlja is situated on the west bank of the Begej River, with approximately 10 000 residents. Two thirds of this neighbourhood falls within the defined AoI. The majority of the population of this neighbourhood are Hungarian (~80%) with Serbian making up ~12%, and the balance comprises other ethnic groups.

Heavy industry is not present however there are small to medium enterprises and companies present, primarily commercial business followed by craftsmanship. Agricultural production, comprising small vegetable farms and greenhouses, are located along the western bank of the Begej River.

The industrial area on the east bank of Begej River is referred to amongst residents as the “old industrial area” which includes the following activities: food processing plants, chemical processing plants, metal industry and; small and medium business services. The “new industrial area” includes the following activities: hazardous medical waste treatment plant; metal industry; rubber and tire industry; and other service providers.

Located between the two zones of industry and closer to the banks of the river is a “weekend zone” – a small settlement of weekend houses. Agricultural land is also interspersed to the east of the Begej River and beyond the industrial areas. A Roma settlement is situated on the 2km radius boundary located north-west of the project site, just beyond the industrial area.

Other activities which occur within the AoI include: sport clubs, water sports and rowing associations; cycling associations; fishing associations; nature enthusiasts and groups; and bird and animal observers and enthusiasts.

The following areas are situated just beyond the AoI:

- Local holiday, recreation and touristic zone, namely Lakes’ to the north west of the project site.
- Settlement of Ečka inhabited predominantly of Serbs (55%) and Romanians (32%) and known for its landscape, touristic and historic sites (e.g. Kaštel Ečka).

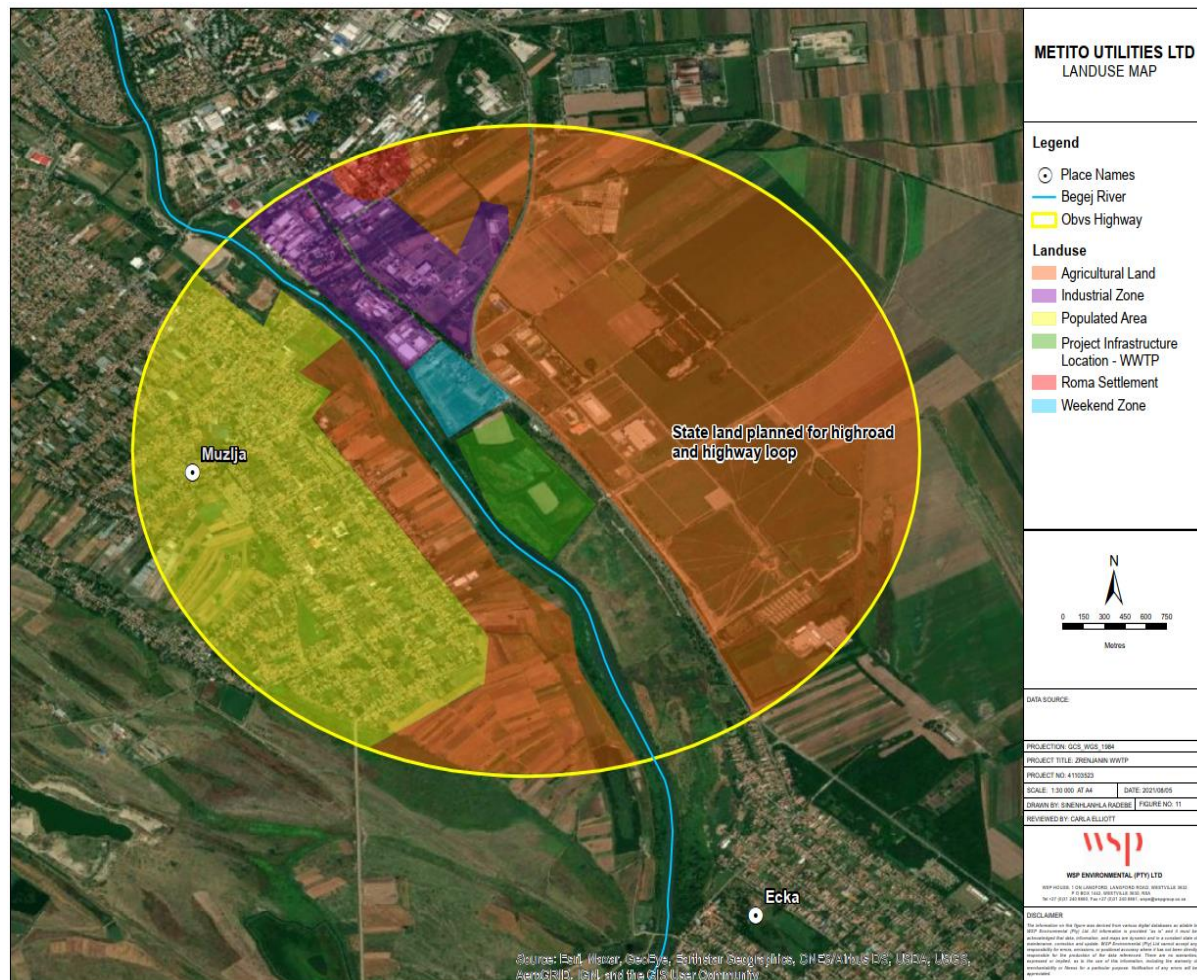


Figure 5-55 Land use within Area of Influence (Dvooper, 2021)

The secondary AoI considers larger scale economic and infrastructure impacts on a wider, regional level, comprising the Zrenjanin Municipality. Whereas the tertiary AoI considers Project impacts on a national scale.

For the purposes of this assessment, fieldwork prioritised the primary AoI. The remaining extent of the AoI has been considered at a desktop level only.

5.4.3 ADMINISTRATIVE STRUCTURE

NATIONAL

Serbia functions as a parliamentary democracy, and the Prime Minister is the head of the government which is broken up into executive, legislative and judiciary branches. The President is seen as a symbol of national unity and is elected by popular vote for a maximum of two five-year terms. The legislative branch is made up of 250 elected deputies that are responsible for enforcing laws, approving budgets, scheduling elections, declaring wars, and ratifying treaties. The judicial branch is made up of a constitutional Supreme Court and several smaller courts. Serbia has been an independent nation since 1991, after the downfall of Yugoslavia, and applied for EU membership in 2009⁸. Serbia received full candidate status for membership of the EU in 2013. Accession negotiations are still underway.

LOCAL AND REGIONAL

Zrenjanin is a city and administrative centre of the Central Banat District in the Autonomous Province (AP) of Vojvodina. Zrenjanin is the largest city in the Serbian part of the Banat geographical region, and the third largest city in the AP of Vojvodina (after Novi Sad and Subotica). Zrenjanin is around 70km north of Belgrade, and about 50km east of Novi Sad, which is also the distance to the present border with the EU (Romania), to the west. The City's position makes it a particularly important transition centre and potential resource in the directions north-south and east-west.

The City of Zrenjanin occupies, by its square area, the biggest territory in the AP of Vojvodina and it is the second city by the size of its territory in the Republic of Serbia (after Kraljevo). The square area of the City of Zrenjanin is 1,326 km², which represents around 8% of the total square area of AP of Vojvodina and 15% of the square area of Banat, which belongs to Serbia. Of the total area that belongs to the City of Zrenjanin, approximately 82.5% comprises agricultural land.

The city consists of Zrenjanin proper and the following settlements / villages: Aradac, Banatski Despotovac, Belo Blato, Botoš, Čenta, Ečka, Elemir, Farkaždin, Jankov Most, Klek, Knicanin, Lazarevo, Lukićevo, Lukino Selo, Melenci, Mihajlovo, Orlovat, Perlez, Stajićevo, Taraš, Tomaševac (**Figure 5-56**). The City of Zrenjanin borders with the municipalities of Kikinda (on the north), Žitište and Sečanj (on the east), Opovo and Kovačica (on the southeast), Belgrade city municipality of Palilula (on the south), Titel and Žabalj (on the west), and Novi Bečej (on the northwest)⁹.

At the beginning of 1990's, when the war broke out on the territory of the former Yugoslavia, it led to difficult social and economic crisis in this area, causing economic stagnation, unemployment, and large migrations of refugees from the former Yugoslav Republics: Croatia, Bosnia and Herzegovina. Zrenjanin experienced the first political changes by the introduction of the multi-party system at the end of 1996, when the local government was ruled by the coalition Zajedno (Together), and in 2000 by the coalition Democratic opposition of Serbia. At the end of 2007, introducing a new national territorial organisation followed by necessary legislation, the Municipality of Zrenjanin was upgraded to an administrative and territorial status of a city. Since 2012, the populist Serbian Progressive Party (SNS) has been the ruling party of Serbia and it established dominant power in Serbian politics.

⁸ <https://worldpopulationreview.com/countries/serbia-population>

⁹ <http://www.zrenjanin.org.rs/en/about-the-city/geographical-position/territory>

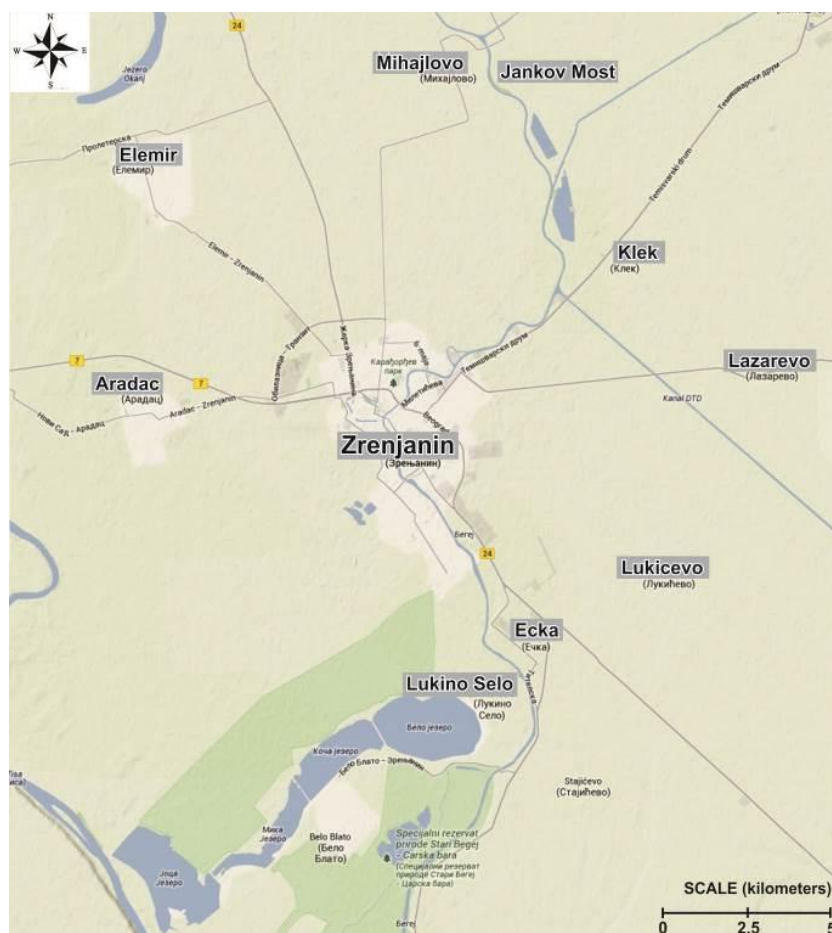


Figure 5-56 Locality Map of Zrenjanin City and Surrounding Settlements (C.R.E.A.M. April 2015)

5.4.4 DEMOGRAPHIC PROFILE

NATIONAL

AGE AND GENDER

The current population of Serbia is 8,699,306 as of Sunday, August 1, 2021, based on Worldometer elaboration of the latest United Nations data¹⁰ with a sex ratio of 49.5% male and 50.5% female. Currently, 56.0 % of the population of Serbia is urban (4,913,420 people in 2019). The median age is 40 years with a life expectancy of 74.3 years (71.5 - men, 77.3 - women)¹¹. **Table 5-35** shows the population age distribution (%) as of 2021.

Table 5-35 National Population Age Distribution (Countrymeters, 2021)

CATEGORY	% OF POPULATION
Population under 15	15.1%
Population between 15 and 64 years old	68.5%
Population 65+	16.5%

¹⁰ <https://www.worldometers.info/demographics/serbia-demographics/#pop>

¹¹ <https://countrymeters.info/en/Serbia#facts>

Dependency ratio of population is a ratio of people who are generally not in the labor force (the dependents) to workforce of a country (the productive part of population). The dependent part includes the population under 15 years old and people aged 65 and over. The productive portion of a population accordingly consists of population between 15 and 64 years. This ratio shows the pressure on productive population produced by the dependent part of population. The value of 46.1 % is relatively low. It shows that the dependent part of population is less than a half of the working part. In other words, the working population (labor force) in Serbia must provide goods for itself and cover expenditure on children and aged persons. And this part of population is less than 50% of working population. The value of less than 50% means that the pressure on productive population in Serbia is relatively low.

NATIONALITY / ETHNICITY

Serbs make up the largest ethnic group in Serbia with 83% of the population, followed by Hungarians (3.5%). There are about 450,000 Romas in the country and 145,000 Bosniaks. Other minorities include Croats, Slovaks, Albanians, Romanians and Bulgarians.

LOCAL AND REGIONAL

AGE AND GENDER

As per the 2011 Census, in Zrenjanin there were 59,856 male and 63,506 female inhabitants. Females comprise 52% of the total population. In all age groups till the age of 44, men outnumber the women. In all other age groups the participation of women is larger. The average age of men is 40.4 and women, 43.9 years. **Table 5-36** details the main population contingents as per 2019 predictions, with a total population of 112,104 (approximately 10% less than the 2011 census).

Table 5-36 Main contingents and indicators of population as per 2019 figures (Source: Republic Statistical Institute)

CATEGORIES	POPULATION IN ZRENJANIN	PERCENTAGE
Pre-school children 0-6 years old	7,134	6%
School children 7-14 years old	9,012	8%
Adults 18+ years old	95,958	86%
Working contingent 15-64 years old	75,485	67%
Average age	43.66	-

Together with a strong depopulation trend in the municipality, there is a current shift in structure and division between urban and rural populations. The dynamics between urban and rural settlements indicate the connection between demographic and economic development. Namely, due to reduction of economic activities in the smaller cities, a strong trend of depopulation is affecting not only rural areas but also smaller municipalities, since the majority of young people are migrating towards bigger centres such are Novi Sad, and Belgrade.

The municipality population is drastically aging. In Zrenjanin, 14% of the inhabitants are less than 14 years old. As the above table shows, the average age among inhabitants of the area is 43.66, compared to 2002 when it was 36 years. Furthermore, the share of urban population in the total population has been increasing while rural population has been constantly decreasing.

From the household survey, all of the primary respondents (head of household) were aged 18 years and above, as expected. Majority of the respondents (53%) were above 60 years of age. The age distribution of primary respondents is shown in **Figure 5-57**.

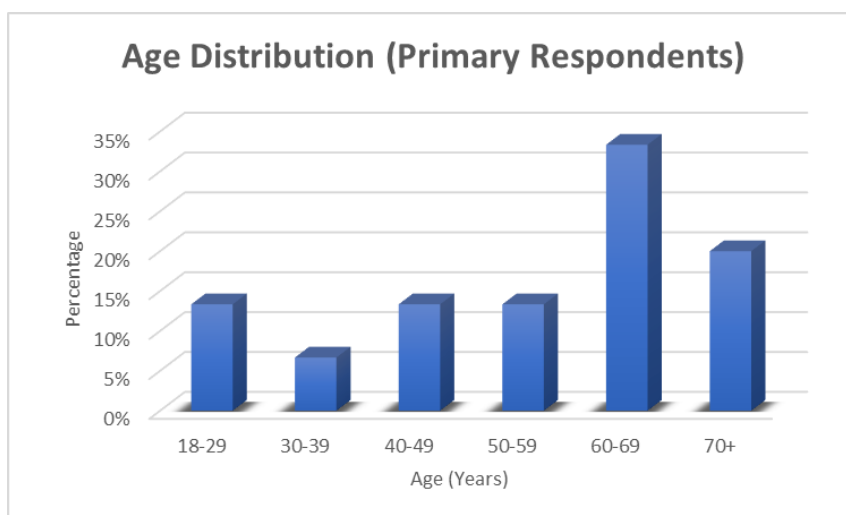


Figure 5-57: Age distribution of primary respondents.

The age of household members ranges from 3 months to 86 years. 24% of household members were indicated as 18 years or below, 48% between 19 and 59 years, and the remaining 28% aged 60 or above. The distribution is shown in **Figure 5-58**.

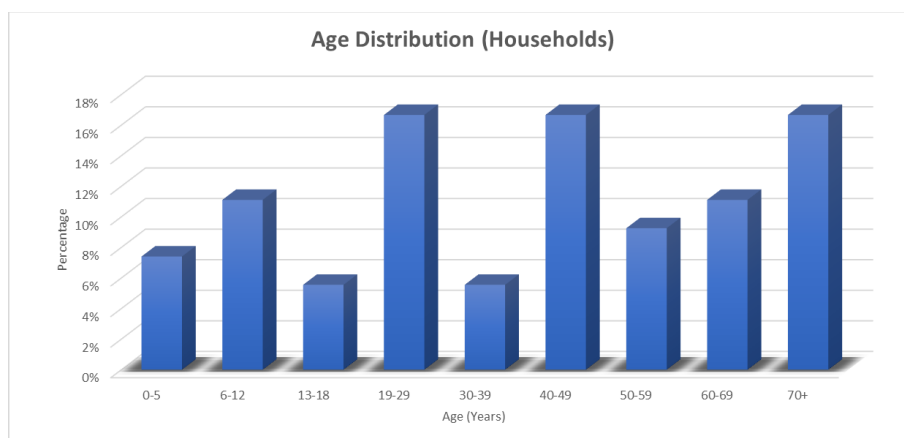


Figure 5-58: Age distribution of household members

Household Size

The mean size of households included in the survey is 3.12, with the largest household comprising six members while the smallest only one individual. The various household sizes are shown in **Figure 5-59**.

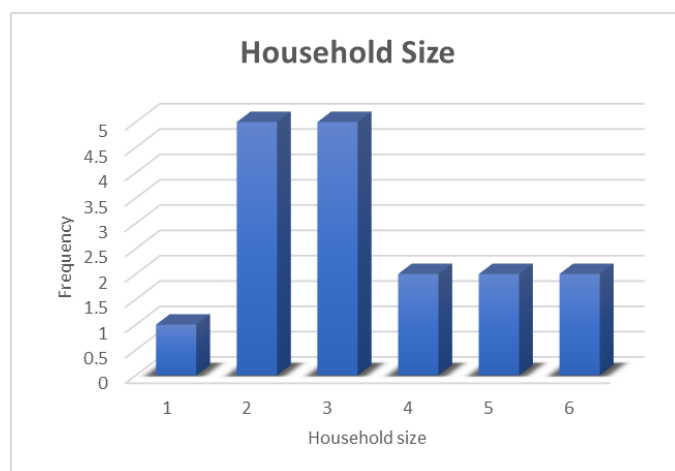


Figure 5-59: Household size

In terms of vulnerable group households, primary respondents to the survey included 60% males and 40% females. The age of the primary respondents ranges from 19 years to 76 years of age, with 53% of the respondents being below the age of 60 years. The age of household members identified ranged from 1 to 78 years of age, with 31% of household members being 18 years or below, 44% between the ages of 19 and 59 years, and the remaining 25% being 60 years or older. The household size ranged from single individuals to a household with 15 members. On average, excluding the household with 15 members, the average surveyed household size was 3.3 members.

NATIONALITY / ETHNICITY, LANGUAGE AND RELIGION

The 2011 census data indicates the following nationalities as having the highest populations within Zrenjanin:

- Serbs: 91,579 (74.24%)
- Hungarians: 12,350 (10.01%)
- Roma: 3,410 (2.76%)
- Romanians: 2,161 (1.75%)
- Slovaks: 2,062 (1.67%)
- Yugoslavs: 592 (0.48%)

In the household survey most primary respondents were of Serbian ethnicity (71%), with the remainder identifying as Roman (18%) and Hungarian (12%). Whereas majority of the primary respondents in the vulnerable groups' households were Hungarian (40%), with equal contribution by Serbians (27%) and Roma (27%), with 7% not disclosing their ethnicity.

The following languages have been established as official languages in AP of Vojvodina since 2011: Serbian, Hungarian, Slovak, Romanian, Croatian, and Rusyn (Russian).

According to the 2002 Census, most of the inhabitants of the Zrenjanin municipality were Orthodox Christians (77.28%). Other faiths include Roman Catholic (12.01%), Protestant (2.13%), and other. Orthodox Christians in Zrenjanin belong to the Eparchy of Banat of the Serbian Orthodox Church with a seat in Vršac. Zrenjanin is also the centre of the Roman Catholic diocese of the Banat region belonging to Serbia.

Most the primary respondents in the household survey (90%) identified as Orthodox and 10% identified as Catholic.

MARITAL STATUS

From the household survey, 76% of the primary respondents were married, with the remaining 24% comprising single people. Similarly, majority of respondents from vulnerable group households are married (67%) with the balance either living together, single, widowed or divorced.

5.4.5 POPULATION CHARACTERISTICS

NATIONAL

POPULATION DECLINE

Since the 1990s, Serbia's population has been gradually declining. The population decline, caused by the war, sanctions of the international community, and NATO bombing, has continued in the 21st century.

At 9.88 million in 1995, the population in 2020 was recorded as 8.74 million. The population decline rate has been increasing every year since 2015, with Serbia's population decreasing at a rate of 0.40% from 2019 to 2020, resulting in a population loss of approximately 35,000 people¹².

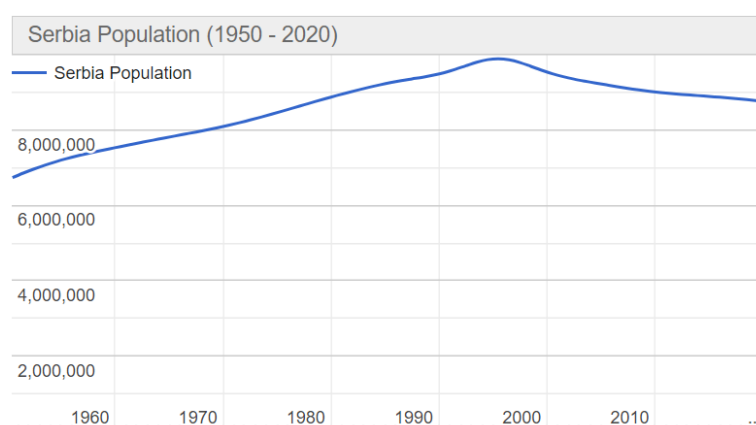


Figure 5-60 Serbia Population Growth / Decline (Source: UN Worldometer¹³)

Serbia is also feeling the effects of a 'brain drain', where the most educated skilled people leave to other countries to find better opportunities. The Serbian population is regarded as an 'ageing population', with a low fertility rate at 1.46 births per woman. About 56.26% of Serbia's population lives in cities and urban areas, while 43.73% live in rural areas.

LOCAL AND REGIONAL

POPULATION DECLINE

According to the Republic Statistical Institute publication "Municipalities and Regions in Serbia" for 2020, the population estimate for the City of Zrenjanin in 2019 was 115,797 inhabitants. **Table 18** provides a comparison of 2002 and 2011 census data, and 2019 estimate.

Table 5-37 Zrenjanin Population (Source: Republic Statistical Institute)

NUMBER OF INHABITANTS	ZRENJANIN
2002 Census	132,051
2011 Census	123,362
2019 Estimation	115,797

According to the 2011 census there were 44,470 households, with 2.8 members on average. The number of inhabitants within Zrenjanin and surrounding main settlements / suburbs is outlined in **Table 19**.

¹² <https://worldpopulationreview.com/countries/serbia-population>

¹³ <https://www.worldometers.info/demographics/serbia-demographics/#pop>

Table 5-38 Number of people living in the main settlements (Source: 2011 Census)

SETTLEMENTS	NUMBER OF INHABITANTS
City of Zrenjanin overall	123,362
City of Zrenjanin urban	76,511
Aradac	3,307
Ečka	3,997
Elemir	4,303
Jankov most	506
Klek	2,711
Lazarevo	2,879
Lukicevo	1,792
Lukino selo	495
Mihajlovo	943

With reference to census data, the trend during the period from 2002 to 2011 indicates a negative annual growth rate, being -1.10% in the project area which is below the national average of -0.56% for the period 2002-2011.

Table 5-39 Population Growth Rates (Source: 2002 Census; 2011 Census)

AREA	CENSUS 2002 – CENSUS 2011
Serbia	-6%
City of Zrenjanin	-8%
Aradac	-4%
Ečka	-13%
Elemir	-8%
Jankov most	-25%
Klek	-9%
Lazarevo	-15%
Lukicevo	-16%
Lukino selo	-20%
Mihajlovo	-6%

Following the analysis of above presented indicators, it is noted that the Zrenjanin population is characterised by a negative growth rate.

MIGRATION

Besides a declining birth rate, migration has also had a significant influence on the reduction of population in the project area. This area is characterised by an intensive emigration of population, and the causes of emigration are: limited possibilities for employment, better salaries in developed areas, better conditions for education, future employment of children, small incomes in the local economy, and economic and social insecurity of young persons, especially those who are living in villages. As mentioned earlier, the population in the Project area is generally migrating from the rural areas to the urban centres of the project area, but also to some other larger urban centres within Serbia.

The most common types of migration include: migration because of marriage, population migration from villages to towns, daily migration and migration of labour to work temporarily abroad. Migrations from village to town are the most characteristic type of permanent migration of the population within the project AoI.

5.4.6 EMPLOYMENT AND ECONOMY

NATIONAL

Serbia's economy shrank 6.4% year-on-year in the second quarter of 2020, after expanding an upwardly revised 5.1% in the previous period. It was the steepest contraction since the last quarter of 1999, amid lockdown restrictions due to the coronavirus pandemic. Household consumption plunged 8%, after growing 3.2% in the first quarter (Q1) of the year; and gross fixed capital formation slumped 11.9%, following a 10.8% expansion. In addition, government spending growth slowed (8.9 %vs 11.8% in Q1). Exports of goods and services tumbled 20.7% (vs 3% in Q1) and imports declined 19.3% (vs 8.1 percent in Q1). On a seasonally adjusted quarterly basis, the Gross Domestic product (GDP) shrank 9.2%, the most since the second quarter of 1999, following a 0.5 percent decline in the prior period¹⁴. GDP from the following sectors all decrease from Q4 2020 to Q1 2021: agriculture, construction, manufacturing, public administration, and services¹⁵.

In Serbia, the employment rate measures the number of people who have a job as a percentage of the working age population. The employment rate decreased from 49.90% in the third quarter of 2020 to 49.70% in the fourth quarter of 2020.

LOCAL AND REGIONAL

The economy of Zrenjanin is diverse, as it has developed processing industry, agriculture, forestry, building industry, and transport. On a national scale, Zrenjanin is most known for its food, textile, leather, metal and chemical industries, oil and natural gas production, civil engineering and traffic / transport. Regarding the percentage of national income realized per economic sector (only available data from 2005) Zrenjanin is receiving its principal income from the manufacturing and processing sector (35.5%) trade (18%) followed by agriculture (17.6%). As of September 2017, Zrenjanin has one of 14 free economic zones established in Serbia.

According to 2019 data of the Republic Statistical Institute, there are 37,184 employed persons with residency in Zrenjanin (out of which 20,159 male and 17,026 female), approximately 49% of the working contingent), or 321 employed persons on average per 1,000 inhabitants. Most are employed in the processing industry (34,3%); wholesale trade, retail and vehicles repair (13.5%); health and social care (7.6%); education (6.2%); transport and storage (5.1%); and public administration and social insurance (4.8%). **Table 5-40** shows the changes in average NET salary per employee with registered residency in Zrenjanin since 2015.

Table 5-40 Net salary per employee (Source: Republic Statistical Institute, 2019)

YEAR	2015	2016	2017	2018	2019	2020
Average salary (RSD) ¹⁶	41,799	43,044	45,093	48,415	52,719	57,228

Out of 4,963 persons, registered as unemployed in 2019 data, 60% (3,008 persons) are looking for their first employment, while 39,1% (1,942 persons) are without any formal qualifications. Gender distribution among the registered unemployed is essentially equal, with 50.9% being female.

From the household survey, the primary source of livelihoods is either formal employment (40%) or pension (40%). The other household heads were either self-employed, not employed, or a student. Occupations identified within the surveyed households included professors, journalist, chemical technician, administrative worker, repair worker, mechanic, production worker, electrician, coordinator, driver, seamstress, administrator, and business secretary. Of the households surveyed 65% include at least one pensioner as a household member, and 35% included at least one student / learner.

In terms of the vulnerable group households, 33% of primary respondents were employed, 27% were pensioners and 40% were not employed.

¹⁴ Serbia GDP Annual Growth Rate, <https://tradingeconomics.com/serbia/gdp-growth-annual>

¹⁵ Serbia GDP Annual Growth Rate, <https://tradingeconomics.com/serbia/gdp-growth-annual>

¹⁶ Serbian dinar

During the survey most of the households (59%) indicated that they consume local produce from the area. Of these households, all identified that they consume agricultural produce, while 40% indicated that consume produce from the Begej River. Other local produce consumed includes meat, milk and cheese.

Among the surveyed households, the mean monthly household income was reported to be RSD 83,375. Mean monthly expenditure in relation to water, sanitation and power/energy supply for the month prior to the survey was reported to be RSD 11,406 per household; ranging between RSD 3,000 and 40,000. 71% of surveyed household indicated that they incur additional expenses, on average RSD 4,349 per month, for other waste / sanitation services.

Comparatively, among the vulnerable groups surveyed households, the mean monthly household income was reported to be RSD 59,972. This is approximately RSD 23,400 less than the mean monthly household income noted in the general household survey. Mean¹⁷ monthly expenditure in relation to water, sanitation and power/energy supply for the month prior to the survey was reported to be RSD 7,547 per household; ranging between RSD 4,000 and 13,000. This is approximately only RSD 3,850 less than the mean monthly household expenditure noted in the general household survey. Furthermore, 47% of surveyed household indicated that they incur additional expenses, on average RSD 4,500 per month, for other waste / sanitation services. This is only marginally less, approximately RSD 150, than that indicated by the 71% of respondents in the general household survey.

Of the households surveyed, 76% indicated that they would be willing or able to pay for improved sanitation services. Whereas 12% indicated they were either not willing or able to pay for improved services. Another 12% indicated that it would depend on what the additional value would be.

Whereas all of the vulnerable households surveyed indicated that they would not be willing or able to pay for improved sanitation services.

5.4.7 LABOUR AND WORKING CONDITIONS

NATIONAL

The Serbian Labour Law (2005) requires that employees must i) be a minimum 15 years of age; and ii) fulfil requirements relating to performance of the particular job, as set out in the Labour Law and in the employer's rulebook on the organisation and systematisation of jobs (e.g. vocational attainment). The employment of persons under the age of 18 requires written consent from their parents, adoptive parents or guardians. Such work must not pose a threat to their health, morals and education nor be prohibited by law. According to the Labour Law, the employment of a person under the age of 18 is possible only if the competent body for health protection confirms that the underage person is capable of performing the job and that the job is not harmful for his health.

The employer may choose to engage on a contract of temporary or occasional work (work that by its nature does not exceeding 120 working days in a calendar year) (i) an unemployed person, (ii) a part time employed person, or (iii) the user of an old-age pension.

According to the Labour Law wages, and how they are calculated, shall be determined by the labour rulebook, collective agreement, or by the employment contract. However, wages shall not be set at less than the minimum wage. The Labour Law defines the minimum wage as net and that it shall be set per working hour. Minimum wage is determined by the decision of the Social-Economic Council not later than 15 September of the current year and it shall be applied as of 1 January of the next year. According to the Decision on the minimum wage amount for 2018 ("Official Gazette of Republic of Serbia" no. 88/2017), the minimum wage shall be RSD 143.00 (net) (approx. € 1) per working hour¹⁸.

¹⁷ Note: One of the households' response were adjusted to from annual to monthly in line with survey requirements.

¹⁸ <https://cms.law/en/int/expert-guides/cms-expert-guide-to-labour-law-in-central-eastern-europe/serbia>

5.4.8 EDUCATION

NATIONAL

According to the World Bank collection of development indicators compiled from officially recognized sources, the following indicators highlight the current education context of Serbia¹⁹:

- Compulsory education, duration (years) in Serbia was reported at 8 years in 2019.
- According to our estimates 7,262,281 persons or 98.11% of adult population (aged 15 years and above) in Serbia are able to read and write. Accordingly about 140,244 adults are illiterate.
- Literacy rate for adult male population is 99.09% (3,539,723 persons). 32,615 are illiterate.
- Literacy rate for adult female population is 97.19% (3,722,559 persons). 107,628 are illiterate.
- Youth literacy rates are 98.59% and 98.4% for males and females accordingly. The overall youth literacy rate is 98.5%. Youth literacy rate definition covers the population between the ages of 15 to 24 years.
- Gross enrolment ratio, primary and lower secondary, both sexes in Serbia was reported at 99.69 % in 2019.
- Gross graduation ratio from lower secondary education, for males was reported at 94.98 % in 2017, marginally lower than gross graduation ratio from lower secondary education for females (95.42% in 2017).
- Percentage of graduates from tertiary education who are female (%) in Serbia was reported at 58.92 % in 2018.

LOCAL AND REGIONAL

Table 5-41 indicates the education level structure of the population older than 15 years of age and per gender, according to the 2011 census for Zrenjanin.

Table 5-41 Education levels (Source: 2011 Census)

	TOTAL	NO FORMAL EDUCATION	INCOMPLETE PRIMARY	PRIMARY EDUCATION	SECONDARY EDUCATION	HIGHER EDUCATION	HIGH EDUCATION	UNKNOWN
Male	50,792	517	3,095	9,348	30,102	2,860	4,769	101
Female	55,125	1,727	7,241	12,055	25,627	3,004	5,362	109
Total	105,917	2,244	10,336	21,403	55,729	5,864	10,131	210
%		2%	10%	20%	53%	6%	10%	0%

From the household survey, 40% a tertiary level education, and 60% of household heads have a secondary education. No household heads had primary or no formal education at all.

In terms of vulnerable group households, only 7% of the primary respondents have a tertiary education, 40% have a secondary education and the majority (53%) have a primary education.

5.4.9 HEALTH

HEALTH AND VULNERABILITY

The 1990s left Serbia particularly vulnerable as it faced civil wars, economic crisis, economic and diplomatic sanctions and NATO bombing all within a short time span. Furthermore, following its international isolation in the 1990s Serbia once again became part of global developments at the beginning of the 21st century, but this also exposed it to pandemics, which pose global risks. The leading causes of death in Serbia in the 2000s were cardiovascular diseases, cancers, HIV and flu viruses²⁰.

¹⁹ <https://tradingeconomics.com/serbia/indicators-wb-data.html?q=education>

²⁰ <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5149467/>

HIV AIDS

The first cases of the HIV epidemic in Serbia were recorded among intravenous drug users (IDUs) and this remained the most common transmission route in the years to come. By the end of the 1990s, intravenous drug use continued to be the number one risk among the cumulative number of HIV/AIDS cases (around 48.9%), followed by sexual transmission (33%). Various factors contribute to the spreading of HIV, the most significant being low social and economic status of a section of the population, but also an inadequate system for controlling the HIV/AIDS epidemic. Although Serbia is believed to have a low HIV infection prevalence, the fact remains that the HIV/AIDS testing rate is very low. In the period from 1985, when the first cases of HIV/AIDS were reported in Serbia, to 2013, at total of 1692 people were reported infected with HIV, of which 1061 (63%) of whom died. Therefore HIV/AIDS not only has a high mortality rate but also leads to negative consequences for the healthcare system, family, and society as a whole. On the other hand, people infected with HIV/AIDS often face basic human rights violation, discrimination, and stigmatisation.

INFECTIOUS DISEASES

H1N1

The rise in infectious diseases, particularly respiratory ones, is a result of the 2009 the outbreak of the new H1N1 pandemic flu. Based on a special epidemiological surveillance, the total number of infected people in Serbia was estimated at between 750,000 and 1,000,000, of which the total number of hospitalized people was 6,021, and 137 died. The then health minister therefore issued a decree declaring the H1N1 flu epidemic an issue of high epidemiological significance on the territory of the Republic of Serbia. The rapid disease transmission is often driven by high population mobility and mass gatherings.

Health issues also have economic implications, and it is estimated that the H1N1 epidemic incurred economic losses in Serbian production and trade, between RSD6.2 and 8.2 billion (€64.5 to 85.5 million). Around 1/6 to 1/8 of all costs were the costs of preventative and anti-epidemic measures. On the other hand, the losses were also reflected in a decreased GDP because of work absences and in health expenditure. Health expenditure per capita in Serbia is 4.7 times lower than the average expenditure in the EU, while the unfavourable economic situation means that drugs without a guarantee of validity are bought at markets or online and that citizens self-medicate without seeing a doctor. The events of the late 20th century still have ramifications for the mental health and lifestyle of Serbia's citizens and a study conducted in 2014 determined that psychological distress, measured on Kessler 6 screening scale, was present in some forms in 20% of adult population, while 5.8% of the population can be said to suffer from serious behavioural disorders or anxiety.

COVID-19

In the Republic of Serbia, the first case of COVID-19 was reported on 6 March 2020, and the outbreak is still ongoing. At the moment, the epidemiological situation is stable with a further decreasing tendency of COVID-19 incidence rate in all parts of the country. However, the SARS-CoV-2 virus is still circulating in the territory of the Republic of Serbia. There have been 720,643 infections and 7,108 coronavirus-related deaths reported in the country since the pandemic began²¹ as recorded at the time of writing this report (July 2021). According to the WHO recognised Covid-19 Corina Tracker²², Serbia has experienced a 1% fatality rate and 98.5% recovery rate of total cases recorded.

Serbia has administered at least 5,487,620 doses of COVID-19 vaccines as recorded at the time of writing this report (July 2021). Assuming every person needs two doses, this is deemed to be sufficient to have vaccinated about 39.5% of the country's population. During the last week (19-25 July 2021) reported, Serbia averaged about 7,222 doses administered each day. At that rate, it will take a further 193 days to administer enough doses for another 10% of the population.

²¹ <https://graphics.reuters.com/world-coronavirus-tracker-and-maps/countries-and-territories/serbia/>

²² <https://www.coronatracker.com/country/serbia/>

2019 SERBIAN NATIONAL HEALTH SURVEY

According to the 2019 Serbian National Health Survey (Statistical Office of the Republic of Serbia, 2021), two thirds of the population (66.5%) perceived their general health as very good/good (significantly more in Belgrade 72.8%), 22.8% of the population considered their health to be fair, while every ninth resident rated their health as bad/very bad. Men had a more positive picture of their own health than women: 71.3% of men rated their general health as very good/good, while among women the percentage was 62.1%.

The existence of an illness or health problem that lasts at least six months (or that is expected to last that long) was recorded in 43.6% of Serbian citizens, slightly more than in 2013 (40.0%). As indicated in **Figure 5-61** the percentage of the population suffering from long standing illness correlates to household income with the wealthiest population reporting the lowest long-standing illnesses. Additionally, the national health survey highlighted that differences relate to socio-demographic characteristics of respondents, specifically a significantly higher percentage of residents who have long-standing illness reside in AP of Vojvodina (46.1%), among women (47.4%), in the lower educated population (57.4%),

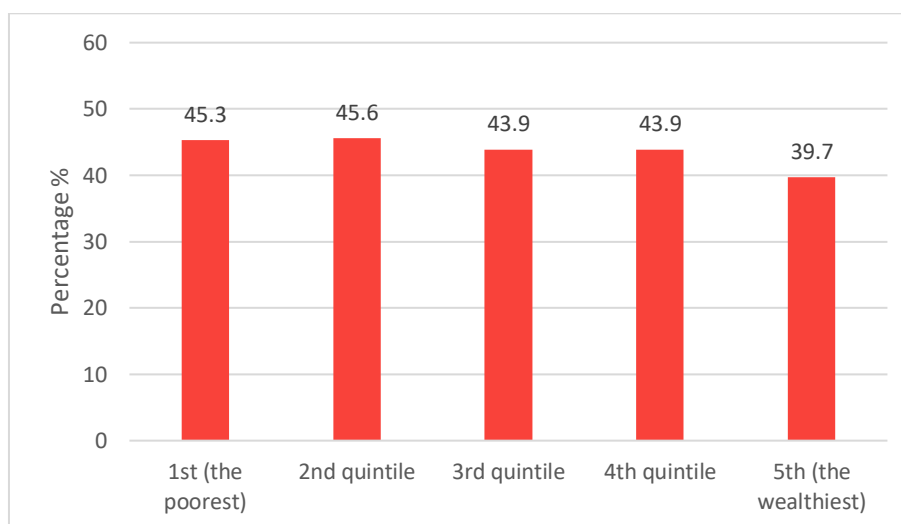


Figure 5-61 Percentage population reporting a long-standing illness or health problems according to quintiles of household income (Source: Statistical Office of the Republic of Serbia, 2021)

Due to health problems, in the last six months preceding the 2019 Survey²³ or longer, 20.3% of the population in Serbia had been limited in their daily activities, which is a significant decrease compared to 2013 (29.9%). Women were significantly more limited in performing daily activities (22.8%), and the residents of urban settlements (24.4%), population with the lowest education (37.1 %) and the population with the poorest financial status (28.2 %).

Monitoring the prevalence of chronic non-communicable diseases is one of greatest public health importance, it is also a prerequisite for the assessment of the general health status of the population. Chronic non-communicable diseases whose treatment requires significant material costs, is the most common reason for the use of health care. Slightly less than half (48.8%) of Serbia's population aged 15 and over in 2019 has had at least one of 17 chronic diseases mentioned in the Survey, significantly more in the region of Southern and Eastern Serbia (52.4%), as well as AP of Vojvodina (51.9%), women more than men (52.9% vs. 44.5%), persons older than 45 years (70.2%), residents with lower level of education (63.8%) and persons which belong to the category of the poorest (52.5%).

Among the population in need of health care, 15.4% did not meet their needs due to long waiting lists, 4.1% due to distance or transportation problems and 31.3% due to financial reasons. Finances were the reason for not meeting the needs of most often dental (13.9%) and medical health care (12.2%), followed by the procurement of prescribed drugs (9.9%) and mental health care (4.0%).

²³ <http://publikacije.stat.gov.rs/G2021/pdfE/G20216003.pdf>

From the household survey, 88% of households indicated that no household members had been sick in the previous three months. Of the 12% of households where members had been sick, none of these were related to water borne diseases.

5.4.10 CRIME

NATIONAL

The United States (US) Department of State Diplomatic Security (OSAC), together with the Regional Security Office at the US Embassy in Belgrade facilitates annual crime reporting to assist travellers abroad make informed decisions to keep themselves safe and secure. Every country is allocated a Travel Advisory, providing tiered levels of advice ranging from Levels 1-4. Serbia is currently reported as Level 2 indicating “travellers should exercise increased caution due to crime”.

According to the Serbia 2020 OSAC Crime and Safety Report²⁴, Belgrade is considered a High-threat location for crime. The considerable risk from crime is due to the activities of Organized Crime (OC) groups, as Serbia is a main trafficking route from the east to Europe. Rival OC groups target each other in a competitive market, as an ongoing turf war between OC groups over drug distribution rights, resulting in violence to include assassination by firearms and explosives.

Street crime does occur. Most crimes against visitors are crimes of opportunity. Pickpocketing in tourist areas and on the public transport systems is common. Residential burglaries are not specific to certain areas of the city with most incidents occurring while occupants are away from home. Internet-based crime and cybercrime in Serbia is on the rise, with the most common types including online fraud and forgery, abuse of payment cards, and unauthorized access to computers and networks. Serbia has identified cybercrime as a growing threat in connection with money laundering, especially through a type of online fraud which consists of email account “hijackings” and fraudulent account changes, typically initiated by email.

Demonstrations by political parties, unions, and other groups occur frequently in front of government buildings, protesting government policies, economic issues, and regional concerns. Corruption levels are perceived to be high by surveyed residents of Serbia, and public trust in key institutions remains low. Public procurement, public administration recruitment processes, mining and rail operations are sectors with a serious problem of conflict of interest.

The European Commission has raised concern over Serbia's judiciary, police, health and education sectors that are particularly vulnerable to corruption. Transparency Serbia estimated in September 2016 that at least 374,000 cases of “petty corruption” in public services remain undiscovered every year.

LOCAL AND REGIONAL

Since the end of 2003, there has been increasing violence in Vojvodina and in other parts of Serbia directed at ethnic, national and religious minorities. In March 2004, Serb ultra-nationalists reacted angrily to news of anti-Serb violence in the mainly Albanian-populated province of Kosovo, subjecting ethnic Albanians, Muslims, and Roma to several particularly violent attacks. Attacks on ethnic Hungarians and Croats, and intimidation and violence towards ethnic Slovaks and Ruthenians in Vojvodina continue to be reported in the 2020s.

While there is no evidence of state involvement in the violence, political and community representatives of ethnic Hungarians and Croats in Vojvodina have accused the Serbian government of failing to acknowledge the seriousness of the incidents, take action to prevent such violence, or properly to punish the perpetrators. In September 2004, the European Parliament adopted a resolution on harassment of minorities in Vojvodina, calling on the Serbian authorities to prevent the incidents and bring those responsible to justice.

The police in Serbia, including Vojvodina, are centralized. The minister of interior has the power to appoint local police commanders in the municipalities. Participation of the ethnic minorities in the police in Serbia is currently far below the percentage of the minorities in the overall population in the province. Hungarians made up only 1.3% of police employees in 2004 despite comprising 3.9% of the overall population.

²⁴ <https://www.osac.gov/Content/Report/b01832c2-4537-4571-b5bb-18b0b3092164>

Serbia is divided into districts. Districts are, in turn, divided into municipalities. Most districts and municipalities have their own criminal courts and prosecutors. District and municipal-level judges and prosecutors are elected by the Serbian parliament in the capital Belgrade. District courts, as a general rule, have jurisdiction over crimes punishable with prison sentences exceeding ten years, while municipal courts have jurisdiction to adjudicate lesser offenses. There are seven districts in Vojvodina, all but one of which contains a district court and district prosecutor. Most of the 45 municipalities in Vojvodina either have their own municipal courts or an outpost of the municipal court from a larger neighbouring municipality.

Under the International Covenant on Civil and Political Rights (ICCPR), which the State Union of Serbia and Montenegro succeeded to in 2001, each state undertakes to respect and to ensure to all persons their fundamental rights without distinction of any kind, including race, language, religion, national origin, or other status. Each state must take the necessary steps to adopt legislative or other measures as may be necessary to give effect to the rights recognized in the Covenant. The International Convention on the Elimination of All Forms of Racial Discrimination, which Serbia and Montenegro succeeded to in 2001, obliges states to guarantee everyone, *"without distinction as to race, colour, or national or ethnic origin ... security of person and protection by the State against violence or bodily harm, whether inflicted by government officials or by any individual, group or institution."*

5.4.11 BASIC SERVICES AND COMMUNITY INFRASTRUCTURE

WATER SUPPLY

The water supply system in Zrenjanin supplies 100% of the urban population in the City of Zrenjanin and 98% of the rural population including Melenci, Aradac, Elemir, Klek, Lazarevo, Lukićevo, Ečka and Stajićevo. The public water utility in Zrenjanin services 46,605 water connections with water meters installed at 99% of the customers.

The Public Utility Company (PUC)²⁵ is aware of approximately 150-200 illegal water connections and makes efforts to discover them and record them as customers. In 2013, out of 9,200,000m³ produced water, 7,359,485m³ was billed to the customers.

Water is being pumped from 35 wells in northeast Zrenjanin. Raw water quality is not potable without significant treatment. There is a health regulation prohibiting the use of this water for drinking and cooking. The City initiated in 2014 the tender for the construction of a new water treatment plant through a public private partnership (PPP) initiative. This facility is not yet operational.

All of the households in the household survey identified the main source of water for domestic purposes as piped water to the household. Furthermore, 6% indicated they also utilised piped water to the yard or a borehole with pump. None of the surveyed households sourced water from the Begej River. All the respondents (100%) indicated that they were not satisfied with the quality of the current water system.

In terms of vulnerable group households, all of the surveyed households noted their main source of water for their household is obtained from piped water to the house. A further 20% indicated they also utilise a hand dug well while 7% practised rainwater harvesting. None of the households source water from the Begej River or the Aleksandrovac Canal. Almost all the respondents (93%) noted that they were not satisfied with the current water supply, especially the quality of water.

EXISTING WASTEWATER SYSTEM

The sewer system in Zrenjanin is well developed in areas that are categorised as urban (i.e. City of Zrenjanin). Wastewater collection is organized by the PUC in the City of Zrenjanin and the settlements Elemir, Ečka, Klek and Melenci comprising 400km of pipeline and ~26 000 connections (**Table 5-42**). In 2014, 94% of population in City of Zrenjanin and 60–75 % of the citizens in the surrounding settlements of Elemir, Ečka and Klek discharged wastewater in the existing sewerage system.

²⁵ Vodovod i kanalizacija

Table 5-42: Wastewater collection in the City of Zrenjanin and surrounding settlements

SEWERAGE CONNECTIONS		2013
Total number of connections to sewerage system		~26,000
Households	Apartment blocks	640
	Individual houses	~24,000
Commercial customers		700

Wastewater from the sewer system is discharged into surface waters (Begej Rivers and Aleksandrovacki Canal) without treatment.

Zrenjanin is flat and the sewer system requires substantial pumping (36 pump stations in total). There are three main pumping stations within the three catchment areas connected to the main sewer located on the eastern bank of the river and discharges into the Aleksandrovacki canal, ~3 km downstream from the city centre and 1.5m from the Begej River. In the same place is the outfall of the stormwater drainage. Other wastewater is discharged into septic tanks.

Blockages occur due to untreated nature of sewage from industry. During blockages, the sewer system fills with oily soft materials from industry, mixed with the waste. It fills the sewer 2-3km upstream from the point where wastewater from oil and dairy industry are being mixed. Back pressure does not allow the free flow of the wastewater in the upstream parts of the catchment area. This phenomenon causes frequent breaks of the older pipelines with smaller diameters. Pump stations constructed before 1990 require rehabilitation, however; sourcing challenges result in slow replacement. The lack of adequate pumps results in overflowing and environmental problems.

The catchment area to the north receives the wastewater from the settlement Elemir (2,500) and from ~32,000 citizens who live in Zrenjanin on the right bank of the River Begej, in total 35,000 population. The pumping station, which has to pump the wastewater from this catchment area towards main sewer, has been out of service for the last 5-6 years and during this time the wastewater is discharged into the stormwater drainage system. A new replacement pumping station 'Centar gradilište' (180 l/sec, 25 m) is under construction. When cooperation it will pump the wastewater collected in this catchment area through a pressure pipeline (600 m) on the left bank, towards the main collector.

During the survey 82% of the households indicated that they dispose of household sewage via the municipal sewer system (i.e. flushing toilet). Other sanitation infrastructure utilised by households, in addition to the flushing toilet, include septic tank (12%) and pit latrine (6%), as indicated in **Figure 5-62**.

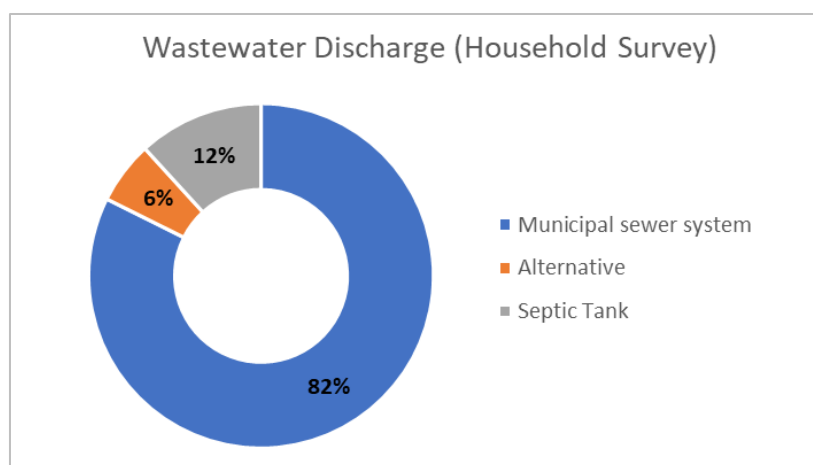


Figure 5-62: Wastewater discharge methods identified by general households surveyed

During the survey 60% of of vulnerable group discharge wastewater via the city sewage network, 27% of into a septic tank, and 13% either throw wastewater into a furrow in the ground or into a nearby pond, as indicated in **Figure 5-63**. In comparison to general households surveyed approximately 20% fewer vulnerable households discharge wastewater via the municipal system, and therefore use alternative disposal methods.

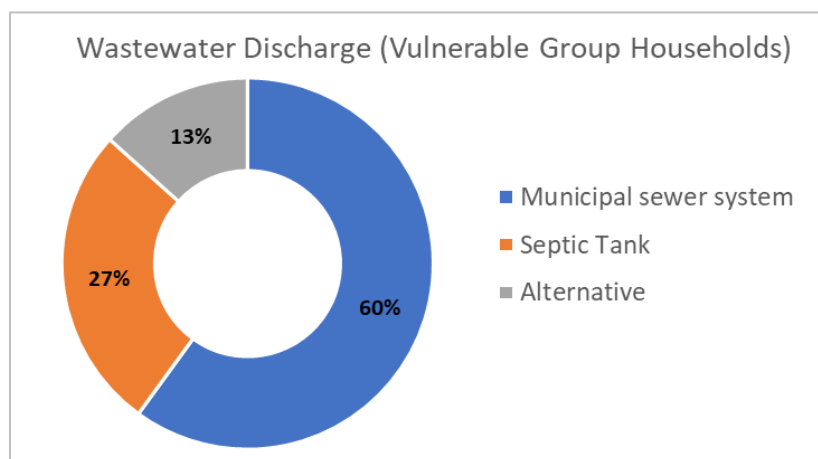


Figure 5-63: Wastewater discharge methods identified for vulnerable group households

WASTE MANAGEMENT INFRASTRUCTURE AND SERVICES

The Municipality of Zrenjanin has two main documents that define waste management at the municipal and regional level.

- Local Waste Management Plan of City of Zrenjanin 2010 – 2020 , May 2010;
- Regional Waste Management Plan for the City of Zrenjanin and Municipalities Secanj, Titel and Kovacica, Mart 2011 ;

The waste management plans are, according to the Law, adopted for a period of 10 years and have to be reconsidered every five years and, if necessary, revised and adopted for a next ten years. Accordingly the documents are both outdated and have not been reconsidered / updated.

WASTE DISPOSAL FACILITIES

The Municipality of Zrenjanin has a single non-sanitary landfill, located approximately 5km southwest from the central business district. The landfill has been in use for more than 20 years for landfilling of solid waste from the entire municipal area. At the landfill, waste is levelled, compacted and spread with partial covering with inert material including construction waste. The site does not meet any of the basic standards for sanitary disposal facilities e.g. waste acceptance limitations, leachate management, gas management and access control. In 2019 the site was expanded extending the airspace and the life of the facility for two more years.

In 2011 the Municipality of Zrenjanin and other municipalities - Secanj, Kovacica and Titel - started with a project to develop a regional waste management system and to develop a modern sanitary landfill in accordance with EU standards, with cogeneration plant, recycling center and waste water treatment (aerated lagoons). For this purpose, the regional waste management plan was developed and revised, a Strategic Environmental Assessment Study (SEA) was completed, and a conceptual design with Feasibility Study was prepared and adopted by local Assemblies. Total estimated time of disposal was 32 years and total costs is calculated on 21 million euros. Unfortunately, due to lack of capacities, investments and in some cases political will, activities on the regional waste management system have been suspended.

As an alternative solution, the Municipality of Zrenjanin considered joining other waste management regions in the western part of Vojvodina (Srem region) including the municipalities of Šid, Sremski Karlovci, Pećinci, Ruma, Irig, Stara Pazova and Indjija. Activities on preparation for regional waste management scheme started in 2011. A landfill developed under the scheme has been partly developed in the Municipality of Indjija. In January 2020, a Serbian governmental commission for Public Private Partnership gave consent on this regional waste management project, in which the Zrenjanin is also included with proposed transfer stations at Zitiste, Titel and Secanj. Following the governmental commission consent it was planned to adopt the project in all municipal Assemblies. Whilst the project was slowed down by the COVID 19 pandemic it is expected to resume in the near future.

WASTE RECYCLING

There are a further 27 informal dumping areas of different sizes located throughout the municipal area. These areas are occasionally cleared but reform due to shortcomings in the municipal waste collection and transport system. There are no formal recycling centres, recycling yards, transfer station or similar facilities in the Municipality of Zrenjanin.

SEWAGE SLUDGE TREATMENT FACILITIES

Serbia has developed a draft National Sludge Management Strategy that has obtained “no objection” from the Ministry, but it is not yet approved by the Government. The Strategy proposes the development of four sewage sludge treatment plants, one of these will be situated in in Vojvodina. In addition, a private company from Serbia - “Eliksir” – is understood to be considering options to develop co- incineration plant somewhere in Vojvodina that will be able to accept sewage sludge.

STORMWATER SYSTEM

The stormwater drainage system was constructed post-1950. The total length of the drainage network is 55km. The main canal is ~7km long (Bagljaš) and collects rainwater in the western part of Zrenjanin and from part of the settlement Muzlja. Poor maintenance negatively affects the drainage canals. There are ~20 outfalls from the stormwater drainage system into the Begej River.

ELECTRICITY SUPPLY

Electricity is supplied and distributed via two existing transformer stations (110kV and 20kV) in Zrenjanin. Supply is satisfactory with strain on the system occurring occasionally. Should further development result in additional demand, a new transformer station will be required. The network is well branched and exists across Zrenjanin in the form of the overhead or underground cables.

HOSPITALS AND CLINICS

A Health Care Centre offering primary health care was constructed in Zrenjanin in 2012. Primary health care (PHC) refers to "essential health care" that is based on scientifically sound and socially acceptable methods and technology. This makes universal health care accessible to all individuals and families in a community. The World Health Organization, elaborates on the goals of PHC as defined by three major categories, "empowering people and communities, multispectral policy and action; and primary care and essential public health functions as the core of integrated health services." Based on these definitions, PHC can not only help an individual after being diagnosed with a disease or disorder, but actively prevent such issues by understanding the individual as a whole.

The General Hospital "Đorđe Jovanović" offers secondary health care with 600 beds. Other health facilities in Zrenjanin include: Special Hospital for Lung Diseases ("Dr Vasa Savić") and a Special Hospital for Rehabilitation ("Rusanda").

SCHOOLS

According to the Municipalities database²⁶ Zrenjanin has 32 Elementary Schools with ~10,105 students; and one high school (“High Technical School of Professional Studies”) with ~1,100 students.

A 2013 study²⁷ conducted by the European Training Foundation entitled “*Mapping of VET educational policies and practices for social inclusion and social cohesion in the Western Balkans, Turkey and Israel Country report: Serbia*” reports that the Chemical, food processing and textiles school (Uroš Predić) has ~800 students in 36 sectors, 115 employees, 20 classrooms, two halls for physical education, a library with a reading room and 12,000 books, 6 laboratories, 10 offices, a multimedia classroom, media library, 4 workshops (sewing and weaving), a mini-bakery, a student restaurant and a mini-dairy plant built with an EU grant. Important social partners with whom the school cooperates are the Centre for Vocational and Art Education, the Regional

²⁶ <http://crm.siepa.gov.rs/municipalities-eng/education.php?ID=188>

²⁷ <https://www.etf.europa.eu/sites/default/files/>

Chamber of Commerce, the National Employment Service, the General Association of Entrepreneurs, the City of Zrenjanin, the Municipality, the Local Economic Development Office, secondary vocational schools in the region, local corporations and companies and the non-governmental organisation sector.

5.4.12 LANDUSE

SURROUNDING AREAS

Arable land is about 87% of the total area of the region, the predominant economic activity is agriculture. It is followed by food processing industry, mainly situated around the city of Zrenjanin. There are two main industrial areas in Zrenjanin, the North Industrial Zone and the South Industrial Zone for heavy industries and two others in Bagljas for light industry and logistics; and Ecka has a recently developed zone for light industries which is still mainly unoccupied. The industries located in the North and in Bagljas either discharge their effluents to the municipal sewers or to the River Begej. The industries in the South discharge their effluents to Aleksandrovacki canal. The canal water quality is monitored by the Institute of Public Health, Zrenjanin. Being the main recipient of industrial wastewater, the canal is heavily polluted.

The Begej River (also known as Plovni Begej or Begej canal) drains to the Tisza River belonging to the Danube (Black Sea) basin. From the city of Timisoara (Romania) to the village of Klek (Vojvodina, NE of Zrenjanin) the Begej was artificially modified to a navigable canal. From Klek to the Tisza River the riverbed is partly regulated, especially through the City of Zrenjanin. Banks were constructed, the meanders were cut-off from the main stream, and the river became a part of the wider canal system Danube-Tisza-Danube (DTD). The DTD is a complex hydro-engineering system used for flood control, irrigation/drainage, navigation, wastewater evacuation, tourism, recreation, fishing, and hunting. It covers the whole territory of Vojvodina and comprises numerous canals connected in various sub-systems.

PROJECT SITE

Historically, the site was used as a disposal area for sugar beets processing waste (plant residues from beet washing). For that purpose, disposal cells were constructed, including embankments and drainage ditches and the cells were filled with non-compacted earth material, with significant organic content. Subsequently the site was cultivated with corn. The site is currently vacant, devoid of any structures, and there is no evidence of the site being used for economic activities.

The proposed WWTP site is situated downstream, south-east of the City, along the east bank of the Begej River, opposite the village of Muzlja. It is located between the Belgrade-Zrenjanin regional road and the Begej River. The Aleksandrovacki Canal runs along the WWTP site, between the Begej River and the western site boundary. The canal discharge point into the Begej is located close to the site western boundary. The regional road Belgrade-Zrenjanin passes about 150 m from the eastern site boundary. There is a local road along the site northern boundary connected to the regional road. The closest connection to the electricity distribution network is located about 100m from the site. Public water supply network connection is available at about 150 m from the site.



Figure 5-64 Aerial view of the project site located between an industrial zone and the Aleksandrovacki Canal (Dvooper, 2021)

LAND ACCESS AND OWNERSHIP

Of the respondents in the household survey 69% indicated that they own the land on which they reside, 6% indicated that they lease the land while 25% indicated that they reside on family-owned land. Of the respondents 13% indicated that they also own a portion of land which they utilise for farming.

5.4.13 LAND ACQUISITION

In Serbia all land that is designated for the purposes of establishing / operating a WWTP is in public ownership.

The ESIA team has been informed by Metito that the land used to be owned by the Republic of Serbia and was transferred to the City of Zrenjanin in February 2020 and that no displacement occurred and the transfer was free of charge.

Article 2 of the Transfer Letter addressed to Republic of Serbia, Autonomous Province of Vojvodina, City of Zrenjanin, City Council states:

Construction land referred to in Article 1 of this Decision shall be acquired by direct agreement, in order creation of property-legal preconditions for bringing the subject land to the planned purpose, and for the needs of arranging public areas - with the aim of building a Wastewater Treatment Plant, in accordance with PGR "Jugoistok" in Zrenjanin (Official Gazette of the City of Zrenjanin No. 32/14, 24/18 and 32/19), which is of general interest for the City of Zrenjanin.

The explanation provided for the decision made, includes:

Article 99, paragraph 19 of the Law on Planning and Construction ("Official Gazette of RS" No. 72/09, 81/09 - corrigendum, 64/10 - decision US, 24/11, 121/12, 42/13 - decision US, 50/13 - decision US, 98/13 decision US, 132/14, 145/14, 83/2018, 31/2019, 37/2019-other law and 9/20), it is prescribed that construction land acquires into public ownership in accordance with the provisions of the Law on Public Property, which refer to the acquisition of other real estate in public ownership.

Article 3, paragraph 1, item 1 of the Decree on the Conditions for Acquisition and Alienation of Real Estate by Direct Agreement, Leasing of Public Property and Procedures for Public Tendering and Collection of Written Bids ("Official Gazette of RS" No. 24/12) prescribes that real estate can be acquired in public ownership by direct agreement, but not above the market value of real estate estimated by the competent authority, if in this case it is the only possible solution, which means the case when real estate acquired in public ownership according to its characteristics the needs of the owner, user, or holder of the right of use, provided that the draft

act, i.e. the act on such disposal contains an explanation of the reasons for justification and expediency of obtaining from the aspect of achieving the interests of the Republic of Serbia, autonomous province local self-government units and the reasons why the acquisition could not be realized through public bidding, i.e. collecting written bids.

As reported above, at the time of transfer of the land from the Government of Serbia to the City of Zrenjanin the site was not inhabited. A review of historic satellite imagery dating back to 2001 provides no evidence dwellings or structures having been erected on the property. Commercial agricultural activities appear to have commenced onsite between 2009 and 2012 up to and including 2019. City of Zrenjanin land tenure arrangements with farmers at the time of transfer and the method of notification to vacate site is unclear. However, it is noted that to date, no comments or grievance related to land use, compensation and loss of livelihoods were raised during the ESIA stakeholder engagement process; or lodged via the grievance mechanism.

In closing, the land was not expropriated from private landowners requiring compensation, rather it was transferred from the State to the Zrenjanin Municipality.

5.4.14 CULTURAL HERITAGE

Zrenjanin is a city of bridges, youth, sports, culture, interesting architecture, and people of more than twenty nationalities. The history of this city is seven centuries long.

Apart from the distinctive look of the cities in Vojvodina, Zrenjanin is also recognised for the great number of religious buildings from different periods, cultural and historical monuments, successful athletes, famous puppet shows and an interesting event called “Dani piva” (Beer days). The Dani piva festival is held annually, during the last week of August, and it was established in 1986. This is a city festival which combines cultural, sport, entertainment and business content. During the festival you can try more than twenty different beers, enjoy rock concerts or “tamburitza” music, and taste many culinary specialties. Zrenjanin also boasts a National museum and the gallery of contemporary art.

Zrenjanin is a city which propagates international tolerance and multi-confessionalism and which pays great attention to culture and art. Apart from spectacular theatrical performances, Zrenjanin is also famous for its choirs of worldwide renown and aquarelle art colonies. Most of the buildings which adorn the streets of this city were built during the 19th and 20th century, representing important historical and cultural monuments as well as distinctive tourist attractions. These include:

- Zrenjanin City Hall, also known as the County Palace;
- Neo-Romantic Cathedral built in 1868 and its patron saint is Jovan Nepomuk (**Figure 5-65**);
- House of a stonecutter Teodosije Tuner nicknamed “Šeherezada” in the city centre (**Figure 5-65**);
- Palace of Justice in which the court and the jail are situated, dominates the landscape around the lake and The Little Bridge.



Figure 5-65 Photos of the Cathedral (left) and Šeherezada (right) in Zrenjanin (Source: Serbia.com, 2021)

The most valuable heritage resources located within the AoI are described in **Table 5-43** below.

Table 5-43 Valuable heritage resources located within the AoI

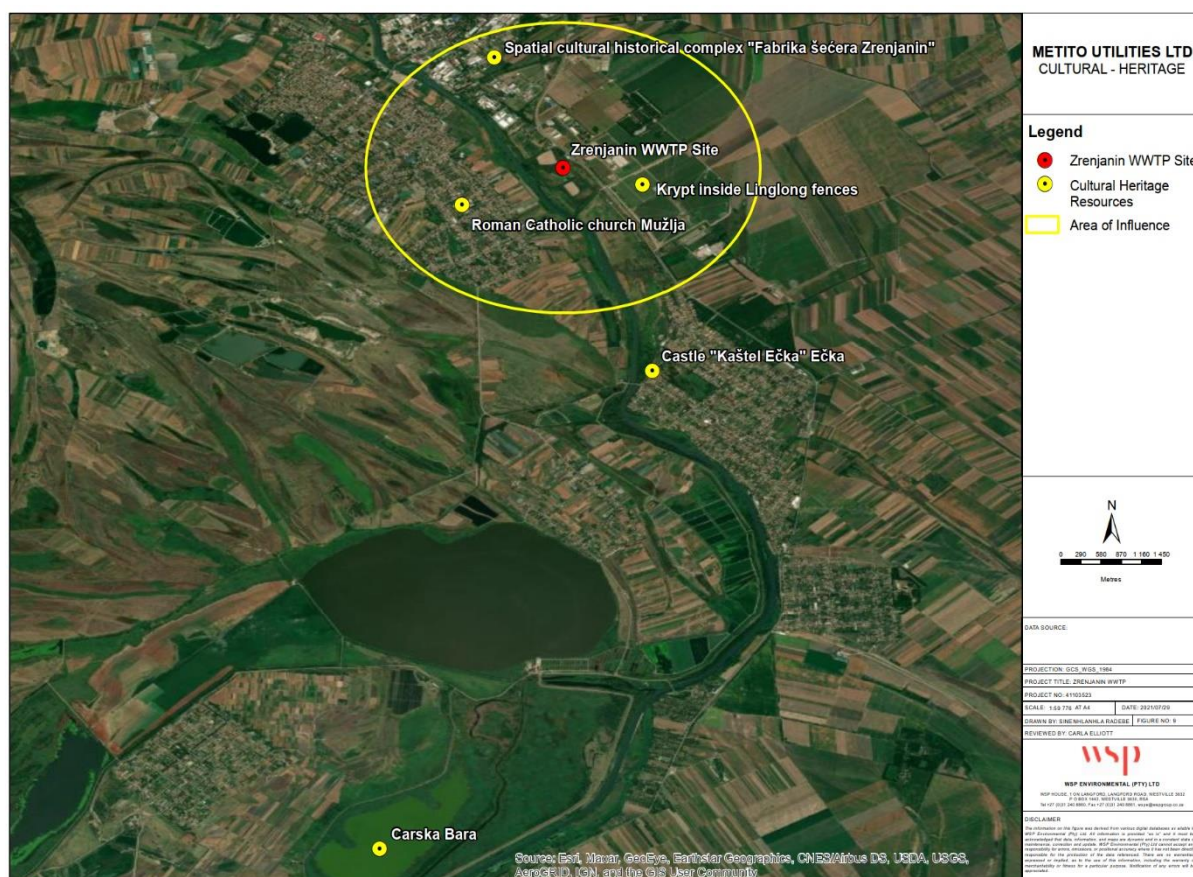
HERITAGE RESOURCE	DESCRIPTION
Modern art gallery of Ečka	Art Colony established in 1956 which holds over 2,000 modern domestic works of art as well as the exhibition space with ~20 different exhibitions a year.
Association of Amateur Cultural and Artistic Societies	Arranges events around folklore, visual arts, music, nurturing of ethno-tradition including the international festival of folklore "Lala".
Crypt	Potential archaeological site which has not been examined yet. It is located near the existing fence of the Linglong Tires industrial complex. It is understood by local specialist that this is dated from medieval times. A similar crypt was ~1km away towards Zrenjanin City. It was archaeologically examined and graves from Celtic period as well as Serbian ones from medieval centuries have been found.
Spatial Cultural Historical Complex "Fabrika šćera Zrenjanin"	This complex has been awarded protection status as it is one of most important resources of industrial cultural heritage in Zrenjanin. This complex consists of industrial and residential buildings built between 1911 and 1930.
Roman Catholic Church, Mužlja	Evidenced cultural heritage built in 1896 located in Mužlja settlement.

Two other cultural resources which lie beyond the AoI but are worth are described **Table 5-44** below.

Table 5-44 Valuable heritage resources located outside of the AoI

HERITAGE RESOURCE	DESCRIPTION
Kaštel Ečka	Established cultural heritage (cultural monument), by Decision of government of republic of Serbia 05 No 633-1767/99 at 2001 May 25th. It was built by the noble family, Lazar (Augustin Lazar of Ečka) in the second decade of the 19th century on the banks of the Begej River. The Castle is a part of larger complex of old noble property consisting of: Roman Catholic Church, old stables and water tower on the channel. After WWII it was transformed to a hotel with a restaurant. Since 2004 it is in private ownership of "Univerzal" company from Belgrade. Today the castle is restored in most parts and it is one of rare examples of successfully revitalized monuments of cultural heritage. It remains a highly ranked luxurious hotel attracting many tourists. Besides tourism value, the castle has a very important cultural function as the Centre of the Ečka Art Colony providing a contemporary gallery and depot of the most significant artwork of domestic artists and painters of the 20th century.
Stari Begej-Carska Bara	Carska Bara is the largest individual "bog" (wetland) in Serbia. Along with the neighbouring pond of Stari Begej (old arm of the Begej River) it forms a Special Nature Reserve. It is located 10 km south west (downstream) from WWTP plant near the mouth of the Begej River into the Tisa River Tisa. The southern border is bounded by the final, navigable section of the Begej River before it empties into the Tisa River, while to the north are the vast Ečka fishponds, the largest in Serbia and second largest in Europe. The entire "bog" belongs to the Municipality of Zrenjanin. Offerings include: bird watching and wildlife viewing, canoeing and boat rides or take a tour on "Carska lađa" tourist boat.

Institutions and cultural resources described above are considered valuable local tourist attractions. The location of key resources, in relation to the project site and defined AoI, are indicate in **Figure 5-66**. It is anticipated that due to their location, the resources downstream of the WWTP may benefit from improved water quality and potential associated tourist offerings.



RESOURCE USERS

Majority of the resource users surveyed (78%) were aware of the proposed Project, with majority of the respondents (61%) having a positive perception of the project, while the 17% were non-committal and 22% opted not to respond. If they had a question or a concern relating to the Project 7 of the respondents indicated that they would consult the local municipality / government, 3 indicated they would consult the proponent and 5 indicated they would consult both these parties. Other respondents noted that they would either approach the investor or media.

Comments raised during the survey indicated that respondents were happy that such a project was finally being undertaken to improve the condition of the river. It was also noted that during works the responsible parties should be socially responsible and that there should be a formal deadline for completion of the works and commencement of operations for the facility, and if these were not met that there should be repercussions for the responsible persons.

COMMUNITY DEVELOPMENT PRIORITIES

Respondents were asked to prioritise the inputs required for local communities to develop and prosper. The responses and the ranking provide useful insight into local perspectives on community development priorities and could be used to inform the Community Development Plans.

Table 5-45 below is based on the household survey. As indicated the top priorities identified by the surveyed households relate to education, and safety, with improved water supply and sanitation indicated as the third most important aspect. Comparatively, as indicated in **Table 5-46**, respondents in the vulnerable groups survey identified improved water supply and sanitation indicated as the third most important aspect, with healthcare and employment aspects the next most important aspects.

Notably in both surveys, improved water supply and sanitation was identified as being of top priority out of 16 aspects. Additional important points include:

- Most of the top-ranked community development requirements refer to key services (education, healthcare, and community safety), and infrastructure (water supply, sanitation, and formal housing / connection to municipal infrastructure).
- Economic opportunities (access to employment, business skills and training);
- Land for business, housing and farming has a low relative priority ranking, suggesting that land is generally in sufficient supply, and that access is adequate.
- Sound local leadership and participation of women and youth and participation in community affairs are given a high priority by some; and
- Support for local business and agriculture, access to small loans, and job /business skills training are noted as important aspects.

Many of the recommendations to promote local development may be opportunities for Project support and / or for collaboration with government and NGOs.

Table 5-45: Requirements for local communities to develop and prosper, as per general households survey

REQUIREMENTS FOR COMMUNITY DEVELOPMENT (RANKED BY TOP PRIORITY FREQUENCY)	IMPORTANCE (% OF RESPONDENTS IN HOUSEHOLD SURVEY)				RESPONDENT RECOMMENDATIONS TO PROMOTE LOCAL DEVELOPMENT
	Top priority	Very important	Important	Not important now	
Access to improved education facilities	53%	18%	24%	6%	- Improve school sanitary system (toilets, running water, etc). - Better curriculum required in schools - Modernization and improvement of gym and sport facilities. - More practical experience is required. - Introduce public voluntary work actions. - More faculties / professional staff required.
Community safety	53%	12%	29%	6%	- Sanitary drinking water in the city and villages required. - Speed reduction measures required on the roads. - Addressing Aleksandrovački canal, removal of sewage from it and cleaning the banks.
Improved water supply and sanitation	47%	41%	12%	0%	- Improved water quality required. - In summer, larger capacity of water supplies are required. - To build a plant and find a final solution for water supply. - To enable better sewage system, clean drinking water and WWTP.
Access to improved healthcare	47%	24%	29%	0%	- More professional staff required. - Scheduling of examinations and doctor appointments required. - More investment in healthcare institutions required. - Require better public healthcare, less expensive healthcare for general population.
Formal housing / Connection to municipal services (e.g. water and electricity supply)	35%	35%	29%	0%	- Fixing of infrastructure - Improve conditions of roads / asphaltting where necessary. - Providing a sewage system where not existing (city, settlements), fixing leakages and improve maintenance.

REQUIREMENTS FOR COMMUNITY DEVELOPMENT (RANKED BY TOP PRIORITY FREQUENCY)	IMPORTANCE (% OF RESPONDENTS IN HOUSEHOLD SURVEY)				RESPONDENT RECOMMENDATIONS TO PROMOTE LOCAL DEVELOPMENT
	Top priority	Very important	Important	Not important now	
Participation of women and youth	35%	24%	35%	6%	- Increased awareness. - Involve more young people in decision making. - Assistance required to help young mothers find work (such as work from home options). - To strengthen NGO and unions of youth, women and to help them with problems they encounter.
Sound local leadership	29%	35%	24%	12%	- Need to be more active on behalf of citizens and community. - Higher levels of education and expertise required. - To include all local representative populations in decision making / local community council which needs to be more involved.
Access to small loans	29%	12%	47%	12%	- Better terms of loans (credit conditions / less interest). - Start-up funding needs to be more accessible.
Land for farming	24%	41%	12%	24%	- Public auctions must be transparent - Better organisation and bidding for public land. - Not to give quality agricultural land to polluting industry - assign land to demonstrated agriculture producers. - Better water = better yield. - More favourable lease terms for small and medium producers.
Job / business-related skills training	24%	29%	35%	12%	- Schools should involve more practical work - On the-job training. - Organize education based on interest such as agriculture, entrepreneur, small business. - Organised lectures / training programmes required.

REQUIREMENTS FOR COMMUNITY DEVELOPMENT (RANKED BY TOP PRIORITY FREQUENCY)	IMPORTANCE (% OF RESPONDENTS IN HOUSEHOLD SURVEY)				RESPONDENT RECOMMENDATIONS TO PROMOTE LOCAL DEVELOPMENT
	Top priority	Very important	Important	Not important now	
Access to employment / jobs	18%	53%	18%	12%	- Greater access to information for unemployed / information from national employment service. - Promote employment on merit (i.e. based on knowledge and experience). - Assist companies in financial distress to be able to retain jobs and provide support for new companies to increase job creation.
Participation in community affairs	18%	35%	35%	12%	- Public to be more involved. - More cooperation from institutions required. - Local community council to work better and transparent. - Public hearings and transparency are necessary.
Land for houses	18%	6%	71%	6%	- Cadastre to be more transparent. - Lower the land prices / more favourable purchase conditions.
Support for local business	12%	41%	35%	12%	- More investments in local entrepreneurs / loans needed. - Credits with good conditions for start-up business - Subsidies.
Communal markets	12%	18%	47%	24%	- Promote local producers, as well as more organic and healthy foods. - Mužlja does not have a public market, should be established.
Land for business	6%	24%	41%	29%	- Assign businesses/enterprises to youth. - More credit lines / improved conditions required.

Table 5-46: Requirements for local communities to develop and prosper, as per vulnerable groups survey

REQUIREMENTS FOR COMMUNITY DEVELOPMENT	IMPORTANCE (% OF RESPONDENTS IN HOUSEHOLD SURVEY)				RESPONDENT RECOMMENDATIONS TO PROMOTE LOCAL DEVELOPMENT
	Top priority	Very important	Important	Not important now	
Improved water supply and sanitation	100%	0%	0%	0%	- Provide piped potable water to the household.

**IMPORTANCE (% OF RESPONDENTS IN
HOUSEHOLD SURVEY)**

REQUIREMENTS FOR COMMUNITY DEVELOPMENT	Top priority	Very important	Important	Not important now	RESPONDENT RECOMMENDATIONS TO PROMOTE LOCAL DEVELOPMENT
Access to improved healthcare	93%	7%	0%	0%	- To have access to all medical services, not only basic services. - More ambulances and doctors required. - Provision of free medical services.
Access to employment / jobs	73%	27%	0%	0%	- Job creation, especially for young people to reduce emigration. - Employment to be made on merit.
Community safety	67%	13%	20%	0%	- Identify and punish polluters. - Ban long/late working hours.
Formal housing / Connection to municipal services (e.g. water and electricity supply)	40%	40%	20%	0%	- Funding from the city budget allocated to housing and infrastructure. - Better roads, lights on the streets, pavements.
Participation of women and youth	40%	40%	20%	0%	- Women to be included in public decision making.
Participation in community affairs	20%	53%	27%	0%	- Inclusive participation.
Access to improved education facilities	13%	27%	60%	0%	- All children should have the same education. - Provision of free education. - More focused education required. - Better access to university and better facilities.
Land for farming	7%	20%	73%	0%	- Ban herbicide and pesticide usage. - Improved access to land for farming purposes required.
Job / business-related skills training	0%	53%	47%	0%	- More professional training and seminars required.
Sound local leadership	0%	13%	60%	27%	- None
Support for local business	0%	7%	40%	53%	- More subsidies for local entrepreneurs and companies required.
Land for business	0%	0%	100%	0%	- None
Land for houses	0%	0%	80%	20%	- None
Communal markets	0%	0%	80%	20%	- None
Access to small loans	0%	0%	20%	80%	- None

6 STAKEHOLDER ENGAGEMENT

6.1 PURPOSE OF STAKEHOLDER ENGAGEMENT

Stakeholder engagement is an inclusive process conducted throughout the project life cycle. Where properly designed and implemented, it supports the development of strong, constructive and responsive relationships that are important for successful management of a project's environmental and social risks.

Stakeholder engagement is most effective when initiated at an early stage of the project development process, and is an integral part of early project decisions and the assessment, management and monitoring of the project's environmental and social risks and impacts.

Stakeholder engagement must be free of manipulation, interference and intimidation. It must be conducted based on timely, relevant, understandable and accessible information in a culturally appropriate format. It involves interactions between identified groups of people and provides stakeholders with an opportunity to raise their concerns and opinions, and ensure that this information is taken into consideration when making project decisions.

The stakeholder engagement process is guided by the following key principles of stakeholder engagement and will adhere to these principles throughout the life of the project:

- Inclusiveness in representation of views, including women, vulnerable and/or minority groups;
- Two-way dialogues that give both the company and stakeholders the opportunity to exchange views and information, to listen, and to have their issues heard and addressed;
- Respect for local traditions, languages, timeframes, and decision-making processes;
- Provide meaningful information in a format and language that is tailored to the needs of the local communities and other affected stakeholders; and
- Provide consultation and decision-making information as early as possible.

The public is an important source of local information and traditional knowledge about the project's likely environmental and social impacts. Stakeholder engagement provides an opportunity to work with the public and addressing any concerns raised. This process goes well beyond the ESIA process, as it will continue throughout the life of the project. The objectives of the stakeholder engagement for the Zrenjanin WWTP ESIA are to:

- Provide ongoing information on the project to the public and government agencies;
- Provide timely and appropriate information prior to and during construction to enable informed participation in the project and definition of appropriate mitigation measures;
- Encourage equal participation of all affected groups in the consultation process;
- Disclose the impacts of the project and proposed mitigation measures;
- Obtain public input on the mitigation measures;
- Provide ongoing information on the implementation of the mitigation measures; and
- Facilitate open and continuous communication and consultation between various groups of stakeholders, and the public.

6.2 GOVERNANCE FRAMEWORK

6.2.1 NATIONAL LEGISLATION

Key legislation of the Republic of Serbia, addressing stakeholder engagement, that pertains to the Project, is summarised in **Table 6-1**.

Table 6-1 National Legislation relating to Stakeholder Engagement

LEGAL MECHANISM	DESCRIPTION
Constitution of the Republic of Serbia (Official Gazette RS 98/06)	Provides a wide platform for public participation and access to information. It also provides the public with the right to submit requests, petitions, and proposals. Article 74 states that everyone has the right to a healthy environment and to timely and complete information about the state of the environment.
Law on Free Access to Information of Public Importance (Official Gazette of the RS 120/04, 54/07, 104/09 and 36/10)	Regulates citizens' rights in relation to access to information, held, used, and managed by public institutions, sets out the principles and exceptions in the achievement of these rights, as well as the procedures for accessing this information and their protection.
Law on the Protector of Citizens (Official Gazette of the RS 79/05 and 54/07)	Establishes an independent state authority which protects the human and minority rights and freedoms of citizens (domestic and foreign physical and legal entities) and controls the work of all administrative authorities.
Law on the Confirmation of the (Aarhus) Convention on Access to Information, Public Participation in Decision Making and Access to Justice in Environmental Matters (Official Gazette of the RS 38/09)	The basic principles of this Convention are also supported by other laws and bylaws of the Republic of Serbia, including the Environmental Protection Law, Environmental Impact Assessment Law, Strategic Environmental Impact Assessment Law, as well as the Regulation on the Procedure for Public Disclosure, Presentation and Public Hearing for the Environmental Impact Assessment. The Aarhus Convention identifies the environment as a public good. The Convention affirms the public's right to be informed as to the state of that environment and what emissions and discharges are being released into it; the right to meaningful consultation on proposed projects or programmes that might affect the environment; and the right to complain if they believe that the environment is not being adequately taken into account.
Law on Waste Management (Official Gazette of the RS 36/09, 88/10 and 14/16)	Prescribes that the issuing of permits for waste management is made public including sludge management, i.e. that any submitted request for waste management and accompanying documentation, are publicly disclosed and available for comments.
Law on Water (Official Gazette of the RS 30/2010, 93/2012, 101/2016, 95/2018 i 95/2018)	Regulates wastewater treatment and prescribes that the issuing of permits for wastewater management is made public, i.e. that any submitted request for wastewater management and accompanying documentation, are publicly disclosed and available for comments.

6.2.2 IFC PERFORMANCE STANDARDS

The IFC PSs on Environmental and the WBG EHS Guidelines are generally accepted as the international benchmark for good practice in environmental and social risk and impact management. The revised standards have been effective since January 2012 and provide guidance to a developer in planning good practice stakeholder engagement.

One of the requirements under the IFC PS 1, Assessment and Management of Environmental and Social Risks and Impacts, is Stakeholder Engagement. Clients are required to engage with affected communities through disclosure of information, consultation, and informed participation, in a manner commensurate with the risks to and impacts on the affected communities. The main aim for consultation and disclosure under PS 1 is to ensure that affected communities are appropriately engaged on issues that could potentially affect them; to build and maintain a constructive relationship with communities; and to establish a grievance mechanism. Stakeholder

engagement is the basis for building strong, constructive, and responsive relationships that are essential for the successful management of a project's environmental and social impacts.

STAKEHOLDER ENGAGEMENT PLAN (SEP)

The IFC PS require the development of a stakeholder engagement plan (SEP) that is scaled to the project risks and impacts and development stage. The SEP presents the general principles, as well as mechanisms and tools which are to be used for engaging the stakeholders throughout the project lifecycle. The SEP was developed as part of the ESIA (**Appendix B**).

The SEP is a living document. Its overall strategy and approach, and the general commitments will not change, but the practical implementation will be modified according to the project life cycle, the on-going consultations with stakeholders, and any relevant issues and lessons learned during the ESIA.

VULNERABLE STAKEHOLDERS

Vulnerable stakeholders require special attention according to the IFC PS 1. Vulnerable people include those who, by virtue of their gender, ethnicity, age, physical or mental disability, economic disadvantage or social status may be more adversely affected by a project than others, and who may be limited in their ability to take advantage of a project's development benefits. The PSs outline requirements for engagement with vulnerable people, which should include differentiated measures to allow for the effective participation of these people.

6.3 SUMMARY OF THE STAKEHOLDER ENGAGEMENT PROCESS AND RESULTS

6.3.1 IDENTIFICATION OF STAKEHOLDERS

Stakeholder identification and analysis is an essential component of effective and meaningful stakeholder engagement activities. Stakeholders were defined as persons and/or institutions and/or communities who:

- Are directly and/or indirectly affected by the Project.
- Have “interests” in the Project that determine them as stakeholders.
- Have the potential to influence the Project outcomes or operations.

Stakeholder identification considered the nature and location of the Project and the nature of potential impacts, as well as institutional, legal and managerial framework applicable to the Project. The initial site reconnaissance undertaken in May 2021 allowed for the initial identification of project affected people (PAPs) and other stakeholders within the AoI.

Stakeholder mapping highlighted the level of interest and influence on the project that each stakeholder bears. On this basis, stakeholders with high interest and influence on the project were engaged to solicit information sufficient to arrive at a suitable scope of assessment.

The engagement exercise informed the identified stakeholders of the project details and enlisted comments on other relevant stakeholders and key issues of interest to be assessed. The approach ensured that the relevant stakeholders, including vulnerable groups, were given equal opportunity and possibility to voice their opinions and concerns, and that these are accounted for in the project decision-making.

A Stakeholder Mapping Matrix (grouped according to both government and non-government stakeholders) and database is available in the SEP.

6.3.2 APPROACH TO STAKEHOLDER ENGAGEMENT

The primary goal of the public consultation process was to ensure that all stakeholders and local communities were informed and their concerns considered in the development and operation of the Project. The process informed stakeholders and local community of the proposed project. The process was conducted with due attention to the residents' wellbeing, the environment, local socio-economic environment, human health, safety

and security. For this purpose, the consultation process presented information to the various stakeholders, which focused on:

- Describing the project and its benefits to the national economy, the region and the local community;
- Explaining possible impacts that are likely to occur during construction and operation;
- Explaining proposed mitigation and management measures of potential environmental and socio impacts; and,
- Providing regular updates on implementation and monitoring as the project moves forward through the various development and operational phases.

The stakeholder engagement process is ongoing throughout the life of the project and includes formal scheduled consultations and meetings. Information will also be disseminated as needed to address significant changes in the schedule or other important project developments.

Table 6-2 Summary of Stakeholder Engagement Activities

STAKEHOLDER ENGAGEMENT OBJECTIVES	ACTIVITIES UNDERTAKEN	DATE / PROGRAMME
Notification to PAPs and NGOs on nature of the project, considering local political, legal and cultural practices of the region	Meeting with Saša Santovac, Deputy Mayor (Zrenjanin Municipality).	Completed 25 May 2021
	Posters containing information about the project and the ESIA (Figure 6-1 to Figure 6-4) were prepared in Serbian, Hungarian and Romanian, and placed at twenty strategic locations within the AoI including: — Ečka - local grocery shops, local community centre, and local tourist centre — Mužlja - local grocery shops, local community centre, local church, transportation stops — Stajićevo - local post office, and local transportation stop — Zrenjanin - local mega market, local community centre, and local medical centre.	Completed June 2021
	Stakeholders identified were informed about the project and ESIA process via email which included a Background Information Document (BID) and Comment Form (Serbian, Romanian and Hungarian)	Completed June 2021
	Placement of BID and Comment Form on the Zrenjanin Municipality Website in Serbian, Romanian and Hungarian: http://www.zrenjanin.rs/sr/brzi-linkovi/anketa-metito-korporacije-u-vezi-sa-izgradnjom-centralnog-precistaca-otpadnih-voda-u-zrenjaninu This remained accessible for the month of July.	Completed July 2021
	Published in local weekly newspaper – “List Zrenjanin” on 2 July 2021 (Figure 6-7).	Completed 2 July 2021
Scoping Process / Identification of Key Issues including the involvement of the following representatives: PAPs, government agencies, local authorities and other organisations	Vulnerable Group representatives were identified with the assistance of NGOs who provide social services to these groups. Fifteen respondents participated in their homes.	Completed 30 June – 4 July 2021
	Four Focus Group Discussions (FGDs) were arranged for the following Stakeholder Groups: — Political Organizations / Parties and Institutions (Figure 6-5)	Completed 7 - 8 July 2021

**STAKEHOLDER
ENGAGEMENT
OBJECTIVES**

ACTIVITIES UNDERTAKEN

**DATE /
PROGRAMME**

	— Sport Associations / Touristic Organisations / Outdoor Enthusiasts / River User Groups and Individuals — Business and Entrepreneur Associations, and Interested Commercial and Industry (C&I) — Non-Government Organisations (NGOs) / Local Activists, Eco Activists / Interested Public (Figure 6-6) These took place at the Zrenjanin Cultural Centre.	
ESIA Report Disclosure	This objective involves making the ESIA Report or Summary available in a language which is accessible to the majority of the PAPs. It is noted that the ESIA Report has been developed for the lender benefit in addition to the local EIA report that is being prepared to meet Serbian Legislation. To avoid causing confusion by stakeholders regarding the local EIA vs. the Lender ESIA the full ESIA document will not be released for public comment; instead, a non-technical summary of the ESIA will be made available to all stakeholders included on the stakeholder database and respondents to surveys for a 30 day comment period. Any additional comments received will be incorporated into the SEP.	Planned September 2021



Figure 6-1 "Gomex" - grocery store chain in Zrenjanin



Figure 6-2 "I Zdravstvena stanica" – health care facility in Zrenjanin



Figure 6-3 "Lehel" - local sport and youth centre in Mužlja



Figure 6-4 "Gomex" - grocery store chain in Ečka



Figure 6-5 FGD with Political Parties



Figure 6-6 FGD with NGOs and Interest Groups



Figure 6-7 Project and ESIA Information placed in Weekly Zrenjanin Newspaper

6.3.3 POST-ESIA STAKEHOLDER ENGAGEMENT

Begej Water is required to continue with a grievance mechanism into the construction and operational phases in order to be aware of and respond to stakeholders' concerns related to the project in a timely manner. To this end a framework Grievance Redress Mechanism (GRM) is included within the ESMP. The grievance mechanism approach adopted will consider the following IFC requirements:

- The grievance mechanism process or procedure should address concerns promptly and effectively, in a transparent manner that is culturally appropriate and readily accessible to all segments of the affected communities, at no cost and without retribution. The mechanism, process or procedure must not prevent access to judicial or administrative remedies. The client will inform the affected communities about the grievance process in the course of its community engagement activities, and report regularly to the public on its implementation, protecting the privacy of affected individuals.
- Handling of grievances is to be done in a culturally appropriate manner and be discreet, objective, sensitive and responsive to the stakeholders' needs and concerns. The mechanism is to also allow for anonymous complaints to be raised and addressed.

In addition, a grievance mechanism will be established for workers to raise workplace concerns. The project team will be required during both the construction and operational phase to inform the workers of the grievance mechanism at the time of recruitment and make it easily accessible to them.

It is accepted good practice to afford affected parties the opportunity to air concerns and grievances related to sensitive issues and to follow up on the resolution of the affected parties' grievances and concerns regarding the environmental and social performance of the project. To this end a Grievance Redress Mechanism (GRM) was implemented during the ESIA. The GRM informed the public of the project and the ESIA process, and provided the ESIA Community Liaison Officer's (CLO) contact details for registration of interest and concerns to be channelled to.

6.4 SUMMARY OF STAKEHOLDER CONCERNS

A comment and response report detailing all expectations, comments and queries raised by the stakeholders and the responses provided by Metito and the ESIA team is provided in the SEP. This section provides a summary of the key expectations and comments received during the FGDs and via the registration / comment form on the municipal webpage.

6.4.1 PUBLIC PRIVATE PARTNERSHIP (PPP) TRANSPARENCY

Concern	The WWTP PPP does not seem to have followed a transparent process with regards to contracting public and expert participation in the process, technology choice, expenses and costs (P&L statement) and responsibility for deadlines. There also appears to be a lack of feasibility investigations. Local city councillors from opposition parties delivered their questions to Municipality (City Assembly) regarding the WWTP's project but did not get any answers. It is recommended that the Municipality bring back a process and organise a tender for PPP or to make project with Metito more transparent.
Response	An agreement on Cooperation between the Government of the Republic of Serbia and the Government of United Arab Emirates led to the mutual relations between the Ministry and Metito, a UAE company. The agreement allows any UAE company to have a direct agreement/negotiation without going through the regular bidding procedure. Therefore, this was arranged between both Metito and the City of Zrenjanin directly without the public bidding procurement being followed. Following this, a Memorandum of Understanding (MoU) was negotiated between the Vojvodina Provincial Government and Metito Utilities (MUL) to develop the water and wastewater sector in the Vojvodina province under a build-operate-transfer (BOT) arrangement. This was signed on the 26th of February 2019. After several discussions and the agreement on the technical and commercial proposal between the City of Zrenjanin and MUL, Metito signed the contract for the Zrenjanin Wastewater Treatment Plant on the 9th of November 2020. The contract is transparent and provides the rights to both the City and MUL during the contract according to the Laws in Republic of Serbia. An EU funded feasibility study was conducted in 2015 through international advisors prior to the involvement of MUL as a basis for their project and has been referenced in providing background on the need for the project. However, MUL and potential lenders has conducted its own technical and legal due diligence on the project to ensure adequate design parameters and bankability of the project. Information regarding government plans for maintenance and investment in 2021 is available at http://www.vikzr.rs/programi-poslovanja/. These include: — Conclusion on the Acceptance of the Business Programme of JKP “Vodovod I kanalizacija” Zrenjanin for 2021 (Assembly of the City of Zrenjanin on 18 December 2020); and — Business Programme of JKP “Vodovod I kanalizacija” Zrenjanin for 2021 (adopted by the Supervisory Board of JKP “Vodovod I kanalizacija” on 30 November, 2020).

6.4.2 POLLUTER PAYS PRINCIPLE WHEN DETERMINING SERVICE TARIFFS

Concern	Price increases associated with improved waste water treatment should not be placed on communal services. The price of wastewater treatment is currently not based on actual use and quantities. Only 60% of households use local sewerage infrastructure. The commercial and industrial (C&I) sector must be charged a higher proportion of the fees due to larger volumes of discharges and associated impacts.
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Prior to operation of the WWTP, the investor must take into consideration the category of company, waste generation, and discharge volumes in the calculation of fees. Local government should create a local register of polluters and work with the investor and local C&I sector to create a more equitable distribution of prices and fees for waste water treatment. All existing and industrial operations and those under construction should provide waste water data to the investor so that capacities and charges can be planned accordingly. Data from the Serbia Environmental Protection Agency (SEPA) National Pollution Register, and other relevant sources can assist in identifying key industrial polluters in the City.

Response The Municipality has the plan to increase the tariff for the industries with a much higher rate compared to the communal and municipal waste. The city has shared the list below of the industries who are currently discharging into the channel and will be redirected into the new facility:

- Dijamant ad
- Toplana Zrenjanin
- Beohemija – inhem doo
- Dafar doo
- Prekon doo
- Modital doo
- Fabrika sintetickog kaučuka Elemir
- Rafinerija gasa Elemir

The Zrenjanin Municipality will set effluent criteria for the industries in order to control their effluent according to the Serbian regulations.

6.4.3 SUSTAINABILITY OF PROPOSED INFRASTRUCTURE

Concern Based on the experience of previous public-private projects in the city (e.g. Zrenjanin water treatment plant²⁸), concern was expressed that the current PPP and planned project will fail to be successfully implemented for the benefit of local communities. It was queried who would take responsibility if the mistakes are repeated. Drinking water is a priority as Zrenjanin has been without access to potable water for 17 years.

Historical experience also highlights the risk of a treatment facilities which do not adopt Best Available Techniques (BAT). Bad odours resulted in public pressure and a company was forced to stop their operations. Odours and air pollution issues continue.

How will investors prevent such issues?

Response Metito is a global leader and provider of choice for total intelligent water management solutions with operations covering three business areas: design and build, specialty chemicals, and utilities. With over 60 years of experience, the Group provides customized, comprehensive, and advanced solutions across the full spectrum of its industry; from clean to dirty water; desalination and re-use; industrial solutions; investing into water and wastewater assets; and structuring both Greenfield and Brownfield schemes under project finance structures.

MUL is the best positioned to undertake the development of multiple water and wastewater treatment projects in the Republic of Serbia on either a Build, Operate, and Transfer (“BOT”), or Operation & Maintenance, Engineering, Procurement, Construction and Finance (“EPCF”) basis.

²⁸ In 2012, the Zrenjanin Municipality signed a design-build-finance-operate contract with a German company for the proposed upgrade to the water treatment plant, however the contract was terminated, reportedly due to political reasons. The Zrenjanin Municipality announced in 2014 that a new tender for the project was being planned. To date, the water treatment plant has not been built (<https://seenews.com/news/serbias-zrenjanin-city-cancels-water-plant-deal-with-wte-wassertechnik-417822>).

Regarding the drinking water, Metito understands the struggle of the availability of drinking water in Zrenjanin and therefore has initiated discussions with the City of Zrenjanin in order to take over the existing Water Treatment Plant and rehabilitate / upgrade it for operation.

The sludge generated in the treatment process has also been identified as a potential odour source. Metito has included design measures aligned with BAT to limit the release of odour from the sludge handling system including aeration of the sludge holding tank to dilute potential emissions and maintain aerobic conditions, and the enclosure of the sludge handling systems.

MUL is following both Serbian regulations and best practice international standards to prevent any issues regarding odour and air pollution to the area surrounding the plant, inclusive of (but not limited to) the following:

- EU Waste Framework Directive (2008/98/EC) (generally applicable to the management of sludge generated by the WWTP)
- EU Sewage Sludge Directive (86/278/EEC)
- Urban Waste Water Treatment Directive (91/271/EEC)

Planned technology at the WWTP will include a state-of-the-art Integrated Fixed Activated Sludge (IFAS) process. This is a combination of an activated sludge process where the microbial growth is suspended in an aerated water mixture, and a Moving Bed Biofilm Reactor (MBBR) where the microbial growth occurs on fixed films. The dewatered sludge will be transported for disposal at a permitted waste disposal facility. Metito is currently considering the Sremska Mitrovica disposal facility in Serbia operated by ISTEP. The company provides sludge treatment and final disposal in its own landfill. The landfill is permitted in terms of the Serbian legislation and includes provision for disposal of all wastes that will be generated by the WWTP as per waste codes corresponding with the European Waste Catalogue (EWC).

Serbia has developed a draft National Sludge Management Strategy that has obtained “no objection” from the Ministry, but it is not yet approved by the Government. The Strategy proposes the development of four sewage sludge treatment plants, one of these will be situated in Vojvodina. In addition, a private company from Serbia - “Eliksir” – is understood to be considering options to develop a co-incineration plant somewhere in Vojvodina that will be able to accept sewage sludge.

A BAT review was undertaken as part of the ESIA. The design of the WWTP will include BAT techniques for prevention of and, where that is not practicable, the reduction of emissions and the impact on the environment as a whole. The BAT review recommends the following to be included in the operating company’s (Begej Water) Environmental and Social Management System (ESMS) :

- Odour Management Plan (where the ESIA identifies and substantiates the potential for odour nuisance at sensitive receptors).
- WWTP Sludges and Residues Management Plan.

Techniques generally aligned with BAT include: i) minimising the residence time of the wastewater in stages where it is prone to generating emissions (particularly under anaerobic conditions), and ii) inclusion of aerobic processes that are less conducive to odour formation.

6.5 VULNERABLE GROUPS

In agreement with the competent institutions and relevant organisations/associations that assisted the survey team to engage with this target group, home visits were recommended due to the following reasons:

- Don’t own a car/ means of transport;
- Daily obligations of single working parents and housewives / mothers (some having as many as 13 children);
- Pensioners often experiencing poor health.

Forty respondents were approached however only fifteen interviews were conducted. Reason for their inability or unwillingness to participate was primarily around work and other obligations. Many vulnerable group members are unemployed, and currently involved as seasonal workers in the field; and work hours are long to increase household income, which is still very modest.

Regardless, the survey team are of the opinion that the fifteen respondents provided an ideal distribution of sufficient diversity according to locations and areas of interest. Efforts were made to ensure equal representation of both genders. This was satisfactorily achieved with females comprising 40% and males comprising 60% of the respondents. Equal representation from the vulnerable categories was achieved with 33% pensioners, 33% employed and 34% unemployed persons.

Concerns raised by the vulnerable groups are similar to those provided in **Section 6.4: Summary of Stakeholder Concerns**. Additional / supplementary comments include:

- All respondents stated that they were not satisfied with the current water supply;
- Most of the respondents are glad that the Begej River will be cleaned, but it is important for polluters to be identified and penalised;
- Measures must be put in place to collect fines from polluters, which can supplement the City budget to cover the additional cost for waste water treatment;
- All respondents have extremely low income and they are not able / willing to pay extra for the improvement of sanitary conditions;
- Safe drinking water is not available to residents, however they are charged for these utilities – this is compounded by the fact that the people of Zrenjanin also need to purchase bottled drinking water. This is a challenge with available household budgets - many respondents drink unsafe water from the tap and buy bottled water only for children and the sick.
- Respondents expressed distrust of foreign investors based on past and current experiences (e.g. Ling Long Tyre Factory is reportedly polluting the environment). Although foreign investment does create jobs, it was expressed that the Serbian Government seems to favour these foreign investors over and above the needs of local workers and farmers.
- Respondents expressed concern over the potential odours associated with water treatment and resulting health impacts.

7 SCOPING OF ENVIRONMENTAL AND SOCIAL IMPACTS

7.1 INTRODUCTION

To provide context to the potential type and level of risks assessed in this ESIA Report, a risk assessment / interactions matrix was used as a scoping tool to identify potential interactions between the project components and physical, environmental and socio-economic aspects.

The risk assessment process was informed by the depth of experience of the Project team on industrial waste and wastewater projects, analysis of the project description, initial review of primary and secondary data obtained from the feasibility team during field surveys, information gained during the ongoing stakeholder engagement, and other bibliographic resources available at the time of understating the study. Interactions were classified in one of three categories:

Table 7-1 Interactions Categories

COLOUR / NATURE				DESCRIPTOR
Negative		Positive		
White		White		An interaction is not reasonably expected and will be scoped out of further consideration in the Impact Assessment process.
Light Shading	N	Light Shading	P	An interaction is reasonably possible, but none of the resulting impacts are likely to result in significant effects.
Dark Shading	N	Dark Shading	P	An interaction is reasonably possible, and at least one of the resulting impacts is likely to lead to an effect that is significant.
Source: African Development Bank Integrated Safeguards System Guidance Materials (2015)				

The level of interaction between project activities and the identified aspects, as to whether it is an insignificant risk (denoted by I); a significant risk (S) or a positive interaction (P), was used to guide the impact identification and screening out of potential impacts.

Interactions that are coloured white were ‘scoped out’ of further consideration in the Impact Assessment process. Interactions with light shading have also been ‘scoped out’, but a discussion that includes the evidence base (e.g. past experience, documented data, etc.) is provided to justify the basis upon which this decision was made. Interactions with dark shading are retained for further consideration in the Impact Assessment process.

Various project features and activities that could reasonably act as a source of impact were identified. These are listed down the vertical axis of the interactions matrix. The resources and receptors relevant to the baseline environment are listed across the horizontal axis of the matrix. Each resulting cell on the scoping matrix thus represents a potential interaction between a project activity and a resource or receptor.

The report outlined the proposed methodology for the ESIA and identified likely significant effects for key environmental topics. The Scoping Report has been used to inform the completion of this ESIA.

7.2 SCOPING RESULTS

PROJECT ACTIVITY		PHYSICAL							ENVIRONMENTAL					SOCIAL									
	Applicable (y/n/a)	Air Quality	Ambient Noise and Vibration	Seismicity	Geology and Soils	Hydrology (Surface Water)	Hydrogeology (Groundwater)	Climate	Terrestrial Habitats and Vegetation	Fauna / Wildlife	Avifauna / Birds	Aquatic Ecosystems	Ecosystem Services	Public Health, Safety and Security	Worker Health and Safety	Social and Cultural Structure	Land Use and Livelihoods	Local and Macro Economy	Infrastructure and Services	Traffic and Transportation	Education and Skills	Cultural Heritage Resources	Landscape and Visual
CONSTRUCTION PHASE																							
Acquisition of project land	Y																N						
Physical and economic displacement (resettlement)	Y																N						
Employment of workforce and contractors	Y																	P					
Influx of work-seekers	N/A ¹																						
Establishing the contractor camp and laydown area	Y																						
Transportation of equipment and materials to site	Y								N					N						N			
Site clearing	Y	N	N			N			N	N	N	N	N										
All construction works	Y	N	N		N	N								N	N				N			N	N
Waste generation, collection, transport and disposal	Y					N	N							N	N								
Wastewater generation, treatment and disposal						N	N																
Lighting														N									
Handling of hazardous materials						N	N							N	N								
OPERATIONAL PHASE																							
Physical presence of WWTP	Y																						N
Employment of workforce and contractors	Y																	P					
Vehicular site access and egress (employees, services etc.)	Y													N									
Handling, storage and treatment of malodourous and air pollutant forming effluent and waste materials	Y	N				N								N	N								
Noise emissions from WWTP processes	Y		N											N	N								

PROJECT ACTIVITY		PHYSICAL							ENVIRONMENTAL					SOCIAL										
	Applicable (y/n/a)	Air Quality	Ambient Noise and Vibration	Seismicity	Geology and Soils	Hydrology (Surface Water)	Hydrogeology (Groundwater)	Climate	Terrestrial Habitats and Vegetation	Fauna / Wildlife	Avifauna / Birds	Aquatic Ecosystems	Ecosystem Services	Public Health, Safety and Security	Worker Health and Safety	Social and Cultural Structure	Land Use and Livelihoods	Local and Macro Economy	Infrastructure and Services	Traffic and Transportation	Education and Skills	Cultural Heritage Resources	Landscape and Visual	
Solid waste generation, collection, transport and disposal	Y					N	N							N	N					N				
Wastewater generation, treatment and disposal	N/A ²																							
Stormwater generation and off-site disposal	Y					N								N										
Discharge of treated effluent to the Begej River	Y	P				P								P										
Notes:																								
1) The project employment resources will be sourced from local areas																								
2) Domestic effluent from the WWTP buildings will be discharged to the WWTP for treatment																								

8 ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT

8.1 INTRODUCTION

This Section outlines the approach to the ESIA, in particular the objectives and overall strategy for the ESIA. Scoping has been an integral process, which is documented within this Section. The Section sets out the evidence base associated with the topics and elements of topics that have been scoped out of the assessment. The approach to the ESIA has been undertaken in general accordance with the EU EIA Directive (detailed in Section 4.3) and the approach outlined in the Scoping Report.

The approach to consultation is also outlined, together with the approach to proportionate assessment, including the assessment criteria and the methodology for assessing cumulative effects.

A local standards EIA that is compliant with national EIA requirements and processes, is being prepared in parallel to this ESIA, using all relevant data and studies.

8.1.1 TEMPORAL AND SPATIAL SCOPE

TEMPORAL SCOPE

This ESIA has addressed effects that are anticipated to arise during the construction of the Project (the construction phase) and following its completion (referred to as the 'operational phase'). The environmental and social effects of these phases can broadly be summarised as follows:

- Any effects during the construction period that may arise as a result of construction activities such as site clearing, establishment of contractor facilities, temporary use of, construction of new infrastructure and buildings, changes in traffic movements and temporary closures or diversions to roads; and
- Any effects during the operational period that may arise as a result of operational activities such as vehicle movements to and from the project site or emission associated with wastewater treatment activities.

Consideration has been given to impacts (changes in the environment) associated with the Project in comparison to the baseline conditions identified in the baseline assessments (conditions that would exist without the presence of the Project).

At the time of writing an assessment of the effects of decommissioning has not been considered appropriate for the whole Project. Any decommissioning work would be likely not result in effects exceeding the level of effects arising during the construction phase. It should be noted that the first element of the project is the rehabilitation and closure of the existing landfill.

SPATIAL SCOPE

The spatial scope of the ESIA varies in accordance to the direct and indirect AoI for each ESIA topic. The study areas for each topic are outlined in the technical Sections.

In the interests of clarity, the 'project site' as referred to in the ESIA report is the area that will be taken up by the project infrastructure including the access road, WWTP, and the associated influent and effluent discharge infrastructure that will be constructed as part of the project.

8.1.2 DETERMINATION OF IMPACT SIGNIFICANCE AND MITIGATION

IMPACT SIGNIFICANCE ASSESSMENT

The assessment of impacts and mitigation evaluates the likely extent and significance of the potential impacts on identified receptors and resources against defined assessment criteria, to develop and describe measures that will

be taken to avoid, minimise or compensate for any adverse environmental impacts, to enhance positive impacts, and to report the significance of residual impacts that occur following mitigation.

The key objectives of the risk assessment methodology are to validate impacts identified through a matrix, identify any additional potential environmental issues and associated impacts likely to arise from the proposed project, and to propose a significance ranking. Issues / aspects will be reviewed and ranked against a series of significance criteria to identify and record interactions between activities and aspects, and resources and receptors to provide a detailed discussion of impacts.

A standard risk assessment methodology is used for the ranking of the identified environmental impacts pre-and post-mitigation. The significance of environmental aspects is determined and ranked by considering the criteria presented in **Table 8-1**.

Table 8-1 Impact Assessment Criteria and Scoring System

CRITERIA	SCORE 1	SCORE 2	SCORE 3	SCORE 4	SCORE 5
Impact Magnitude (M) The degree of alteration of the affected environmental receptor	Very low: No impact on processes	Low: Slight impact on processes	Medium: Processes continue but in a modified way	High: Processes temporarily cease	Very High: Permanent cessation of processes
Impact Extent (E) The geographical extent of the impact on a given environmental receptor	Site: Site only	Local: Inside activity area	Regional: Outside activity area	National: National scope or level	International: Across borders or boundaries
Impact Reversibility (R) The ability of the environmental receptor to rehabilitate or restore after the activity has caused environmental change	Reversible: Recovery without rehabilitation		Recoverable: Recovery with rehabilitation		Irreversible: Not possible despite action
Impact Duration (D) The length of permanence of the impact on the environmental receptor	Immediate: On impact	Short term: 0-5 years	Medium term: 5-15 years	Long term: Project life	Permanent: Indefinite
Probability of Occurrence (P) The likelihood of an impact occurring in the absence of pertinent environmental management measures or mitigation	Improbable	Low Probability	Probable	Highly Probably	Definite
Significance (S) is determined by combining the above criteria in the following formula:	$[S = (E + D + R + M) \times P]$ $Significance = (Extent + Duration + Reversibility + Magnitude) \times Probability$				
IMPACT SIGNIFICANCE RATING					
Total Score	4 to 15	16 to 30	31 to 60	61 to 80	81 to 100
Environmental Significance Rating (Negative (-))	Very low (-)	Low (-)	Moderate (-)	High (-)	Very High (-)
Environmental Significance Rating (Positive (+))	Very low (+)	Low (+)	Moderate (+)	High (+)	Very High (+)

CUMULATIVE IMPACT ASSESSMENT

A Rapid Cumulative Impacts Assessment has been carried out to determine whether the project activities are likely to significantly affect the viability or sustainability of selected VECs (such as surface water, valued fauna and flora, habitats, livelihoods and community structures).

ADDITIONAL MITIGATION AND MONITORING

Additional mitigation describes actions that will require further activity in order to achieve the anticipated outcome. Examples include additional design measures, for example enclosing equipment to reduce noise emissions.

Where the potential for likely significant adverse effects have been identified in the assessment, measures to prevent or reduce and, if possible, offset likely significant adverse effects on the environment are described.

Monitoring is typically required where there are significant adverse residual effects. In some cases, for instance where there is uncertainty of residual effects remain, it may also be appropriate to implement monitoring.

Impacts have been assessed following the inclusion of mitigation measures. If any significant effects remain after implementation of mitigation measures, this is recorded within the ESIA.

Proposed additional mitigation and monitoring measures are set out within Technical Sections where necessary. As well as additional mitigation, the embedded mitigation measures within the Project are also recorded.

8.2 AIR QUALITY

8.2.1 LEGISLATION, POLICY AND GUIDANCE

Legislation, policy and guidance as well as the normative standards considered as part of the assessment are identified below, this includes applicable EU legislation.

NATIONAL LEGISLATION

Serbia's Law on Environmental Protection²⁹ was adopted in 2004 and has since been amended multiple times in efforts to harmonise Serbian legislation with key European Union Directives. This regulation provides a general framework for environmental protection in Serbia by defining terms, subjects of environmental protection, main principles as well as a set of laws to cover specific environmental topics, including air quality. Air quality is explicitly mentioned in Article 24 which provides guidelines to achieve air quality protection, namely prescribing measures such as systematic air quality monitoring, reduction of air emissions that rise above defined limit values and the application of technical and technological solutions for pollution reduction³⁰.

The Law on Air Protection³¹ accompanied by several by-laws, and specifically the Regulation on Monitoring Conditions and Air Quality Requirements³² provides the legal framework for air quality protection in Serbia. Main features of this legislation include:

- Responsibilities for both the public (i.e. national, provincial and local government) and private (i.e. companies and industry) sectors to ensure air quality protection and improvement;
- Air quality monitoring requirements for the competent authority as well as legal entities licensed to perform this function;
- Conditions for establishing air quality zones and agglomerations;
- Conditions for air quality monitoring including criteria, methodologies, assessment requirements, quality assurance, scope and report content;
- Responsibilities for developing local Air Quality Plans (AQP) and Short-term Plans (STP);
- Measures and responsibilities for preventing and reducing air pollution, particularly in cases of accidental releases;

²⁹ Law on Environmental Protection, Official Gazette of the Republic of Serbia, No. 135/04, 36/09, 72/09, 43/11, 14/16, 76/18, 95/18 and 26/21.

³⁰ Popović, T. (2020): Report on air quality protection at the local self-government level in the Republic of Serbia (URL: https://www.rs.undp.org/content/serbia/en/home/library/environment_energy/report-on-air-quality-protection-at-the-local-self-government-le.html)

³¹ Air Quality Protection Law, Official Gazette of the Republic of Serbia, No. 36/09 and 10/13.

³² Regulation on Monitoring Conditions and Air Quality Requirements, Official Gazette of the Republic of Serbia, No. 11/10, 75/10 and 63/13.

- Limit values beneath which ambient concentrations of criteria pollutants, namely sulphur dioxide, nitrogen dioxide, carbon monoxide, particulate matter less than 10 and 2.5 microns, benzene and lead, must remain in order to preserve air quality in accordance with sustainable development principles;
- Target values for reducing exposure to ground-level ozone, arsenic, cadmium, nickel and benzo(a)pyrene; and
- Maximum allowable concentrations (MAC) for an array of organic, inorganic and carcinogenic compounds, suspended particulates and soot that are applicable to case specific measurements.

EUROPEAN ENVIRONMENT AGENCY

The Republic of Serbia is a member state of the EU and thus has committed to incorporate or transpose EU directives into national legislation. Air quality in EU member states is directed by the European Environment Agency (EEA) Ambient Air Quality Directive (2008/50/EC)³³ of the European Parliament, and of the Council of 21 May 2008, on ambient air quality and cleaner air for Europe. Directive 2008/50/EC defines the limit values for ambient concentrations of criteria pollutants, and the requirements for government to improve and report upon air quality in their jurisdiction. The limit values and requirements outlined in Directive 2008/50/EC³³ have been transposed into Serbian law, specifically within the *Regulation on Monitoring Conditions and Air Quality Requirements*³⁴.

Odour is regulated in the EU through the Industrial Emissions Directive 2010/75/EU of the European Parliament and of the Council of 24 November 2010³⁵. This directive establishes a general framework for determining limits, including odour limits for many industrial activities/processes intending to (among others) control odour emissions. The covered sectors include, the energy industry, metals production and processing, waste management, chemical and mineral industry, and agriculture sectors such as animal production. This Directive rules that listed installations may only operate if they hold a written permit which must define conditions to achieve a high level of environmental protection. These conditions are based on the concept of BAT, for which BREF documents have been compiled by the European Commission. Some other legally binding documents and guidelines related to odours are available in a few European countries (i.e. France, Germany, Austria, Hungary, United Kingdom, Spain, the Netherlands and Belgium). Those odour regulations are used when no specific criteria are set in a BREF, or when Directive 2010/75/EU does not cover the odour-emitting activity.

INTERNATIONAL GUIDANCE

International Finance Corporation: Environmental Health and Safety

The IFC EHS offers general guidelines and approaches, industry specific guidelines and approaches and pollutant-specific guidelines and approaches to management of EHS. The general IFC EHS approach to protecting ambient air quality is ensuring that pollutant concentrations do not exceed national legislated standards or, in their absence, the current WHO air quality guidelines. The IFC EHS guideline suggests that ambient pollution concentrations resulting from a single facility should not exceed 25% of the applicable air quality standards³⁶.

World Health Organisation

The WHO provide guidelines for protecting public health from the adverse effects of air pollutants and to eliminate or reduce exposure to those pollutants that are known or likely to be hazardous to human health or well-being. The guidelines are based on expert evaluation of current scientific evidence and are intended to inform policy makers and to provide targets for air quality management. In establishing pollutant levels below which exposure does not constitute a significant public health risk over a specified period of time, the guidelines provide a basis for setting standards or limit values for air pollutants. In general, the guidelines address single pollutants (identified to be of special environmental and health significance to countries of the European Region) whereas in reality, exposure to mixtures of chemicals occurs, with potentially additive, synergistic or antagonistic effects. In dealing with practical situations or standard-setting procedures, therefore, consideration should be given to the interrelationships between the various air pollutants. In setting legally binding standards, considerations such as

33 European Parliament (2008) Council Directive 2008/50/EC on Ambient Air Quality and Cleaner Air for Europe

34 Regulation on Monitoring Conditions and Air Quality Requirements, Official Gazette of the Republic of Serbia, No. 11/10, 75/10 and 63/13.

35 European Parliament (2010) Council Directive 2010/75/EU on Industrial Emissions (integrated pollution prevention and control)

36 IFC 2007. Environmental, Health and Safety Guidelines: General EHS Guidelines, Air Emissions and Ambient Air Quality, (URL: www.ifc.org/ifcext/enviro.nsf/Content/Environmentalguidelines)

prevailing exposure levels, technical feasibility, source control measures, abatement strategies, and social, economic and cultural conditions also should be taken into account³⁷.

Texas Commission on Environmental Quality

The Texas Commission on Environmental Quality (TCEQ) is the environmental agency for the state of Texas in the United States. TCEQ have developed Effects Screening Levels (ESLs) to evaluate impacts from pollutant concentrations predicted by dispersion modelling simulations. ESLs, which include both short- (1-hour) and long-term (annual) limit values, are chemical-specific concentration limits set to protect human health and welfare.. Short-term ESLs are based on data concerning acute health effects, the potential for nuisance odour and effects on vegetation, while long-term ESLs are based on data concerning chronic health and vegetation effects. Welfare ESLs (i.e. odour and vegetation effects) are based on effect thresholds while health ESLs are based on toxicity factors and dose responses relevant to humans³⁸. The TCEQ short-term ESLs are useful in the absence of short-term guidelines in other guideline systems.

8.2.2 SUMMARY OF POLLUTANT STANDARDS AND GUIDELINES

A summary of the standards, guidelines and odour detection limits (ODT) applied in this assessment for pollutants relevant to the proposed WWTP are provided in **Table 8-2**. The thresholds provided are for specified time-weighted averages and therefore not directly applicable to concentrations measured over other averaging periods. Averaging periods do not apply to ODT.

Table 8-2: Ambient standards, guidelines and ODT for pollutants relevant to this study

Compound	Averaging Period	Serbia ³⁹	EU EEA ⁴⁰	IFC / WHO ⁴¹	TCEQ ESL ⁴²	ODT
		µg/m ³				
Ammonia	1-hour	-	-	-	180	1000 ⁽⁴³⁾
	3-hour	200	-	-	-	
	24-hour	100	-			
	Annual	-	-	-	92	
Hydrogen sulphide	30-minute	-	-	7	-	0.2 – 2 ⁽⁴⁴⁾
	24-hour	150	-	150	-	
Benzene	1-hour	-	-	-	170	5000 ⁽⁴⁵⁾
	Annual	5	5	0 ⁽⁴⁶⁾	4.5	
Toluene	1-hour	-	-	-	4 500	1000 ⁽⁴⁷⁾
	1-week	260	-	260	-	
	Annual	-	-	-	1 200	

37 World Health Organisation (2000): Ambient Air Quality Guidelines for Europe (URL: http://www.euro.who.int/__data/assets/pdf_file/0005/74732/E71922.pdf). Subsequently updated in 2005: WHO Air quality guidelines for particulate matter, ozone, nitrogen dioxide and sulfur dioxide (http://apps.who.int/iris/bitstream/handle/10665/69477/WHO_SDE_PHE_OEH_06.02_eng.pdf?sequence=1)

38 TCEQ (2006): Guidelines to Develop Effects Screening Levels, Reference Values and Unit Risk Factors. RG-442

39 Regulation on Monitoring Conditions and Air Quality Requirements, Official Gazette of the Republic of Serbia, No. 11/10, 75/10 and 63/13.

40 European Parliament (2008) Council Directive 2008/50/EC on Ambient Air Quality and Cleaner Air for Europe

41 World Health Organisation (2000): Ambient Air Quality Guidelines for Europe (URL:

http://www.euro.who.int/__data/assets/pdf_file/0005/74732/E71922.pdf).

42 Texas Commission on Environmental Quality (2017): Effects Screening Levels using in the review of Air Permitting Data (URL:

https://www.tceq.texas.gov/toxicology/esl/list_main.html)

43 Nagata, Y. (2003): Measurement of odor threshold by triangular odor bag method. Odor Measurement Review, Japan Ministry of the Environment:118-127.

44 World Health Organisation (2000): Ambient Air Quality Guidelines for Europe (URL:

http://www.euro.who.int/__data/assets/pdf_file/0005/74732/E71922.pdf).

45 US EPA (2012): Hazard Summary - Benzene (URL: <https://www.epa.gov/sites/default/files/2016-09/documents/benzene.pdf>)

46 Benzene is carcinogenic to humans and no safe levels of exposure can be recommended by the World Health Organisation. The continuous exposure concentrations of airborne benzene associated with an excess lifetime risk of 1:10 000 for leukaemia is 11.165 $\mu\text{g}/\text{m}^3$. The geometric mean of the range of estimates of the excess lifetime risk of leukaemia at an air concentration of 1 $\mu\text{g}/\text{m}^3$ is 6×10^{-6} . The concentrations of airborne benzene associated with an excess lifetime risk of 1:10 000, 1:100 000 and 1:1 000 000 are 17, 1.7 and 0.17 $\mu\text{g}/\text{m}^3$ respectively.

47 World Health Organisation (2000): Ambient Air Quality Guidelines for Europe (URL:

http://www.euro.who.int/__data/assets/pdf_file/0005/74732/E71922.pdf).sa

Compound	Averaging Period	Serbia ³⁹	EU EEA ⁴⁰	IFC / WHO ⁴¹	TCEQ ESL ⁴²	ODT
		$\mu\text{g}/\text{m}^3$				
Ethylbenzene	1-hour	-	-	-	26 000	10 000 ⁽⁴⁸⁾
	Annual	-	-	-	570	
Xylene	1-hour	-	-	-	2 200	5000 ⁽⁴⁹⁾
	Annual	-	-	-	180	
Chloroform	1-hour	-	-	-	100	400 000 ⁵⁰
	Annual	-	-	-	10	
Dichloromethane	1-hour	-	-	-	3 600	875 000 ⁵¹
	24-hour	-	-	3 000	-	
	1-week	-	-	450	-	
	Annual	-	-	-	350	
Trichloroethylene	1-hour	-	-	-	540	150 000 ⁵²
	Annual	-	-	0 ⁽⁵³⁾	54	
Vinyl chloride monomer	1-hour	-	-	-	20 000	676 000 – 10 400 000 ⁵⁴
	Annual	-	-	0 ⁽⁵⁵⁾	1.2	
Formaldehyde	30-minute	-	-	100	-	30 – 600 ⁽⁵⁶⁾
	1-hour	-	-	-	15	
	Annual	-	-	-	3.3	
Styrene	30-minute			70	-	70 ⁽⁵⁷⁾
	1-hour			-	110	
	1-week			260	-	
	Annual				140	

Odour impact criteria guidelines assist with the assessment of model simulated nuisance impacts. However, as of 2019, the only BREF in Europe with an established odour limit is the Waste Treatment BREF, which prescribes a range of 200 to 1000 OU_E/m³ as the maximum allowed odour emission concentration related to the biological treatment of waste⁵⁸. The BREF for Common Waste Water Treatment Systems⁵⁹ recommends odour monitoring by dynamic olfactometry (EN 13725) as part of an odour management plan, however does not prescribe an odour impact limit. The limit established for WWTP in the Netherlands (**Table 8-3**)⁶⁰ is presented as it is the only WWTP specific odour limit established by a fellow EU member state.

Table 8-3: Criteria limit for acceptable odour exposure relating to WWTP in the Netherlands (amended from Brancher *et al*, 2016)

48 US EPA (2000): Hazard Summary - Ethylbenzene (URL: <https://www.epa.gov/sites/default/files/2016-09/documents/ethylbenzene.pdf>)

49 US EPA (2000): Hazard Summary - Xylene (URL: <https://www.epa.gov/sites/default/files/2016-09/documents/xylenes.pdf>)

50 USEPA (2000): Hazard Summary – Chloroform (URL: <https://www.epa.gov/sites/default/files/2016-09/documents/chloroform.pdf>)

51 USEPA (2000): Hazard Summary – Methylene Chloride (URL: <https://www.epa.gov/sites/default/files/2016-09/documents/methylene-chloride.pdf>)

52 USEPA (2000): Hazard Summary – Trichloroethylene (URL: <https://www.epa.gov/sites/default/files/2016-09/documents/trichloroethylene.pdf>)

53 Trichloroethylene is genotoxic and carcinogenic to humans and no safe levels of exposure can be recommended by the World Health Organisation. The ranges of ambient air concentrations of trichloroethylene corresponding to an excess lifetime risk of 1:10 000, 1:100 000 and 1:1 000 000 are 230, 23 and 2.3 $\mu\text{g}/\text{m}^3$ respectively.

54 USEPA (2020): Hazard Summary – Vinyl Chloride (URL: https://www.epa.gov/sites/default/files/2020-05/documents/vinyl_chloride_march_26_2020.pdf)

55 Vinyl chloride is carcinogenic to humans and no safe levels of exposure can be recommended by the World Health Organisation. Estimates based on human studies indicate a lifetime risk from exposure to 1 $\mu\text{g}/\text{m}^3$ to be 1:1 000 000.

56 World Health Organisation (2000): Ambient Air Quality Guidelines for Europe (URL: http://www.euro.who.int/_data/assets/pdf_file/0005/74732/E71922.pdf).

57 World Health Organisation (2000): Ambient Air Quality Guidelines for Europe (URL: http://www.euro.who.int/_data/assets/pdf_file/0005/74732/E71922.pdf).

58 Bokowa, A., *et al* (2021): Summary and Overview of the Odour Regulations Worldwide. Atmosphere Vol 12, 206

59 European Commission (2016): Best Available Techniques (BAT) Reference Document for Common Waste Water and Waste Gas Treatment/Management Systems in the Chemical Sector

60 Brancher, M., Griffiths, K.D., Franco, D. and de Melo Lisboa, H. (2016): A review of odour impact criteria in selected countries around the world in *Chemosphere*, 2017, vol. 168 pp 1531-1570

Region	Limit value (OU _E /m ³)	Percentile ⁶¹	Averaging period	Applicability
Netherlands	1	98 th	1-hour	Residential areas or sensitive receptors

8.2.3 ACTIVITY RELEVANT POLLUTANTS AND ASSOCIATED HEALTH EFFECTS

The composition of air pollutant mixtures, pollutant concentrations, duration of exposure and other susceptibility factors (e.g. age, nutritional status and predisposing conditions) can lead to diverse impacts on human health. Health effects can range from nausea and skin irritation to cancer and mortality⁶². High risk individuals include the elderly, people with pre-existing heart or lung disease, pregnant women, asthmatics, and children. Possible health implications associated with pollutants applicable to the operation of the WWMF are summarised in **Table 8-4**.

Table 8-4: Air pollutants and associated human health impacts

Pollutant	Description	Health effects
Ammonia (NH₃)	NH₃ is an alkaline chemical widely used in industrial applications as a feedstock for fertilizers, plastics, and explosives. It is a colourless, water soluble gas with an unpleasant, sharp, and pungent odour. NH₃ vapour causes irritation to the eyes and respiratory tract with high concentrations causing conjunctivitis, laryngitis, and pulmonary oedema. Ammonia combines with moisture in the eyes and mucous membranes to form ammonium hydroxide. Ammonium hydroxide causes saponification and liquefaction of the exposed, moist epithelial surfaces of the eye and can easily penetrate the cornea and damage the iris and the lens. Damage to the iris may eventually lead to cataracts. Inhalation exposure may result in an increase in systemic arterial blood pressure. Odour thresholds for NH₃ vary from 30 to 73,000 µg/m³ causing annoyance and potentially exacerbating pre-existing asthma⁶³.	— Eye, nose and throat irritation — Coughing — Dermal irritation or burns — Damage to the eyes — Increased blood pressure — Respiratory failure
Hydrogen sulphide (H₂S)	H₂S is a colourless gas, soluble in water. It is formed in the presence of organic material and sulphate under anaerobic conditions. Most of the atmospheric H₂S has natural origins, occurring around sulphur springs and lakes, and in geothermally active areas. In industry, H₂S is formed when elemental sulphur or sulphur-containing compounds come into contact with organic materials at high temperatures⁶⁴.	— Nausea; — Headaches; — Skin and eye irritation; — Delirium; — Tremors; — Convulsions; — Confusion and anxiety; — Unconsciousness; — Mortality.
Total volatile organic compounds (TVOC)	TVOC refers to a class of several hundred carbon based chemical compounds that easily vaporize from the solid or liquid phase into a gas. Some VOCs have little to no known human health effects while others are extremely toxic and potentially carcinogenic. Little is known about how VOCs combine in the atmosphere or what the potential cumulative impacts might be on the human body, making analysis, risk assessment and guideline setting for these collective compounds exceptionally difficult.	— Eye, nose and throat irritation; — Headaches; — Nausea; — Dizziness; — Fatigue; — Dermal irritation; — Damage to the kidneys, liver and central nervous system; — Loss of coordination; — Cancer; — Mortality.

⁶¹ P98 hourly concentrations are the 98th percentile hourly average concentrations at each grid point for the applicable meteorological period. This translates to 98% of hourly concentrations at each grid point falling below the P98 concentration calculated for that grid point. The P98 hourly outputs are specified for comparison with the selected (Netherlands) guideline.

⁶² Kampa, M., and Castanas, E. (2007): *Human health effects of air pollution*, *Environmental Pollution* 151 (2008) 362-367, Elsevier

⁶³ OEHHA (1999): Appendix D.2 Acute RELs and toxicity summaries (URL: <https://oehha.ca.gov/media/downloads/cmr/appendixd2final.pdf>)

⁶⁴ World Health Organization (2000): *Air Quality Guidelines for Europe* (2nd edition), Copenhagen, Denmark. (WHO Regional Publications, European Series, No 91)

Pollutant	Description	Health effects
Benzene (C₆H₆)	Benzene in its purest form is a colourless liquid with an aromatic odour. Crude oil is the largest natural source of benzene, with benzene used in many products, including plastics, synthetic rubber, glues, paints, furniture wax, lubricants, dyes, detergents, pesticides and some pharmaceuticals. Benzene is emitted from industrial sources as well as from combustion sources such as motor engines, wood combustion and stationary fossil fuel combustion. The major source is exhaust emissions and evaporation losses from motor vehicles, and evaporation losses during the handling, distribution and storage of petroleum products⁶⁵. Benzene is an established carcinogen⁶⁶.	– Drowsiness; – Dizziness; – Headaches; – Irritation of the eyes, skin and respiratory tract; – Visual disorders; – Fatigue; – Impaired coordination; – Haematological problems; – Adverse foetal development; – Cancer; – Mortality.

8.2.4 ODOUR

The sensation of odour occurs when airborne compounds stimulate receptors in the nasal cavity. These sensations are induced either by the olfactory epithelium in the nose (resulting in olfactory sensations described as floral, fishy, faecal, etc.) or by stimulating the trigeminal nerve endings in the nose, throat and lungs at elevated concentrations (inducing irritant sensations, e.g. tickling, burning, itching, etc.). Olfaction has multiple dimensions, including intensity, identity and hedonic tone ('pleasantness')⁶⁷. The function of the olfactory system is to allow for the learning of odours particular to an individual's life experiences and environment, while the function of the intranasal trigeminal system is to prevent the inhalation of potentially life-threatening substances by triggering protective reflexes such as sneezing, neurogenic inflammation of the mucosa and watering eyes⁶⁸.

The concentration at which an odour is just detectable to the human nose is known as the detection threshold concentration. While the detection threshold is the concentration at which the odour can be sensed, a higher concentration is usually required before the odour can be positively identified. The recognition threshold represents the concentration at which an odour becomes recognisable as a specific odour by 50% of the exposed population. The recognition threshold is on average three times the detection threshold. The annoyance threshold represents the concentration necessary to provoke a sensation of annoyance within the community⁶⁹.

Annoyance is defined as the human reaction that occurs because of exposure to an ambient stressor (odour) resulting in a negative state of mind requiring some degree of coping to overcome. Nuisance is caused by repeated events of annoyance over an extended period of time that leads to modified behaviour (e.g. complaint reporting, closing of windows, avoiding use of the garden, keeping odour diaries, participating in protest action, etc.).

Considering that the odour threshold for many odorous chemicals are several orders of magnitude less than that required to cause adverse health effects for people or the environment, odorous compounds have the ability to create a significant nuisance at concentrations much lower than what would be considered a public health issue from a traditional public health perspective. Nuisance occurs when people are affected by an odour in their living or working environment that is perceived as negative⁷⁰. However, the stress associated with annoyance can have indirect health impacts, thus blurring the distinction⁷¹.

⁶⁵ US EPA (2012): *Health effects of Hazardous Air Pollutants – Benzene* (www.epa.gov/airtoxics)

⁶⁶ World Health Organization (2000): *Air Quality Guidelines for Europe* (2nd edition), Copenhagen, Denmark. (WHO Regional Publications, European Series, No 91)

⁶⁷ Schiffman, S.S. and Williams, C.M. (2005): *Science of odour as a potential health issue* in *Journal of Environmental Quality*, 34, 129-138.

⁶⁸ Guarneros, M.; Drucker-Colin, R.; Esquivelzeta, J. and Hudson, R. (2011): *Adverse effect of air pollution on odour perception* in *Advanced Topics in Environmental Health and Air Pollution Case Studies*.

⁶⁹ Naddeo, V.; Belgioirno, V. and Zarra, T. (2013): *Odour Characterisation and Exposure Effects* in Belgioirno, V.; Naddeo, V. and Zarra, T. (ed.) *Odour Impact Assessment Handbook*, Wiley & Sons, Chichester, 7 - 28.

⁷⁰ Naddeo, V.; Belgioirno, V. and Zarra, T. (2013): *Odour Characterisation and Exposure Effects* in Belgioirno, V.; Naddeo, V. and Zarra, T. (ed.) *Odour Impact Assessment Handbook*, Wiley & Sons, Chichester, 7 - 28.

⁷¹ Naddeo, V.; Belgioirno, V. and Zarra, T. (2013): *Introduction* in Belgioirno, V.; Naddeo, V. and Zarra, T. (ed.) *Odour Impact Assessment Handbook*, Wiley & Sons, Chichester, 1 - 5.

ODOROUS EMISSIONS FROM WASTEWATER TREATMENT

VOCs, H₂S and NH₃ are emitted from wastewater treatment, collection and storage systems, through the volatilisation of compounds at the liquid surface⁷². Sources of atmospheric emissions from a WWTP include aeration during primary treatment, aerobic digestion, mechanical thickening of sludge, anaerobic digestion, sludge drying and flaring (where applicable).

WWTPs are common sources of odour and are usually located in close proximity to residential areas. In most cases facilities are built beforehand with residential and commercial land uses encroaching as the demand for available urban space increases over time. Odour management is complex due to plant design (with tanks placed outdoors) and odour originating from several emission sources in the plant area. In general, odour characteristics depend on the source of the wastewater for individual plants, however, overall WWT odours are a combination of several VOCs, NH₃, H₂S and aldehydes. Different chemical and biological processes and processing conditions, such as pH, temperature and retention time, may have a great effect on the odour character. Long retention times and low oxygen levels or even complete anaerobic conditions favour the generation of malodorous sulphur compounds and carboxylic acids⁷³.

Zarra *et al* (2008)⁷⁴ characterised odorous emissions from a single WWTP and measured 39 different VOC substances during the treatment process. Almost 50% of these were found to be 'smell relevant' compounds representative of the 'typical' WWT odour⁷⁵. Odours generating annoyance for surrounding communities were predominantly found to originate from raw wastewater influent (52%) and sludge handling activities (40%). The predominant odorous emission from sludge drying activities was H₂S.

8.2.5 IMPACT ASSESSMENT METHODOLOGY

EMISSIONS INVENTORY

An emissions inventory is a list of air pollution sources, including their physical and chemical parameters. Emission factors are used to estimate emissions where actual emission data is not available. In most cases, these factors are averages of available data of acceptable quality, and are generally assumed to be representative of long-term averages for all facilities in the source category. An emission factor is a value representing the relationship between an activity and the rate of emissions of a specified pollutant. Emission factors are always expressed as a function of the weight, volume, distance or duration of the activity emitting the pollutant. The general equation used for the estimation of emissions is:

$$E = A \times EF \times \left(1 - \frac{ER}{100}\right)$$

Where:

E	= emission rate
A	= activity rate
EF	= emission factor
ER	= overall emission reduction efficiency (%)

Construction Phase

The construction of the WWTP is planned to commence in November 2021 and has an 18-month construction timeline. Construction activities will commence with site preparation, which will entail land clearance of vacant state-owned land, site establishment, levelling, and delivery of materials and plant/equipment, followed by the construction of the physical infrastructure and installation of various mechanical and electrical components.

Emissions during construction are associated with land clearing, drilling and potential blasting, ground excavation, cut and fill operations and vehicle traffic on temporary roads. Pollutants associated with construction activities

⁷² NPI (2011): Emission estimation technique manual for sewage and wastewater treatment, v2.1.

⁷³ Lehtinen, J. (2013): *Case studies for Assessment, control and prediction of odour impact - Urban wastewater treatment in Belgioirno, V.; Naddeo, V. and Zarra, T. (ed.): Odour Impact Assessment Handbook*, Wiley & Sons, Chichester, 205 - 219.

⁷⁴ Zarra, T., Naddeo, V., Belgioirno, V., Reiser, M. and Kranert, M. (2008): *Odour monitoring of a small wastewater treatment plant located in a sensitive environment in Water Science & Technology*, vol. 58.1, 89-94.

⁷⁵ It should be noted that although this study comprised of both sensorial and chemical analysis techniques, only VOCs were assessed. The chemical array within the odour sample, determined by the sniff panel as 'a typical WWTW odour', neglected to consider other odorous compounds such as H₂S or NH₃. As such, it cannot be assumed that these compounds were not present.

are typically total suspended particulates (TSP), PM₁₀ and PM_{2.5} with lesser contributions of CO, NO₂, SO₂ and C₆H₆ from the exhausts of heavy construction vehicles.

Heavy construction activity is a source of dust emissions that can have a significant but temporary impact on local air quality. The amount of dust emitted from construction operations depends on the area of land being worked, the proportion of land lying exposed at any time, the clearing and dozing equipment used, the number and type of vehicles on temporary roads, and the duration of the construction phase. A large proportion of dust emissions generally result from heavy vehicle traffic over temporary roads at the construction site. Considering the proposed development site is small (approximately 0.027 km²) emissions arising during construction are anticipated to be low. With the implementation of appropriate mitigation techniques (e.g. wet suppression to limit dust, and rules against construction vehicle idling or speeding to limit gaseous emissions), there is opportunity to limit any potential impacts on neighbouring sensitive receptors to a reasonable level, with cognisance that any such impacts will be temporary in nature.

Operational Phase

VOC emission factors for headworks screening, grit removal, primary settling, anaerobic digestion, secondary clarification, sludge thickening and a belt filter press were applied from documented emission factors⁷⁶. H₂S emissions were provided for the facility by the client, Metito (**Table 8-5** and **Table 8-6**):

Table 8-5: Off-gas percentages at equipment source

Equipment	% Off-gas
Inlet Headwork	15%
Grit and Grease Removal	70% (air flow 430 Nm ³ /hr)
DC-102	10%
DC-103	4%
Anaerobic Tank	0.05%
Anoxic Tank	0.05%
ASP Tank	1% (air flow 4600 Nm ³ /hr)
IFAS Tank	0.5% (air flow 3400 Nm ³ /hr)

Table 8-6: H₂S emissions at equipment source (with 5% SO₄)

ID	H ₂ S Emissions (kg/hr)	% of H ₂ S Emissions
Inlet Headwork	0.042	15.18
Grit and Grease Removal	0.194	70.11
DC-102	0.028	10.12
DC-103	0.01	3.61
Anaerobic Tank	0.0001	0.04
Anoxic Tank	0.0001	0.04
ASP Tank	0.0028	1.01
IFAS Tank	0.0014	0.51
Total Emissions	0.2767	100

Emissions Summary

A summary of emission rates from ambient pollutants as calculated for the proposed WWTP is presented in **Table 8-7**. Ammonia emissions were found to be negligible at the proposed operating conditions.

⁷⁶ Australian National Pollutant Inventory (NPI, 2011): Emission Estimation Technique Manual for Sewage and Wastewater Treatment (Version 2.1, June 2011).

Table 8-7: Emission rate summary

Pollutant	Emission rate (g/s)
Hydrogen sulphide	0.77E-01
Benzene	1.27E-02
Toluene	2.98E-02
Ethylbenzene	2.47E-05
Xylene	2.97E-02
Chloroform	2.36E-03
Dichloromethane	1.74E-03
Trichloroethylene	4.48E-03
Vinyl chloride monomer	5.82E-03
Formaldehyde	2.30E-03
Styrene	3.42E-04

ATMOSPHERIC DISPERSION MODELLING

Atmospheric dispersion modelling mathematically simulates the transport and fate of pollutants emitted from a source to the atmosphere. Algorithms incorporate source criteria, surface topography, land use and meteorology to predict the downwind concentrations of these pollutants. These provide a useful tool to ascertain the spatial and temporal patterns of ground level pollutant concentrations arising from various point, line, area and volume sources. These outputs are primarily used in environmental and health impact assessments, risk assessments and to determine monitoring requirements, including spatial and temporal resolution.

The type of assessment is dependent on technical factors such as geophysical and meteorological context and the complexity of the emissions inventory. The temporal and spatial resolution and accuracy required from a model must also be taken into account.

An AERMOD assessment is applicable in generic assessments where:

- The distribution of pollutant concentrations and deposition are required in time and space.
- Pollutant dispersion can be reasonably treated by a straight-line, steady-state, Gaussian plume model with first order chemical transformation.
- Emissions are from sources where the greatest impacts are in the order of a few kilometres (less than 50 km) downwind.

AERMOD is a new generation air dispersion model designed for short-range dispersion of airborne pollutants in steady state plumes that uses hourly sequential meteorological files with pre-processors to generate flow and stability regimes for each hour. The model outputs can be used to produce maps of plume spread with key isopleths for visual interpretation and statistical outputs allowing for comparison with national and international ambient air quality guidelines and standards for compliance testing. AERMOD is the US EPA preferred regulatory dispersion model.

The AERMOD atmospheric dispersion modelling system is an integrated system that includes three modules:

- A steady-state dispersion model designed for short-range (up to 50 km) dispersion of air pollutant emissions from stationary sources.
- A pre-processor (AERMET⁷⁷) that accepts surface meteorological data, upper air soundings, and optionally, data from onsite instrument towers. It then calculates atmospheric parameters needed by the dispersion model, such as atmospheric turbulence characteristics, mixing heights, friction velocity, Monin-Obukhov Length and surface heat flux.
- A terrain pre-processor (AERMAP) to provide the physical relationship between terrain features and the behaviour of air pollution plumes. It generates location and height data for each receptor location. It also

⁷⁷ <http://en.wikipedia.org/wiki/Meteorology> meteorological data <http://en.wikipedia.org/wiki/Preprocessor>

provides information that allows the dispersion model to simulate the effects of air flowing over hills or splitting to flow around hills.

Model Inputs

A description of model input variables is provided below. A summary of key input variables is given in

Terrain and Land Use

Local topography is considered flat. Since over 50% of the land use within 3 km of the study site comprises agricultural activity the model's overall land use classification was set to 'Rural'.

Meteorology

Meteorological conditions affect how pollutants emitted into the air are directed, diluted and dispersed within the atmosphere, and therefore incorporation of reliable data to an air quality assessment is of the utmost importance. To represent meteorological conditions at the site, WRF (Penn State/NCAR Fifth Generation Mesoscale Model) data was purchased from Lakes Environmental. For the purposes of this study, an AERMET-ready WRF dataset for the years January 2018 – December 2020 centred at 45.34713°N, 20.42235°E was used to produce the surface and profile meteorological files for model input (**Figure 8-1**).

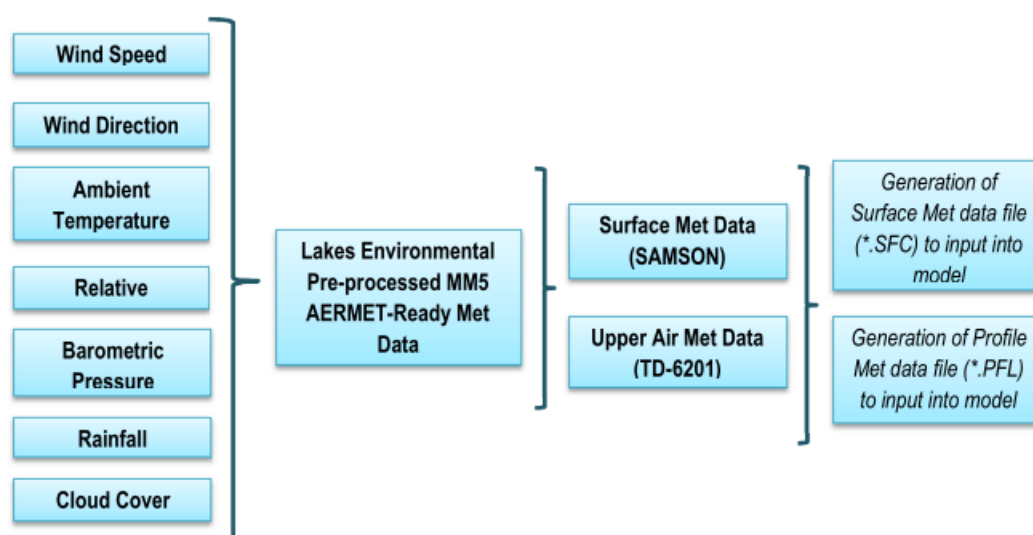


Figure 8-1: Meteorological data path

Grid Resolution

The selected size and extent of the model domain is influenced by factors such as source buoyancy, terrain features (i.e. mountains) and the location of contributing sources. Larger domains are recommended for elevated, buoyant sources (e.g. stacks) while smaller domains are considered sufficient for lower release heights, particularly if emissions are at or near ambient temperature. The modelling domain for this study was defined as 10 km by 10 km centred over the proposed WWTP development site. A multi-tier receptor grid was used with a grid resolution of 50 m x 50 m up to 1 000 m from the centre of the site and 100 m x 100 m thereafter. This resulted in a grid of 11,445 points for concentration calculation.

Discrete receptors

Discrete receptors selected for assessment are listed in **Table 8-8** and shown in **Figure 8-2**. These were selected for specialist assessment in the ESIA based on proximity to the study site (i.e. the closest sensitive receptors identified). Ambient concentrations of pollutants from low-level area sources tend to decrease radially outwards from the source. As such, the closest receptors along key wind trajectories provide insight on worst case potential impacts.

Table 8-8: Sensitive receptors

ID	Description	Receptor type	Latitude (°N)	Longitude (°E)	Distance from site (m)	Cardinal direction from site
MT1	House at Pančevačka bb, Zrenjanin	Residence	45.349510	20.420537	195	N

Domain centre	Latitude (°N)	45.34713
	Longitude (°E)	20.42235
Receptor grid type		Multi-tier
Grid resolution	Tier I	50 m (within 1 000 m of site)
	Tier II	100 m (within 5 000 m of site)
Sensitive / Discrete receptors		Four

Model Outputs

The model outputs that follow show simulated pollutant concentrations experienced at ground level for the proposed operations. Where applicable, ambient concentrations are compared with national limit values/MAC or relevant international guidelines (in the absence of local MAC) to assess impact. For the purposes of this investigation, the following statistical outputs were generated:

- The long-term scenario refers to the period average concentration, which is calculated by averaging all hourly concentrations for the three-year assessment period. The calculation is conducted for each grid point within the modelling domain and for the discrete (sensitive) receptors.
- 99th percentile (P99) concentrations were calculated for comparison with short-term limit values (1-hour and 24-hour). The use of the 99th percentile limits the impact of extreme outliers on the interpretation of results. These outliers can be the result of anomalies in the meteorological model or artefacts of the simulation process.
- 98th percentile (P98) H₂S concentrations are calculated for short-term odour concentrations as specified for comparison with the Netherlands odour criteria limit. An H₂S odour detection threshold of 1 µg/m³ was assumed for the calculation of odour units.

8.2.6 RESULTS

Predicted pollutant concentrations at sensitive receptors are presented in **Table 8-10**. Isopleth maps showing simulated dispersion of H₂S, odour and benzene are presented in **Figure 8-3** to **Figure 8-7**. Where applicable, predicted concentrations have been evaluated against short-term (i.e. 1-hour and 24-hour) and long-term (i.e. annual) national limit values/MAC or relevant international guidelines. Key findings are as follows:

- P99 1-hour H₂S concentrations at key receptors MT1, MT2 and MT4 exceed the WHO **nuisance** guideline (applied in the absence of a local H₂S nuisance/1-hr average criterion).
 - The frequency of nuisance impact is presented in **Figure 8-5** as the percentage of time that simulated 1-hour H₂S concentrations exceed 7 µg/m³.
 - For sensitive receptors, this is predicted to occur between 0.9% (MT3) to 4.4% (MT1) of the time.
- P98 1-hour odour concentrations (based on predicted H₂S levels only) at key receptors MT1 - MT4 exceed the Netherlands **odour criteria limit** (applied in the absence of local odour criteria).
- P99 24-hour H₂S concentrations at all sensitive fall below the WHO **health** guideline and Serbian MAC.
- All hydrocarbons fall well below identified ambient guidelines across averaging periods (including the Serbian annual benzene MAC and the 1-week average toluene MAC).
- Pollutants such as benzene, trichloroethene and vinyl chloride are considered genotoxic and/or carcinogenic and therefore no safe levels of exposure are recommended by the WHO. Predicted concentrations of these pollutants are low and fall within guidelines of insignificant to reasonable risk (e.g. 1:1 000 000 or 1: 100 000 excess lifetime risk on the long term average).

Assuming measured pollutant concentrations in the two monitoring campaigns represent background levels across averaging periods, the above finding of no significant health impacts of the facility holds when considering cumulative ambient levels of measured pollutants.

Table 8-10: Simulated concentrations for sensitive receptors

Pollutant	Unit	Averaging period	Standard / Guideline	Reference	Percentile	Sensitive receptor			
						MT1	MT2	MT3	MT4
Hydrogen sulphide	µg/m ³	1-hour	7 ⁽⁷⁸⁾	IFC / WHO	P99	25.64	7.62	6.19	22.12
		24-hour	150	Serbian MAC	P99	9.82	3.34	2.63	7.34
Odour	OU _E /m ³	1-hour	1 - 3.5	Netherlands	P98	17.49	2.39	1.78	14.01
Benzene	µg/m ³	1-hour	170	TCEQ ESL	P99	4.22	1.25	1.02	3.64
		Annual	5	Serbian MAC	NA	0.19	0.04	0.03	0.14
			0.17	WHO 1:1 000 000 excess lifetime risk					
			1.7	WHO 1:100 000 excess lifetime risk					
Toluene	µg/m ³	1-hour	4 500	TCEQ ESL	P99	9.91	2.95	2.39	8.55
		Annual	1 200	TCEQ ESL	NA	0.46	0.09	0.08	0.34
Ethylbenzene	µg/m ³	1-hour	26 000	TCEQ ESL	P99	0.01	0.00	0.00	0.01
		Annual	570	TCEQ ESL	NA	0.00	0.00	0.00	0.00
Xylene	µg/m ³	1-hour	2 200	TCEQ ESL	P99	9.88	2.94	2.39	8.52
		Annual	180	TCEQ ESL	NA	0.46	0.09	0.08	0.34
Chloroform	µg/m ³	1-hour	100	TCEQ ESL	P99	0.79	0.23	0.19	0.68
		Annual	10	TCEQ ESL	NA	0.04	0.01	0.01	0.03
Dichloromethane	µg/m ³	1-hour	3 600	TCEQ ESL	P99	0.58	0.17	0.14	0.50
		Annual	350	TCEQ ESL	NA	0.03	0.01	0.00	0.02
Trichloroethylene	µg/m ³	1-hour	540	TCEQ ESL	P99	1.49	0.44	0.36	1.28
		Annual	54	TCEQ ESL	NA	0.07	0.01	0.01	0.05
			2.3	WHO 1:1 000 000 excess lifetime risk					
Vinyl chloride	µg/m ³	1-hour	20 000	TCEQ ESL	P99	1.94	0.58	0.47	1.67
		Annual	1.2	TCEQ ESL	NA	0.09	0.02	0.02	0.07
			1	WHO 1:1 000 000 excess lifetime risk					
Formaldehyde	µg/m ³	1-hour	15	TCEQ ESL	P99	0.77	0.23	0.18	0.66
		Annual	3.3	TCEQ ESL	NA	0.04	0.01	0.01	0.03
Styrene	µg/m ³	1-hour	110	TCEQ ESL	P99	0.11	0.03	0.03	0.10
		Annual	140	TCEQ ESL	NA	0.01	0.00	0.00	0.00

⁷⁸ Applicable to a 30-minute averaging period

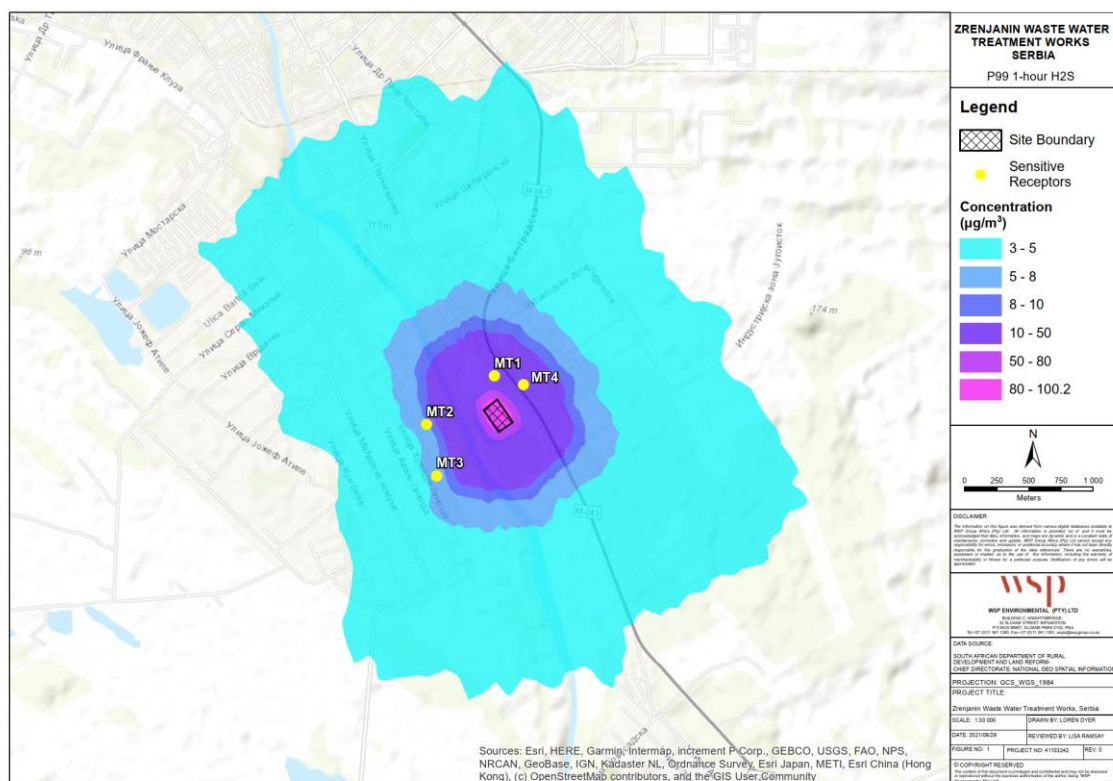


Figure 8-3: P99 1-hour H₂S

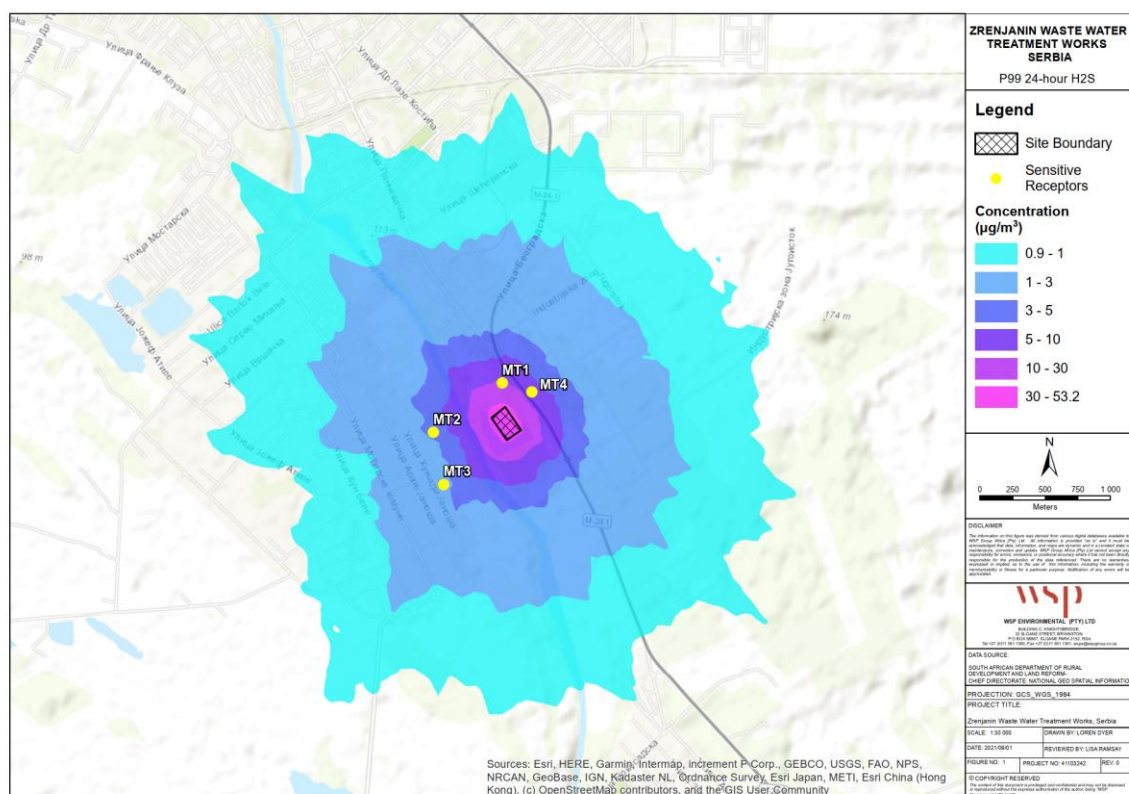
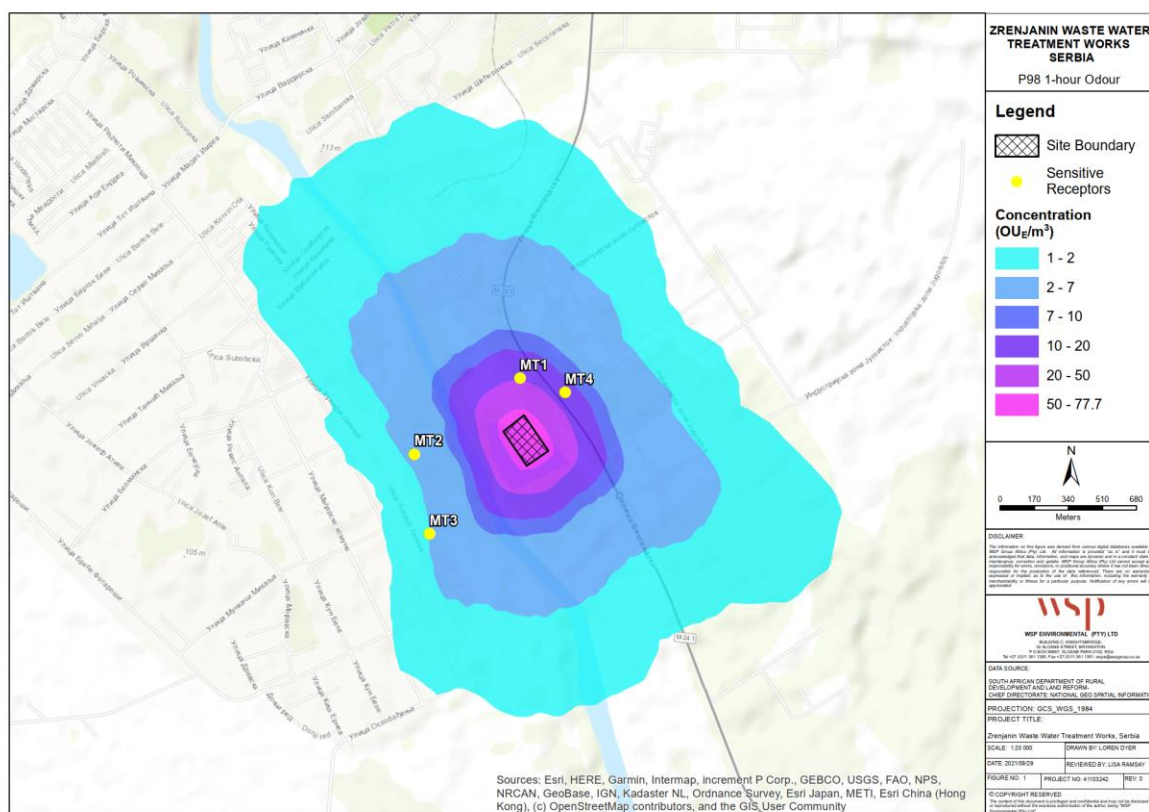
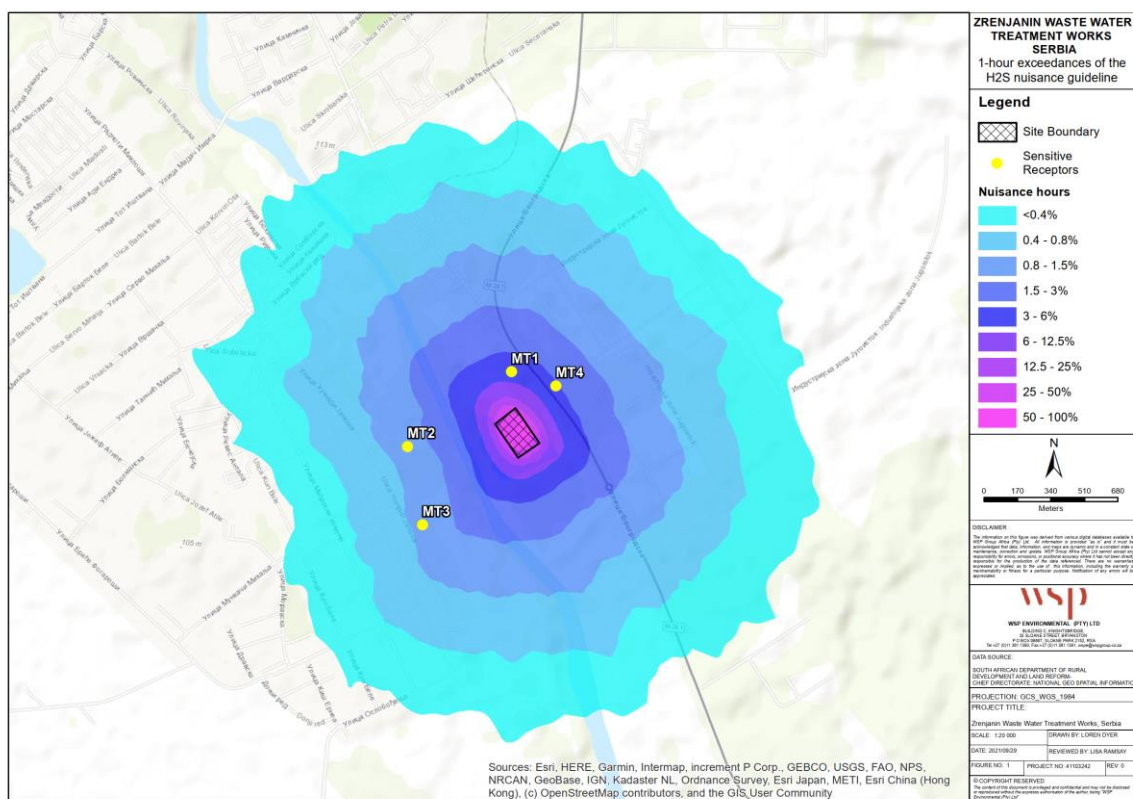
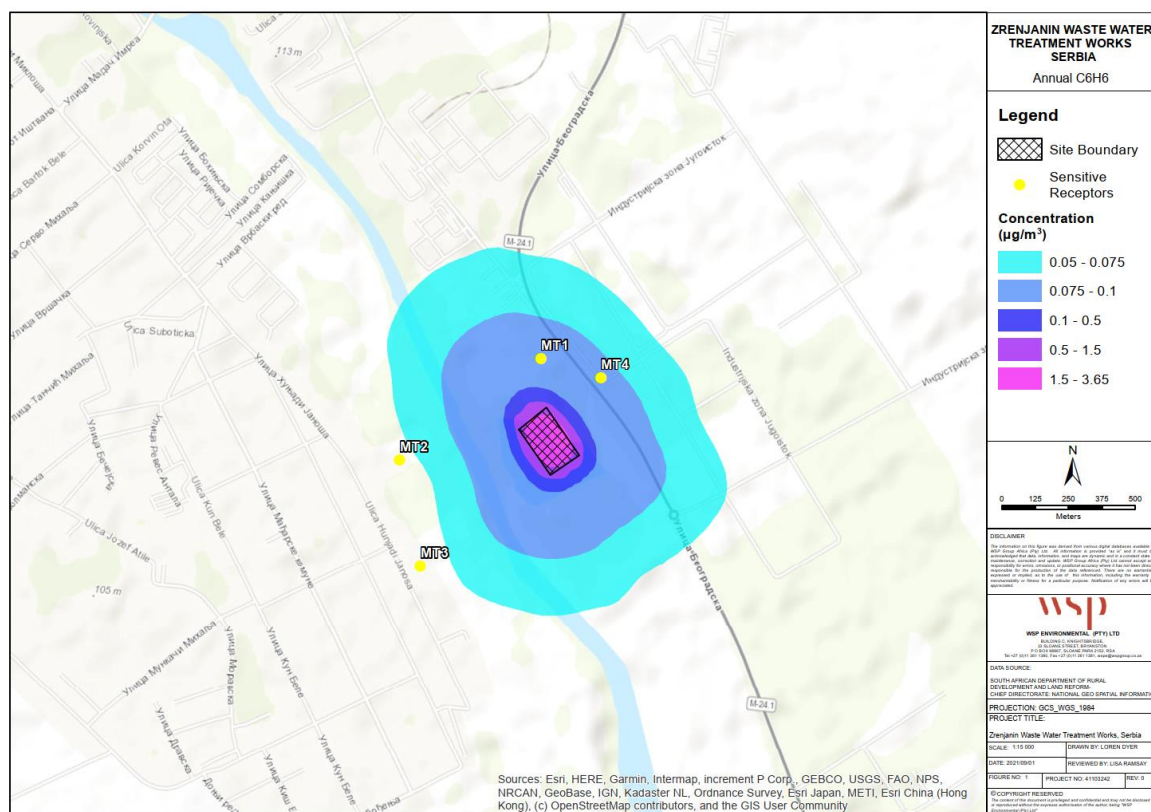


Figure 8-4: P99 24-hour H2S





8.2.7 CONSTRUCTION PHASE IMPACTS

Impact Ref: 1 Health and dust / nuisance impacts associated with construction activities

Impact Description	The construction of the WWTP is planned to commence in November 2021 and has an 18-month construction timeline. Construction activities will commence with site preparation, which will entail land clearance of vacant state-owned land, site establishment, levelling, and delivery of materials and plant/equipment, followed by the construction of the physical infrastructure and installation of various mechanical and electrical components. Emissions during construction are associated with land clearing, drilling and potential blasting, ground excavation, cut and fill operations and vehicle traffic on temporary roads. Pollutants associated with construction activities are typically total suspended particulates (TSP), PM₁₀ and PM_{2.5} with lesser contributions of CO, NO₂, SO₂ and C₆H₆ from the exhausts of heavy construction vehicles. Heavy construction activity is a source of dust emissions that can have a significant but temporary impact on local air quality. The amount of dust emitted from construction operations depends on the area of land being worked, the proportion of land lying exposed at any time, the clearing and dozing equipment used, the number and type of vehicles on temporary roads, and the duration of the construction phase. A large proportion of dust emissions generally result from heavy vehicle traffic over temporary roads at the construction site. Considering the proposed development site is small (approximately 0.027 km²) emissions arising during construction are anticipated to be low. With the implementation of appropriate mitigation techniques (e.g. wet suppression to limit dust, and rules against construction vehicle idling or speeding to limit gaseous emissions), there is opportunity to limit any potential impacts on neighbouring sensitive receptors to a reasonable level, with cognisance that any such impacts will be temporary in nature.
Mitigation	Minimise vehicle tailpipe emissions by limit idling of vehicles, particularly at site entrances; erecting signs erected to request drivers and machine operators to shut down between periods of activity to limit idling; provision of clear and direct routes to limit vehicle kilometres travelled at the construction site; limiting speeds of vehicles on site (spot fines). Implement standard dust control measures during construction to manage emissions from earth moving, materials stockpiles, road / working area surfaces, and the use of machinery. See detailed measures in the ESMP.

Impact Scoring	CRITERION	PRE-MITIGATION	POST MITIGATION
	Character	Negative	Negative
	Magnitude	Medium	Low
	Extent	Local	Local
	Reversibility	Reversible	Reversible
	Duration	Short-term	Short-term
	Probability	Medium	Low
	Significance	Low	Very Low

8.2.8 OPERATIONAL PHASE IMPACTS

Impact Ref: 2 Health Impacts associated with operational phase WWTP airborne emissions

Impact Description	None of the modelled pollutants are predicted to exceed identified health relevant standards / guidelines at any of the sensitive receptors for any of the averaging periods assessed.
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For pollutants with no specified criterion value (e.g. genotoxic and/or carcinogenic pollutants), predicted concentrations fell within guidelines of insignificant to reasonable excess risk.

From a cumulative emission perspective (assuming measured pollutants represents consistent background levels across averaging periods), the above finding holds for pollutants for which measured data is available.

Mitigation No mitigations required.

Impact Scoring	CRITERION	PRE-MITIGATION	POST MITIGATION
	Character	Negative	Negative
	Magnitude	Very Low	Very Low
	Extent	Local	Local
	Reversibility	Recoverable	Recoverable
	Duration	Long-term	Long-term
	Probability	Improbable	Improbable
	Significance	Very Low	Very Low

Impact Ref: 3 Odour / nuisance impacts associated with operational phase WWTP airborne emissions

Impact Description P99 1-hour H₂S concentrations at three of the four proximate sensitive receptors exceed the WHO 30-minute nuisance guideline (applied in the absence of local H₂S nuisance/1-hr average criterion). The frequency of exceedance of the nuisance guideline is predicted to occur between 0.9% - 4.4% of the time for proximate receptors.

P98 1-hour odour concentrations (based on predicted H₂S levels only) exceed the Netherlands odour criteria limit (applied in the absence of local odour criteria) at the four proximate sensitive receptors. As such, odour nuisance at these proximate receptors is expected.

However, ambient concentrations will decrease steadily with distance from the proposed facility and this assessment of the proximate receptors represents worst case receptor impacts.

WSP recommends monitoring of the load added and the sludge generated at the operational stage of this facility to validate modelling inputs and emission estimates.

Mitigation WSP recommends the following to reduce potential odour nuisance impacts:

- Cover emission points and vent emissions to control systems (e.g., compost beds, bio-filters, chemical scrubbers, etc.) as applicable in line with IFC recommendations.
- More than 70% of H₂S emissions are predicted to be emitted from the grit and grease removal tank. This should be the focus of emission mitigation.
- Develop a vegetative environmental buffer (VEB) along the perimeter of the development . WSP recommends the use of indigenous leafy trees that extend to height and that maintain their leaves throughout the year. Multiple rows of trees (with taller and shorter but bushier species alternating) will increase effectiveness of the barrier. Planting established trees will allow for more immediate protection. Additional value of the VEB is protection from bioaerosols, noise mitigation and improved aesthetics.
- Masking agents offer an additional odour neutralisation option should complaints arise despite the above recommendations. The effectiveness of commercial additives varies significantly and local options can be investigated.
- Fenceline monitoring of H₂S will provide real-time indicator of potential odour impact.
- Warning communities of potential odour events during upset conditions (or as soon as fenceline monitors show increased concentrations) can generate increased trust and facilitate communication between parties.

Impact Scoring	CRITERION	PRE-MITIGATION	POST MITIGATION
	Character	Negative	Negative
	Magnitude	Medium	Low
	Extent	Local	Local
	Reversibility	Recoverable	Recoverable
	Duration	Long-term	Long-term
	Probability	High	High
	Significance	Moderate	Moderate

8.3 NOISE

8.3.1 LEGISLATION, POLICY AND GUIDANCE

Legislation, policy and guidance as well as the normative standards considered as part of the assessment are identified below, this includes applicable EU legislation.

SERBIAN NOISE LEGISLATION

Environmental noise in Serbia is governed under the *Law on Environmental Noise Protection* (“Official Gazette of Republic of Serbia”, no. 36/2009, 88/2010). The law outlines measures and conditions for noise protection in the environment, noise measurements, access to information and other elements relevant for environmental protection and public health in regards to noise. Legal entities that undertake commercial activities that produce noise are subject to this law. Both the National (and Provincial in case of AP Vojvodina) and local authorities define conditions and measures for noise protection, including those in the process of an ESIA and (where applicable) integrated permit issuance. Monitoring of noise pollution is performed by environmental protection inspectors on National, Provincial and Local level.

The *Law on Environmental Noise Protection* provides the following definitions:

- *Environmental noise*: Unwanted or harmful sound (hereinafter referred to as noise);
- *Annoyance*: The degree of human disturbance by noise, which is determined by on-site testing by prescribed assessment methods;
- *Noise limit value*: The highest allowed value of noise indicator (hereinafter referred to as limit value). Limit values can be different, for different noise sources, i.e. different acoustic zones, as well different closed and opened spaces where people are staying; and
- *Acoustic zone*: The area with the unified prescribed noise indicators limit values.

Under the *Law on Environmental Noise Protection*, noise limit values have subsequently been specified within the *Regulation on Noise Indicators, Limit Values, Assessment Methods for Indicators of Noise, Disturbance and Harmful Effects of Noise in the Environment* (“Official Gazette of Republic of Serbia”, no. 75/2010). The limit values for noise in different zones are presented in **Table 8-11**. Limit values are equal for day and evening time. The limit values refer to overall noise from all sources in the considered area.

Table 8-11: Limit values for outdoor noise indicators

Zone	Purpose of the area	Noise level in dB(A)	
		Day and Evening	Night
1	For rest and recreation, hospitals and recovery facilities, cultural-historical locations, large parks	50	40
2	Touristic areas, camps and school zones	50	45

3	Residential areas	55	45
4	Business-residential areas, commercial-residential areas and children's playgrounds	60	50
5	City centre, trade, commercial, administrative zones with dwellings, areas along the motorways, main roads and city roads	65	55
6	Industrial, storage and servicing areas and transport terminals without dwellings	At this area borders, noise must not exceed the limit value of the neighbouring area	

As per the above Regulation and as stipulated in the *Rulebook on Noise Measurement Methods, Contents and Scope of Noise Measurement Reports* ("Official Gazette of Republic of Serbia", no. 72/2010), measurement methods must be undertaken in accordance with:

- SRPS ISO 1996-1:2019 Acoustics – Description, Measurement and Assessment of Environmental Noise – Part 1: Basic Quantities and Assessment Procedures
- SRPS ISO 1996-2:2019 Acoustics – Description, Measurement and Assessment of Environmental Noise – Part 2: Determination of Sound Pressure Levels

ENVIRONMENTAL NOISE DIRECTIVE (2002/49/EC)

The Environmental Noise Directive (END) is the main instrument to identify noise pollution levels and to identify actions for Member States across the European Union (EU). The aims of the END focus on:

- The determination of exposure to environmental noise;
- Ensuring that information on environmental noise and its effects is made available to the public; and
- Preventing and reducing environmental noise where necessary and preserving environmental noise quality where it is good.

The END specifies that limit values of each individual Member State will apply in the local context and measurement methods and noise definitions are identical to those specified in Serbia.

WORLD HEALTH ORGANISATION GUIDELINES FOR COMMUNITY NOISE

The World Health Organisation (WHO) together with the Organisation for Economic Co-operation and Development (OECD) are the main International bodies that have collected data and developed assessments on the effects of exposure to environmental noise. This has provided the following summary of thresholds for noise nuisance in terms of the outdoor day-time equivalent continuous A-weighted sound pressure level (L_{Aeq}) in residential districts:

- At 55 - 60 dB(A) noise creates annoyance;
- At 60 - 65 dB(A) annoyance increases considerably; and
- Above 65 dB(A) constrained behaviour patterns, symptomatic of serious damage caused by noise

The WHO therefore recommends a maximum outdoor day-time (07:00 – 22:00) L_{Aeq} of 55 dB(A) in residential areas and schools in order to prevent significant interference with normal activities. It further recommends a maximum night-time (22:00 – 07:00) L_{Aeq} of 45 dB(A) outside dwellings. No distinction is made as to whether the noise originates from road traffic, from industry, or any other noise source.

The WHO guideline for industrial noise is set at 70 dB(A) over a period of 24 hours. Anything above this level would cause hearing impairment, however, a peak noise level of 110 dB(A) is allowable on a fast response measurement.

Further to the above mentioned Guidelines for Community Noise, in 2009 the WHO developed night noise guidelines for Europe (WHO, 2009). Considering the scientific evidence on the thresholds of night noise exposure indicated by $L_{night, outside}$ as defined in the END (2002/49/EC), an $L_{night, outside}$ of 40 dB(A) should be the target of the night noise guideline to protect the public, including the most vulnerable groups such as children, the chronically ill and the elderly. An $L_{night, outside}$ value of 55 dB(A) is recommended as an interim target for the countries where the night noise guideline cannot be achieved in the short term for various reasons, and where policy-makers choose to adopt a stepwise approach. These guidelines are applicable to the Member States of the

European Region, and may be considered as an extension to, as well as an update of, the previous WHO Guidelines for Community Noise (1999).

In 2018, the WHO then developed the Environmental Noise Guidelines for the European Region (WHO, 2018). These guidelines provide guidance to Member States that is compatible with the noise indicators used in the EU's END (EC, 2002). The main purpose of these guidelines is to provide recommendations for protecting human health from exposure to environmental noise originating from various sources: transportation (road traffic, railway and aircraft) noise, wind turbine noise and leisure noise.

WORLD BANK GROUP ENVIRONMENTAL, HEALTH AND SAFETY GUIDELINES

From the WBG EHS Guidelines, the impacts of noise beyond the property boundary of a facility are addressed in section 1.7. The noise guidelines are grouped into two categories, namely “Residential; institutional; educational” and “Industrial; commercial” (**Table 8-12**). Such guidelines are in-line with the WHO guidelines as discussed above and are as such applicable to this assessment. Noise impacts should not exceed these levels or result in a maximum increase in background noise levels of 3 dB(A) at the nearest off site receptor location.

Table 8-12: WBG Environmental Noise Level Guidelines

Receptor	One hour LA _{eq} (dB(A))	
	Daytime (07:00 – 22:00)	Night-time (22:00 – 07:00)
Residential; institutional; educational	55	45
Industrial; commercial	70	70

The guideline also states that highly intrusive noise, such as noise from aircraft flyovers and passing trains should not be included when establishing background noise levels.

The WBG also provides guidance in the WBG EHS Guidelines for Water and Sanitation. With respect to noise, such guidance indicates that high noise levels can be present in the vicinity of operating machinery and flowing water at water and sanitation facilities. Impacts and mitigation measures are similar to those at other industrial facilities, and the General EHS Guidelines (as detailed above) should therefore be followed.

8.3.2 IMPACT ASSESSMENT METHODOLOGY

ACOUSTIC INVENTORY

Construction Phase

Table 8-13 presents a list of potential construction equipment that will be utilised during the construction of the WWTP, as well as the sound power level (PWL) specifications of the equipment (BSI, 2009; Standards Australia, 2010). Construction will be erratic in nature with no set locations for equipment at a given time. To represent a worst-case scenario, it is assumed that one of each piece of equipment will be operational simultaneously at the boundary of the plant area, in closest proximity to each sensitive receptor. Such a worst-case scenario is unlikely to occur in reality. The sum (logarithmic) of the PWLs from all noise sources was utilised to calculate resultant noise levels at specified distances from the facility. Such resultant receptor noise levels were calculated using attenuation-over-distance acoustic calculations.

Table 8-13 Construction phase noise sources and sound power level data

Source	Quantity	Type	Operational Time	Sound Power Level (dB(A))	Location
Excavator	1	30 ton	9 hours	103.0	Within plant area
Grader	1		9 hours	112.0	Within plant area
Roller compactors	1	20 ton	9 hours	106.0	Within plant area

Haulers	4		9 hours	107.0	Within plant area
Cranes	3	75 ton (wheeled & tracked)	9 hours	103.0	Within plant area
Concrete trucks	4/hour	6m ³ , 8m ³ and 10m ³	9 hours	112.0	Within plant area

Operational Phase

The sources of noise identified during the operational phase of the WWTP are presented in **Table 8-14**. These sources and sound power level (PWL) specifications (Edie, 2000; Sinclair Knight Merz, 2005; City of Johannesburg, 2012; Berger et al., 2016; Shini Group, 2017; and KP Acoustics, 2019) were used as input into the acoustic model.

It is noted that all sources were run as a worst-case scenario with no mitigation (enclosures) included in the modelling. Additionally to represent the absolute worst-case operational scenario, all noise sources (including the fire water pumps and standby generator) were considered to be operational simultaneously.

ACOUSTIC MODELLING

Acoustic modelling was used to calculate noise contours indicating the spatial extent of projected noise levels from the proposed Project within a specified grid area (5 km x 5 km) as well as the noise levels at specific receivers (sensitive receptors). The acoustic modelling software used in this study is the internationally recognised package, CadnaA (Computer Aided Noise Abatement). The CadnaA software provides an integrated environment for noise predictions under varying scenarios and calculates the cumulative effects of various sources. The model uses ground elevations in the calculation of the noise levels in a grid and uses standard meteorological parameters that have an effect on the propagation of noise. CadnaA has been utilised in many countries across the globe for the modelling of environmental noise and town planning. It is comprehensive software for three-dimensional calculations, presentation, assessment and prediction of environmental noise emitted from industrial plants, parking lots, roads, railway schemes or entire towns and urbanized areas.

SENSITIVE RECEPTORS

Sensitive receptors are identified as areas that may be impacted negatively due to noise associated with the proposed WWTP. Examples of receptors include, but are not limited to, schools, shopping centres, hospitals, office blocks and residential areas. To avoid repetition in this ESIA document, the details and locations of sensitive receptors are provided in the Section on Baseline Environmental and Social Descriptions - **Section 0** (Noise), and are summarised below. The summary of measured baseline noise levels at receptor locations is as follows:

- Noise levels at receptor MT2 (house at 149 Hunjadi Janoška Street, Zrenjanin) were slightly above the Serbian Zone 3 (residential) limit value of 55 dB(A).
- Current evening noise levels at all receptor locations were on or below the relevant Serbian limit values.
- Night-time noise levels at three of the four receptor locations were slightly above their respective limit values.
- Night-time noise levels at receptor MT3 (house at 169 Hunjadi Janoška Street, Zrenjanin) were below the Serbian Zone 3 limit value of 45 dB(A).

Table 8-14 Operational phase noise sources and sound power level data

Source	Quantity	Type	Operational Time	Sound Power Level (dB(A))	Location
A. PRELIMINARY TREATMENT					
GRIT & GREASE REMOVAL SYSTEM					
Grit Air Blowers	2	Positive displacement blower	24 hours	91.0	Outside
Grit Removal Pumps	2	Submersible pump	24 hours	0.0	Outside (inside tank)
OFFLINE BALANCING TANK & PUMPS					
Balancing Tank-1 Pumps	2	Submersible pump	24 hours	0.0	Outside (inside tank)
Balancing Tank Mixers	4	Submersible mixer	24 hours	0.0	Outside (inside tank)
Off specification pumps	2	Submersible pump	24 hours	0.0	Outside (inside tank)
B. BIOLOGICAL TREATMENT					
ANAEROBIC ZONE					
Anaerobic Tank Mixers	2 per tank	Submersible mixer	24 hours	0.0	Outside (inside tank)
ANOXIC ZONE					
Anoxic Tank Mixers	2 per tank	Submersible mixer	24 hours	0.0	Outside (inside tank)
INTEGRATED FIXED ACTIVATED SLUDGE (IFAS) / MBBR ZONE					
Inlet Recycle Pump	3	Submersible pump	24 hours	0.0	Outside (inside tank)
Air Blower	5	Positive displacement blower	24 hours	91.0	Inside
C. SECONDARY TREATMENT – SETTLING					
SECONDARY CLARIFIER					
Return Activated Sludge (RAS) Pumps	3	Submersible pump	24 hours	0.0	Outside (inside tank)
D. TERTIARY TREATMENT					
ULTRAVIOLET DISINFECTION SYSTEM					
Service Water Pumps	2	Vertical centrifugal pump	24 hours	104.0	Outside
Fire Water Pumps	2	Vertical centrifugal pump	24 hours	104.0	Outside

Source	Quantity	Type	Operational Time	Sound Power Level (dB(A))	Location
E. SLUDGE HANDLING TREATMENT					
RETURN ACTIVATED SLUDGE (RAS) PUMPS					
Return Activated Sludge (RAS) Pumps	3	Submersible centrifugal pump	24 hours	0.0	Outside (inside tank)
WASTE ACTIVATED SLUDGE (WAS) PUMPS					
Waste Activated Sludge (WAS) Pumps	2	Submersible centrifugal pump	24 hours	0.0	Outside (inside tank)
SLUDGE HOLDING TANK					
Sludge Holding Tank Air Blower	2	Positive displacement blower	24 hours	91.0	Inside
SLUDGE DEWATERING FEED PUMP					
Sludge Dewatering Feed Pump	3	Progressive cavity pumps	24 hours	104.0	Outside
BELT FILTER PRESS					
Belt Filter Press	3		24 hours	92.0	Inside
Screw Conveyor	3		24 hours	101.0	Partially outside
Mixing Drum Mixer	3	Vertical mixer	24 hours	80.0	Inside
POLYMER PREPARATION UNIT FOR SLUDGE DEWATERING					
Agitator	2	Vertical agitator	24 hours	80.0	Inside
Polymer Feed Pumps	3	Progressive cavity pumps	24 hours	104.0	Inside
F. DRAINAGE SYSTEM					
Drain Transfer Pumps	2	Submersible pump	24 hours	0.0	Outside (inside tank)
G. OTHER					
Standby Generator Set	1		When needed	118.0	Inside
Sludge Skip Trucks	4 per day		Daytime	90.0	Outside

8.3.3 CONSTRUCTION PHASE IMPACTS

Impact Ref: 4 Environmental noise impacts associated with construction activities

Impact Description Unlike general industry, construction activities are not always stationary and in one location. Construction activities at the WWTP site will include civil works (including surveying), reinforced concrete works, masonry works, waterproofing works, façade works, floor works, carpentry works and painting including mechanical, electrical and plumbing installation works.

Based on a worst-case cumulative sound power level of 116.5 dB(A) stemming from all construction equipment operational during the construction phase, as outlined in **Table 8-13**, the resultant noise levels at specified distances from the source are presented in **Figure 8-8**. Noise levels in the immediate vicinity of the construction activities are predicted to be high, as would be expected. From 50 m from the source, noise levels will reduce considerably, with noise levels at 142 m from the source dropping below the Zone 5 limit value of 65 dB(A) and at 448 m from the source dropping below the Zone 3 limit value of 55 dB(A).

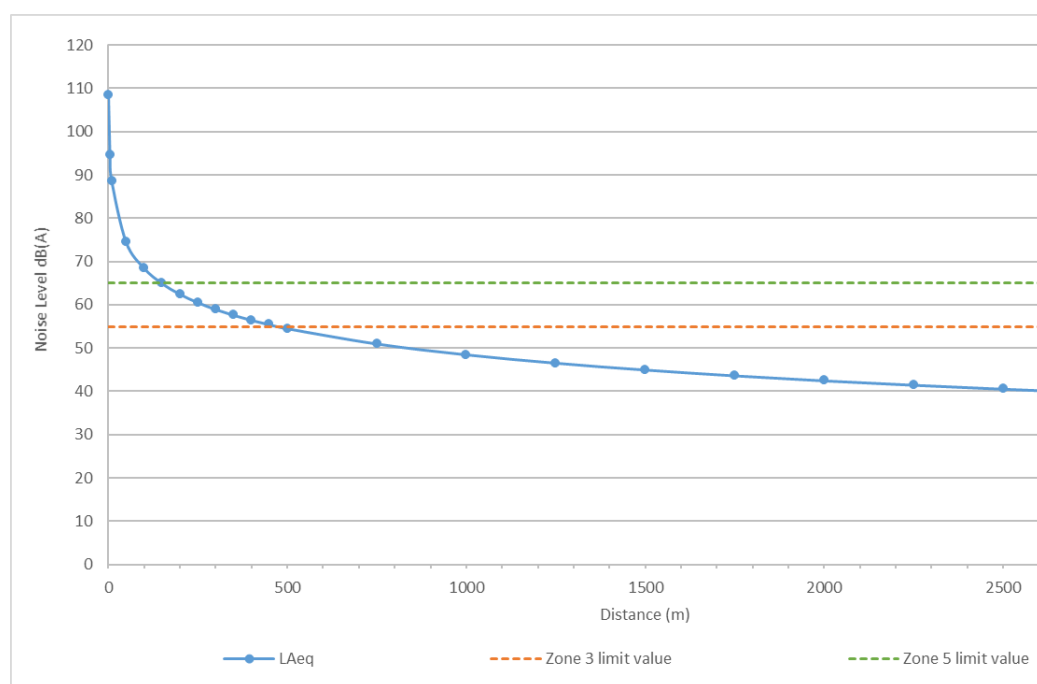


Figure 8-8: Worst-case predicted noise levels associated with the construction phase

The predicted noise levels at the specified receptor locations associated with the construction of the WWTP are presented in **Table 8-15**. This includes baseline (monitored) noise levels in order to assess changes in noise levels at each location. Construction activities will only take place during daytime hours, so results presented are only for the daytime scenario. It must be noted that these results represent a worst-case scenario when construction activities are occurring on the closest boundary to the receptor in question and do not represent noise levels that will occur all the time. Since sound levels are represented in logarithmic units, simple addition cannot be applied to obtain the cumulative sound levels, but rather logarithmic addition.

Predicted cumulative daytime noise levels at MT1 and MT4 are below the Zone 5 limit value of 65 dB(A). Predicted cumulative noise levels during the day at MT3 are below the Zone 3 limit value of 55 dB(A), however, cumulative noise levels at MT2 are slightly above this level. Daytime noise levels are predicted to increase by between 2.7 dB(A) and 6.4 dB(A) at these receptor locations. At all receptors, except MT4, such increases are above the IFC 3 dB(A) threshold for annoyance as per the IFC EHS Guidelines for noise. Such a situation represents a worst-case scenario, which is unlikely to occur in reality. Additionally, it must be noted that the

construction phase is transient in nature and will only endure for eighteen months. Mitigation interventions are advised during the construction phase. These mitigation recommendations are detailed in the section that follows.

Table 8-15: Predicted day-time noise levels at the receptors during the construction phase

Receptor	Predicted Noise Level (dB(A))	Current (monitored) Noise Level (dB(A))	Cumulative Noise Level (dB(A))*	Change (dB(A))
MT1	62.7	60.7	64.8	+4.1
MT2	55.5	54.9	58.2	+3.3
MT3	53.1	47.8	54.2	+6.4
MT4	61.3	61.9	64.6	+2.7

* It is noted that noise levels are logarithmically added due to their logarithmic nature

Mitigation

In order to minimise the acoustic impacts from the construction phase of the proposed Project, various mitigation techniques can be employed. These options include both management and technical options:

- Planning construction activities in consultation with local communities so that activities with the greatest potential to generate noise are planned during periods of the day that will result in least disturbance. Information regarding construction activities should be provided to all local communities. Such information includes:
 - *Proposed working times;*
 - *Anticipated duration of activities;*
 - *Explanations on activities to take place and reasons for activities; and*
 - *Contact details of a responsible person on site should complaints arise.*
- When working near a potential sensitive receptor, limit the number of simultaneous activities to a minimum as far as possible;
- Using noise control devices, such as temporary noise barriers and deflectors for high impact activities, and exhaust muffling devices for combustion engines;
- Selecting equipment with the lowest possible sound power levels; and
- Ensuring equipment is well-maintained to avoid additional noise generation.

Impact Scoring

CRITERION	PRE-MITIGATION	POST MITIGATION
Character	Negative	Negative
Magnitude	Medium	Low
Extent	Local	Local
Reversibility	Reversible	Reversible
Duration	Short-term	Short-term
Probability	Medium	Low
Significance	Low	Low

8.3.4 OPERATIONAL PHASE IMPACTS

Impact Ref: 5 Daytime noise impacts associated with the operation of the WWTP

Impact

Description

The predicted daytime noise levels at the specified receptor locations associated with the WWTP are presented in **Table 8-16**. The predicted noise levels were compared with the current baseline noise levels (monitored) to assess any changes and the resultant impacts on the

surrounding receptors. A visual output of the modelled results is presented in **Figure 8-9**. It must be noted that the visual output is associated with the proposed WWTP alone and is not cumulative (i.e. taking the existing background noise levels into account).

Predicted cumulative daytime noise levels at MT1 and MT4 are below the Zone 5 limit value of 65 dB(A). Predicted cumulative noise levels during the day at MT2 and MT3 are below the Zone 3 limit value of 55 dB(A). Daytime noise levels are predicted to increase by between 0.2 dB(A) and 0.6 dB(A) at these receptor locations. Such increases are well below the IFC 3 dB(A) threshold for annoyance as per the IFC EHS Guidelines for noise. Such increases are minimal and are likely to go unnoticed.

Based on the low predicted daytime noise levels and resultant minimal increases at all sensitive receptors, no buffers or areas to be avoided have been identified in this assessment.

Table 8-16 Predicted daytime noise levels at specified receptor locations

Receptor	Predicted Noise Level (dB(A))	Current (monitored) Noise Level (dB(A))	Cumulative Noise Level (dB(A))*	Change (dB(A))
MT1	47.5	60.7	60.9	+0.2
MT2	41.1	54.9	55.1	+0.2
MT3	39.8	47.8	48.4	+0.6
MT4	48.0	61.9	62.1	+0.2

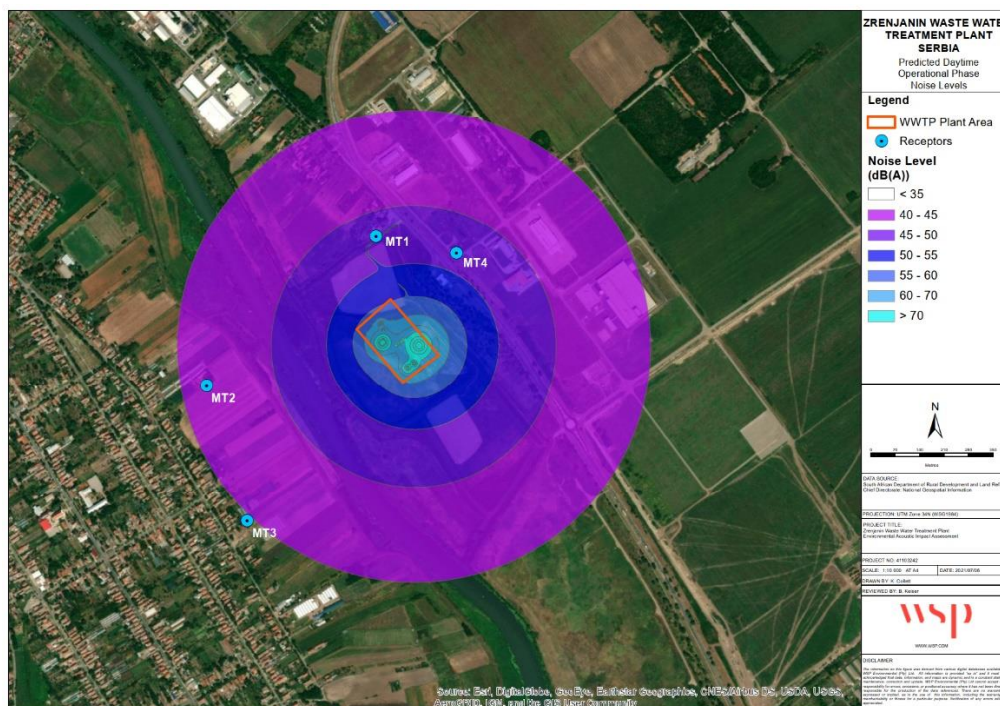


Figure 8-9 Predicted daytime noise levels during the operational phase of the WWTP

Mitigation See mitigation recommendations in **Section 8.3.5**.

Impact Scoring

CRITERION	PRE-MITIGATION	POST MITIGATION
Character	Negative	Negative
Magnitude	Low	Low
Extent	Local	Local

Reversibility	Recoverable	Recoverable
Duration	Long-term	Long-term
Probability	Low	Low
Significance	Low	Low

Impact Ref: 6 Night-time noise impacts associated with the operation of the WWTP

Impact Description The predicted night-time noise levels at the specified receptor locations associated with the WWTP are presented in **Table 8-17**. The predicted noise levels were compared with the current baseline noise levels (monitored) to assess any changes and the resultant impacts on the surrounding receptors. A visual output of the modelled results is presented in **Figure 8-10**. It must be noted that the visual output is associated with the proposed WWTP alone and is not cumulative (i.e. taking the existing background noise levels into account).

Predicted cumulative night-time noise levels at MT1 and MT4 are slightly above the Zone 5 limit value of 55 dB(A). It must be noted that the current (monitored) noise levels at these locations also exceed the limit value. Predicted cumulative noise levels at night at MT3 are below the Zone 3 limit value of 45 dB(A). Predicted cumulative night-time noise levels at MT2 exceed the Zone 3 limit value of 45 dB(A), however, it must be noted that the current noise levels at this location already exceed the limit value. Night-time noise levels are predicted to increase by between 0.4 dB(A) and 2.3 dB(A) at these receptor locations. Such increases are below the IFC 3 dB(A) threshold for annoyance. Such increases are minimal and are likely to go unnoticed.

Based on the low predicted night-time noise levels and resultant minimal increases at all receptors, no buffers or areas to be avoided have been identified in this assessment.

Table 8-17 Predicted night-time noise levels at specified receptor locations

Receptor	Predicted Noise Level (dB(A))	Current (monitored) Noise Level (dB(A))	Cumulative Noise Level (dB(A))*	Change (dB(A))
MT1	46.8	56.6	57.0	+0.4
MT2	41.1	45.1	46.6	+1.5
MT3	39.8	41.3	43.6	+2.3
MT4	48.0	56.1	56.7	+0.6

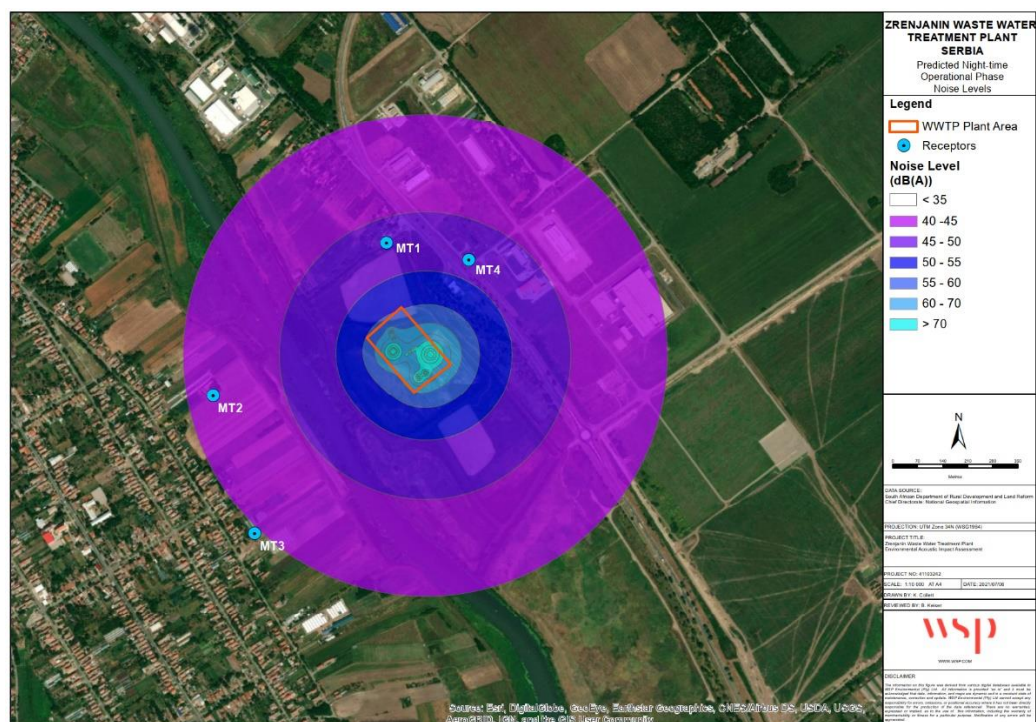


Figure 8-10 Predicted night-time noise levels during the operational phase of the WWTP

Mitigation See mitigation recommendations in Section 8.3.5.

Impact Scoring

CRITERION	PRE-MITIGATION	POST MITIGATION
Character	Negative	Negative
Magnitude	Low	Low
Extent	Local	Local
Reversibility	Recoverable	Recoverable
Duration	Long-term	Long-term
Probability	Low	Low
Significance	Low	Low

8.3.5 GENERAL MITIGATION AND MONITORING RECOMMENDATIONS

MITIGATION

It is understood that the positive displacement blowers and standby generator will all be installed indoors within acoustic enclosures. The modelled results above, however, present a worst-case scenario, with none of this mitigation in place. Although predicted noise levels from the proposed WWTP will be low at nearby receptor locations, it is recommended that these sources are enclosed as well as considering various other mitigation options onsite to further diminish noise from the site (WBG, 2007; Wakefield Acoustics, 2021). These include:

- Selecting equipment with lower sound power levels;
- Locating noise sources in less sensitive areas to take advantage of distance and shielding;
- Installing silencers for fans;
- Installing suitable mufflers on engine exhausts and compressor components;
- Installing acoustic enclosures for equipment casing radiating noise;
- Improving the acoustic performance of constructed buildings through the application of sound insulation;

- Installing acoustic screens alongside noisy equipment;
- Installing acoustic barriers without gaps and with a continuous minimum surface density of 10 kg/m² in order to minimize the transmission of sound through the barrier. Barriers should be located as close to the source or to the receptor location to be effective;
- Limiting the hours of operation for specific pieces of equipment or operations, especially mobile sources operating through community areas;
- Installing rectangular and circular attenuators;
- Installing inlet and combined inlet silencers for aeration blowers;
- Installing fully welded discharge silencers to reduce pipe breakout noise;
- Installing blow-off silencers;
- Installing acoustic louvres for natural or forced ventilation systems; and
- Developing a mechanism to record and respond to complaints.

MONITORING

Since noise impacts may result during the construction phase, it is recommended that at least one noise monitoring campaign is initiated during this phase.

Additionally, annual noise monitoring in the first year of the operational phase should be implemented to confirm any impacts on receptors and assess the need for any additional mitigation measures.

Monitoring must observe the following guidelines:

- Monitoring locations and impact assessment methodologies must be the same as those applied during construction phase monitoring
- Monitoring locations should include sensitive receptors (i.e. places where sensitive individuals may be impacted) within a 1 km radius of the Project site where monitoring was undertaken during (see Section 0).
- All sound level measurement procedures should be undertaken in line with ISO 1996-1:2019 (Acoustics - Description, Measurement and Assessment of Environmental Noise - Part 1: Basic Quantities and Assessment Procedures) and ISO 1996-2:2019 (Acoustics - Description, Measurement and Assessment of Environmental Noise - Part 2: Determination of Sound Pressure Levels) specifications.
- As per the Regulation on Noise Indicators, Limit Values, Assessment Methods for Indicators of Noise, Disturbance and Harmful Effects of Noise in the Environment (“Official Gazette of Republic of Serbia”, no. 75/2010), the 24-hour time period for monitoring must be divided into three reference time intervals, namely day (06:00 – 18:00), evening (18:00 – 22:00) and night (22:00 – 06:00).
- The predicted noise levels were compared with the current baseline noise levels (monitored during the ESIA) to assess any changes and the resultant impacts on the surrounding receptors.

8.3.6 CONCLUDING IMPACT STATEMENT

A detailed noise impact assessment was undertaken as part of the ESIA. The assessment included the development of an acoustic inventory, acoustic modelling, monitoring of baseline noise levels at sensitive receptor locations, and comparison of the cumulative noise levels at these locations with the Law on Environmental Noise Protection (“Official Gazette of Republic of Serbia”, no. 36/2009, 88/2010), World Health Organisation Guidelines for Community Noise, and the WBG EHS Guidelines.

During construction changes in noise levels at the modelled receptor locations were all predicted to be above the IFC 3 dB(A) threshold for annoyance as per the IFC EHS Guidelines for noise. However, such a situation represents a worst-case scenario, which is unlikely to occur. Additionally, the construction phase is transient in nature and will only endure for eighteen months.

During the operational phase noise levels at the modelled receptor locations were predicted to increase by between 0.2 dB(A) and 0.6 dB(A) at receptor locations during the day, and by between 0.4 dB(A) and 2.3 dB(A) at night. Such increases are below the IFC 3 dB(A) threshold for annoyance as per the IFC EHS Guidelines for noise. In conclusion, the noise impact assessment concludes that with such minimal increases in noise levels at neighbouring receptors during the operational phase, it is envisaged that the operation of the WWTP can be authorised without any major impacts or complaints.

8.4 WORKER HEALTH AND SAFETY

This section broadly assesses the impact of the proposed development on the health and safety of workers during construction and operation of the WWTP.

8.4.1 CONTEXTUAL INFORMATION

LEGISLATION, POLICY AND GUIDANCE

SERBIAN LEGISLATIVE FRAMEWORK

The Law on Occupational Health and Safety (Official Gazette of the Republic of Serbia, No. 101/2005) is the main legislative document regulating occupational health and safety issues in Serbia. The Law was brought into force in 2005 and incorporates the principles of the EU Workplace Health and Safety Directive (89/391/EEC).

The Law is based on general principles of prevention and requires: avoidance of risks; assessment of unavoidable risks; risk elimination at source; adjustment of working activities and workplace to employees; change hazardous technological processes to safe or less hazardous ones; give priority to collective and not individual operational health and safety measures; and appropriate training of employees.

The Law on the Protection from Fire (Official Gazette of the Republic of Serbia, No. 111/2009) entered into force in 2010. This law prescribes the general obligations for the prevention and protection from fire. These include the obligation to enact a Sanitation plan to be enacted for the removal and elimination of the consequences of fire; employees to be trained; capable persons to ensure there is protection from fire; a plan must be in place for the protection from fire; enact rules for the protection from fire for owners and users of business space and other edifices (including evacuation plan), and an obligation to cooperate with the fire brigade.

INTERNATIONAL FINANCE CORPORATION

The International Finance Corporation (IFC) publication 'Policy on Environmental and Social Sustainability' (2012) has been a key consideration in the production of this Section. A review of the Performance Standards within the IFC has been undertaken to identify any key health and safety impacts that should be considered. Performance Standard 2 (Labour and Working Conditions) relates directly to worker health and safety impact, while Performance Standard 3 (Resource Efficiency and Pollution Prevention) is indirectly related to worker health and safety impact.

8.4.2 CONSTRUCTION PHASE IMPACTS

Impact Ref: 7 General occupational health and safety risks during the construction, and decommissioning of the WWTP

Impact Description	The construction of the proposed development will pose several H&S risks to the construction workers employed on the project, in addition to members of the public who could potentially access the site during the construction phase. These risks include — Over-exertion: Over-exertion, and ergonomic injuries and illnesses, such as repetitive motion, over-exertion, and manual handling, are among the most common causes of injuries. — Slips and Falls: Slips and falls on the same elevation associated with poor housekeeping, such as excessive waste debris, loose construction materials, liquid spills, and uncontrolled use of electrical cords and ropes on the ground, are also among the most frequent cause of lost time accidents at construction and decommissioning sites.
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- **Work at Heights:** Falls from elevation associated with working with ladders, scaffolding, and partially built or demolished structures are among the most common cause of fatal or permanent disabling injury at construction or decommissioning sites.
- **Struck by Objects:** Construction and demolition activities may pose significant hazards related to the potential fall of materials or tools, as well as ejection of solid particles from abrasive or other types of power tools.
- **Moving Machinery:** Vehicle traffic and use of lifting equipment in the movement of machinery and materials on a construction site may pose temporary hazards, such as physical contact, spills, dust, emissions, and noise.
- **Confined Spaces and Excavations:** Examples of confined spaces that may be present in construction or demolition sites include utility vaults, tanks, sewers, pipes, and access shafts. Ditches and trenches may also be considered a confined space when access or egress is limited.

Mitigation See General Mitigation Measures in Section 8.4.4.

Impact Scoring	CRITERION	PRE-MITIGATION	POST MITIGATION
	Character	Negative	Negative
	Magnitude	Very High	Very High
	Extent	Local	Local
	Reversibility	Irreversible	Irreversible
	Duration	Permanent	Permanent
	Probability	High	Improbable
	Significance	High	Low

8.4.3 OPERATIONAL PHASE

Impact Ref: 8 Accidents and Injuries to workers during the operation of the WWTP

Impact Description Work at water and sanitation facilities is often physically demanding and may involve hazards such as open water, trenches, slippery walkways, working at heights, energized circuits, and heavy equipment. Work may also involve entry into confined spaces, including manholes, sewers, pipelines, storage tanks, wet wells, digesters, and pump stations.

Methane generated from anaerobic biodegradation of sewage can lead to fires and explosions however this is not applicable at the proposed WWTP as there are no significant methane generating processes.

Mitigation See General Mitigation Measures in Section 8.4.4.

In addition, a series of facility design and operational and management guidelines are provided in the ESMP. These should be referenced during the design finalisation of the WWTP and for the development of operating procedures. The guidelines include measures for general prevention of accidents and injuries to workers e.g. installing railing around all process tanks and pits. Require use of a life line and personal flotation device (PFD) when workers are inside the railing and ensuring rescue buoys and throw bags are readily available.

Impact Scoring	CRITERION	PRE-MITIGATION	POST MITIGATION
	Character	Negative	Negative
	Magnitude	Very High	Very High
	Extent	Local	Local
	Reversibility	Irreversible	Irreversible

Duration	Permanent	Permanent
Probability	High	Improbable
Significance	High	Low

Impact Ref: 9 Worker exposure to chemicals and hazardous atmospheres during the operation of the WWTP

Impact Description Hazardous chemical risks at the WWTP will be limited to the storage and handling of Iron trichloride (FeCl_3) flocculation agent which is hazardous (H302 - harmful if swallowed, H314 – may cause severe skin burns and eye damage, and H318 – causes serious eye damage). The dosing system is provided within a bund and will be contained within a bund in case of accidental loss.

The wastewater being treated at the plant may contain potentially hazardous chemicals depending on the industries discharging to the sewer, including chlorinated organic solvents and pesticides, Polychlorinated biphenyls (PCBs), polycyclic aromatics, petroleum hydrocarbons, flame retardants, nitrosamines, heavy metals, asbestos, dioxins, and radioactive materials. In addition, workers may be exposed to hydrogen sulphide, methane, carbon monoxide, chloroform, and other chemicals generated during wastewater treatment. Oxygen may be displaced or consumed by microorganisms, thus resulting in an oxygen deficient environment in areas where wastewater or wastewater residues are processed.

Mitigation A series of facility design and operational and management guidelines are provided in the ESMP. These should be referenced during the design finalisation of the WWTP and for the development of operating procedures. The guidelines include measures for preventing, minimizing, and controlling exposure to hazardous atmospheres e.g. implementing a training program for operators who work with hazardous chemicals regarding safe handling practices and emergency response procedures.

Impact Scoring	CRITERION	PRE-MITIGATION	POST MITIGATION
	Character	Negative	Negative
	Magnitude	Very High	Very High
	Extent	Local	Local
	Reversibility	Irreversible	Irreversible
	Duration	Permanent	Permanent
	Probability	High	Improbable
	Significance	High	Low

Impact Ref: 10 Worker exposure to pathogens and vectors during the operation of the WWTP

Impact Description Workers and staff at the WWTP, as well as operators of sludge collection vehicles, can be exposed to the many pathogens contained in sewage. Processing of sewage can generate bioaerosols which are suspensions of particles in the air consisting partially or wholly of microorganisms, such as bacteria, viruses, molds, and fungi. These microorganisms can remain suspended in the air for long periods of time, retaining viability or infectivity. Workers may also be exposed to endotoxins, which are produced within a microorganism and released upon destruction of the cell and which can be carried by airborne dust particles. Vectors for sewage pathogens include insects (e.g., flies), rodents (e.g., rats) and birds.

Mitigation A series of facility design and operational and management guidelines are provided in the ESMP. These should be referenced during the design finalisation of the WWTP and for the development of operating procedures. The guidelines include measures to prevent, minimize,

and control exposure of workers to pathogens at the proposed WWTP e.g. use of vacuum trucks or tugs for removal of faecal sludge instead of manual methods.

Impact Scoring

CRITERION	PRE-MITIGATION	POST MITIGATION
Character	Negative	Negative
Magnitude	Very High	Very High
Extent	Local	Local
Reversibility	Irreversible	Irreversible
Duration	Permanent	Permanent
Probability	High	Improbable
Significance	High	Low

8.4.4 MITIGATION MEASURES

GENERAL MEASURES APPLICABLE TO THE CONSTRUCTION AND OPERATIONAL PHASES

- a) Policies and procedures: A series of documents to govern the general OHS Management of the site need to be drafted these should include:
 - Emergency Procedures
 - First aid and injury management
 - Personal Protective Equipment
 - Plant and equipment maintenance and management
 - Slips trip and falls
 - Signage
 - Drugs and alcohol use
 - Inappropriate behaviour
 - Housekeeping
 - Working hours
 - Site access and Security
 - Covid-19
- b) Risk Assessments: All work activities must be executed in a safe and controlled manner. To accomplish this, hazard identification analysis and control systems must be introduced where necessary. These systems must be appropriate for the type of work to be carried out. Begej Water shall ensure that risks arising from hazardous activities are identified, eliminated, or managed in a way that reduces risks to an acceptable level. Elimination of risk should be done in line with the OHS Hierarchy of Controls.
- c) High Risk Activities: Contractor(s) / Subcontractor(s) / WWTP Staff are required to complete specific high-risk activities on site. These activities must have specific detailed management measures to reduce/eliminate risk (e.g. Detailed Risk Assessments, Permits to Work etc.) prior to commencement. Examples of these types of activities are as follows:
 - Confined space entry
 - Hot works
 - Excavation
 - Lift and hoist
 - Working at heights
 - Maintenance of machinery and equipment (LOTO)
 - Electrical energy installations
 - Pressure test

- Removal gratings / handrails
 - Overhead travelling cranes
 - Road blockage.
- d) A register of all Risk assessments / Permits to Work should be maintained at the site office and be immediately available on request.
- e) Welfare: Adequate welfare facilities must be supplied by both Begej Water and sub-contractors. It is the responsibility of Begej Water to confirm that the sub-contractors' welfare facilities meet the required standard. When managing the welfare of the workforce the following should be considered:
- f) Heat stress - In case of high temperatures or environmental heat hazard on site or workplace special protocols will be taken on site in order to protect health and human lives.
- g) Facilities - Everyone who works on any site must have access to adequate toilet and washing facilities, a place for preparing and consuming refreshments and somewhere for storing and drying clothing and PPE.

Drinking water - Adequate drinking water must be supplied by both Begej Water and sub-contractors. The social surveys conducted as part of the ESIA indicate that the municipal water supply is not potable, therefore bottles or tanks of water must be provided. If water is stored, it should be changed often enough to prevent it from becoming stale or contaminated. Drinking water should be tested to confirm and control the quality.

8.4.5 CONCLUDING IMPACT STATEMENT

Worker health and safety impacts during the construction and decommissioning of the WWTP include a significant range of physical and chemical hazards and are assessed broadly within this ESIA. Impacts associated with the operational phase are general in nature and include over-exertion, slips and falls, work at heights, strikes by objects, moving machinery, and confined spaces and excavations. Impacts associated with the operational phase of water and sanitation projects are both general and facility specific and include accidents and injuries, chemical exposure, hazardous atmosphere, exposure to pathogens and vectors, and noise.

Whilst there is the potential for construction and operation workers to be exposed to such risks, it is assumed that any incidents causing death or injury are preventable through the implementation of and adherence to appropriate H&S management systems including hazard identification and risk assessment (HIRA). It is essential for a H&S culture to be embedded in the workers. In addition, it is expected that many workers associated with the project, and those within site management roles, will be familiar with the appropriate H&S measures for such construction projects.

8.5 COMMUNITY HEALTH AND SAFETY

This section broadly assesses the impact of the proposed development on the health and safety of the public during construction and operation of the WWTP.

INTERNATIONAL FINANCE CORPORATION

The International Finance Corporation (IFC) publication 'Policy on Environmental and Social Sustainability' (2012) has been a key consideration in the production of this Section. A review of the Performance Standards within the IFC has been undertaken to identify any key health and safety impacts that should be considered. Performance Standard 4 (Community Health, Safety and Security) relates directly to community health and safety impact, while Performance Standard 3 (Resource Efficiency and Pollution Prevention) is indirectly related to community health and safety impact.

8.5.1 CONSTRUCTION PHASE IMPACTS

Impact Ref: 11 Construction traffic risks to communities during the construction and decommissioning of the WWTP

Impact Description The construction phase of the project has the potential to generate significant traffic volumes associated with the transportation of equipment and materials to the site, most notably the import of fill material that may be required to raise the development platform. Whilst the project is located within an industrial district there is potential for construction related road traffic to pass through more sensitive areas outside of the immediate project area, increasing the risk to pedestrians and other road users.

Mitigation A Traffic and Transportation Safety Management Plan should be developed to address community traffic safety risks during construction. The plan should align with the risk mitigation topics contained in the World Bank EHS Guidelines / General EHS Guidelines / Occupational Health and Safety.

The plan should promote best transport safety practices across all aspects of project operations with the goal of preventing traffic accidents and minimizing injuries suffered by project personnel and the public. Measures should include:

- Emphasizing safety aspects among drivers
- Improving driving skills and requiring licensing of drivers
- Adopting limits for trip duration and arranging driver rosters to avoid overtiredness
- Avoiding dangerous routes and times of day to reduce the risk of accidents
- Use of speed control devices (governors) on trucks, and remote monitoring of driver actions
- Regular maintenance of vehicles and use of manufacturer approved parts to minimize potentially serious accidents caused by equipment malfunction or premature failure.

Impact Scoring

CRITERION	PRE-MITIGATION	POST MITIGATION
Character	Negative	Negative
Magnitude	Very High	Very High
Extent	Local	Local
Reversibility	Irreversible	Irreversible
Duration	Permanent	Permanent
Probability	Medium	Improbable
Significance	Moderate	Low

Impact Ref: 12 Influx related risks, such as increased exposure to communicable diseases, during the construction phase

Impact Description Communicable diseases pose a significant public health threat worldwide. Health hazards typically associated with large development projects are those relating to poor sanitation and living conditions, sexual transmission and vector-borne infections. Communicable diseases of most concern during the construction phase due to labour mobility are sexually transmitted diseases (STDs), such as HIV/AIDS, and Covid-19.

The construction of the WWTP is considered to be relatively small in comparison with major projects where labour influx tends to be an issue (large scale infrastructure such as dams and linear developments). Metito has confirmed that a local civil contractor will be appointed for the work and it is anticipated that the majority of the workers will be sourced from the local area and will commute to work on a daily basis. Due to the limited employment opportunities

associated with the project the potential for influx related impacts, such as migrant labour issues / Sexual and Gender Based Violence (SGBV), and communicable diseases is limited.

Mitigation To minimise influx related impacts during the construction phase of the proposed project, it is recommended that:

- Local employment be prioritised, whenever possible.
- Appoint a dedicated team with responsibilities to identify and implement actions to mitigate the effects of communicable diseases, especially COVID-19, on the company and community.
- Providing treatment through standard case management in on-site or community health care facilities. Ensuring ready access to medical treatment, confidentiality, and appropriate care, particularly with respect to migrant workers.

Impact Scoring	CRITERION	PRE-MITIGATION	POST MITIGATION
	Character	Negative	Negative
	Magnitude	Medium	Medium
	Extent	Regional	Regional
	Reversibility	Recoverable	Recoverable
	Duration	Short Term	Short Term
	Probability	Low	Improbable
	Significance	Low	Very Low

8.5.2 OPERATIONAL PHASE

Impact Ref: 13 Health and safety risks to communities associated with hazardous waste during the construction and operation of the WWTP

Impact Description Waste generated by the WWTP constitutes a health risk to the local population in the event that it comes into contact with the local population either at the point of generation and after disposal at a facility if it does not have access controls. Potential hazards include spread of disease or plant and animal pests.

Solid waste collected in the Municipality of Zrenjanin is currently being discarded in a non-sanitary landfill site without access control. Accordingly, there could be potential exposure to hazards at this existing landfill (toxic, corrosive, infectious, flammable substances) by community members on the facility (such as pickers / scavengers) and off-site e.g. nearby residential areas.

Mitigation Disposal of waste from the WWTP may only be to a sanitary waste management or disposal facility that is permitted in accordance with National legislation (Serbian, or other countries) where the applicable legislation is substantively aligned with EU legislation.

Impact Scoring	CRITERION	PRE-MITIGATION	POST MITIGATION
	Character	Negative	Negative
	Magnitude	Medium	Medium
	Extent	Regional	Regional
	Reversibility	Recoverable	Recoverable
	Duration	Long Term	Long Term
	Probability	Low	Improbable
	Significance	Low	Very Low

Impact Ref: 14 Community health and safety impacts associated with treated effluent discharges from the WWTP

Impact Description	Treated wastewater effluents will be discharged to the Begej River where direct or indirect human contact with treated wastewater is likely. The development of the proposed WWTP will have a positive community health and safety impact by improving the quality of water in the Begej River downstream of the Aleksandrovacki canal discharge point. It is however noted that the water quality upstream of the discharge point is already significantly contaminated as Class V (poor ecological status. Surface waters belonging to this class may not be used for any purpose) (See Section 5.1.6 – Water Quality); therefore, the community risk cannot be entirely negated as a result of the proposed WWTP. Whilst the proposed WWTP will have a positive impact on water quality, this could be temporarily negated in the event of a failure in the WWTP requiring the untreated effluent to be discharged directly to the Begej River via the Aleksandrovacki canal.
Mitigation	It is recommended that a communication system is developed to inform residents of a potential situation where the WWTP is bypassed resulting in the discharge of untreated wastewater to the Begej River via the Aleksandrovacki canal, thereby preventing / reducing the risk of community exposure.

Impact Scoring	CRITERION	PRE-MITIGATION	POST MITIGATION
	Character	Positive	Positive
	Magnitude	Medium	Medium
	Extent	Regional	Regional
	Reversibility	Recoverable	Recoverable
	Duration	Long Term	Long Term
	Probability	Low	Definite
	Significance	Moderate	High

8.5.3 CONCLUDING IMPACT STATEMENT

The construction phase of the project has the potential to generate significant traffic volumes associated with the transportation of equipment and materials to the site, most notably the import of fill material that may be required to raise the development platform. Whilst the project is located within an industrial district there is potential for construction related road traffic to pass through more sensitive areas outside of the immediate project area, increasing the risk to pedestrians and other road users. This impact can be mitigated by adoption of best transport safety practices across all aspects of construction and project operations with the goal of preventing traffic accidents and minimizing injuries suffered by project personnel and the public.

There is potential for community exposure to hazardous waste generated by the WWTP if it is not disposed or managed appropriately; therefore this waste may only be a sanitary waste management or disposal facility that is permitted in accordance with National legislation (Serbian, or other countries) where the applicable legislation is substantively aligned with EU legislation.

The development of the proposed WWTP will have a positive community health and safety impact by improving the quality of water in the Begej River downstream of the Aleksandrovacki canal discharge point. However, it is recommended that a communication system is developed to inform residents of a potential situation where the WWTP is bypassed resulting in the discharge of Begej River via the Aleksandrovacki canal.

Note: Atmospheric Emissions and Odour

Airborne emissions from wastewater treatment operations may impact negatively on communities as a result of emissions. Odours from treatment facilities can also be a nuisance to workers and the surrounding community.

8.6 ECOLOGY

8.6.1 LEGISLATION, POLICY AND GUIDANCE

SERBIAN LEGISLATION

Several Serbian laws and by-laws determines quality of wastewater which can be discharged into the recipient, limit values of priority hazardous substances in water and deadlines for their reaching, methods for measuring quality and quantities of wastewater, limit values of pollutants in surface water and deadlines for their reaching, reference conditions for types of surface water, determining of water bodies of surface water, limit values of emission of pollutants into the waters and deadlines for their reaching and parameters of ecological and chemical status of surface waters.

Quality of discharged treated waters need to be in accordance with requirements in relevant mentioned by-laws. These and other regulations, which mentions types and ecological classes of surface waters and water bodies, are listed below:

- Water management strategy on the territory of the Republic of Serbia until 2034 (Official Gazette RS No. 3/2017)
- Rulebook on determination of water units and their borders (Official Gazette RS No. 8/2018)
- Decree on limit values of priority and priority hazardous substances that pollute surface waters and deadlines for their achievement (Official Gazette RS No. 24/2014)
- Law on water (Official Gazette RS No. 30/2010, 92/2012, 101/2016, 95/2018)
- Rulebook on dangerous substances in water (Official Gazette SRS No. 31/1982)
- Rulebook on the manner and conditions for measuring quantities and testing the quality of wastewater and the content of the report on performed measurements (Official Gazette RS No. 33/2016)
- Decree on limit values of pollutants in surface and groundwater and sediment and deadlines for their achievement (Official Gazette RS No. 50/2012)
- Rulebook on reference conditions for surface water types (Official Gazette RS No. 67/2011)
- Decree on limit values for emissions of pollutants into water and deadlines for their achievement (Official Gazette RS No. 67/2011, 48/2012 and amendments 1/2016)
- Rulebook on parameters of ecological and chemical status of surface waters and parameters of chemical and quantitative status of groundwater (Official Gazette RS No. 74/2011)
- Decision on determining the list of waters of the first order (Official Gazette RS No. 83/2010)
- Rulebook on determination of surface and groundwater bodies (Official Gazette RS No. 96/2010)

Other Serbian regulations, relevant to the project, are:

- Rulebook on the proclamation and protection of strictly protected and protected wild species of plants, animals and fungi (Official Gazette RS No. 5/2010, 47/2011, 32/2016, 98/2016)
- National Environmental Protection Program (Official Gazette RS No. 12/2010)
- Decree on protection regimes (Official Gazette RS No. 31/2012)
- National strategy for sustainable use of natural resources and goods (Official Gazette RS No. 33/2012)
- Rulebook on criteria for selection of habitat types, about habitat types, sensitive, endangered, rare and for protection priority habitat types and about protection measures for their conservation (Official Gazette RS No. 35/2010)
- Regulation on bringing under control the use and trade of wild flora and fauna (Official Gazette RS No. 31/2005, 45/2005, 22/2007, 38/2008, 9/2009, 69/2011)
- Law on nature protection (Official Gazette RS No. 36/2009, 88/2010, 91/2010, 14/2016, 95/2018)
- Law on Protection and sustainable use of fish stock (Official Gazette RS No. 128/2014, 95/2018)

- Law on environmental protection (Official Gazette RS No. 135/2004, 36/2009, 72/2009, 43/2011, 14/2016, 76/2018, 95/2018)

EU LEGISLATION

Directives of European Union/European Commission considers conditions and requirements for protection of surface and ground waters against pollution and achieving their good ecological status. Most important directives in case of this project are listed below:

- Council Directive of 21 May 1991 concerning urban wastewater treatment (91/271/EEC)
- Council Directive of 12 December 1991 concerning the protection of waters against pollution caused by nitrates from agricultural sources (91/676/EEC)
- Directive 2000/60/EC of the European Parliament and of the Council of 23 October 2000 establishing a framework for Community action in the field of water policy (''Water Framework Directive'' - WFD)
- Directive 2006/11/EC of the European Parliament and of the Council of 15 February 2006 on pollution caused by certain dangerous substances discharged into the aquatic environment of the Community
- Directive 2010/75/EU of the European Parliament and of the Council of 24 November 2010 on industrial emissions (integrated pollution prevention and control)

IFC PERFORMANCE STANDARDS

This impact assessment is used to satisfy the applicable environmental and social requirements of international financial institutions that are prospective lenders to the project. The requirements addressed comprise:

- International Finance Corporation (IFC) Policy on Social and Environmental Sustainability, 2012, the IFC Performance Standards on Social and Environmental Sustainability (PS) and the IFC Environmental, Health & Safety (EHS) Guidelines⁷; and
- European Bank for Reconstruction and Development (EBRD) Environmental and Social Policy, 2014, including the EBRD Performance Requirements (PR).

The IFC Policy on Social and Environmental Sustainability sets out the environmental, health & safety and community requirements for projects financed by IFC. IFC requirements are set out in its Performance Standards of Social and Environmental Sustainability (PSs), with the relevant PS summarised below:

IFC PS 6: BIODIVERSITY CONSERVATION AND SUSTAINABLE NATURAL RESOURCE MANAGEMENT

This Performance Standard reflects the objectives of the Convention on Biological Diversity to conserve biological diversity and promote the use of renewable natural resources in a sustainable manner. This Performance Standard addresses how project sponsors can avoid or mitigate threats to biodiversity arising from their operations as well as sustainably manage renewable natural resources. Specific objectives of this Performance Standard (July 2019) are:

- to protect and conserve biodiversity; and
- to promote the sustainable management and use of natural resources through the adoption of practices that integrate conservation needs and development priorities.

RECEPTOR EVALUATION

The sensitivity of ecological resources has been valued by taking into account those that have been designated for their nature conservation interest, and the uses of professional judgement to determine biodiversity values, including any social, community and economic values of ecological resources. The valuation has made use of available guidance and information and considered the distribution or status of the species or features. Where uncertainty exists, or where features cannot be valued with confidence due to lack of survey data, an 'up to' valuation has been applied as a precautionary approach, using professional judgement based on available information. The conservation categories of value in Table 8-18 have been used.

Table 8-18 Ecological Receptor Evaluation Categories

VALUE / SENSITIVITY	CRITERIA	EXAMPLES
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Very High	High importance and rarity, international scale and limited potential for substitution.	— Internationally designated sites, such as Ramsar Sites.
High	High importance and rarity, international, national or regional scale with limited potential for substitution.	— Ramsar, Biosphere Reserves, National Nature Parks; — Critical Habitats (as per PR6); and — Critically Endangered or Endangered Species (as per IUCN ⁷⁹).
Medium	High or medium importance and rarity, local or regional scale, and limited potential for substitution.	— Local areas of conservation with potential for substitution; and — Species with locally restricted distribution.
Low	Low or medium importance and rarity, local scale.	— Non-designated sites / areas of some local biodiversity.
Negligible	Very low importance and rarity, local scale.	— Other sites with little or no local biodiversity.

The ecological value / sensitivity of the project area, which will be directly affected by the proposed WWTP is low, with a low ecological importance on a local scale. The value / sensitivity of the Begej River is medium, but despite the current impacted status of the system, the regional scale of the system and the connectivity to the Carska Bara Nature Reserve make the system important. The substitutability of the river system is also limited. The value / sensitivity of the Carska Bara Nature Reserve is very high, and this is attributed to the area being a designated Ramsar wetland.

The assessment has initially considered the effects in the absence of mitigation. This gives an indication of the need for additional mitigation to be implemented. The likely effectiveness of that mitigation is considered, and a residual effect is stated.

The assessment of significance of effects takes into account the following:

- The size, value and sensitivity of the receptor;
- The duration, magnitude and extent of the impacts;
- The timing and frequency of the impacts;
- The ability of the affected receptor to recover from temporary impacts and timescale of recovery;
- The potential for implementation of, and effectiveness of, additional mitigation or enhancement measures; and
- The level of confidence in these predictions.

Impact assessment definitions in the following tables (Table 8.2 and Table 8.3) describe criteria used for assessing impact magnitude, confidence levels and the overall appraisal categories used in the assessment.

Impact assessment definitions in the following tables (Table 8.2 and Table 8.3) describe criteria used for assessing impact magnitude, confidence levels and the overall appraisal categories used in the assessment.

Table 8-19 Magnitude of Impact

MAGNITUDE	CRITERIA
Major	Major effect on the nature conservation status of the Site, habitats or species, likely to threaten the long-term integrity of the system.
Moderate	Moderate effect on the nature conservation status of the Site, habitats or species, but would not threaten the long-term integrity of the system.
Minor	Noticeable effects, but either of sufficiently small scale or short duration to cause no harm to the conservation status of the Site, habitats or species.

⁷⁹ IUCN (2021). The IUCN Red List of Threatened Species. Available at: <https://www.iucnredlist.org/> (Accessed 07/2021).

Negligible	Not expected to affect the conservation status of the Site, habitats or species under consideration in any way, therefore no noticeable effects on the ecological resource.
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Table 8-20 Confidence in Predictions

CONFIDENCE LEVEL	DESCRIPTION
Certain	Probability estimated at 95% chance or higher.
Probable	Probability estimated above 50% and below 95%.
Unlikely	Probability estimated above 5% but less than 50%.
Extremely Unlikely	Probability estimated at less than 5%.

The final stage of the assessment used the values as obtained with reference to the above tables in order to provide a qualitative assessment of the resulting effects.

8.6.2 CONSTRUCTION PHASE IMPACTS

The project area has been altered by development that is visible as per Google Earth since 2006 (Figure 5-31). The impacts pertain predominantly to the project footprint area and exclude the Begej River. The riparian habitat adjacent to the Begej River has been considered for the impacts posed to the habitat. The extent of the project area has been classified as transformed habitat and represents a disturbed landscape with a general low sensitivity. No flora species of international conservation concern were recorded for the project area. Internationally protected faunal species were recorded for the project area. The transformed status has allowed for some fauna and flora species to re-establish in the area, but these are considered to be adaptable species. Despite the presence of an altered landscape housing a modified biotic community, the project area does present sensitivity to further degradation.

The impacts considered for the Construction Phase are:

- Land clearing and habitat disturbance;
- Displacement (or even potential mortalities) of faunal community including protected species due to habitat loss, direct mortalities and disturbance (road collisions, noise, dust, vibration and possible poaching);
- Pollution / contamination of the area by machinery, vehicles, building materials and chemical storage;
- Continued encroachment and displacement of the natural vegetation community due to alien invasive plant species and erosion;
- Final landscaping and post-construction rehabilitation.

The tables presented below have assessed the significance of each impact with discussions around each impact and associated mitigation.

Impact Ref: 15 Impacts on habitat during the construction phase

Impact Description	The existing habitat will be cleared for the construction of the WWTP. This will entail the removal of all vegetation for the construction of the facilities, roads, pumps, buildings and all associated infrastructure. The vegetation in between the main infrastructure will also be removed and the area will be covered with open concrete slabs. Bare surfaces will be susceptible to wind and water erosion, which will alter the landscape to some extent, but also contribute to sedimentation of lower lying areas. Vegetation will be removed from the footprint of the development. The associated vegetation currently provides habitat for several bird, mammals, reptile, amphibian and insect species. The main impact associated with the habitat loss would be in the destruction of the woody and shrubby plants, especially on the eastern and northern side of project area: English walnut (<i>Juglans regia</i>), Manna ash (<i>Fraxinus ornus</i>), Black poplar (<i>Populus alba</i>), White willow (<i>Salix alba</i>), Black mulberry (<i>Morus nigra</i>), Cherry plum (<i>Prunus cerasifera</i>), Tart cherry (<i>Prunus cerasus</i>), Black elder (<i>Sambucus nigra</i>) and Common briar (<i>Rosa canina</i>). These species along with the riparian vegetation provides refuge for most of the faunal species.
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The disruption of the riparian habitat or vegetation on the edge of the system would also result in the disruption of movement corridors for faunal species. It is recommended that this area be rehabilitated and re-vegetated with indigenous vegetation to allow for an ecological support corridor.

The magnitude of the loss of habitat were rated as negatively moderate pre-mitigations, and this is attributed to the transformed state of the area. This is despite some level of recovery of the area to re-established certain areas to viable habitat since the disturbance in 2006.

Through the implementation of mitigations, the overall impact of the habitat loss can be reduced to low. Mitigation includes the avoidance of trees on the border of the project area and minimising the overall disturbance footprint area. A set-back or buffer area from the riparian area is also recommended. Implementation of a suitable storm water management is required, and this should be implemented for the respective phases of the project.

Mitigation See mitigation measures in **Section 8.6.3**

Impact Scoring	CRITERION	PRE-MITIGATION	POST MITIGATION
	Character	Negative	Negative
	Magnitude	Low	Low
	Extent	Regional	Local
	Reversibility	Recoverable	Recoverable
	Duration	Long Term	Short Term
	Probability	High	Medium
	Significance	Moderate	Low

Impact Ref: 16 Impact of direct mortalities and disturbance on fauna

Impact Description The potential disturbance or mortalities of fauna during the construction phase are likely to arise from the following activities:

- Removal of vegetation / habitat;
- Storage of building materials;
- Increase in human presence and on-site activities;
- Machinery moving in the area or compacting of the soil;
- Vehicles moving in the area; and
- Construction activities in general.

Displacement of faunal community including protected species could be due to habitat loss, direct mortalities and disturbance (road collisions, noise, dust, vibration, water quality change and possible poaching).

The species found in the area were a mixture of more common species such as European hare (*Lepus europaeus*), Herb field mouse (*Apodemus uralensis*), Common raven (*Corvus corax*) and Hooded crow (*Corvus cornix*) to a Near Threatened Pond Turtle (*Emys orbicularis*). The disturbances to the mammals and avifauna are expected to be somewhat less as they are more adaptable species that could move into the nearby undisturbed areas, with some species able to access and navigate the Begej River. Although the aquatic threatened species could move along the river system a change in water quality even is also likely to disturb this ecosystem and species will respond accordingly.

No nests or borrows were found in the project area, therefore the effect of vibrations would be less of a risk as the likelihood of the burrows falling in or egg breakages is unlikely. As some of the species observed have been recorded in the pet trade (Pond Turtle (*Emys orbicularis*)) the restriction of poaching must be made a priority. Overall, it is expected that the greatest impacts on the faunal community in the area would be the loss of habitat, and impacts caused by dust

and noise. The effect of dust and noise has been well studied and has been found to not only influence the general health of species but also their reproductive success (mating calls are often drowned out by noise).

Based on the above, the increase and personnel, machinery and equipment will create a disturbance, and encounters with some species could result in a mortality. The species found were mostly common adaptable species and the area has previously been disturbed, therefore the residual effects, once the mitigation measures are taken into account, are expected to be insignificant during the construction phase.

Mitigation See mitigation measures in **Section 8.6.3**

Impact Scoring	CRITERION	PRE-MITIGATION	POST MITIGATION
	Character	Negative	Negative
	Magnitude	High	Medium
	Extent	Regional	Local
	Reversibility	Recoverable	Recoverable
	Duration	Medium Term	Short Term
	Probability	High	Medium
	Significance	Moderate	Low

Ref: 17 Impact of contamination by machinery, vehicles, building materials and chemical storage

Impact Description This impact is as a result of the pollution to the terrestrial and nearby canal and Begej River through the spillage of amongst other pollutants, hydrocarbons from the construction machinery and the vehicles used to transport the construction materials. Contamination of the area and river may also be a result of spillages associated with improper chemical storage. Further contamination may stem from poor “housekeeping” and indiscriminate dumping of building materials outside of designated areas. Contamination of the Begej River will not be isolated, with the effects of the contamination transported downstream of the system.

Hydrocarbons such as oil, diesel and petroleum could pollute the Begej River, contributing cumulatively to the already impaired water quality of the system. The spillage of these compounds will also pollute the soil and prevent any flora species from growing in that area, hindering rehabilitation of any areas where this should take place.

It is also expected that chemicals will be stored on site for the duration of the construction phase, should adequate spillage plans not be in place this could result in the contamination of the soil and nearby Begej River.

Contamination of the terrestrial environment is likely to be restricted to the site, and isolated. However, the spillage of pollutants into the river is extensive and will be beyond the project area, affecting downstream reaches. If best practices are followed and machinery / vehicles are well serviced, and if reputable companies are used this impact is unlikely and may only occur in extraordinary cases.

Mitigation See mitigation measures in **Section 8.6.3**.

Impact Scoring	CRITERION	PRE-MITIGATION	POST MITIGATION
	Character	Negative	Negative
	Magnitude	Medium	Medium
	Extent	Regional	Local
	Reversibility	Irreversible	Recoverable
	Duration	Medium Term	Short Term

Probability	High	Low
Significance	Moderate	Low

Impact Ref: 18 Continued encroachment and displacement of the natural vegetation community due to alien invasive plant species and erosion

Impact Description The following processes will contribute to this impact during the construction phase:

- Disturbance of soil due to roads and site clearance;
- Removal of vegetation;
- Machinery and vehicles moving in the area;
- Poor management of soil stockpiles and seed banks; and

If construction is not done progressively and timeously, the disturbed areas will lead to alien invasive plant growth and erosion.

The spread of alien invasive species will result in further degradation of habitat, with some less disturbed areas potentially being lost. Alien vegetation infestation will also lead to competition with indigenous flora species. The clearing of areas and disturbance of soil allows the establishment of alien invasive species. Disturbances to areas infested with alien vegetation is also likely to cause seed dispersal resulting in the establishment of alien vegetation to adjacent areas.

The extent of the project area is transformed, with large expanses of indigenous and natural vegetation removed from the area to accommodate historical land uses, most recently crop agriculture. The crop agriculture coupled with the establishment of alien vegetation along the “edges” and in selected areas across the site, have largely replaced indigenous vegetation.

Alien vegetation is relatively well established across the site, specifically in areas not previously cultivated. The area does currently have several alien invasive species, however if this is not managed correctly and efficiently this will lead to a larger impact.

Mitigation See mitigation measures in **Section 8.6.3**

Impact Scoring	CRITERION	PRE-MITIGATION	POST MITIGATION
	Character	Negative	Negative
	Magnitude	Medium	Low
	Extent	Regional	Local
	Reversibility	Recoverable	Reversible
	Duration	Short Term	Short Term
	Probability	High	Low
	Significance	Moderate	Very Low

8.6.3 CONSTRUCTION PHASE MITIGATION

The focus of the construction phase mitigation measures is to reduce the significance of potential impacts associated with the development and thereby to:

- Prevent the further loss or fragmentation of the vegetation community or areas in the nearby vicinity (such as the riparian area);
- As far as possible, reduce the negative fragmentation effects of the development and enable safe movement of faunal species; and
- Prevent the direct and indirect loss and disturbance of faunal species and community (including occurring and potentially occurring species of conservation concern).

The following is a list of general mitigations that must be strictly adhered to during the construction phase:

PRE-CONSTRUCTION WALK-THROUGH

- The area must be walked through prior to any construction to let fauna species move out of the area, should any species not move out of the area on their own accord appropriate specialist must be contacted to advise on appropriate guidelines.
- If any species of conservation concern faunal species are found on site all construction must be seized and appropriate specialist must be contacted to advise on the permits required and relocation of the species.
- The timing between clearing of an area and subsequent development must be minimized to avoid fauna from re-entering the site to be disturbed.

SITE CLEARANCE, PREPARATION AND DEMARCATION OF AREAS

- The areas to be developed must be specifically demarcated to prevent movement of workers into surrounding environments that could be more sensitive.
- Areas of indigenous vegetation, even secondary communities, with the exception of approved infrastructure areas should under no circumstances be fragmented or disturbed further or used as an area for dumping of waste.
- Where possible, existing access routes and walking paths must be made use of, and the development of new routes limited.
- A site plan of the area must be made available onsite for all contractors and personnel indicating parking & storage areas, site offices and placement of ablution facilities.
- All laydown, storage and temporary infrastructure areas must be within area set to be developed to reduce the overall footprint.

REHABILITATION

- Areas that are denuded during construction need to be re-vegetated with indigenous vegetation to prevent erosion during flood events. This will also reduce the likelihood of encroachment by alien invasive plant species

CONTROL OF ALIEN INVASIVE SPECIES

- It should be made an offence for any staff to bring or plant any plant species into any portion of the project area, unless undertaken in line with required / approved rehabilitation. No plant species whether indigenous or exotic should be brought into the project area, to prevent the spread of exotic or invasive species.
- An alien plant management plan be compiled to remove all alien vegetation from within the project area; The use of herbicide needs to be restricted because of the nearby water source and only mechanical methods may be utilised.

SCHEDULING OF ACTIVITIES TO LIMIT IMPACTS

- The timing between clearing of an area and subsequent development must be minimized to avoid fauna from re-entering the site to be disturbed.
- Where possible, work should be restricted to one area at a time. This will give the smaller birds, mammals and reptiles a chance to weather the disturbance in an undisturbed zone close to their natural territories.
- Minimise noise impacts by scheduling high impact activities during the day. All relevant machines, vehicles and equipment must be fitted with noise muffling devices.

WHAT TO DO IF WILDLIFE IS ENCOUNTERED

- All encounters with fauna, or findings of carcasses must be reported and documented by the environmental manager.
- Any evidence of active breeding or residence in burrows / nests should be highlighted and advice from a suitable specialist obtained on safe translocation of the species at risk to appropriate and safe locations.

EROSION AND TOPSOIL MANAGEMENT

- A storm water and erosion control management plan must be compiled and implemented.
- Topsoil must be stored as per known standards and must also be managed accordingly.
- Appropriate speed humps, enforcing of speed limits and mitre drains must be constructed along the access roads (every three metres of elevation) in order to slow the flow of water run-off from the road surface, if this does not already exist.

GENERALLY PROHIBITED ACTIVITIES

- Damage or destruction of trees on the border of the project area must be avoided.
- No harvesting of resources such as firewood, food, plants (medicinal, food etc) from the project area by employees or contractors is permissible.
- No trapping, killing, or poisoning of any wildlife is to be allowed on site. Signs must be put up to enforce this.

OTHER GENERAL MEASURES

- Outside lighting should be designed to minimize impacts on fauna. Fluorescent and mercury vapour lighting should be avoided, and sodium vapour (yellow) lights should be used wherever possible.
- Refuse bins will be emptied and secured to prevent the tipping over or gaining access via the opening / lip by fauna.

8.6.4 OPERATIONAL PHASE IMPACTS

The operational phase will involve the abstraction of the untreated wastewater from the Aleksandrovački channel and subsequent treatment and cleaning of the wastewater to environmental protection levels. Thereafter the treated wastewater will be discharged back into the Begej River via the Aleksandrovački channel. Routine monitoring and maintenance will be carried out for the life of the project.

During the operational phase the following impacts were considered:

- Disruption of habitat;
- Displacement of faunal community due to direct mortalities and disturbance (road collisions, noise, dust, vibration and possible poaching);
- Potential leaks, discharges and/or pollutant from the treatment system leaching into the surrounding environment and water sources;
- Continued encroachment and displacement of the natural vegetation community due to alien invasive plant species and erosion;
- Environmental flow alterations associated with the operation of the WWTP; and
- Water quality impacts associated with the discharge of treated wastewater into the Begej River.

Impact Ref: 19 Disruption of habitat during the operational phase

Impact Source	The habitat will further be disrupted through the operational phase, and this is likely due to ineffective implementation of necessary plans. Additional processes that could lead to the disruption of habitat include: — Unsuccessful alien invasive management; — Unsuccessful stormwater / erosion plan implementation; and — Exposed areas that are not rehabilitated.
Impact Description	Areas that are denuded during construction must be rehabilitated with indigenous vegetation to ensure that alien invasive species do not dominate. Re-vegetation of the area, coupled with effective storm water manage will provide stabilisation to the area, preventing the erosion of the landscape.

The vegetation can also be lost if fire management is not implemented correctly, for the safety of the site it is understandable that a fire break must be present however this must be done in a controlled fashion and fire must not be allowed to just burn uncontrolled in the surrounding areas. Uncontrolled burning will not allow the vegetation to recover and to become established, which would contribute to soil stabilisation but also offer some level of habitat / refuge for fauna.

This impact will last for the duration of the project and will need to be continuously monitored. The creation of an ecological support corridor along the Begej River could lead to an improvement in the overall vegetation state for the project area.

- Mitigation**
- No unnecessary and non-authorised clearance of habitat area is permitted.
 - Areas of indigenous vegetation, even secondary communities, should under no circumstances be fragmented or disturbed further or used as an area for dumping of waste;
 - Where possible, existing access routes and walking paths must be made use of, and the development of new routes limited;
 - Areas disturbed during construction that is not part of the exact infrastructure footprint must be rehabilitated and revegetated with indigenous vegetation;
 - An extensive alien plant management plan be compiled to remove all alien vegetation from within the project area; The use of herbicide needs to be restricted as a result of the nearby water source and only mechanical methods may be utilised;
 - A storm water and erosion control management plan must be compiled and implemented;

Also see mitigation measures in **Section 8.6.3**.

Impact Scoring	CRITERION	PRE-MITIGATION	POST MITIGATION
	Character	Negative	Negative
	Magnitude	Medium	Low
	Extent	Regional	Local
	Reversibility	Recoverable	Reversible
	Duration	Long Term	Short Term
	Probability	Medium	Low
	Significance	Moderate	Very Low

Impact Ref: 20 Displacement of faunal community due to habitat loss, direct mortalities, and disturbance (road collisions, noise, dust, vibration and possible poaching)

Impact Description The potential disturbance or mortalities of fauna during the operational phase are likely to arise from the following activities:

- Clearance of non-authorised area/s;
- Increase in human presence and activity;
- Machinery and vehicles moving in the area; and
- Maintenance activities in general.

The clearance of areas that have not been authorised will lead to the direct loss of habitat. This clearance may not be permitted, irrespective of the need and duration. In the event clearance is necessary, it must be mitigated. The operation of the facility will require the movement of personnel, equipment and vehicles across the site, and this is likely to result in encounters with fauna. Further to this, this movement and activity will create a disturbance to fauna. Some fauna species are more adaptable and might seek permanent refuge in concealed areas of the facility, this is pertinent to some avifauna and bat species. The nesting or roosting of species within the facility must be discouraged to avoid encounters and potential mortalities.

Mitigation See mitigation measures in **Section 8.6.5**

Impact Scoring	CRITERION	PRE-MITIGATION	POST MITIGATION
	Character	Negative	Negative
	Magnitude	Medium	Low
	Extent	Regional	Local
	Reversibility	Recoverable	Reversible
	Duration	Medium Term	Immediate
	Probability	Medium	Improbable
	Significance	Moderate	Very Low

Impact Ref: 21 Potential leaks, discharges and/or pollutant from the treatment system leaching into the surrounding environment and water sources

Impact Description Potential leaks, discharges and/or pollutant from the treatment system leaching into the surrounding environment and water sources could result in impacts to the surrounding habitat and the Begej River.

The flora will be affected by the high levels of heavy metals and nutrients, which could initially cause the plants to have a growth spurt but will lead to the death of the plants over an extended period of time. The fauna will mainly be influenced through the loss or degradation of habitat which includes the pollution of the Begej River. High levels of metals and Organophosphates can lead to the poisoning of faunal species should they ingest it. The spread of bacteria associated with the pollution can also result in the spread of disease to the fauna species.

The project area is in a transformed state, with an assigned low ecological value. The Begej River is considered to have a medium ecological value, with the ability to transport impacts further downstream to a regional scale. The Carska Bara Nature Reserve is downstream of the project area and impacts to this area must be avoided

This impact will need to be monitored for the duration of the project lifespan, with care and maintenance of the facility a necessity.

Mitigation See mitigation measures in **Section 8.6.5**.

Impact Scoring	CRITERION	PRE-MITIGATION	POST MITIGATION
	Character	Negative	Negative
	Magnitude	High	Low
	Extent	National	Local
	Reversibility	Irreversible	Reversible
	Duration	Long Term	Short Term
	Probability	Medium	Low
	Significance	Moderate	Very Low

Impact Ref: 22 Environmental flow alterations associated with the operation of the WWTP

Impact Description The potential flow aspect impacts arising from the operational phase are likely to arise from the following activities:

- The abstraction of the untreated wastewater from the Aleksandrovački channel; and

- The discharge of treated effluent into the Aleksandrovački channel and associated impacts on this system.

The abstraction of the untreated wastewater from the Aleksandrovački channel is expected to decrease flow volumes and lower the water level within this channel. Lowered water levels are expected to have a reduction in marginal/bankside vegetation (under the current condition of the canal banks) in the wetted area. The extent of this is subject to the volume of water being abstracted.

The discharge of the treated effluent back into the Aleksandrovački channel will return the flow volumes and increase the water levels to those present within this channel prior to abstraction. This will largely be considered to have no effect on overall environmental flows of both the channel and the Begej River. The increased impact scoring is related to the duration of the impact which will be for the life of the project.

Mitigation No obvious mitigation measures are required for the fluctuating water levels, as the return of the water following treatment is expected to return the water levels within the channel to pre-abstraction levels.

Impact Scoring	CRITERION	PRE-MITIGATION	POST MITIGATION
	Character	Negative	Negative
	Magnitude	Very Low	Very Low
	Extent	Site Only	Site Only
	Reversibility	Reversible	Reversible
	Duration	Immediate	Immediate
	Probability	Improbable	Improbable
	Significance	Very Low	Very Low

Impact Ref: 23 Water quality improvement associated with the discharge of treated wastewater into the Begej River

Impact Source The treatment of the abstracted wastewater from the Aleksandrovački channel will result in water quality alterations downstream of the discharge point.

Impact Description The treatment of the abstracted wastewater from the Aleksandrovački channel is expected to improve water quality conditions downstream of the discharge point. This will result in improved instream and marginal habitat conditions as well as improved water quality for biota using the water, and an associated increase in biodiversity should the water quality improve in the Begej River. This is also likely to benefit the water quality of the Carska Bara Nature Reserve.

This impact is considered to have a positive effect on the environmental conditions in both the channel and the downstream Begej River. This will result in increased biodiversity within these systems provided the treated water has a dilution effect on the receiving Begej River.

Mitigation See mitigation measures in **Section 8.6.5**

Impact Scoring	CRITERION	PRE-MITIGATION	POST MITIGATION
	Character	Positive	Positive
	Magnitude	Medium	Medium
	Extent	National	National
	Reversibility	Reversible	Reversible
	Duration	Long Term	Long Term

Probability	High	Definite
Significance	Moderate	Moderate

8.6.5 OPERATIONAL PHASE MITIGATION

The focus of the operational phase mitigation measures is to reduce the significance of potential impacts associated with the development and thereby to:

- Prevent of and/or contain of leaks that could impact detrimentally on surrounding habitat and the Begej River.
- Prevent impacts on the Begej river associated with the discharge of treated effluent.

MEASURES FOR PREVENTION OF AND/OR CONTAINMENT OF LEAKS THAT COULD IMPACT DETRIMENTALLY ON SURROUNDING HABITAT AND THE BEGEJ RIVER.

- Have action plans on site, and training for contactors and employees in the event of spills, leaks of hazardous materials (e.g. sewage) and other impacts to the surrounding environment.
- Overflow alarms or float level sensors must be installed at the pump station to ensure maintenance is conducted before a spillage can take place into the water sources and surrounding environment.
- Sulphurous odours are normally the first indication that the WWTP is not functioning optimally. The source of odour must be investigated immediately, and appropriate corrective measures taken.
- Any leaks and failures of the infrastructure must be fixed immediately, and areas rehabilitated as needed.

MEASURES FOR PREVENTION OF IMPACTS ON THE BEGEJ RIVER ASSOCIATED WITH THE DISCHARGE OF TREATED EFFLUENT

- An infrastructure monitoring and service plan must be compiled and implemented for maintenance needs for the life of the project. This will include the monitoring the treatment facility, all clean stormwater and treated effluent discharge points, and energy dissipation structures.
- Sulphurous odours are normally the first indication that the WWTP is not functioning optimally. The source of odour must be investigated immediately, and appropriate corrective measures taken.
- During operation of the WWTP all infrastructure must be properly and regularly managed, maintained and operated throughout the life of the project.
- Any leaks and failures of the infrastructure must be fixed immediately, and areas rehabilitated as needed.
- Appropriate corrective action must be taken if contamination is detected or if effluent quality does not meet discharge standards.

INFLUENT / EFFLUENT MONITORING

- The monitoring of influent will be undertaken through the use of an online analyser for COD, pH and electrical conductivity (EC) as primary indicators. The influent will be treated through the WWTP if COD is within acceptable level. If inlet COD is higher (i.e., off-spec influent), influent will automatically be taken to an 'off-spec tank'. The off-spec influent can be stored up to 500 m³, and subsequently it can be fed back to the inlet of the WWTP for dilution into the system at lower flow. The WWTP design also includes provision to manually bypass the off-spec influent back to the Aleksandrovački Canal, in case the off-spec quality influent comes continuously for more than 30 minutes.
- In addition to the online monitoring, daily on-site laboratory analysis will be conducted for COD, BOD, TSS, TKN, NH₄-N, TP, pH, TDS, Alkalinity, FOG, Conductivity, and Temperature.
- Treated effluent flow will be measured and monitored on an hourly basis, and effluent quality will be sampled on a daily basis and analysed for COD, BOD, TSS, NH₄-N, TN, TP, pH, Alkalinity and FOG.

8.6.6 CONCLUDING IMPACT STATEMENT

The project area has been altered by development. The impacts pertain predominantly to the project footprint area and include the Begej River. The riparian habitat adjacent to the Begej River has been considered for the impacts posed to the habitat. The extent of the project area has been classified as transformed habitat and represents a disturbed landscape with a general low sensitivity. No flora species of international conservation concern were recorded for the project area. Internationally protected faunal species were recorded for the project area. The transformed status has allowed for some fauna and flora species to re-establish in the area, but these are adaptable species. Despite the presence of an altered landscape housing a modified biotic community, the project area does present sensitivity to further degradation.

Despite some level of recovery of the area since disturbance in 2006; the loss of habitat and potential impacts on habitat, and associated fauna and flora occurring on the site due to construction activities are not significant due to the transformed state of the area.

The operational phase will involve the abstraction of the untreated wastewater from the Aleksandrovački channel and subsequent treatment and cleaning of the wastewater to environmental protection levels. Thereafter the treated wastewater will be discharged back into the Begej River via the Aleksandrovački channel. The key operational phase impacts on ecology relate to potential leaks, discharges and/or pollutant from the treatment system leaching into the surrounding environment and water sources; and, continued encroachment and displacement of the natural vegetation community due to alien invasive plant species and erosion. Provided that mitigation measures are implemented the significance of these impacts is very low. The project will not result in any significant effects on environmental flows of both the channel and the Begej River.

The most significant ecological impact of the project is positive in nature relating to the improvement of water quality in the Begej River downstream of the discharge point. This will result in improved instream and marginal habitat conditions as well as improved water quality for biota using the water, and an associated increase in biodiversity should the water quality improve in the Begej River. This is also likely to benefit the water quality of the Carska Bara Nature Reserve.

8.7 VISUAL AND LANDSCAPE

This section assesses the effects of the project on the landscape and on visual amenity. It defines the extent to which the proposed WWTP would be visible and the effect it might have on visual amenity.

8.7.1 LEGISLATION, POLICY AND GUIDANCE

SERBIAN LEGISLATIVE FRAMEWORK

Serbia is a signatory to the European Landscape Convention (ELC), the fundamental point of which is that all landscapes are important, not just in special places and whether beautiful or degraded. Contracting Parties undertake to: recognise landscapes in law; establish and implement landscape protection, management and planning policies and; establish procedures for public participation. The implementation of the ELC is included in the Spatial Plan of the Republic of Serbia 2010-2020 (Official Gazette RS, no. 88/10), which includes a section on the Protection and Development of Landscapes. This states that “The basic goal of protection and development of landscapes in Serbia is to achieve various high quality and adequately used landscapes and physically developed rural and urban settlements pleasant for living and leisure, with rich identity based on respect and affirmation of natural and cultural values”.

The strategic priority under this is a programme of landscape character identification and assessment, with the aim of creating a basis for the valorisation and protection of natural and cultural landscapes, and for planning and controlling their quality. Pilot projects are highlighted for a number of areas considered as a priority because of their particular value and importance, for areas requiring restoration, and for areas under special development pressure. Included in the last category is South Banat, because of pressure for wind energy development. However, at the time of writing this pilot project has not been undertaken.

The Law on Environment Protection 2004 is the framework national environmental law. Article 1 states “This Law shall regulate the integral system of environmental protection which shall ensure human right to live and

develop in healthy environment as well as balanced economy growth and protection of the environment in the Republic”.

REGULATIONS

The Rules on the Content of the Environmental Impact Assessment Study (“Official Journal RS”, No. 69/05) prescribes in more detail the content of the Environmental Impact Assessment. Article 3 requires a description of the site designated for the implementation of the project, including an “overview of the main properties of the landscape”. Article 6 requires a description of the environmental factors that are likely to incur significant risk due to proposed construction projects including landscape. Article 7 requires a description and assessment of the potential impacts of the project on the different aspects of the environment, including “landscape features of the area and similar.”

8.7.2 ASSESSMENT METHODOLOGY

The project is in a peri-urban area and the WWTP is consistent with the commercial and industrial activities in the area. Accordingly, an interaction between the landscapes was scoped as being possible, but none of the resulting impacts are likely to result in significant effects. A desk-based review was undertaken to determine existing landscape features, landscape character, and potential visual receptors. The baseline data has been obtained through a combination of the site visits, and desk-based review of third party / consultation information.

The approach to the visual and landscape impact assessment within this ESIA is therefore a screening assessment that considers the following factors:

- The field of view exposed to the proposed WWTP.
 - The viewing distance and visibility of the proposed facility from selected sites.
 - The visual absorption capacity of the surrounding landscape.
 - Effect of elevation on views towards the WWTP.
 - Potential sensitive receptors within the viewshed.
-

8.7.3 RESULTS

FACTORS CONTRIBUTING TO VISUAL IMPACT

FIELD OF VIEW

The ‘field of view’ indicates the areas from which the proposed project will be visible. A field of view analysis of the project was generated using Google Earth Pro based on the visibility of a central point in the middle of the WWTP project area with a height of 3m. The analysis shows that the site is visible for 360 degrees for a distance of 10km in all directions (the maximum extent of the field of view tool) (**Figure 8-11**). However, this is very conservative as it does not take into account the screening effect of structures above ground level such as buildings which could block the view of the WWTP.

VIEWING DISTANCE

Based on the above viewshed analysis, several areas which are potentially sensitive to the proposed facility may exist in the surrounding areas. The distance of these areas from the proposed facility is an important factor in determining the significance of the impact, where the greater the distance the more diminished the impact. The following zones of impact define the extent that receptors could be affected by the project:

- **Foreground:** The foreground is generally within a distance of 1 km from the project and from where details such as colour, texture, and form are highly visible.
- **Middle ground:** The middle ground is generally greater than 1 km, but within a distance of 3 km from the proposed facility and from where details such as colour, texture, and form become less distinctive and moderately visible.

- **Background:** The background generally refers to those areas 3 km or further from the proposed development and from where line and colour is still visible, but textures and form are not.

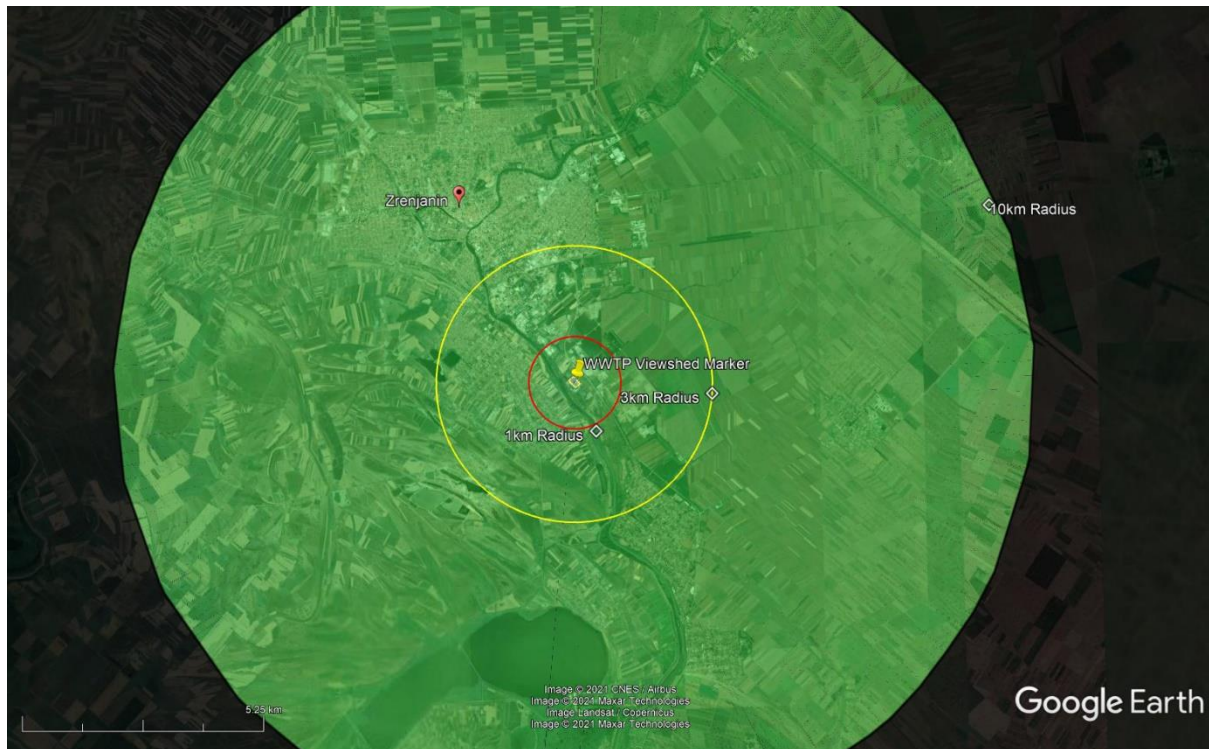


Figure 8-11 Project Field of View incl. Visual Impact Zones (Source: Google Earth Pro)

VISUAL ABSORPTION CAPACITY OF THE SURROUNDING LANDSCAPE

The landscape surrounding the WWTP is peri-urban with a high level of transformation from the natural landscape. Structures occurring within the foreground and background zones include residential buildings, commercial and industrial buildings, roadways, and agricultural land. The specific project landscape is therefore considered as having a strong effect on absorbing the visual impact of the WWTP.

OBJECT PROFILES AND VIEWPOINT ELEVATION

The elevation of the viewpoint determines how much of the horizontal profile of the object is visible. An object would be most visible from an elevated viewpoint, and less visible from a viewpoint at the same or lower elevation.

The topography in the foreground is relatively flat with a maximum elevation range of 6m within a 1km radius of the site. As a result, the WWTP will have a small visible area as it will be viewed side-on.

SENSITIVE POTENTIAL RECEPTORS

The following potential sensitive receptors within the field of view are identified:

RESIDENTIAL AREAS

The following residential receptors are within the foreground (**Figure 8-12**):

- ‘A’ - The eastern extent of the residential area of Muzlja situated approx. 600m west. The WWTP will be visible from the first few rows of houses in Area A, it is likely that the WWTP will not be visible to the houses situated further to the west as they would be blocked by the houses in-between.
- ‘B’ - Small cluster of residential dwellings situated 200m to the north on the other side of vacant land that has been earmarked for future phases of the WWTP.

- 'C' - Small cluster of residential dwellings situated 400m to the north situated on the other side of Residential Area B and agricultural fields.
- 'D' - Small cluster of residential dwellings situated 500m to the northeast situated on the other side of the main freeway and several commercial / industrial buildings.



Figure 8-12 Residential Visual Receptors in the Foreground

AREAS OF ECOLOGICAL IMPORTANCE AND PROTECTED AREAS

The World Database on Protected Areas indicates that the closest protected area is the Carska Bara Nature Reserve (IUC N Category IV). This is located in the background, approximately 6 km (off channel) downstream of the discharge area. This park is too distant to be visually impacted by the proposed development.

TOURISTIC AND RECREATIONAL AREAS

There are several recreational and touristic attractions in the Zrenjanin including but not limited to:

- Dry Bridge, Graffiti Chaplin, and Palata dundjerski, City beach "Peskara" (touristic attractions)
- Kristalna Dvorana Hala (Sports complex)
- Park Strelište, Slepa ulica, Šećeranski Park (Parks and open spaces)

All of these sites are situated in the background with the closest being City beach "Peskara" approx 3.4km from the project. Due to the relatively small footprint of the WWTP and the built up nature of the surrounding area these sites are too distant to be visually impacted by the proposed development.

8.7.4 CONSTRUCTION PHASE IMPACTS

Impact Ref: 24 Landscape and visual impacts associated with the construction of the WWTP

Impact Description There will be change in the aesthetic of the site from vacant land to an active construction site with bare soil, machinery and equipment, and potentially visible dust emissions. This will result in some deterioration of the local landscape character and visual amenity.

Residential areas located within the foreground field of view have the potential to be affected by visual changes associated with the WWTP.

The change in aesthetic is not anticipated to have a significant impact on views from residential areas A, C and D. This is due to the relatively small footprint of the WWTP, the viewing distance (400-600m), and the high absorptive capacity of the landscape (including the presence of existing commercial properties in the viewshed).

The change in aesthetic will be more noticeable from Area B as it is closest to the WWTP (200m). There are no existing buildings or infrastructure in-between this area and the WWTP. The absorptive capacity of the landscape is also less as the background is dominated by vacant land and the Begej River.

Mitigation

- The removal / loss of vegetation should be minimised.
- The use of artificial lighting on the site at night should be minimised; and, where needed, directional lighting should be used that points away from the residential areas.
- After construction, bare areas that are not part of the WWTP hard standing should be revegetated in a manner that is as natural sympathetic to the surrounding vegetated areas and landform as possible.

Impact Scoring	CRITERION	PRE-MITIGATION	POST MITIGATION
	Character	Negative	Negative
	Magnitude	Low	Low
	Extent	Local	Local
	Reversibility	Reversible	Reversible
	Duration	Short Term	Short Term
	Probability	Low	Low
	Significance	Very Low	Very Low

8.7.5 OPERATIONAL PHASE IMPACTS

Impact Ref: 25 Landscape and visual impacts associated with the operation of the WWTP

Impact Description Residential areas located within the foreground field of view have the potential to be affected by visual changes associated with the WWTP.

The change in aesthetic is not anticipated to have a significant impact on views from residential areas A, C and D. This is due to the relatively small footprint of the WWTP, the viewing distance (400-600m), and the high absorptive capacity of the landscape (including the presence of existing commercial properties in the viewshed).

The change in aesthetic will be more noticeable from Area B as it is closest to the WWTP (200m). There are no existing buildings or infrastructure in-between this area and the WWTP. The absorptive capacity of the landscape is also less as the background is dominated by vacant land and the Begej River.

- Mitigation** The following mitigation measures will reduce adverse effects of the Project on surrounding landscape character and visual amenity during the operational phase:
- Plant any non-hardstanding areas such as embankments with grass to soften the appearance of the facility.
 - Plant suitable fast-growing indigenous tree species in-between the WWTP and residential Area B to screen the view from this area.
 - The use of artificial lighting on the site at night should be minimised; and, where needed, directional lighting should be used that points away from the residential areas.

Impact Scoring	CRITERION	PRE-MITIGATION	POST MITIGATION
	Character	Negative	Negative
	Magnitude	Medium	Low
	Extent	Local	Local
	Reversibility	Irreversible	Irreversible
	Duration	Long Term	Long Term
	Probability	Medium	Low
	Significance	Moderate	Low

8.7.6 CONCLUDING IMPACT STATEMENT

The project is in a peri-urban area and the WWTP is consistent with the commercial and industrial activities in the area. An interaction between the landscapes was scoped as being possible, but none of the resulting impacts are likely to result in significant effects.

A desk-based review was undertaken to determine existing landscape features, landscape character, and potential visual receptors. The baseline data was obtained through a combination of the site visits, and desk-based review of third party / consultation information. A number of factors were taken into account when determining the potential visual and landscape impact of the project including the field of view; viewing distance; visual absorption capacity of the surrounding landscape, and viewpoint elevation.

The change in aesthetic of the site during construction and during operation is not anticipated to have a significant impact on views on three of the four residential areas in the viewshed due to the relatively small footprint of the WWTP, the viewing distance, and the high absorptive capacity of the landscape (including the presence of existing commercial properties in the viewshed).

There could be a more noticeable change in aesthetic viewed from a small residential cluster 200m north of the WWTP (200m). The overall impact significance is very low during construction as the impact duration will be short term. The permanent presence of the WWTP could have a greater impact on this receptor location due to its permanence. Mitigation measures have been proposed including landscaping of the facility and periphery, planting of vegetative screening, the judicious use of lighting at night.

8.8 SOCIO-ECONOMIC

This section broadly assesses the socio-economic impacts of the proposed development during construction and operation of the WWTP.

8.8.1 LEGISLATION, POLICY AND GUIDANCE

SERBIAN LEGISLATION

KEY RELATED REGULATIONS		APPLICABILITY TO PROJECT
Labour rights including child and forced labour	Labour Law (“Official Gazette of RS”, no. 24/2005, 61/2005, 54/2009, 32/2013, 75/2014, 13/2017, 113/2017 and 95/2018)	The provisions of the Labour Law apply to employees of any legal entity or individual. It is directly enforceable, providing the legal framework, inter alia, for contracts of employment, company-level agreements and collective agreements. The law guarantees a minimum level of protection of basic rights of employees and regulates a number of conditions of work and pay such as the minimum working age, prohibition of discrimination, protection of employees, maximum working hours, daily rest periods, minimum annual leave, etc. It also recognises the right to information and consultation at the national level and to protection in case of collective redundancies or transfer of an enterprise.
Gender Equality	The Labour Law (2005), the Law on gender equality (2009) and the Anti-Discrimination Law (2009). Serbia is also party to a number of international conventions on equal opportunities, including the UN Convention on the Elimination of all forms of Discrimination Against Women (CEDAW).	Discrimination on grounds of gender in relation to employment is prohibited under Serbian legislation. The objective of the Law is to achieve the equality of women and men in all spheres of social life by legally ensuring equal rights and opportunities of women and men.

EU LEGISLATION

Directives of European Union/European Commission considers social aspects including anti-discrimination and labour rights. Important directives associated with this project include, but are not limited to:

- Council Directive 2000/43/EC of 29 June 2000 implementing the principle of equal treatment between persons irrespective of racial or ethnic origin: also called the "Race Directive" (Directive 2000/43/EC on Anti-discrimination).
- Council Directive 2000/78/EC of 27 November 2000 establishing a general framework for equal treatment in employment and occupation.
- Council Directive 2004/113/EC of 13 December 2004 implementing the principle of equal treatment between men and women in the access to, and supply of goods and services.
- Directive 2006/54/EC of the European Parliament and of the Council of 5 July 2006 on the implementation of the principle of equal opportunities and equal treatment of men and women in matters of employment and occupation.
- Council Directive 91/533/EEC on an employer's obligation to inform employees of the conditions applicable to the contract or employment relationship.

OEEB POLICY

As a fundamental benchmark, the OeEB observe the ecological and social standards agreed upon by the Association of European Development Finance Institutions (EDFI). These include the IFC Performance Standards on Social and Environmental Sustainability, as well as the "Environmental, Health and Safety Guidelines" of the World Bank Group, and international conventions of the International Labour Organization (ILO).

IFC PERFORMANCE STANDARDS

The IFC Policy on Social and Environmental Sustainability sets out the environmental, health and safety as well as the community requirements for projects financed by the IFC. Relevant IFC requirements are summarised below:

IFC PS1 - ASSESSMENT AND MANAGEMENT OF ENVIRONMENTAL AND SOCIAL RISKS AND IMPACTS.

PS1 highlights the importance of managing social and environmental performance throughout the life of a project (any business activity that is subject to assessment and management). This PS details the implementation of an environmental management system from the project's inception. The objectives of PS1 are summarised below:

- To identify and assess environmental and social risks and impacts of the project;
- To adopt a mitigation hierarchy to anticipate and avoid, or where avoidance is not possible, minimise, and, where residual impacts remain, compensate/offset for risks and impacts to workers, the Affected Communities, and the environment
- To promote improved environmental and social performance of clients through the effective use of management systems;
- To ensure that grievances from Affected Communities and external communications from other stakeholders are responded to and managed appropriately; and
- To promote and provide means for adequate engagement with Affected Communities throughout the project cycle on issues that could potentially affect them and to ensure that relevant environmental and social information is disclosed and disseminated.

IFC PS2 - LABOUR AND WORKING CONDITIONS

PS2 relates to labour and working conditions. IFC requires for its clients to have good human resources management and a sound worker-management relationship based on respect for workers' rights, including freedom of association and right to collective bargaining, which are key to the sustainability of enterprises. The objectives of PS2 are to:

- Respect and protect the fundamental principles and rights of workers;
- Promote the decent work agenda, including fair treatment, non-discrimination and equal opportunities of workers;
- Establish, maintain and improve a sound worker-management relationship;
- Promote compliance with any collective agreements to which the client is a party, national labour and employment laws;
- Protect and promote the safety and health of workers, especially by promoting safe and healthy working conditions; and
- Prevent the use of forced labour and child labour as it relates to project activities.

IFC PS4 – COMMUNITY HEALTH, SAFETY, AND SECURITY

Business activities and infrastructure projects may expose local communities to increased risks and adverse impacts related to worksite accidents, hazardous materials, spread of diseases, or interactions with private security personnel. PS4 helps companies adopt responsible practices to reduce such risks including through emergency preparedness and response, security force management, and design safety measures. The objectives of PS4 are to:

- Anticipate and avoid adverse impacts on the health and safety of the Affected Community during the project life from both routine and non-routine circumstances.
- Ensure that the safeguarding of personnel and property is carried out in accordance with relevant human rights principles and in a manner that avoids or minimizes risks to the Affected Communities.

INTERNATIONAL LABOUR ORGANISATION (ILO) CONVENTIONS

Labour and working conditions associated with the construction and operation of the Zrenjanin WWTP project are required to conform to the ILO fundamental conventions, including:

- C029 - Forced Labour Convention, 1930 (No. 29)

- C087 - Freedom of Association and Protection of the Right to Organise Convention, 1948 (No. 87)
- C098 - Right to Organise and Collective Bargaining Convention, 1949 (No. 98)
- C100 - Equal Remuneration Convention, 1951 (No. 100)
- C105 - Abolition of Forced Labour Convention, 1957 (No. 105)
- C111 - Discrimination (Employment and Occupation) Convention, 1958 (No. 111)
- C138 - Minimum Age Convention, 1973 (No. 138) Minimum age specified: 15 years
- C182 - Worst Forms of Child Labour Convention, 1999 (No. 182)

8.8.2 CONSTRUCTION PHASE IMPACTS

Impact Ref: 26 Impact on land ownership and land use associated with construction activities

Impact Description	<u>Land Ownership</u> The land designated for the establishment of the WWTP is owned by the City of Zrenjanin. The land was originally owned by the Republic of Serbia, but was transferred to the City in February 2020, free of charge. Historically, the site was used as a disposal area for sugar beets processing waste. For that purpose, disposal cells were constructed, including embankments and drainage ditches and the cells were filled with non-compacted earth material, with significant organic content. Subsequently the site was cultivated with corn. A review of historic satellite imagery dating back to 2001 provided no evidence of dwellings or structures having been erected on the property. Commercial agricultural activities appear to have commenced onsite sometime between 2009 and 2012, continuing up to and including 2019. The City of Zrenjanin land tenure arrangements with farmers at the time of transfer and the method of notification to vacate site is unclear. However, it is noted that to date, no comments or grievance related to land use, compensation and loss of livelihoods were raised during the ESIA stakeholder engagement process; or lodged via the grievance mechanism. The site is therefore devoid of any inhabitants, buildings, or agricultural activities. Therefore, the proposed project will not result in any physical or economic displacement. <u>Land Use</u> A total of approximately 2.8 ha of agricultural land has been designated for the development of the proposed WWTP, as such this land will no longer be available for agricultural activities. This translates to 0.0035% of the total 80,044 ha of agricultural land in the Zrenjanin⁸⁰. All the contractor's facilities and material laydown areas will be strictly located within the site boundary, adjacent to the WWTP development footprint. Additionally, no workforce accommodation will be provided. As such, no additional land and associated land use will be required for establishment of the proposed project. However, during the construction process adjacent agricultural land could be impacted upon during initial earthworks / site preparation, as well as due to movement of mobile plant and staff offsite. Mitigation To minimise damage to surrounding agricultural land during the construction phase of the proposed Project, it is recommended that the Proponent clearly demarcate the site and restrict access outside of this area and designate routes during construction.
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⁸⁰ Statistical Office of the Republic of Serbia. Municipalities and regions in the Republic of Serbia, 2020, page 236. www.stat.gov.rs

Significance Rating	CRITERION	PRE-MITIGATION	POST MITIGATION
	Character	Negative	Negative
	Magnitude	Very Low	Very Low
	Extent	Local	Local
	Reversibility	Recoverable	Recoverable
	Duration	Short Term	Short Term
	Probability	Low	Improbable
	Significance	Low	Very Low

Impact Ref: 27 Access to plots / land use impacts associated with construction activities

Impact Description During initial site establishment, development of the site access road, and as well as a result of increased traffic (particularly the presence of heavy vehicles), some of the local land users may have temporary difficulties accessing plots of land adjacent the project site.

These activities are most likely to affect the plots of land surrounding the WWTP site, which are being utilised for agricultural purposes, as well as the small businesses at the intersection of the State Road 13 and the proposed access road to the site.

Mitigation The following mitigation measures are required:

- Provide timely information to users of land of when access to their land might be more difficult.
- Establish and implement a community grievance mechanism.

Significance Rating	CRITERION	PRE-MITIGATION	POST MITIGATION
	Character	Negative	Negative
	Magnitude	High	High
	Extent	Local	Local
	Reversibility	Reversible	Irreversible
	Duration	Short Term	Immediate
	Probability	High	Low
	Significance	Moderate	Low

Impact Ref: 28 Employment and procurement opportunities associated with construction activities

Impact Description The project has an estimated 18-month construction period, with earthworks and infrastructure development scheduled to take place over the initial 9 months followed by a 9-month installation period of mechanical, electrical and instrumentation. Not all workers will be employed all the time, the frequency at which workers will be employed and the duration of their engagement could not be estimated at the time of developing the ESIA and will depend on the contractors' organisation of work.

The number of construction employment opportunities has not yet been determined, however based on the relatively small size of the project, it is not anticipated that a large workforce will be required for the development of the proposed WWTP.

The workforce needed during the construction phase of the Project will likely be sourced locally (primarily from the Zrenjanin Municipality, including the directly affected local communities), nationally (from other parts of Serbia) and internationally, through third party construction firms. Notably, construction firms typically employ unskilled labour from the local communities, primarily to reduce costs associated with travel and accommodation.

The breakdown of the labour categories (skilled, semi-skilled, and unskilled) that are required for the Project have also not been defined at this point. Due to the technical nature of the Project, it is likely that most of the skilled and semi-skilled labour will be sourced nationally and internationally, however certain skills may also be found among the local population residing in the municipality.

Although an accurate number of potential direct employment opportunities that may result from the construction phase of the project is not known, the anticipated number is not considered to be significant. The total working age population (15 to 65) in the Zrenjanin is approximately 75,485, with 4,963 individuals recorded as unemployed (as of December 2019). Employment of locals will therefore only include a small portion of the total population and will not significantly reduce unemployment in the area, however; this will have a significant effect on those who are employed and their household.

In addition to employment opportunities, the project is anticipated to benefit the local economy during the construction phase as a result of purchasing of materials and from local suppliers. Bulk materials (aggregate, cement, steel etc.) will be sourced from existing lawful commercial sources; as there will be no direct mining, harvesting or extraction of natural resources undertaken as part of the project. Where possible, equipment is to be sourced locally, however equipment will be purchased outside of Serbia where this makes commercial sense.

Indirect benefits which are likely to arise as a result of the construction activities include boosting of the local economy due to increased expenditure by households with an employed member in the project area (i.e. in local shops, restaurants, etc.), spending by project employees in local communities, as well as improved local skill set which may be valuable for future projects. Additionally, employment of local community members may lead to improved relationships between the Project and local communities. Notably, indirect employment is likely to provide more opportunities for women, as opposed to direct employment, which will most likely involve more men during the construction phase.

- Mitigation** The following mitigation measures are required:
- Implement transparent and fair recruitment procedures.
 - Ensure that all non-employee workers are engaged in line with both national legislation and applicable international (ILO) standards and recommendations.
 - Local employment and procurement of local goods and services to be prioritised, whenever possible.
 - Establish and implement a worker grievance mechanism

Significance Rating	CRITERION	PRE-MITIGATION	POST MITIGATION
	Character	Positive	Negative
	Magnitude	Low	Low
	Extent	Local	Regional
	Reversibility	Reversible	Reversible
	Duration	Short Term	Short Term
	Probability	Low	Medium
	Significance	Very Low	Low

Impact Ref: 29 Impacts on livelihoods during the construction activities

Impact Description Considering the small scale of land take required for the project and the general availability of agricultural land in the area, the reduction in land available for agriculture is not expected to have any impact on livelihoods of the local community.

Increased incomes generated through direct and indirect employment may have a positive effect on livelihoods in the local area. Households in the local communities whose members will be employed by the project, will have increased incomes and consequently improved

standard of living. Although this may be significant for the households in question, it is not significant to the population as a whole. Some increased spending of these households together with non-local employees in the local area could further positively benefit the local economies.

Transport and increased traffic are not expected to have impacts on livelihoods. Difficulties in accessing land, described in the relevant section above, may only be occasional, temporary and impact few individuals. Transport of materials to and from the project site will be done via the existing regional transport network and proposed minor access road. There may be short term disruptions, however; businesses in the area along the transport routes are not expected to suffer income losses as a result of project related increased traffic. Similarly, residents living along the transport route may experience short term disruptions, however; impacts on livelihoods are not expected.

As transport to and from the site is to be undertaken via designated access routes, and all work is to be undertaken within the defined site boundary, damages to surrounding land, crops and compaction of agricultural soil will be avoided, however, although unlikely they remain possible.

Overall, the potential benefit to improved livelihoods resulting from economic input into the local economy due to increased employment and associated increased expenditure, as well as procurement of local resources / services, is expected to outweigh potential temporary negative impacts.

Mitigation The following procedures are recommended:

- Clearly demarcate the site and restrict access outside of this area and off designated routes during construction.
- Provide timely information to people/households located along selected transport route that there will be increased transport activity in their area.
- If required, compensate all users of land for lost crops and any other damages at full replacement value, in accordance with the Serbian Law on Planning and Construction and IFC PSs.
- Fully reinstate land after disruption.
- Establish and implement a grievance mechanism.

Significance Rating

CRITERION	PRE-MITIGATION	POST MITIGATION
Character	Positive	Negative
Magnitude	Very Low	Low
Extent	Regional	Regional
Reversibility	Reversible	Reversible
Duration	Short Term	Short Term
Probability	Medium	Medium
Significance	Low	Low

Impact Ref: 30 Impacts to existing infrastructure during construction activities

Impact Description

Construction activities will require the use of existing roads for the transportation of staff, equipment, and construction materials to and from site. Damages to road surfaces during transport of heavy machinery, leading to damages to motor vehicles, road accidents and the increase in costs for local government, are also possible.

The Project will not place significant additional demands on community infrastructure during the construction phase, however; connecting the WWTP utility services, i.e. water, electricity, sewage, to the municipal network may result in temporary disruptions to service provision within the project area.

- Mitigation** The following procedures are recommended
- Ensuring roads on identified routes are suitable for heavy transport before construction.
 - Restoration of roads to at least pre-construction level
 - Locate all underground utilities before undertaking earthworks / trenching.
 - Development and implementation of a Transportation and Traffic Management Plan aligned with the World Bank EHS Guidelines / General EHS Guidelines: Occupational Health and Safety.
 - All contractor drivers must hold valid licenses and be able to demonstrate technical training for respective class of vehicle.
 - Workers code of conduct (guidance on safe driving)

Significance Rating	CRITERION	PRE-MITIGATION	POST MITIGATION
	Character	Negative	Negative
	Magnitude	Low	Very Low
	Extent	Local	Local
	Reversibility	Recoverable	Recoverable
	Duration	Short Term	Short Term
	Probability	Medium	Low
	Significance	Low	Low

8.8.3 OPERATIONAL PHASE IMPACTS

Impact Ref: 31 Impact on land use and livelihoods associated with operation activities

Impact Description Due to discharge of untreated wastewater into the Begej River there is currently a high risk of contaminated water being used for irrigation purposes. The poor quality of water negatively affects the quality of agricultural production. The WWTP operations will result in the removal of untreated wastewater from being discharged into the Begej River, thereby improving the water quality of the river system. This will result in the availability of improved water quality for irrigation purposes, thereby improving agricultural production within the project area.

In addition, the removal of untreated wastewater from the river system has the potential to increase the value of the land adjacent to the Begej River, as well as resulting in greater use of the area by the local communities / resource users. From the results of the household survey, the main reasons for residents not utilising the river environment was due to the odour and pollution associated with the untreated effluent being discharged into the river.

Mitigation No obvious mitigation measures are required.

Significance Rating	CRITERION	PRE-MITIGATION	POST MITIGATION
	Character	Positive	-
	Magnitude	Low	-
	Extent	Regional	-
	Reversibility	Reversible	-
	Duration	Long Term	-
	Probability	High	-
	Significance	Moderate	-

Impact Ref: 32 Employment and procurement opportunities associated with operation activities

Impact Description The life of the project is expected to be at least 25 years. The Proponent estimates that approximately 25-30 individuals will be employed during operations. This will give long term stability to the full-time employees and will have a significant effect on their lives. However, in relation to unemployment numbers within the local communities and at the national level, the number of employment opportunities in relation to currently unemployment is very low.

Indirect employment may occur as a result of increased spending of those employed by the Proponent, however; due to the limited number of individuals to be employed, this is not deemed significant. The procurement of local goods and services is also likely to be minimal and have a negligible effect on local economies.

Mitigation The following mitigation measures are required:

- Implement transparent and fair recruitment procedures.
- Ensure that all non-employee workers are engaged in line with both national legislation and applicable international (ILO) standards and recommendations.
- Local employment and procurement of local goods and services to be prioritised, whenever possible.

Significance Rating	CRITERION	PRE-MITIGATION	POST MITIGATION
	Character	Positive	Negative
	Magnitude	Very Low	Low
	Extent	Regional	Regional
	Reversibility	Reversible	Reversible
	Duration	Long Term	Long Term
	Probability	Low	Medium
	Significance	Low	Low

Impact Ref: 33 (S8) Increased cost of living associated with operation activities

Impact Description At the time of writing the ESIA the municipality had not undertaken relevant calculations as to the required tariff increases and implementation structure. That being said, it is evident from the social surveys undertaken that increased tariffs will be felt by residents of the Zrenjanin municipality, including the directly affected local communities. Although in terms of percentages this impact may be seen as only a minor negative for some households, vulnerable households will experience the increased costs more significantly, with all of the vulnerable households surveyed indicating that they could not afford additional tariffs.

Mitigation This aspect cannot be mitigated by the developer as tariffs are determined and implemented by the City of Zrenjanin. Post mitigation significance assumes that the City of Zrenjanin will:

- Determine tariff increases in line with the 'Polluter pays principle', and based on actual usage and quantities in relation to consumer and industrial users.
- Set effluent criteria for the industries in order to control their effluent according to the Serbian regulations and establish monitoring requirements against these criteria.

Significance Rating	CRITERION	PRE-MITIGATION	POST MITIGATION
	Character	Negative	Negative
	Magnitude	Very High	Low
	Extent	Regional	Regional
	Reversibility	Reversible	Reversible
	Duration	Long Term	Long Term
	Probability	Definite	Medium
	Significance	High	Low

Impact Ref: 34 (S9) Improved service infrastructure and potential for further improved service delivery

Impact Description The WWTP will not place undue pressure on the wider community infrastructure in terms of water and electricity supply, and wastewater from the facility will be discharged directly to the plant for treatment. During the survey 82% of the households indicated that they dispose of household sewage via the municipal sewer system (i.e. flushing toilet). Other sanitation infrastructure utilised by households, in addition to the flushing toilet, include septic tank (12%) and pit latrine (6%) With the development of the WWTP, and increased revenue the municipality may receive as a result, it is anticipated that additional benefits may include improvements to the surrounding sewerage infrastructure system to connect areas / settlements not yet serviced to the WWTP network. Providing these local communities with access to formal sanitation infrastructure.

Currently the Municipality dedicates resources and revenue to continual maintenance and response to emergency incidents associated with blockages in the system related to untreated nature of sewage from industry. Blockages result in impacts 2-3km upstream from the discharge point (breaks of the older pipelines). Treatment achieved by the new WWTP will assist in the reducing the frequency of these incidents.

Establishment of the WWTP also provides the potential for further future developments, either by the Municipality or third parties. These opportunities include development for the use of treated water for non-potable uses (irrigation), development of alternative waste management options associated with dewatered sludge, such as composting for agricultural input, and as fuel in co-incineration processes.

Successful implementation of the WWTP project by the Proponent may also facilitate additional projects in the area, of which may include the rehabilitation / upgrade of the Water Treatment Plant for operation.

Mitigation No obvious mitigation measures are required.

Significance Rating	CRITERION	PRE-MITIGATION	POST MITIGATION
	Character	Positive	-
	Magnitude	High	-
	Extent	Regional	-
	Reversibility	Recoverable	-
	Duration	Long Term	-
	Probability	Medium	-
	Significance	Moderate	-

8.8.4 CONCLUDING IMPACT STATEMENT

The ESIA considered effects on communities and individuals, as well as their social and economic assets, associated with land use, employment and procurement opportunities, livelihoods, community health, safety and security, revenue generation for municipality, increased costs for local communities and improved infrastructure.

During construction, the proposed development will have limited negative effects in terms of loss of agricultural land or access to land, as well as limited negative impacts on existing infrastructure in the project area. All negative impacts can be successfully mitigated through implementation of appropriate measures, including provision of timely information to affected people, grievance management, etc.

On the other hand, the project will also have some positive impacts related to creation of direct and indirect employment opportunities and associated positive impacts on livelihoods. To further enhance these impacts, it will be important to foster local hiring and local procurement of goods and services.

During operations positive impacts include creation of employment opportunities, however; local communities (especially vulnerable groups), will feel the negative impact of increased tariffs. Mitigation recommendations have been provided and are essential to reduce the significance of these impacts.

The proposed development will result in generation of revenue for the local government for operation and maintenance of broader service infrastructure, and with it the potential for improvements to the surrounding sewerage infrastructure system to connect areas / settlements not yet serviced to the WWTP network -providing these local communities with access to formal sanitation infrastructure. In addition, emergency incidents associated with blockages and upstream impacts will be less frequent.

The associated improvement of Begej River and surrounding environment may also result in possible recreational and tourism enhancement opportunities, while the improved wastewater management infrastructure may also attract new investments, which will contribute to further economic development in the municipality.

On-going communication and consultation with local communities will be key in enhancing positive impacts.

8.9 CULTURAL HERITAGE

8.9.1 LEGISLATION, POLICY AND GUIDANCE

EU LEGISLATION

The EU does not have decision making power on cultural heritage but the Treaty of Lisbon states in Article 3.3. TEU “(...) The Union shall respect its rich cultural and linguistic diversity, and shall ensure that Europe’s cultural heritage is safeguarded and enhanced”. (http://ec.europa.eu/culture/our-policy-development/cultural-heritage_en.htm)

SERBIAN LEGISLATION

The Serbian Cultural Property Law regulates the system of the protection and use of cultural property and defines conditions for the implementation of activities relating to the protection of cultural property. Cultural property can be of exceptional or great importance in which case it is subject to the provisions of the Cultural Property Law. None of the assets identified in the course of this study are of exceptional or great importance.

Article 109 of the Cultural Property Law provides that: “If archaeological sites or archaeological artefact are found in the course of execution of construction and other works, the executor of works shall immediately and without delay suspend works and inform the competent institute for the protection of cultural monuments, and take measures so that the finding is not destroyed and damaged, and that it is preserved in the place and position where it was found”.

In the event of immediate danger of damaging the archaeological site or artefact, the competent institute for the protection of cultural monuments shall temporarily suspend the works until it is established, based on this Law,

whether the immovable property or object are cultural property or not. If the competent institute for the protection of cultural monuments fails to suspend the works, the works will be suspended by the Republic Institute for the Protection of Cultural Monuments.

IFC PERFORMANCE STANDARDS

IFC PS 8 recognizes the importance of cultural heritage for current and future generations. Its objectives are:

- To protect cultural heritage from the adverse impacts of project activities and support its preservation.
- To promote the equitable sharing from the benefits of the use of cultural heritage.

It requires the protection of cultural heritage in project design and execution with stipulations for chance find procedures, consultation, community access, removal of replicable cultural heritage, removal of non-replicable public heritage and critical cultural heritage. It goes on to provide guidance on the project's use of cultural heritage http://www.scribd.com/fullscreen/84697434?access_key=key-1do8v46kzf4u4h6nu17e

8.9.2 CONSTRUCTION PHASE IMPACTS

Impact Ref: 35 Disturbance to Cultural Resources associated with earth moving activities

Impact Description	Damage or loss of unknown cultural resources below ground during construction phase excavation activities.
Mitigation	Construction activities may lead to disturbance or destruction of cultural resources (archaeological and historical remains and sacred sites e.g. graves) should the development footprint encroach on identified cultural/heritage sites within the project area. According to the Zrenjanin Heritage Institute no culturally important sites or artefacts are known to occur within the project footprints. There however has been recent reporting of artefacts from the Celtic period being unearthed at the Linglong site, approximately 1km from the WWTP site. Earthworks may accidentally expose unidentified subsurface remains / artefacts. This will result in a lost opportunity to preserve local cultural heritage and historical records should appropriate management measures not be in place. Care therefore needs to be given when planning excavation activities; and in the event that a cultural resource is unearthed. The following mitigation measures are required: — All excavation works to be overseen by personnel on the ground. — Notify the Heritage Institute 15 days before commencement of earthmoving activities. — Implementation of Chance Find Procedure as outlined in the ESMP (stop construction immediately; and notification of authorities in accordance with law prescribed for the protection of objects with cultural heritage importance for Serbia).

Significance Rating	CRITERION	PRE-MITIGATION	POST MITIGATION
	Character	Negative	Negative
	Magnitude	Low	Low
	Extent	National	National
	Reversibility	Irreversible	Reversible
	Duration	Short Term	Short Term
	Probability	Low	Improbable
	Significance	Low	Low

8.9.3 OPERATIONAL PHASE IMPACTS

Impact Ref: 36 Improved water quality and potential for enhanced recreational use and tourism

Impact Description	Improvement in water quality within the Begej River as a result of treatment has the potential to result in the area being more attractive to recreational users and tourists. The improved quality of the environment within and around the Begej River may result in improved tourism in the area (e.g. Kastel Ecka). As identified in Section 5.4.14 Cultural Heritage, the AoI has certain tourist facilities that have the potential for further development should the quality the environment improve. For the purposes of the ESIA it is difficult to assess whether the WWTP alone will stimulate tourism in the area, thereby further contributing to local economic development, however it is considered a significant contributor to facilitating the promotion of the area for recreational use and tourist development.
Mitigation	No obvious mitigation measures are required.

Significance Rating	CRITERION	PRE-MITIGATION	POST MITIGATION
	Character	Positive	-
	Magnitude	High	-
	Extent	Regional	-
	Reversibility	Recoverable	-
	Duration	Long Term	-
	Probability	Medium	-
	Significance	Moderate	-

8.9.4 CONCLUDING IMPACT STATEMENT

No culturally important sites or artefacts are known to occur within the project footprint. There however has been recent reporting of artefacts from the Celtic period being unearthed at the Linglong site, approximately 1km from the WWTP site.

During construction, earthworks may accidentally expose unidentified subsurface remains / artefacts. This will result a lost opportunity to preserve local cultural heritage and historical records should appropriate management measures not be in place. Care therefore needs to be given when planning excavation activities; and if a cultural resource is unearthed.

The improved quality of the environment within and around the Begej River may result in improved tourism in the area (e.g. Kastel Ecka). The AoI has certain tourist facilities that have the potential for further development should the quality the environment improve. For the purposes of the ESIA it is difficult to assess whether the WWTP alone will stimulate tourism in the area, thereby further contributing to local economic development, however it is considered a significant contributor to facilitating the promotion of the area for recreational use and tourist development.

8.10 CLIMATE CHANGE

In this section the potential for climate change to impact on the project, and the associated environmental impacts of the project, has been assessed.

8.10.1 CONSTRUCTION PHASE IMPACTS

Impact Ref: 37 Pollution risk to the Begej River associated with Climate Change (increased flooding)

Impact Description	Due to the location of the WWTP within the floodplain of the Begej River there is a potential for damage to the facility and the release of pollutants into the Begej River (sludges, untreated effluents, chemicals). The design of the WWTP has been based on information from the Municipality related department in Vojvodina Vode and is based on the maximum level of Begej river of 77.14m. To include a conservative factor, the design the design of the WWTP has considered 80.0 m as FGL. It has not been possible to determine within the ESIA whether flood levels associated with climate change have been specifically taken into consideration in the determination of the FGL. Climate change projections indicate that Serbia and the Western Balkans⁸¹ face a high probability of continuing temperature increases, along with more frequent and prolonged droughts and wildfires. Over the past two decades, droughts, floods, exceptionally harsh winters and other weather-related extreme events have caused major physical damage, financial losses and even deaths, with significant impacts on the economy, especially in the agricultural sector.
Mitigation	Whilst the design freeboard of 2.86m is acknowledged, it has not been possible to determine within the ESIA whether flood levels associated with climate change have been specifically taken into consideration. It is recommended that this confirmation is provided by a suitably qualified person within the design team prior to finalisation.

Significance Rating	CRITERION	PRE-MITIGATION	POST MITIGATION
	Character	Negative	Negative
	Magnitude	Very High	Very High
	Extent	Regional	Regional
	Reversibility	Recoverable	Recoverable
	Duration	Medium Term	Medium Term
	Probability	Indeterminate	Improbable
	Significance	Indeterminate	Very Low

8.10.2 CONCLUDING IMPACT STATEMENT

The ESIA identifies the potential for increased flooding in Serbia due to climate change. Whilst the design of the WWTP includes a freeboard of 2.86m it has not been confirmed that this takes into consideration the potential for climate change related flood risk. It is a key recommendation of the ESIA that this confirmation is obtained.

⁸¹ <https://www.climatelinks.org/resources/climate-risk-profile-serbia>

8.11 GROUNDWATER

8.11.1 OPERATIONAL PHASE IMPACTS

Impact Ref: 38 Groundwater Pollution Risk Associated with Leaks and Overflows

Impact Description	The WWTP includes various containment structures for wastewater at various stages of the treatment process. Leaks and potential overflows from the containment structures have the potential to permeate into the sub-soil environment resulting in potential ground and groundwater contamination.
Mitigation	a) Develop Infrastructure Maintenance and Monitoring and Service Plan [ESMP Section 4.2.3] b) As part of the ESIA, piezometers were installed to a depth of 8-10m at two locations on the project site (See ESIA Table 5 9/ Figure 5 24). The monitoring data from these wells is a suitable baseline against which potential groundwater pollution from the WWTP associated with potential leaks or overflows will be assessed during the operation of the facility. The monitoring should be undertaken on a bi-annual basis and implemented in accordance with a groundwater monitoring plan. The range of physico-chemical determinants to be monitored include those initially measured during the ESIA i.e. the Limit Values of Polluting, Harmful and Hazardous Substances in Soil ("Official Gazette Of RS", No. 30/2018 and 64/2019, Annex 2: Remediation Values of Pollutants, Harmful and Dangerous Substances in the Aquifer); and, Maximum Permitted Values according to the Regulation on Limit Values Of Pollutants in Surface and Groundwater and Sediment and Deadlines for their Achievement (Official Gazette of RS 50/2012). In addition to the above the determinants to be monitored should include any additional chemical substances reasonably expected to be present in the WWTP.

Significance Rating	CRITERION	PRE-MITIGATION	POST MITIGATION
	Character	Negative	Negative
	Magnitude	Very High	Very High
	Extent	Regional	Regional
	Reversibility	Recoverable	Recoverable
	Duration	Medium Term	Medium Term
	Probability	Indeterminate	Improbable
	Significance	Indeterminate	Very Low

8.11.2 CONCLUDING IMPACT STATEMENT

The WWTP includes various containment structures for wastewater at various stages of the treatment process. Leaks from the containment structures and due to potential overflows on non-hard-standing areas have the potential to permeate into the sub-soil environment resulting in potential ground and groundwater contamination. Mitigation measures include the development and implementation of an Infrastructure Maintenance and Monitoring and Service Plan and a Groundwater Monitoring Plan.

8.12 SUMMARY OF IMPACTS

Table 8-21 on the following page contains a summary of the impacts and values used in the determination of impact significance as per the impact assessment methodology in **Section 8.1.2**.

Table 8-21 Summary of Impacts and Significance

ESIA Report Impact Number	Impact Abbreviated	Stage	Character	Pre-Mitigation							Post-Mitigation						
				(M+)	E+	R+	D)x	P=	S	Rating	(M+)	E+	R+	D)x	P=	S	Rating
1	Health and dust / nuisance impacts associated with construction activities	Construction	Negative	3	2	1	2	3	24	N2	2	2	1	2	2	14	N1
Significance				N2 - Low							N1 - Very Low						
2	Health Impacts associated with operational phase WWTP airborne emissions	Operation	Negative	1	2	4	4	1	11	N1	1	2	4	4	1	11	N1
Significance				N1 - Very Low							N1 - Very Low						
3	Odour / nuisance impacts associated with operational phase WWTP airborne emissions	Operation	Negative	3	2	3	4	4	48	N3	2	2	3	4	4	44	N3
Significance				N3 - Moderate							N3 - Moderate						
4	Environmental noise impacts associated with construction activities	Construction	Negative	3	2	1	2	3	24	N2	2	2	1	2	2	14	N1
Significance				N2 - Low							N1 - Very Low						
5	Daytime noise impacts associated with the operation of the WWTP	Operation	Negative	2	2	3	4	2	22	N2	2	2	3	4	2	22	N2
Significance				N2 - Low							N2 - Low						
6	Night-time noise impacts associated with the operation of the WWTP	Operation	Negative	2	2	3	4	2	22	N2	2	2	3	4	2	22	N2
Significance				N2 - Low							N2 - Low						
7	General occupational health and safety risks during the construction of the WWTP	Construction	Negative	5	2	5	5	4	68	N4	5	2	5	5	1	17	N2
Significance				N4 - High							N2 - Low						
8	Accidents and Injuries to workers during the operation of the WWTP	Operation	Negative	5	1	5	5	4	64	N4	5	1	5	5	1	16	N2
Significance				N4 - High							N2 - Low						
9	Worker exposure to chemicals and hazardous atmospheres during the operation of the WWTP	Operation	Negative	5	1	5	5	4	64	N4	5	1	5	5	1	16	N2
Significance				N4 - High							N2 - Low						

10	Worker exposure to pathogens and vectors during the operation of the WWTP	Operation	Negative	5	1	5	5	4	64	N4	5	1	5	5	1	16	N2
Significance				N4 - High							N2 - Low						
11	Construction traffic risks to communities during the construction of the WWTP	Construction	Negative	5	2	5	5	3	51	N3	5	2	5	5	1	17	N2
Significance				N3 - Moderate							N2 - Low						
12	Influx related risks, such as increased exposure to communicable diseases, during the construction phase	Construction	Negative	3	3	3	2	2	22	N2	3	3	3	2	1	11	N1
Significance				N2 - Low							N1 - Very Low						
13	Health and safety risks to communities associated with hazardous waste during the construction and operation of the WWTP	Construction and Operation	Negative	3	3	3	4	2	26	N2	3	3	3	4	1	13	N1
Significance				N2 - Low							N1 - Very Low						
14	Community health and safety impacts associated with treated effluent discharges from the WWTP	Operation	Positive	3	3	3	4	4	52	P3	3	3	3	4	5	65	P4
Significance				P3 - Moderate							P4 - High						
15	Impacts on existing habitat	Construction	Negative	3	2	3	3	4	44	N3	2	2	3	2	3	27	N2
Significance				N3 - Moderate							N2 - Low						
16	Impact of direct mortalities and disturbance on fauna	Construction	Negative	4	3	3	3	4	52	N3	3	2	3	2	3	30	N2
Significance				N3 - Moderate							N2 - Low						
17	Impact of contamination by machinery, vehicles, building materials and chemical storage	Construction	Negative	3	3	5	3	4	56	N3	3	2	3	2	3	30	N2
Significance				N3 - Moderate							N2 - Low						
18	Continued encroachment and displacement of the natural vegetation community due to alien invasive plant species and erosion	Construction	Negative	3	3	3	2	4	44	N3	2	2	1	2	2	14	N1
Significance				N3 - Moderate							N1 - Very Low						
19	Disruption of habitat during the operational phase	Operation	Negative	3	3	3	4	3	39	N3	2	2	1	2	2	14	N1

Significance				N3 - Moderate							N1 - Very Low						
20	Displacement of faunal community due to habitat loss, direct mortalities, and disturbance (road collisions, noise, dust, vibration and possible poaching)	Operation	Negative	3	3	3	3	3	36	N3	2	2	1	1	2	12	N1
Significance				N3 - Moderate							N1 - Very Low						
21	Potential leaks, discharges and/or pollutant from the treatment system leaching into the surrounding environment and water sources	Operation	Negative	4	4	5	4	3	51	N3	2	2	1	2	2	14	N1
Significance				N3 - Moderate							N1 - Very Low						
22	Environmental flow alterations associated with the operation of the WWTP	Operation	Negative	1	1	1	1	2	8	N1	1	1	1	1	2	8	N1
Significance				N1 - Very Low							N1 - Very Low						
23	Water quality improvement associated with the discharge of treated wastewater into local watercourses	Operation	Positive	3	4	1	4	4	48	P3	3	4	1	4	5	60	P3
Significance				P3 - Moderate							P3 - Moderate						
24	Landscape and visual impacts associated with the construction of the WWTP	Construction	Negative	2	2	1	1	2	12	N1	2	2	1	1	2	12	N1
Significance				N1 - Very Low							N1 - Very Low						
25	Landscape and visual impacts associated with the operation of the WWTP	Operation	Negative	3	2	5	4	3	42	N3	2	2	5	4	2	26	N2
Significance				N3 - Moderate							N2 - Low						
26	Impact on land ownership and land use associated with construction activities	Construction	Negative	1	2	3	2	2	16	N2	1	2	3	2	1	8	N1
Significance				N2 - Low							N1 - Very Low						
27	Access to plots / land use impacts associated with construction activities	Construction	Negative	4	2	1	2	4	36	N3	4	2	1	1	2	16	N2
Significance				N3 - Moderate							N2 - Low						
28	Employment and procurement opportunities associated with construction activities	Construction	Positive	2	2	1	2	2	14	P1	2	3	1	2	3	24	P2

Significance				P1 - Very Low							P2 - Low						
29	Impacts on livelihoods during the construction activities	Construction	Positive	1	3	1	2	3	21	P2	2	3	1	2	3	24	P2
Significance				P2 - Low							P2 - Low						
30	Impacts to existing infrastructure during construction activities	Construction	Negative	2	2	3	2	3	27	N2	1	2	3	2	2	16	N2
Significance				N2 - Low							N2 - Low						
31	Impact on land use and livelihoods associated with operation activities	Operation	Positive	2	3	1	4	4	40	P3						0	#N/A
Significance				P3 - Moderate							#N/A						
32	Employment and procurement opportunities associated with operation activities	Operation	Positive	1	3	1	4	2	18	P2	2	3	1	4	3	30	P2
Significance				P2 - Low							P2 - Low						
33	Increased cost of living associated with operation activities	Operation	Negative	5	3	1	4	5	65	N4	2	3	1	4	3	30	N2
Significance				N4 - High							N2 - Low						
34	Improved service infrastructure and potential for further improved service delivery	Operation	Positive	4	3	3	4	3	42	P3						0	#N/A
Significance				P3 - Moderate							#N/A						
35	Disturbance to Cultural Resources associated with earth moving activities	Operation	Negative	2	4	5	4	2	30	N2	2	4	5	4	1	15	N1
Significance				N2 - Low							N1 - Very Low						
36	Improved water quality and potential for enhanced recreational use and tourism	Operation	Positive	4	3	3	4	3	42	P3						0	#N/A
Significance				P3 - Moderate							#N/A						
37	Pollution risk to the Begej River associated with Climate Change (increased flooding)	Operation	Negative	5	3	3	3	3	42	N3	5	4	3	3	1	15	N1
Significance				N3 - Moderate							N1 - Very Low						
38	Groundwater Pollution Risk Associated with Leaks and Overflows	Operation	Negative	4	2	3	4	3	39	N3	4	2	3	4	1	13	N1
Significance				N3 - Moderate							N1 - Very Low						

8.13 CUMULATIVE IMPACT ASSESSMENT

The ESIA process serves to assess, mitigate, and manage the environmental and social impacts of individual projects, but may be insufficient for identifying and managing incremental impacts on areas or resources used or directly affected by a given development from other existing, planned, or reasonably defined developments. The IFC Good Practice Handbook: Cumulative Impact Assessment and Management defines cumulative impacts as follows:

“Cumulative impacts are those that result from the successive, incremental, and/or combined effects of an action, project, or activity (collectively referred to in this document as “developments”) when added to other existing, planned, and/or reasonably anticipated future ones. For practical reasons, the identification and management of cumulative impacts are limited to those effects generally recognized as important on the basis of scientific concerns and/or concerns of affected communities.”

The cumulative impact assessment (CIA) process analyses the potential impacts and risks of proposed developments in the context of the potential effects of other human activities and natural environmental and social external drivers on the chosen valued environmental and social components (VEC) over time, and proposing sound measures to avoid, reduce, or mitigate the impacts as far as possible.

A rapid cumulative impact assessment (RCIA) process (in contrast to comprehensive CIA) was adopted for the project.

IDENTIFICATION OF APPLICABLE VECs, SPATIAL AND TEMPORAL BOUNDARIES

Based on broad evaluation of the range of potential impacts that may results from the proposed project, the following VECs been identified as having the potential to be a) impacted by the project, and b) materially affected by other activities outside of the scope of the project:

Table 8-22 Identification of Applicable VECs, Spatial and Temporal Boundaries

VEC	SUMMARY OF WWTP IMPACT IN ISOLATION	SPATIAL EXTENT	TEMPORAL EXTENT
Air Quality	(Negative Impact) - Deterioration of air quality in the localised area, during construction, due to the emission of dust	Airshed within 1km of the WWTP	Construction Phase (~12 months)
	(Negative Impact) - Deterioration of air quality in the localised area, during operation, due to the emission of air pollutants from the WWTP.	Airshed within 5km of the WWTP	Operational lifespan (25 years)
Communities	(Negative Impact) - The construction phase of the project has the potential to generate significant traffic volumes associated with the transportation of equipment and materials to the site, most notably the import of fill material that may be required to raise the development platform. Whilst the project is located within an industrial district there is potential for construction related road traffic to pass through more sensitive areas outside of the immediate project area, increasing the risk to pedestrians and other road users.	Localised road network around the WWTP Major roads and intersections leaving the city of Zrenjanin (in the case of construction materials import by road)	Construction Phase (~12 months)

VEC	SUMMARY OF WWTP IMPACT IN ISOLATION	SPATIAL EXTENT	TEMPORAL EXTENT
Water Quality	(Negative Impact) - Due to the location of the WWTP within the floodplain of the Begej River there is a potential for damage to the facility and the release of pollutants into the Begej River (sludges, untreated effluents, chemicals). The design of the WWTP has been based on information from the Municipality related department in Vojvodina Vode and is based on the maximum level of Begej river is of 77.14m. To include a conservancy, factor the design of the WWTP has considered 80.0 m as FGL. It has not been possible to determine within the ESIA whether flood levels associated with climate change have been specifically taken into consideration in the determination of the FGL.	Downstream of the WWTP on the Begej River as far as the Carska Bara Nature Reserve (IUC N Category IV) located approximately 6 km (off channel) downstream of the discharge area.	Operational lifespan (25 years)
	(Positive Impact) - Improvement of water quality in the Begej River downstream of the discharge point. This will result in improved instream and marginal habitat conditions, as well as improved water quality for biota using the water, and an associated increase in biodiversity should the water quality improve in the Begej River. This is also likely to benefit the water quality of the Carska Bara Nature Reserve.	Downstream of the WWTP on the Begej River as far as the Carska Bara Nature Reserve (IUC N Category IV) located approximately 6 km (off channel) downstream of the discharge area.	Operational lifespan (25 years)
Visual and Aesthetics	(Negative Impact) - There could be a noticeable change in aesthetics viewed from a small residential cluster 200m north of the WWTP (200m). The overall impact significance is very low during construction as the impact duration will be short term. The permanent presence of the WWTP could however have a greater impact on this receptor location due to its permanence.	The foreground - a distance of 1 km from the project and from where details such as colour, texture, and form are highly visible	Operational lifespan (25 years)

IDENTIFICATION OF OTHER ACTIVITIES AND DRIVERS

In this section other existing and reasonably predictable projects and human activities that do/would affect the VEC have been identified.

Projects identified in the Spatial Plan of the City of Zrenjanin

The identification of regional projects was based on the Spatial Plan of the City of Zrenjanin 11/11 and 32/15. The plan was developed *inter alia* based on the Law on the Spatial Plan of the Republic of Serbia, from 2010 to 2020, which sets out the development goals for the region under various categories, for instance ‘development of renewable energy sources’, and ‘development of waste management infrastructure’.

Table 8-23 identifies planned projects as having the potential to compound the construction phase impacts associated with the proposed project, and vice versa. The location and potential influence of these projects is considered in this RCIA.

Table 8-23 Planned projects in the Spatial Plan of the City of Zrenjanin

CATEGORY	PROJECT SUMMARY
Road Infrastructure	— Several road construction and upgrade projects were proposed during the planning period (2010-2020); however the only construction project that is currently ongoing /

CATEGORY	PROJECT SUMMARY
	may be ongoing at the time of the construction of the WWTP project is the 'Banat Highway' Project. It can be reasonably predicted that in addition to the Banat Highway project there could be other minor road upgrade and constructions within a 5-10 km radius of the project.
Flood Protection	Development of defensive embankments along the watercourses Tamiš, Begej and Tisa, for achieving the required degree of protection against centenarians or two hundred years of 'great waters' / flood event. It could not be ascertained in the ESIA what the temporal extent and spatial extent of these projects is; it was therefore assumed that projects are ongoing and that these could potentially have an impact on flood flows in the Begej River.
Energy (gas pipelines)	The plan identifies the following major gas pipeline projects in the region. The stage of progress of these projects was not determined in the ESIA. These projects are located to the North of Zrenjanin and are not reasonably expected to contribute cumulatively to the impacts of the WWTP. Construction of a two-way gas pipeline between Gospodjinci and Banatski Dvor, and the south stream main gas pipeline. In January 2019, Russian and Serbian gas companies Gazprom and Srbijagas signed a Memorandum of Understanding (MoU) on the project for the capacity expansion of Banatski Dvor underground gas storage by 300 million cubic meters to a total of 750 million cubic meters. Construction of medium gas supply pipelines pressure, measuring and regulating stations and distribution gas pipeline of the following settlements: Taraš, Lukino Selo, Orlovat, Tomaševac, Belo Blato, Knićanin, Perlez, Čenta and Farkaždin.
Energy (petroleum pipelines)	Construction of the product pipeline system: Sombor-Novi Sad-Pancevo-Smederevo-Jagodina-Nis; which would transport petroleum products. The spatial and temporal extent of these projects was not determined in the ESIA; however, this is immaterial as the projects are not reasonably expected to contribute cumulatively to the impacts of the WWTP.
Water Supply	Several projects were proposed for the upgrading and reconstruction of the existing distribution network, construction water towers, arrangement or total relocation and formation of new springs in some populated places in the planning period. The spatial and temporal extent of these projects was not determined in the ESIA; however, this is immaterial as the projects are not reasonably expected to contribute cumulatively to the impacts of the WWTP.

Southeast Industrial Zone

As the WWTP is to be established in the Zrenjanin Southeast Industrial Zone, it is anticipated that new industrial facilities will be developed in this area in the future. The spatial and temporal extent of these projects was not determined in the ESIA. The RCIA is based on a general assumption that industries with similar air emissions to the WWTP could come online in future.

Future WWTP Phases

Land has been earmarked in the vacant land around the proposed WWTP for future phases of development which may include additional wastewater treatment and water recovery facilities. There is no specific information on these projects therefore temporal extent is unknown. For the purposes of the RCIA it is assumed that future phases could occur within the 25-year lifespan of the WWTP.

Climate Change (Environmental Driver)

Climate change projections indicate that Serbia and the Western Balkans⁸² face a high probability of continuing temperature increases, along with more frequent and prolonged droughts and wildfires. Over the past two decades, droughts, floods, exceptionally harsh winters and other weather-related extreme events have caused major physical damage, financial losses and even deaths, with significant impacts on the economy, especially in

⁸² <https://www.climatelinks.org/resources/climate-risk-profile-serbia>

the agricultural sector. Climate change is an environmental driver of potential cumulative impacts of the WWTP insofar that flood levels of the Begej River could be affected.

Water Quality Improvements in the Begej River (Environmental Driver)

The levels of wastewater management within Serbia are significantly lower than the average levels within the EU, with only 10% of wastewater being treated prior to discharge. These discharges are significant sources of water pollution in the river systems; and, related to this Project, the Begej River is generally considered one of the most polluted water courses in the province of Vojvodina. As a transboundary river, coming from Romania, the Begej River enters Serbia being already under pressure from various upstream industrial, domestic and agricultural pollution sources.

Following the above, it can be reasonably predicted that water quality in the Begej River will improve over time as a result of sanitation projects within the catchment.

IDENTIFICATION OF CUMULATIVE IMPACTS ON VECs

This section provides a qualitative evaluation of the potential cumulative effects in **Table 8-24** below.

Table 8-24 Evaluation of Cumulative Effects

ESIA IMPACT REFERENCE	CUMULATIVE EFFECT
Impact Ref 1: Deterioration of air quality in the localised area during construction, due to the emission of dust.	It is possible that dust generated from simultaneous construction projects in the area could result in the addition of dust to the emissions from the project. Based on the review of regional projects in the Spatial Plan of the City of Zrenjanin, and based on the knowledge of the local EIA consultant, the only major project that will be ongoing is the construction of the ‘Banat Highway’ – a bypass road around the town of Zrenjanin planned for separation of transit flows from the state road M-7 (Novi Sad-Zrenjanin) to the state road M-24 (Zrenjanin-Belgrade). For the most part, this construction project occurs outside of the city limits (the closest construction activity is in the northeast of the city of Zrenjanin approximately 5km from the WWTP). Due to the localised nature of dust impacts (expected to occur within a radius of less than 1km) it is unlikely that the area of impacts on the airshed would overlap. As such no incremental impact is anticipated.
Impact Ref 2: Deterioration of air quality in the localised area during operation, due to the emission of air pollutants from the WWTP	For cumulative emissions to occur it would be necessary for the same pollutants emitted from the WWTP to be generated in the area in the future. It is noted that the baseline cumulative impact on air quality (i.e. the WWTP operating simultaneously with the existing industry in the area) has been assessed as part of the ESIA by adding the predicted emissions from the WWTP with the measured air quality at the site. As the WWTP is in the Zrenjanin Southeast Industrial Zone it is anticipated that new industrial facilities will be developed in this area in the future, which may emit a similar profile of emissions to the WWTP. This could incrementally increase the impact on the airshed. As the nature of these industries and the temporal extent cannot be reasonably predicted it is not possible to predictively assess the cumulative impact. The onus for the assessment of cumulative impacts would be on the developers of future projects (as part of the EIA – if required); and the responsibility for the monitoring of air quality in Zrenjanin belongs to the Government of Serbia.
Impact Ref 11: Construction traffic risks to communities during the construction and decommissioning of the WWTP	It is possible that construction traffic generated from other projects in the area could add to the traffic volumes of the WWTP construction project. These cumulative volumes could be experienced in the road network near the WWTP construction project; or, in areas outside of the immediate project area (e.g. along main roads into the Zrenjanin area). This combined effect on traffic could result in an additional risk to pedestrians and other road users. As indicated previously, the main construction project in the region is the development of the ‘Banat Highway’; however, there could be other projects occurring within the municipality as well.

**ESIA IMPACT
REFERENCE**

CUMULATIVE EFFECT

	Without information on the traffic volumes that could be generated by the WWTP construction project, and other projects, and the associated routing of vehicles, it is not possible the accurately determine whether this cumulative impact will occur. To cater for this, the need for the recommended Traffic and Transportation Safety Management Plan is highlighted. <table><tr><th colspan="3">WWTP IN ISOLATION</th></tr><tr><th>CRITERION</th><th>(POST MITIGATION)</th><th>CUMULATIVE IMPACT</th></tr><tr><td>Character</td><td>Negative</td><td>Negative</td></tr><tr><td>Magnitude</td><td>Very High</td><td>Very High</td></tr><tr><td>Extent</td><td>Local</td><td>Local</td></tr><tr><td>Reversibility</td><td>Irreversible</td><td>Irreversible</td></tr><tr><td>Duration</td><td>Permanent</td><td>Permanent</td></tr><tr><td>Probability</td><td>Improbable</td><td>Low</td></tr><tr><td>Significance</td><td>Low</td><td>Moderate</td></tr></table>	WWTP IN ISOLATION			CRITERION	(POST MITIGATION)	CUMULATIVE IMPACT	Character	Negative	Negative	Magnitude	Very High	Very High	Extent	Local	Local	Reversibility	Irreversible	Irreversible	Duration	Permanent	Permanent	Probability	Improbable	Low	Significance	Low	Moderate
WWTP IN ISOLATION																												
CRITERION	(POST MITIGATION)	CUMULATIVE IMPACT																										
Character	Negative	Negative																										
Magnitude	Very High	Very High																										
Extent	Local	Local																										
Reversibility	Irreversible	Irreversible																										
Duration	Permanent	Permanent																										
Probability	Improbable	Low																										
Significance	Low	Moderate																										
Impact Ref 37: Pollution risk to the Begej River associated with Climate Change (increased flooding)	The WWTP has been designed with a FGL of 80.0m above mean sea level (amsl), which includes a design freeboard of 2.86m amsl in relation to the maximum level of Begej River which is 77.14m amsl. The ESIA recommends the need for confirmation of whether this is sufficient to withstand increase flooding associated with climate change. In addition to the above, based on the Spatial Plan of the City of Zrenjanin it is understood that defensive embankments along the watercourses Tamiš, Begej and Tisa, were recommended for the planning period 2010 – 2020 for achieving the required degree of protection against centenarians or two hundred years of ‘great waters’ / flood event. It is unclear whether these flooding measures were implemented; nor whether these measures would have an effect on the flood-levels in the vicinity of the proposed WWTP (i.e. by containing flood events upstream there is the possibility of increasing downstream flood intensity). In order to address this potential cumulative impact, it is recommended that confirmation is obtained from the municipality, on whether the flood-level of the Begej River takes the defensive projects into account. The assessment of significance of this impact at a cumulative level has already been assessed in the impact section. There is no change to significance associated with the RCIA.																											
Impact Ref 23: Water quality improvement associated with the discharge of treated wastewater into the Begej River	It can be reasonably predicted that water quality in the Begej River will improve over time as a result of sanitation projects within the catchment. This will have a positive incremental cumulative effect on water quality. <table><tr><th colspan="3">WWTP IN ISOLATION</th></tr><tr><th>CRITERION</th><th>(POST MITIGATION)</th><th>CUMULATIVE IMPACT</th></tr><tr><td>Character</td><td>Positive</td><td>Positive</td></tr><tr><td>Magnitude</td><td>Medium</td><td>High</td></tr><tr><td>Extent</td><td>National</td><td>National</td></tr><tr><td>Reversibility</td><td>Reversible</td><td>Reversible</td></tr><tr><td>Duration</td><td>Long Term</td><td>Long Term</td></tr><tr><td>Probability</td><td>Definite</td><td>Definite</td></tr><tr><td>Significance</td><td>Moderate</td><td>Moderate</td></tr></table>	WWTP IN ISOLATION			CRITERION	(POST MITIGATION)	CUMULATIVE IMPACT	Character	Positive	Positive	Magnitude	Medium	High	Extent	National	National	Reversibility	Reversible	Reversible	Duration	Long Term	Long Term	Probability	Definite	Definite	Significance	Moderate	Moderate
WWTP IN ISOLATION																												
CRITERION	(POST MITIGATION)	CUMULATIVE IMPACT																										
Character	Positive	Positive																										
Magnitude	Medium	High																										
Extent	National	National																										
Reversibility	Reversible	Reversible																										
Duration	Long Term	Long Term																										
Probability	Definite	Definite																										
Significance	Moderate	Moderate																										

**ESIA IMPACT
REFERENCE**

CUMULATIVE EFFECT

Impact Ref 25: Landscape and visual impacts associated with the operation of the WWTP	Future phases of development in the land adjacent to the WWTP will increase the extent of the aesthetic changes viewed from small residential cluster to the north, and the residential area to the west on the opposite bank of the Begej River. The onus for the assessment of impacts and mitigation would be with the future developers of the site.	
	WWTP IN ISOLATION	
	CRITERION	(POST MITIGATION) CUMULATIVE IMPACT
	Character	Negative
	Magnitude	Low
	Extent	Local
	Reversibility	Irreversible
	Duration	Long Term
	Probability	Low
	Significance	Moderate

9 GENERAL RECOMMENDATIONS

This section includes general recommendations to enhance the positive environmental and impacts identified within the ESIA. The impact assessment has not been predicated on these recommended measures, as such they are not mandatory.

REHABILITATION OF THE EMBANKMENTS ADJACENT TO THE WWTP

The embankments adjacent to the WWTP for the Aleksandrovački channel (382 m on both banks) and the Begej River (910 m) should be rehabilitated to improve the phytoremediation (biological cleaning of water) capacity of the riverbanks to further enhance the positive impacts of the project:

- The rehabilitation would improve local biodiversity within the project area and surrounding open areas, post-construction the alien vegetation within the undeveloped areas within the project boundary should be replaced with indigenous vegetation. Studies by Threlfall et al. (2017) have shown that reducing exotic vegetation cover and increasing indigenous vegetation cover in the form of increased tree cover, understorey vegetation volume and percentage of native vegetation will benefit a broad array of biodiversity in rehabbed areas. The rehabilitation efforts should include indigenous flowering vegetation known to attract pollinating animals (birds, small mammals and insects such as bees, butterflies and moths).
- Additional however more intensive rehabilitation strategies would involve the reshaping of the client owned riverbanks, with focus on the unnaturally steep banks which should be stabilized by re-establishing and re-profiling a more natural hydrological gradient. These steep banks are often prone to large scale erosion which silts up the watercourse, with a large loss of bankside vegetation and topsoil.
- An angle of approximately 35 degrees is recommended (depending on the physical properties of the bank material). Angle's steeper than this should be avoided. As a result of gentler gradients, the width of the micro and macro channel will be wider than existing channel widths (this includes the Aleksandrovački channel). This is beneficial as it will accommodate higher flows during flood peaks while the wider channel will support greater volumes of vegetation which will assist in improved phytoremediation. The gentle slope of the reshaped watercourse banks will promote natural repopulation of bank side plants and to limit the erosion potential.

AQUATIC BIOMONITORING

A biannual aquatic biomonitoring programme is recommended to determine the efficacy of the treatment facility to achieve National biodiversity goals in the downstream reaches. An aquatic biomonitoring programme is an essential management tool. The monitoring programme should be designed to enable the detection of potential negative/ positive impacts brought about by the treated effluent discharges. Table 9-1 highlights some important aspects to monitor in reference to aquatic biota for the life of the WWTP facility.

Table 9-1: Aquatic Ecology Monitoring Plan

LOCATION	MONITORING OBJECTIVES	FREQUENCY OF MONITORING	PARAMETERS TO BE MONITORED
Current sites used in this assessment together with additional strategic sites located on the Begej River upstream and downstream of the discharge point.	Overall Aquatic Present Ecological Status.	Biannual (high and low flow seasons)	Standard River Ecosystem Monitoring Programme (Ecostatus) methods.
Current sites used in this assessment together with additional strategic sites located on the Begej River upstream and downstream of the discharge point.	Determine if water quality deterioration is occurring.	Biannual (high and low flow seasons)	Macroinvertebrate community should not decrease/deteriorate.
		Bi-monthly (operation phase)	Chemical parameters used for National WWTP discharge standards.

LOCATION	MONITORING OBJECTIVES	FREQUENCY OF MONITORING	PARAMETERS TO BE MONITORED
Current sites used in this assessment together with additional strategic sites located on the Begej River upstream and downstream of the discharge point.	Determine if water/habitat quality deterioration is occurring.	Biannual (high and low flow seasons)	Monitor for presence of fish.

10 CONCLUSION

The levels of wastewater management within Serbia are significantly lower than the average levels within the EU, with only 10% of wastewater being treated prior to discharge. These discharges are significant sources of water pollution in the river systems; and, related to this Project, the Begej River is generally considered one of the most polluted water courses in the province of Vojvodina. As a transboundary river, coming from Romania, the Begej River enters Serbia being already under pressure from various upstream industrial, domestic and agricultural pollution sources. The current pollution levels in the Begej River are a severe threat to public health and aesthetics for the inhabitants of the Municipality of Zrenjanin and downstream water users, as well as to the natural ecosystems.

Currently untreated wastewater from the Municipality of Zrenjanin and surrounding settlements is discharged into the Begej River, via the Aleksandrovacaki canal, contributing to the already elevated pollution levels of the Begej River impacting water users and natural ecosystems.

The justification for the Project is therefore to establish a WWTP to treat the wastewater prior to discharge into the Begej River, via the Aleksandrovacaki canal, thereby reducing the level of pollution/contaminants entering the river system. The Project is aligned with the Serbian national goals in environmental protection, which correspond to European Union (EU) objectives, primarily those set in the Urban Wastewater Treatment Directive (European Council Directive 91/271/EEC).

Whilst the ESIA has identified a significant number of potential detrimental environmental and social impacts these can largely be reduced in significance to low status. Detailed measures have been developed to mitigate the full scope of impacts identified in the ESIA including an Environmental and Social Management Plan (ESMP).

The following key recommendations are made as an outcome of the ESIA:

- 1) Begej Water should consider and implement as far as is reasonably possible the recommendations contained in the ESIA Report (Section 8 [Impact Assessment]).
- 2) Begej Water should implement the ESMP during the construction and operational phases; this applies to the main contractor and all subcontractors involved in the construction and O&M phases of the project.
- 3) The ESIA recommendations and ESMP are critical environmental management tools to be implemented during the construction phase; however, their effectiveness is underpinned by the level of adoption by the construction contractor. To this end, these documents should be made available to the contractor for inclusion in its own environmental and social management system.
- 4) Begej Water should implement an Environmental and Social Management System (ESMS) in line with the requirements of IFC Performance Standard 1 and guided by the Environmental and Social Management System (ESMS) Implementation Handbook (General, 2015). A guideline is provided within the ESMS.
- 5) Begej Water must implement the ESCP (**Appendix D**) to address a broader requirements of the IFC Performance Standards and to manage EHS aspects over the life of the project.
- 6) Begej Water should develop a legal register as part of the ESMS which identifies all legal compliance requirements and obligations in terms of Serbian and EU legislation relating to EHS aspects.
- 7) Begej Water should develop the following plans as recommended in the Best Available Techniques (BAT) Reference Document on Waste Treatment (WT BREF)
 - i) Odour management plan.
 - ii) Noise management plan
 - iii) Accident management plan.
 - iv) WWTP Sludges and Residues Management Plan.
- 8) Begej Water should develop the following plans as recommended in the ESIA report / by WSP's ESIA specialists:

- i) Storm water and erosion control management plan
 - ii) Alien plant management plan
 - iii) Plan for the prevention of spills and leaks of hazardous materials
 - iv) Infrastructure monitoring and service plan
 - v) Traffic and transportation safety management plan
 - vi) Groundwater Monitoring Plan
- 9) It is recommended that Begej Water undertakes the following environmental monitoring as a minimum. Additional monitoring requirements that are required in terms of the pending Serbian EIA approval must also be undertaken as specified.
- i) Noise: Since noise impacts may result during the construction phase, it is recommended that at least one noise monitoring campaign is initiated during this phase. Additionally, annual noise monitoring in the first year of the operational phase should be implemented to confirm any impacts on receptors and assess the need for any additional mitigation measures.
 - ii) Air Quality: Fenceline monitoring of H₂S must be undertaken to provide real-time indicator of potential odour impacts.
- 10) The following general (non-mandatory) recommendations have been provided to enhance the positive environmental impacts identified within the ESIA:
- i) A biannual aquatic biomonitoring programme is recommended to determine the efficacy of the treatment facility to achieve National biodiversity goals in the downstream reaches. An aquatic biomonitoring programme is an essential management tool. The monitoring programme should be designed to enable the detection of potential negative/ positive impacts brought about by the treated effluent discharges. Table 7 11 highlights some important aspects to monitor in reference to aquatic biota for the life of the WWTP facility.
 - ii) A recommendation of the ESIA that could lead to ecological enhancement of the site is to rehabilitate the embankments of the Begej River adjacent to the WWTP. This could improve the phytoremediation (biological cleaning of water) capacity of the riverbanks to further improve water conditions related to the proposed project activities.
- 11) The ESIA is limited to the project description as contained in this report. Any changes in the project description that have potential to materially affect the findings of the ESIA should be evaluated by Begej Water, as appropriate, in accordance with its own ESMS.
- 12) The ESIA identifies the potential for increased flooding in Serbia due to climate change. Whilst the design of the WWTP includes a freeboard of 2.86m it has not been confirmed that this takes into consideration the potential for climate change related flood risk. It is a key recommendation of the ESIA that this confirmation is obtained by a suitably qualified person within the design team prior to finalisation.
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- Website <https://vodevojvodine.com> (Public Water Management Company “Vode Vojvodine”)
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- Website www.hidmet.gov.rs (Republic Hydrometeorological Service of Serbia)
- Website www.jpp.gov.rs (Public Private Partnership Commission)
- Website www.paragraf.rs (online database of legal acts)
- Website www.psp.vojvodina.gov.rs (AP Vojvodina Secretariat for Agriculture, Forestry and Water Management)
- Website www.rdvode.gov.rs (Republic Water Directorate)
- Website www.region.vojvodina.gov.rs (AP Vojvodina Secretariat for Regional Development, Interregional Cooperation and Local Self-Government)
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- Website www.vojvodina.gov.rs (Government of AP Vojvodina)
- Website www.zrenjanin.rs (City of Zrenjanin)
- Website/online database www.stat.gov.rs (Statistical Office of the Republic of Serbia)

APPENDIX

A MONITORING DATA / REPORTS



APPENDIX

A-1 *ENVIRONMENTAL NOISE MEASUREMENT REPORT (ANAHAM LABORATORIJA, 2021)*

APPENDIX

A-2 *SOIL ANALYSIS REPORT (ANAHAM LABORATORIJA, 2021)*

APPENDIX

A-3 *WATER ANALYSIS REPORT (ANAHEM LABORATORIJA, 2021)*

APPENDIX

A-4 *GROUNDWATER ANALYSIS REPORT (ANAHM LABORATORIJA, 2021)*

APPENDIX

A-5 *AIR QUALITY ANALYSIS REPORT (ANAHM LABORATORIJA, 2021)*

APPENDIX

B

STAKEHOLDER ENGAGEMENT PLAN



APPENDIX

C ENVIRONMENTAL AND SOCIAL MANAGEMENT PLAN (ESMP)

APPENDIX

D

ENVIROMENTAL AND SOCIAL
COMMITMENT PLAN (ESCP)

