FICHTNER

Final Report

Task 1 - ESSRA Report

Renewable Energy Programme ESM

KfW

ENGINEERING CONSULTING

Contact

Fichtner GmbH & Co. KG
Sarweystrasse 3
70191 Stuttgart
Germany

www.Fichtner.de

Melanie Siems
+49 (711) 8995 235
+49 (163) 8995 235
Melanie.Siems@Fichtner.de

Fichtner GmbH & Co. KG

Document approval

	Name	Signature	Position	Date
Prepared by:	GEING Armen Bodoyan Christina Mansfeld	Digitally signed by Mansfeld, Christina Date: 2023.01.17 09:24:37 +02'00'	HSE Experts Senior EHS Expert	16.01.2023
Checked by:	Melanie Siems	Digital signiert von Siems, Melanie Datum: 2023.01.17 10:23:29 +01'00'	Project Manager	17.01.2023

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Disclaimer

Table of Contents

List of Figures

List of Tables

List of Abbreviations

Acronym	Definition
ACM	Asbestos Containing Material
BAU	Business As Usual
BMZ	Federal Ministry for Economic Cooperation and Development
BOD	Biological Oxygen Demand
CKZ	Cukali-Krasta Zone
COD	Chemical Oxygen Demand
EHS	Environmental, Health and Safety
EIA	Environmental Impact Assessment
EMAS	Eco-Management and Audit Scheme
ERC	Regulatory Commission for Energy and Water Services
ESCP	Environmental and Social Commitment Plan
ESHS	Environmental, Social, Health and Safety
ESIA	Environmental and Social Impact Assessment
ESM	*Elektrani na Severna Makedonija*
ESMMP	Environmental and Social Management and Monitoring Plan
ESMP	Environmental and Social Management Plan
ESS	Environmental and Social Standards
ESSRA	Environmental and Social Site Risk Assessment
ETS	Emission Trading System
GDP	Gross Domestic Production
GHG	Greenhouse Gases
GIIP	Good International Industry Practice
GRM	Grievance Redress Mechanism
HES	Hydro Energy System
HMS	Hydro Meteorological Service
HPP	Hydro Power Plant
HPS	Hydro Power System
IARM	Institute for Accreditation of the Republic of Macedonia
IBA	Important Bird Area
IFC	International Finance Corporation
ILO	International Labor Organization
IPA	Instrument for Pre-Accession Assistance
ISO	International Organization for Standardization
ISRSM	The Institute of Standardization of the Republic of North Macedonia
IUCN	International Union for Conservation of Nature
JSC	Joint Stock Company
LHPP	Large Hydropower Plants
LOTO	Lock Out Tag Out
m.a.s.l.	Meter above sea level
MEPP	Ministry of Environment and Physical Planning
MSDS	Material Safety Data Sheet
NGO	Non-governmental Organization

Acronym	Definition
NPAA	National Program for the Adoption of the Acquis Communautaire
NSSD	National Strategy for Sustainable Development
OHL	Overhead Transmission Line
OHS	Occupational Health & Safety
ONAN	Oil Natural Air Natural
ONAF	Oil Natural Air Forced
PBA	Prime Butterfly Area
PCB	Polychlorinated Biphenyl
PIU	Project Implementation Unit
PPE	Personal Protective Equipment
RNM	Republic of North Macedonia
SEI	State Environmental Inspectorate
SEP	Stakeholder Engagement Plan
TSS	Total suspended solids
SMM	Serbo-Macedonian Massif
UNFCCC	United Nations Framework Convention on Climate Change
WEEE	Waste from Electrical and Electronic Equipment
WHO	World Health Organization
WMZ	West-Macedonian Zone

1 Non-Technical Summary

Project Scope: Considering the condition of the 6 hydropower plants (HPP) of Vrutok, Vrben, Raven, Tikves, Spilje and Globochica and the years of their construction (1950s and 1960s), JSC ESM has started with the implementation of the project for rehabilitation of six Hydropower Plants and associated facilities. These HPPs represent 85% of the total installed hydropower capacity in Macedonia and have an important part in the control of the whole Energy Power Sector in Macedonia. The present Project is the continuation of the rehabilitation activities financed in the previous phases by World Bank and KfW Bank and is the result of the identified deficiencies in the previous phases.

Project Activities: Rehabilitation activities will be performed on all 6 HPPs and their intake infrastructures in HES Mavrovo, HES Crn Drim and HPP Tikves.

The project activities consist of replacement or improvement of existing facilities including repair or replacement of hydro- and electromechanical components (e.g. valves, turbines, generators, transformers, etc.) and repairs and improvements to the existing structures. The project also involves the renewal of the conductors of a 13.85 km long 35 kV transmission line between the Vrben HPP and the Vrutok HPP, as well as the rehabilitation of some water intakes of the water conveying channels/tunnels system.

Project Objectives: The upgrade of the 6 HPPs and related infrastructures will increase the reliability and safety as well as the efficiency of the HPP's operation. The replacement of the outdated hydro-mechanical equipment and the improvement of the infrastructure will contribute to reduction in water losses, and thus, allow for better use of scarce water resources.

The rehabilitation project is expected to have several positive ESHS impacts, such as:

- additional power generation from additionally installed capacity and reduced losses
- increased stability in electricity generation (through new turbines and generators) and electricity transmission (reduction of losses on the overhead line);
- reduced water losses and more efficient water utilization;
- improved water management and control of the biological minimum flow;
- reduced water seepage and improved dam stability.

Project Environmental Categorization: According to the KfW Sustainability Guideline (February 2022) the Project is categorized as Category B+, triggered by the location of part of the works in or nearby protected areas (some of the facilities from HES Mavrovo are located within the National Park (NP) Mavrovo and NP Shar Planina, and HPP Tikves near the Strict Nature Reserve) and because single significantly adverse environmental and social impacts and risks may occur.

Project ESHS Requirements and Permitting: The procedure for EIA is regulated in North Macedonia by the Law on Environment (Official Gazette of RNM). The first step of the EIA procedure is the submission of the Notification Letter to the Ministry of Environment and Physical Planning (MoEPP), who, based on the type of project activities, will decide on the elaboration of a full ESIA for large-scale projects; or an EIA Report (Elaborate) for small-scale projects. According to the national environmental legislation ESM has submitted the Notification Letter to the MoEPP in order to inform about the planned rehabilitation activities. Based on the submitted Notification Letter and type of the project activities (rehabilitation) the MoEPP issued Decision no.11-3621/2 from 03.08.2021 that there is no need for the preparation of an EIA Report for the Project.

To allow KfW to take a final decision on the financial support of the Project, the following documents shall be developed and to be approved by KfW and ESM:

- Environmental and Social Site Risk Assessment (ESSRA): aims to identify and assess potentially negative and positive environmental and social risks and impacts of the rehabilitation project, while at the same time assuring compliance with national and international environmental and social legal requirements;
- Stakeholder Engagement Plan (including Grievance Mechanism);
- Environmental and Social Management Plan (Site specific ESMP - separate document): provides measures to avoid, minimize, or mitigate potential negative environmental and social impacts and risks, while striving to enhance benefits to local communities and the environment;
- Environmental and Social Commitment Plan (ESCP - separate document) sets out measures and actions, any specific documents and plans, as well as the timing for each of these to be implemented by the borrower (ESM) and is a key requirement of KfW as a part of the Special Agreement of Loan Agreements.

Project locations: The 6 HPPs are in different parts of the country. HES Mavrovo is located in the western part of the country, including the municipalities of Gostivar, Vrapcishte, Mavrovo and Rostushe and includes the following components: the Mavrovo cascade with the Vrben HPP, the Mavrovo reservoir and the Vrutok and Raven HPPs, and a 124 km long water conveyance system with 13 Tyrolean type of intakes. Part of the conveyor system as well as the Vrben HPP and the Mavrovo reservoir are located in the zone of active management and zone of sustainable use of Mavrovo National Park (NP). The Vrutok and Raven HPPs and parts of the conveyor system border also with National Park Mavrovo. In the vicinity of the intakes (Stirovica from Gorna Radika and intakes from Sharski Vodi) there are no houses or other objects or facilities, except the 4 warehouses/maintenance operators auxiliary buildings related to the intakes. In the area of direct influence of HPP Vrben, there are a few houses from the settlement Vrben.

In the direct area of influence of HPP Vrutok is settlement Vrutok and in the direct area of influence of Raven is settlement Raven.

In the area of influence of 35 kV transmission line (starting from Vrutok HPP to Vrben HHP and crossing Mavrovo NP) belongs to settlement Mavrovi Anovi, Recane and Vrutok, as well as other objects (e.g religious objects, cemeteries, local roads, river Vardar, part of NP Mavrovo).

Gorna Radika Water Supply System (WSS) dams up waters from the upper part of the Radika River, in the region of Korab and Shara Mountains. Part of the waters, originally belonging to the Adriatic water basin, have been diverted to the Aegean basin through the Vardar River. It consists of the 6 main intakes: Stirovica, Crn Kamen, Agina Reka, Brodecka Reka, Krakornicka Reka and Bogdevska Reka.

Gorna Radika water system as part of the HES Mavrovo, collects waters from the upper water stream of the Radika River, from the mountain peaks of Korab, located within the NP Mavrovo. This system consisting of water intake Stirovica (located at 1,450 m.a.s.l), then goes to the HPP Vrben and then is discharged in Mavrovo accumulation. The nearest populated area, relevant for the Gorna Radika system, is settlement Vrben, near the HPP Vrben. This water is used for mostly for electricity production (HPP Vrben) and for recreation and tourism activities (fishing in Mavrovo lake). Indirectly this water is used for irrigation purposes trough the final water recipient – Vardar River.

The Sharski Vodi Water Supply System (WSS) was constructed in the period 1960-1970. It collects waters from the Shara Mountain and consists of 13 main intakes, named according to the rivers: Ulivericka, Kamenjanska, Fiskajet, Novoselska, Mazalec, Lomnicka, Dumkovo, Vraca, Mazdraca, Kucibabska, Prosevska, Vranjovska, and Nevestinska. All intakes are located between 1354 and 1236 m.a.s.l. The fkm^2 with an average yearly water inflow of 144 million m^3.

The Mavrovo Dam is a soil-dike (rockfill) dam. It is 61.9 m high with a crown length of 210 m and a width of 7 m. The dam's volume is 767,747 m^3 of land dike. The dam has a concrete overflow diversion tunnel and foundation outlet. The length of the concrete overflow diversion tunnel is 470 m. The dam was finalized in 1952 when the reservoir was filled. The Mavrovo reservoir is a major water storage facility for the HES Mavrovo. The reservoir covers an area of 13.2 km^2, at a height of 1,233 m.a.s.l. The maximal depth is 50 m. The storage capacity is 274.8 million m^3.

HPP Spilje is the largest storage hydropower plant in the catchment area of the Crn Drim river near Debar. The hydropower plant is located at the confluence of the Crn Drim and Radika rivers, so the inflow regime in the reservoir depends on the regime of the two rivers. In the vicinity of the HPP is located the city of Debar. The water from the reservoir in Spilje is used mostly for electricity production, then for recreation and tourism activities (fishing in Spilje lake). HPP Spilje is located near the City of Debar, at the foot of Spilje Dam, along the riverbeds of Crn Drim and Radika rivers. HPP Globocica is located halfway between Lake Ohrid and City of Debar, about 8 km downstream of Globocica Dam. HPP Spilje accumulation volume is 506 million m^3 water, with useful volume of 218 million m^3 water. The reservoir is mainly fed by Crn Drim and Radika rivers, so inflows regime depends on water flows from both rivers. The inflow from the Crn Drim River during the year is quite stabile due to existence of two water storages upstream: Ohrid Lake and Globocica reservoir.

HPP Tikves is located about 15 km west of City of Kavadarci, at the foot of the Tikves Dam, which impounds the Crna River. HPP Tikves accumulation volume is 479 million m^3 water, with useful volume of 309 million m^3 water. In Figure 1: Photos from site meetings and inspections, September 2022 some site visit photos from 12.09.-16.9.2022, are given.

Figure 1: Photos from site meetings and inspections, September 2022

Stakeholder Engagement Plan (SEP): Stakeholder mapping to identify the stakeholder groups who may be affected by and/or may have an interest in/influence on the Project, including initial consultation of relevant stakeholders was done. Based on this the SEP (separate document) was prepared to guide stakeholder engagement activities to be undertaken during the Project implementation. The SEP is

aligned with the World Bank ESS 10. Grievance mechanism proportionate to the potential risks and impacts of the project was established in the frame of the SEP.

Methodology and Approach: Methodology for development of ESSRA includes different types of activities: (i) desktop-based review/research of available data related to the project, (ii) review of associated Environmental, Social and H&S policies and standards of ESM, (iii) review of applicable international E&S and H&S legal framework (iv) collection of social baseline data from secondary and primary sources, including site visits and meetings with ESM representatives, (v) preparation of the Stakeholder Engagement Plan (vi) identification of the area of direct influence for each project location; (vii) identification of potential E&S and H&S risks and impacts and their prioritization/assessment (vii) public disclosure of the document.

The consultant has performed review of the overall available documentation relevant to the Project, including all documents received from ESM/Branch offices and KfW, as well as other documentation available on the websites of ESM and collected from relevant municipalities, NP Managements and other institutions. National and international regulatory, policy, and institutional framework for the proposed Project's planned rehabilitation measures were analysed and their relevance to the project was assessed. Environmental and social baseline conditions were analysed based on the available documentation and conducted site visits on all 6 HPPs, relevant intakes and dams with all infrastructure and facilities.

For the purposes of the development of the ESSRA report, site verification visits were undertaken by two separate teams: the social team and the environmental & technical experts' team. The social team performed the site visits from the 5th to the 9th of September 2022, while the environmental & technical team performed the site visits from the 12th to the 16th of September 2022. Also, meetings with the representatives from NP Mavrovo and NP Shar Mountain were performed.

Project's Environmental & Social Baseline: The wider area of influence is defined on the level of the municipalities. In that context there are five project affected municipalities within three statistical regions. The municipalities of Gostivar (HPP Raven and Vriutok) and Mavrovo and Rostushe (HPP Vrben and Mavrovo dam) belong to the Polog Region, the municipalities of Debar (HPP Spilje) and Struga (HPP Globocica) belong to the Southwest Region and the municipality of Kavadarci (HPP Tikves) belongs to the Vardar Region. The municipalities are dominated by small and medium enterprises that comprise over 90% of the total number of enterprises. The most popular sector is related to accommodation and food services activities, wholesale and retail trade and less in transport, storage and manufacturing.

According to the geographical location of the 6 HPP's, they have different climatic characteristics ranging from cold continental climate (HPP Vrutok, HPP Raven, HPP Vrben, HPP Spilje and HPP Globocica) to moderate continental climate and some areas even with modified Mediterranean climate (HPP Tikves).

Water streams relevant for the project mainly belong to two watersheds: Vardar River and river Crn Drim. HPP Vrben, Vrutok, Raven and Tikves are located on water streams that belong in watershed of Vardar River. HPP Vrben is located on the water streams from the watershed of river Radika, where trough this HPP the water is directed towards the Mavrovo accumulation and from there towards the HPP Vrutok and HPP Raven directed to river Vardar.

Waters from HPP Spilje (river Radika and river Crn Drim) and HPP Globocica (river Crn Drim) belong to the watershed of river Crn Drim.

Related to the biodiversity and protected areas on the project locations HPP Vrben as part of Mavrovo System is located in the NP Mavrovo, HPP Vrutok and Raven are bordering with the NP Shar Planina (all intakes are located within the NP) and HPP Tikves is in the surrounding (but outside) of the Strict Nature Reserve Tikves as protected area. HPP Globocica is within the proposed protected area Jablanica. Near HPP Globocica, the Nature Park "Drenachka River", IPA "Crn Drim gorge" are located. No protected areas are identified near HPP Spilje. Relevant water sources for the 6 HPPs are: River Radika from Rostushe until the inlet in Debar Lake, Mavrovo lake, River Crn Drim from Struga till the border with Albania, Debar lake, Crna Reka, and Tikves lake.

ESM performs regular water monitoring on the inlet and outlet of each of the intakes. Monitoring is carried out by accredited laboratories for sampling and analysis of surface water. According to the received monitoring report for surface water quality of Vrben HPP and Vrutok HPP, following parameters have been monitored: pH, dissolved oxygen, COD, BOD, nitrites, nitrates, TSS, colour, odour, turbidity, visible waste materials, Cl, SO_4, NH_4, total solids, alkalinity, Fe, Mn, Cr, Zn, Ca, Mg. The water quality parameters do not fully comply with the national limits for surface water quality for the following parameters: pH, dissolved oxygen, COD, nitrites. However, water quality measured on the outlet of the turbines showed the same values as on inlet, so it could be concluded that HPPs activities do not have impacts on surface water quality. Based on the Monitoring report for water quality in Tikves lake on intake and outlet (water laboratory analysis sampling 23.12.2020), following parameters have been monitored: turbidity, COD, total solids, conductivity, pH, dissolved oxygen, BOD, TSS, total phosphorus, ammonia, nitrites, nitrates, chlorides, sulphates, Fe, Mn, oxygen saturation. Also, microbiological analysis (coliforms bacteria, *enterococcus* and *Escherichia coli*) has been performed on the surface water. Water quality parameters do not fully comply with the national limit values for the following parameters: turbidity and phosphorus (corresponding to IV class of water quality); the remaining parameters indicate II – I class of water.

Regarding the reports from pH measurements performed by ESM personnel for pH in HPP Spilje and HPP Globocica, it is evident that the pH is above the limit values for II class of water quality even before the inlet of each HPP.

The HPP Vrben, HPP Raven, HPP Vrutok and HPP Tikves are located in areas of *first (I) degree of noise protection* with respect to their location within the boundaries of the protected areas (National Park Mavrovo, National Park Shar Mountain and Strict Nature Reserve Tikves). The activities that will take place at this project site should observe the limit values of the noise level. (Ld = 50, Le = 50, Ln =40). The HPP Spilje and HPP Globocica are located in *second (II) degree of noise protection* area. Activities at this project sites shall observe the respective allowed limits for noise levels. The activities that will take place at this project site should observe the limit values of the noise level. (Ld = 55, Le = 55, Ln =45).

Main conclusions from the ESHS baseline conditions:

- Even though ESM and Hydro Electrical Systems (HESs) under the management of ESM were/are certified for ISO 9001, ISO 14001 and ISO 45001, the ISO requirements and standards are not practically implemented in all project systems (Mavrovo HES, Crn Drim HES, Tikves HPP). The ESHS management system and related documentation are not updated and or missing, most of the employees are not trained in ESHS MS procedures and its requirements. Considering the fact that rehabilitation works shall be done in parallel with operations this may create a high risk for both the employees of ESM and Construction Contractors' staff.

- Despite the fact that Mavrovo HES operates mainly in Shar Planina and Mavrovo National Parks areas, the Consultant identified a lack of written documentation that would reflect communication and agreements with NPs Authorities. This will need to be improved to avoid an impact on the time frame of the project implementation.
- Hazardous materials/substances and/or chemicals, as well as hazardous waste handling system at all HESs is not known (no evidence provided of proper handling and disposal of waste) and storage conditions are very poor and non-appropriate at all project sites, which can create high risks during the project implementation as rehabilitation works shall be done in parallel to operations.
- Asbestos containing materials (ACM, Class B and F insulation in poles, klingrit gaskets/insulations for pipes) were identified and are planned to be replaced in two HPPs.
- PCB presence in transformer oils is likely, as the transformers to be replaced are dating from 1960s, 1970s.
- The necessity of vegetation cleaning and bushes cutting is likely on small areas in order to get access to the intakes at Shar Planina NP, which will require a special authorization from NPs or MoEPP.

Project ESHS Risks: The Environmental and Social Site Risk Assessment was undertaken for the planned rehabilitation activities of the 6 HPP including consideration of occupational and community health and safety issues by prioritizing the main negative risks related to the works to be undertaken at the sites so that appropriate strategies to address the risks and their associated potential impacts can be developed.

Based on the analysed documentation and the findings from the site inspections the main conclusion is that only few of the identified risks are considered to have a "high" or even "extreme" probability of occurring. Examples to highlight here are the lack of monitoring and implementation of the biological minimum flow, and the presence of asbestos and PCBs is existing equipment. In addition, the significance of the risks was assessed, and classified as "high" or "extreme" when human life would be potentially placed in danger or for activities within or nearby protected zones.

Critical risks are the following:

- the biological minimum flow continues not to be monitored - since this is a situation which presently exists, there is the risk that, without specific efforts of the operator in this direction, this will continue in the future;
- the presence of asbestos and PCBs on site may cause environmental and health risks for the workers and the communities;
- possible rock falls and small landslides activation at intakes system as natural hazards identified in the area of intakes from Sharski Vodi and Gorna Radika can cause injuries of workers or damage of equipment.

High risks are those that will cause persistent reduction in ecosystem function on a landscape scale or significant disruption of an environmental media, or sensitive species, such as loss of a significant portion of a valued species or loss of effective ecosystem function.

High risks are the following:

- all those related to possible water contamination because the works are to be undertaken in an aquatic environment;
- those related to vegetation clearing (pruning of branches of trees as regular maintenance activity which is performed on every 3 years period) in the National Parks along the 35 kV corridor;

- those related to the EHS management systems of the HPPs;
- those related to environmental documentation for all HPPs and especially related to waste management;
- all of those that can cause injuries/loss of life of workers and/or community members.

With the mitigation measures proposed in the ESMP (separate document), the critical and high risks will be reduced to an acceptable level.

The above evaluation does not withstand two important factors:

- The construction works are limited in time, leading to the fact that some of the impacts will be of short-term duration (for example, disturbance to local fauna due to noise emissions);
- The risk assessment is based on pre-mitigation risks and impacts. The construction contractor and the ESM shall develop and implement management plans to tackle the above-identified risks and impacts (as described in ESMP Task 2 and ESCP Task 3).

Recommendations: Based on the above-mentioned findings the following actions are recommended to be implemented by ESM prior to the project implementation:

- Continue to improve implementation of ISO 9001, 14001 and 45001 standards and International ESHS best practices at all HESs under the ESM management and get ESHS compliance required by IFIs prior to the project start, including:
  - regular inspection of firefighting equipment (fire extinguishers),
  - Relevant firefighting means at each working and auxiliary facility,
  - Hazardous materials (oils, lubricants, cylindric gases etc.): proper handling, including storage conditions (ventilation, firefighting means, secondary containments, spill kits, compatibility, labeling, documentation, PPEs), transportation (tools, equipment), regular inspection (storage compatibility, emissions/spills, containment, validity) according to the Material Safety Data Sheets (MSDS),
  - LOTO systems application at least to all high voltage electrical systems (control panels, cables, wires, grids),
  - Wellbeing of workers including the sanitary and hygienic conditions of facilities for workers, including kitchen, toilets, washrooms and rest areas,
  - Full, comprehensive and visible evacuation plans and signs at all HPPs and related facilities,
  - First aid kits and certified for first aid personnel.
- Establish good communication and cooperation with Mavrovo and Shar Planina National Parks authorities and get all required permits and authorizations before specific activities start;
- Improve implementation of ESM's waste management system and hazardous substances handling procedure and train employees on the same;
- Identify authorized organizations and establish the contracts for final removal and disposal of Hazardous and non-hazardous wastes;
- Start the process of Asbestos, asbestos containing materials (ACMs) and PCBs identification at all HESs through the sampling and analysis at licensed laboratories. Identify all ACM and PCB containing materials/substances;
- Provide proper and easy access to towers of the 35 kV transmission line in NP Mavrovo;
- Improve H&S knowledge of the HPPs employees through specific trainings;
- Continuous maintenance of the access roads to the intakes;

- Contracting an authorized company for collection of all temporary stored barrels with waste oils, transportation and treatment, as well as for other waste types.

Besides the necessary activities that need to be implemented by ESM the Implementation Consultant will support ESM in the following tasks:

- Provide analysis of concentration of PCBs in transformers oils from external accredited laboratory;
- Specification for equipment and installation of equipment for continuous monitoring of average multi-year flow for each water stream before the intakes and to guarantee the biological minimum flow (that is 1/10 from the average multi-year flow) in the water streams after intakes for each water stream;
- Provide mitigation measures for elimination of stone collapse risks near the intakes.
- Provide ACM analysis of poles of generators from accredited laboratory before the project activities start (the analysis report should be part of the tender documentation for the Contractor).

Besides the necessary activities that need to be implemented by ESM, the Construction Contractors are obliged to prepare lot-specific Project Area ESMPs (PA-ESMP) and respective sub-plans following the stipulations given in the project ESMPs (separate document, Task 2).

Project Information Disclosure: Before mobilization for construction phase, project information shall be disclosed by the Project Owner, including detailed information about the type of rehabilitation activities, their location and planned duration, as well as on potential benefits and risks of the planned activities and related mitigation measures.

2 Introduction and Background

2.1 Project Background

Republic of North Macedonia´s topography and climate conditions make an excellent environment to use the hydro potential on national level. Hydroelectric production in Republic of North Macedonia is around 20% of the total electricity production in the country.

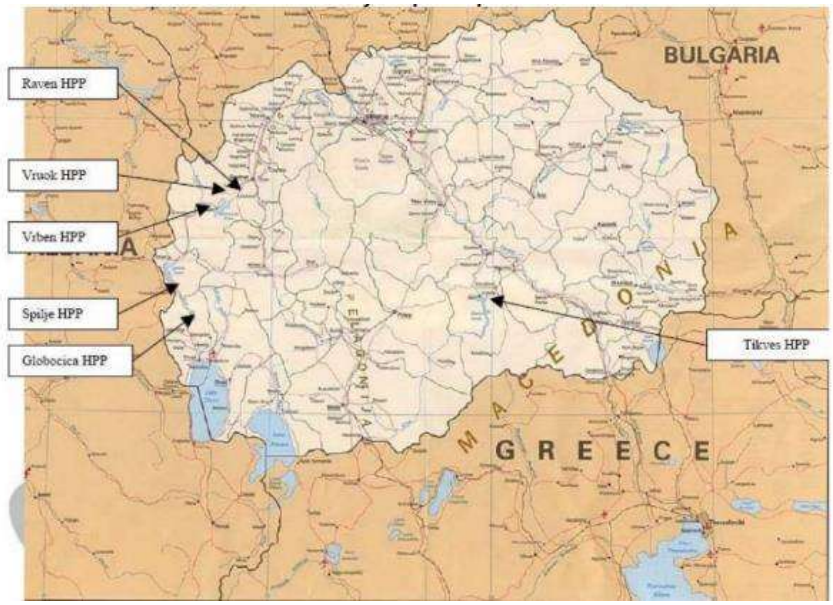


Figure 2: Location of hydro power plants (provided by ESM project team)

Six hydro power plants in the Republic of North Macedonia (RNM), **Vrutok, Vrben, Raven, Tikves, Spilje** and **Globocica** represent 85% of the total installed hydropower capacity in Macedonia. Furthermore, these HPP have an annual electricity generation of approximately 1000 GWh which is 15 -20% from the total electricity generation in the electricity power sector in RNM. Furthermore, in electricity generation, these HPP have an important part in the control of the whole Energy Power Sector in Macedonia, voltage and frequency regulation, as well as for covering daily peaks in electricity consumption.

The HPPs were commissioned in the 1950s and 1960s. Since then, there have been two major rehabilitation programs: 1998 to 2004 (World Bank funded) and 2010 to 2014 (funded by KfW).

KfW Development Bank (KfW) will finance the "Renewable Energy Programme" of the ESM (III phase). Component 1 of this program is the Rehabilitation of six Hydropower Plants and associated facilities.

The project locations of each HPP are described and given in the following Chapter 3.

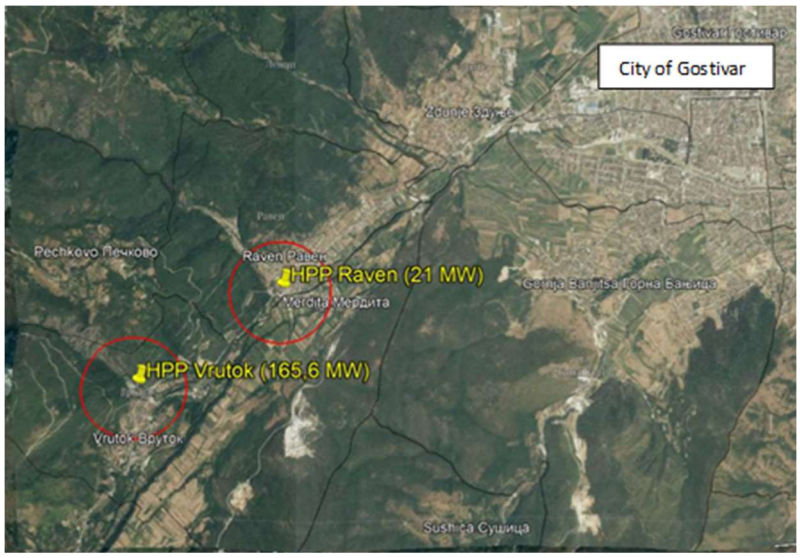
The project activities consist exclusively of replacement or improvement of existing facilities. These include repair, improvement or replacement of hydro and electromechanical components (valves, turbines, generators, transformers, etc.) and repairs and improvements to the building fabric. The upgrading will increase the reliability and safety of the HPPs, reduce water pollution from oil leakages and use the existing flow rate for energy production. The latter will increase the installed capacity from the current 4,291 MW to 4,426 MW.

The project also involves the renewal of the conductors of a 13.85 km long 35 kV transmission line between the Vrben HPP and the Vrutok HPP, as well as the rehabilitation of some water intakes of the water channels/tunnels system.

ESM has prepared a preliminary technical concept for the definition and scoping of the activities to be undertaken under the Project.

2.2 Project Locations

HES Mavrovo HPP system is located within the municipalities of Gostivar, Vrapcishte and Mavrovo & Rostushe. It includes the following components: the Mavrovo cascade with the **Vrben HPP**, the Mavrovo reservoir and the **Vrutok and Raven HPPs**, and a 124 km long conveyance system. Part of the conveyor system as well as the Vrben HPP and the Mavrovo reservoir are located in the Mavrovo National Park (NP). The Vrutok and Raven HPPs and parts of the conveyor system border also with National Park Mavrovo. On Source: OSSP katastar.gov.mk

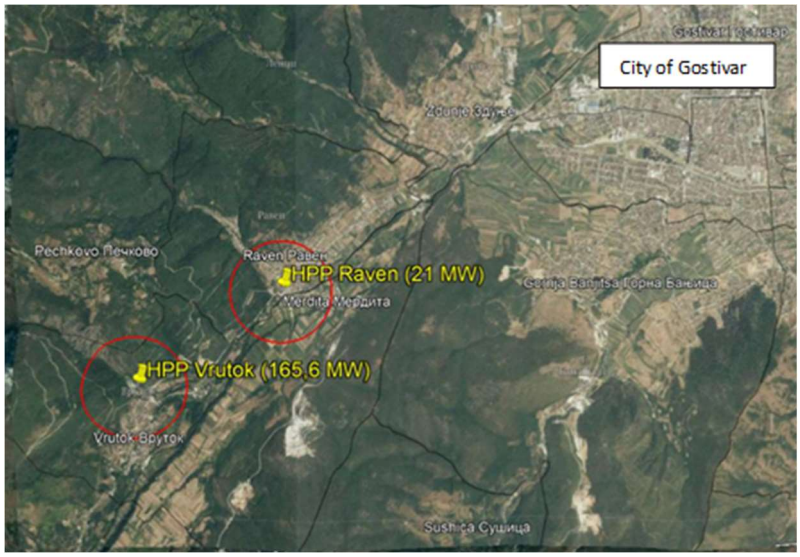
Figure 3 and 

Source: OSSP katastar.gov.mk

Figure 4 project location for HES Mavrovo (HPP Vrben, HPP Vrutok, HPP Raven and Mavrovo dam) and 35 kV transmission line from HPP Vrben to HPP Vrutok are given.

Source: OSSP katastar.gov.mk

Figure 3: Project location Mavrovo dam and HPP Vrben and 35 kV transmission line from HPP Vrben to HPP Vrutok

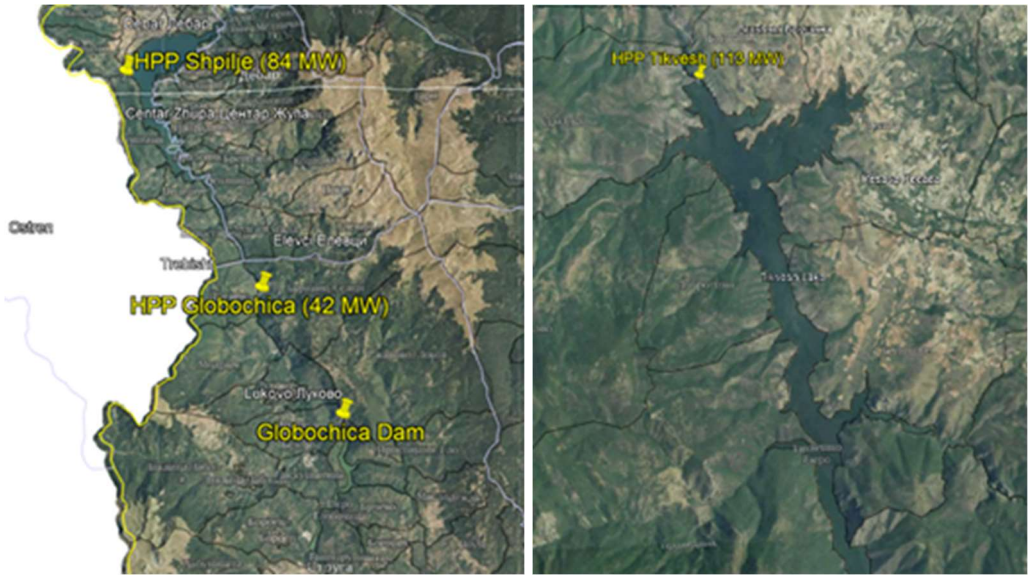


Source: OSSP katastar.gov.mk

Figure 4: Project location HES Mavrovo System (HPP Raven and HPP Vrutok)

HPP Spilje is located near the City of Debar, at the foot of Spilje Dam, along the riverbeds of Crn Drim and Radika rivers. **HPP Globocica** is located halfway between Lake Ohrid and City of Debar, about 8 km downstream of Globocica Dam. Project locations of HPP Spilje, HPP Globocica and Globocica dam are given in the following figureSource: OSSP katastar.gov.mk

Figure 5.



Source: OSSP katastar.gov.mk

Figure 5: Project locations of HPP Spilje, HPP Globocica, Globocica dam, HPP Tikves and Tikves dam

HPP Tikves is located about 15 km west of the City of Kavadarci, at the foot of the Tikves Dam, which impounds the Crna River.

2.3 Stage of the Project

This Project is the continuation of the rehabilitation activities financed in the previous phases and is the result of the identified deficiencies in the previous phases. The project has already defined the main goals of the rehabilitation in each HPP. There is a detailed description of what ESM intends to achieve with each activity; however there seem to be some remaining open points regarding some technical details and targeted equipment.

For example, ESM had shared with Fichtner the selected intakes which shall be repaired on Sharski vodi supply system. However, during the site visits undertaken by GEING & Fichtner in September 2022 the team learnt that the intakes were still not definitely defined. Hence, Fichtner's assessment is based on the preliminary selection only as was shared by ESM and described below.

Sharski Dovod intake system consists of 13 intakes and the **Gorna Radika intake system** consists of 7 "Tirolian" type water intake structures connected with each other by an underground tunnel conveying water by gravity. Not all of the intakes will be rehabilitated during the present project. ESM had pre-selected 6 intakes for rehabilitation, which were communicated to the Consultant before the site visits. During the site verification visit in total 8 intakes (Proshevska, Kuchibabaska, Mazdraca, Vraca I, Vraca II, Dumkovo, Lomnica in Sharski Dovod system and Stirovica in Gorna Radika system) were inspected, out of which ESM intends to select 6. Taking into consideration that the terrain conditions and installed equipment on each of the intakes from Sharski Vodi are very comparable and the proposed project rehabilitation activities are similar for all the intakes, the E&S impacts are expected to be identical and not to differ between all intakes that were visited.

ESHS impacts that might arise from changes in the planned rehabilitation works in relation to those that were assessed by Fichtner during the site visit (see chapter 3.1 and 3.2 of the inception report; e.g., not visited intakes, change of selected locations, additional works like concreting or reinforcement of intake structures not planned till date) are assumed to be of similar and comparable nature to the potential risks that are included in the present risk assessment and respective related ESMP.

During the site visits, ESM also mentioned potential changes in the rehabilitation activities with regards to more efficient revitalization of equipment for overall improvements. This is however out of the present scope and for the Owner's Engineer to evaluate at a later stage of the rehabilitation program.

2.4 Rationale for the Project

The project proponent is JSC Power Plants of North Macedonia (ESM). For the implementation of the project "Revitalization of 6 HPP - Phase III", ESM has formed the Project Implementation Unit (PIU) with 8 members.

The following are the contact details for the Coordinator and Deputy coordinators of PIU for the project realization:

1. Darko Mickoski - Electricity Production Department, Coordinator of WG
2. Nevenka Jakimova Filipovska - Electricity Production Department, Deputy Coordinator
3. Eyup Beqiri – HES Mavrovo, Deputy coordinator - technical part
4. Gligor Jauleski – HES Crn Drim, Member
5. Trajche Tefov – HPP Tikves, Member

6. Vlatko Pavleski - Department for Development and Investments, Member
7. Vlatko Jovanov - Department for Development and Investments, Member (Finance)
8. Goran Kovacevic - Department for Development and Investments, Member (Environment).

The PIU can include and consult other employees of ESM or external experts or independent companies for supervision or inspection in its work and in accordance with the existing legal regulations.

For the undertaken activities, the PIU shall report to the General Director through the Director of Electricity Production.

2.5 Project Categorization

Projects are classified according to the KfW Sustainability Guideline (February 2022) into one of the following categories according to the relevance of their potentially adverse environmental and social impacts and risks:

- Category A, if they may have diverse significant adverse environmental or social impacts and risks because of the complex nature of the project, the scale, the sensitivity of the location or if the impacts and risks are irreversible or unprecedented. Category A projects require an independent ESIA study including an Environmental and Social Management Plan (ESMP).
- Category B, if they may have potentially adverse risks and impacts, although to a lesser extent than these of category A projects and can usually be mitigated through standard, best available mitigation approaches. Potential impacts are limited to a local area, are site-specific and in most cases reversible and easier to mitigate through appropriate mitigation measures. For Category B projects, the need for and the scope, the priorities and depth of an ESIA are determined through a case-by-case evaluation.
- Category B+, if a Category B project is expected to have single significantly adverse environmental and social impacts and risks. For these cases, an ESIA and an ESMP as well as an ESMS adapted to these impacts and risks are required.
- Category C, if projects are expected to have no or only minor adverse environmental and social impacts or risks, and if the implementation and operation of the project does not require any protection, compensation or monitoring measures. Usually, no additional analysis or any further due diligence procedures are needed.

The project "Rehabilitation of six Hydropower Plants (HPP)" encompasses the rehabilitation of the following six hydropower plants and associated facilities by ESM:

- Mavrovo HPP system: it includes the following components: the Mavrovo cascade with the **Vrben HPP**, the Mavrovo reservoir and the **Vrutok** and **Raven HPPs**, and a 124 km long conveyance system of canals and tunnels including Gorna-Radika and Sharski dovod. Part of the conveyor system as well as the Vrben HPP and the Mavrovo reservoir are located in the Mavrovo National Park (NP). The Vrutok and Raven HPPs and parts of the conveyor system border the National Park Shar Planina.
- **Spilje HPP** near the town of Derbar at the foot of Spilje Dam, which dams the Crn Drim and Radika rivers.
- **Globocica HPP** located at halfway between Lake Ohrid and Debar, about 8 km downstream of Globocica Dam.
- **Tikves HPP**, located about 15 km west of the town of Kavadarci at the foot of the Tikves Dam, which impounds the Crna River. The reservoir is also used to store water for irrigation purposes. Water withdrawal for irrigation has priority.

The project also involves the renewal of the conductors of a 13.85 km long **35 kV transmission line** between the Vrben HPP and Vrutok HPP and the **rehabilitation of some water intakes** of the water channels/tunnels system.

The interventions in the Project are exclusively for the replacement or improvement of existing facilities/equipment.

Due to the nature of the works to be performed (rehabilitation works with no need for transportation of heavy parts nor construction of new accesses or structures), and the respective duration (one week per site), these are considered in a first stage to pose a moderate environmental and social risk. It shall also be noted that the potential impacts of the Project are expected to be site specific, reversible, and easy to mitigate. However, due to the location of part of the works in or nearby protected areas (some of the facilities from HES Mavrovo are located within the National Park (NP) Mavrovo and NP Shar Planina, and HPP Tikves near the Strict Nature Reserve), single significantly adverse environmental and social impacts and risks may occur. Therefore, KfW categorized the overall project as **Category B+** (substantial risk). After the site visit and review of all documentation, the Fichtner/GEING team agree with KfW's categorization of the Project as B+.

2.5.1 National Decision No. 11-3621/2 from 03.08.2021

The procedure for EIA is regulated in North Macedonia by the Law on Environment (Official Gazette of RNM No. 53/05, 81/05, 24/07, 159/08, 83/09, 48/10, 124/10, 51/11, 123/12, 93/13, 187/13, 42/14, 44/15, 129/15, 192/15, 39/16 and 99/18). This legal document states that the first step of the EIA procedure is submission of the Notification Letter to the Ministry of Environment and Physical Planning (MoEPP), who, based on the type of project activities, will decide on the elaboration of:

a full ESIA (ESIA Study) for large-scale projects; or
an EIA Report (Elaborate) for small-scale projects.

Based on the submitted Notification Letter and type of the project activities (rehabilitation), the MoEPP issued the Decision No.11-3621/2 from 03.08.2021 that there is no need for preparation of the ESIA Report for the Project.

2.6 Aims and Objectives for the ESSRA

The elaboration of an **Environmental and Social Site Risk Assessment (ESSRA)** has been agreed between the Consultant and KfW during the contract negotiation and the project's Kick-Off-Meeting at 26.07.2022. The ESSRA aims at respecting the requests of KfW for an assessment of environmental and social impacts and risks, while at the same time assuring compliance with the national environmental and social legal requirements.

The ESSRA aims to identify and assess potentially negative and positive environmental and social risks and impacts of the rehabilitation project. The associated **Environmental and Social Management Plan** (Site specific ESMP - separate document) presents management measures to avoid, minimize, or mitigate potential negative environmental and social impacts and risks, while striving to enhance benefits to local communities and the environment. This includes consideration of Community and Health & Safety (H&S) matters. The ESMP is presently being developed and will be added to a future version of this report.

The ESSRA describes the social and ecological baseline environment and assesses the risks and potential impacts associated with the Project's activities. The separate ESMP establishes adequate safeguard measures in line with international good practice and relevant E&S and H&S standards.

A separate Stakeholder Engagement Plan (SEP) including a Grievance Redress Mechanism (GRM) has been prepared for the project and shall be read in conjunction with this report.

The **Environmental and Social Commitment Plan** (ESCP - separate document) is a key requirement of KfW as a part of the Special Agreement of Loan Agreements for projects that are subject to an Environmental and Social Due Diligence (ESDD) according to KfW Sustainability Guideline. Based on the preliminary ESCP prepared by KfW and the findings of this present ESSRA & ESMP phase, Fichtner will adapt the preliminary ESCP and complement it to a final ESCP version, that will serve as a basis for the loan agreement.

The ESSRA, ESMP, SEP and ESCP are intended to be used for decision-making by KfW and internally by ESM.

2.7 Methodology for the ESSRA

The approach and methodology for preparation of the ESSRA is based on the following steps:

- desktop based review/research of available data related to the project (E&S, CHS and OHS documentation, maps, studies, plans, etc.)
- review of associated Environmental, Social and H&S policies and standards of ESM
- review of applicable E&S, CHS and OHS framework (Sustainability Guidelines of the KfW Development Bank, World Bank Environmental and Social Standards, Fundamental Conventions of the International Labor Organization, etc.)
- review of applicable national laws and regulations in North Macedonia (relevant legislation for environment, H&S, community safety, biodiversity, energy, social aspects, etc.)
- collection of social baseline data from secondary and primary sources. The used secondary data base consists of the publications and databases of the Statistical Office of the Republic of North Macedonia, information obtained by project affected municipalities and services, other strategies, plans, documents, etc. During the site visits the consultants gathered primary data related to the project activities, project location, key information of social infrastructure, road infrastructure, etc.
- initial kick-off discussion with ESM/PEA team and FICHTNER/GEING (held on 12 and 16 September 2022)
- site visits for all 6 HPPs by the project team of GEING and FICHTNER:
  - from 5 to 9 of September 2022: social team
  - and from 12 to 16 of September 2022: environmental and technical team
- meetings with ESM representatives from each HPPs
- stakeholder mapping and identification of the main stakeholder groups relevant for the Project
- preparation of the Stakeholder Engagement Plan with GRM
- initial consultation with key stakeholders (representatives from ESM, representatives from each HPP, local communities, management of NP Mavrovo and NP Shar Planina, etc.)
- analysis of the type of rehabilitation project activities
- identification of the area of direct influence for each project location; the "area of direct influence" is defined as the project environment that is located outside the area of the overall project and extends from its boundaries to a distance of 500 meters in every direction
- identification of potential E&S and H&S risks and impacts and their prioritization/assessment

- preparation of the ESSRA document
- public disclosure of the document.

2.8 Literature Review

The consultants have performed review of the overall available documentation relevant for the Project: all documents received from ESM/Branch offices and KfW, as well as other documentation available on the web sites of ESM/relevant Municipalities/ NP Management's/ and other Ministries/Institutions.

Key documents which were reviewed for the Project are:

- study for Revitalization of Large Hydropower Plants Phase III, JSC ELEM, 2020
- EIA Reports for each HPP from previous phases
- water permits for each HPP (Annex 9.2)
- review of ISO documentation of ESM:
  - list of procedures according implemented ISO 9001
  - list of procedures according implemented ISO 14001
  - list of procedures according implemented ISO 45001
- ISO documentation (Environment and OH&S Policy, list of procedures according to ISO 14001, 45001, etc.)
- request for the establishment of a working group for the implementation of the project "Revitalization of 6 GHE – Phase III"
- Notification letter for performing the project, Project: Rehabilitation of 6 HPP – III phase (HPP Vrutok, HPP Raven and HPP Vrben, HPP Globocica, HPP Spilje and HPP Tikves), Skopje, July 2021
- Received Opinion, no. 11-3621/2, 03.0.2021, from the Ministry of Environment and Physical Planning that there is no need for EIA Report preparation
- maps with location of all relevant intakes (Sharski dovod and Gorna Radika), all 6 HPPs, Mavrovo and Tikves dams, 35 kV transmission line from HPP Vrben to HPP Vrutok within NP Mavrovo
- physical and chemical analysis from water monitoring of HPP Vrben (on inlet and outlet of HPP)
- studies for revalorization of NP Mavrovo, Shar Mountain and Strict Nature Reserve Tikves, etc.
- study for revalorization of Strict Nature Reservoir „Tikves", October 2010
- study for revalorization of protected area Mavrovo, Oxfam Italy 2012
- study for revalorization of NP Sharr Mountain, Tetovo-Skopje, 2020
- Draft Management plan NP Shar mountains (2022-2031) Draft Version, July 2022, etc.

The whole list of reviewed literature and documentation for preparation of ESSRA is shown in Chapter 7.

2.9 Site Verification Visits

Site verification visits were undertaken by two teams: the social team; and the environmental & technical experts' team. The social team performed the site visit from 5 to 9 September 2022, while the environmental & technical team performed the site visit from 12 to 16 September 2022.

The Consultant project teams conducted rapid visual surveys at the HPP sites and the 35 kV transmission line in NP Mavrovo[1] in order to determine baseline environmental and social conditions, distance from

[1] During the site visit a meeting was undertaken with the representatives from NP Mavrovo (15.9.2022), who pointed out that the lynx population will not be affected by the implementation of the project activities along the transmission line in NP Mavrovo, taking into consideration the type of the project activities (vegetation pruning) and their duration (short-term).

nearest settlements, surrounding biodiversity and sensitive receptors, nearest protected areas, current conditions in rivers/lakes, etc.

Before the site visit, meetings with representatives from ESM and each HPPs were performed on sites. The key findings from the site visits are presented in Annex 9.1.

Also, a meeting with the representatives from NP Mavrovo was performed on their premises and all project activities were presented, as well as the expected potential risks and impacts, and mitigation measures proposed. On 25 October 2022, a virtual meeting between the consultant's environmental team and the representative from NP Shar Mountain took place to present the main aim of the project and related project activities and their duration, in order to identify the potential environmental risks (with emphasizing the location of the intake Mazdraca, located in the **zone of strict protection in NP Shar Mountain**[i]) and to propose mitigation measures within the ESMP for rehabilitation of 6 HPPs.

In addition, informal interviews with the community residing in the project areas were conducted to get communities' perspectives about the proposed project. The results and information of these consultations were integrated in the outcomes of the stakeholder consultations that were carried out during the detailed public consultations.

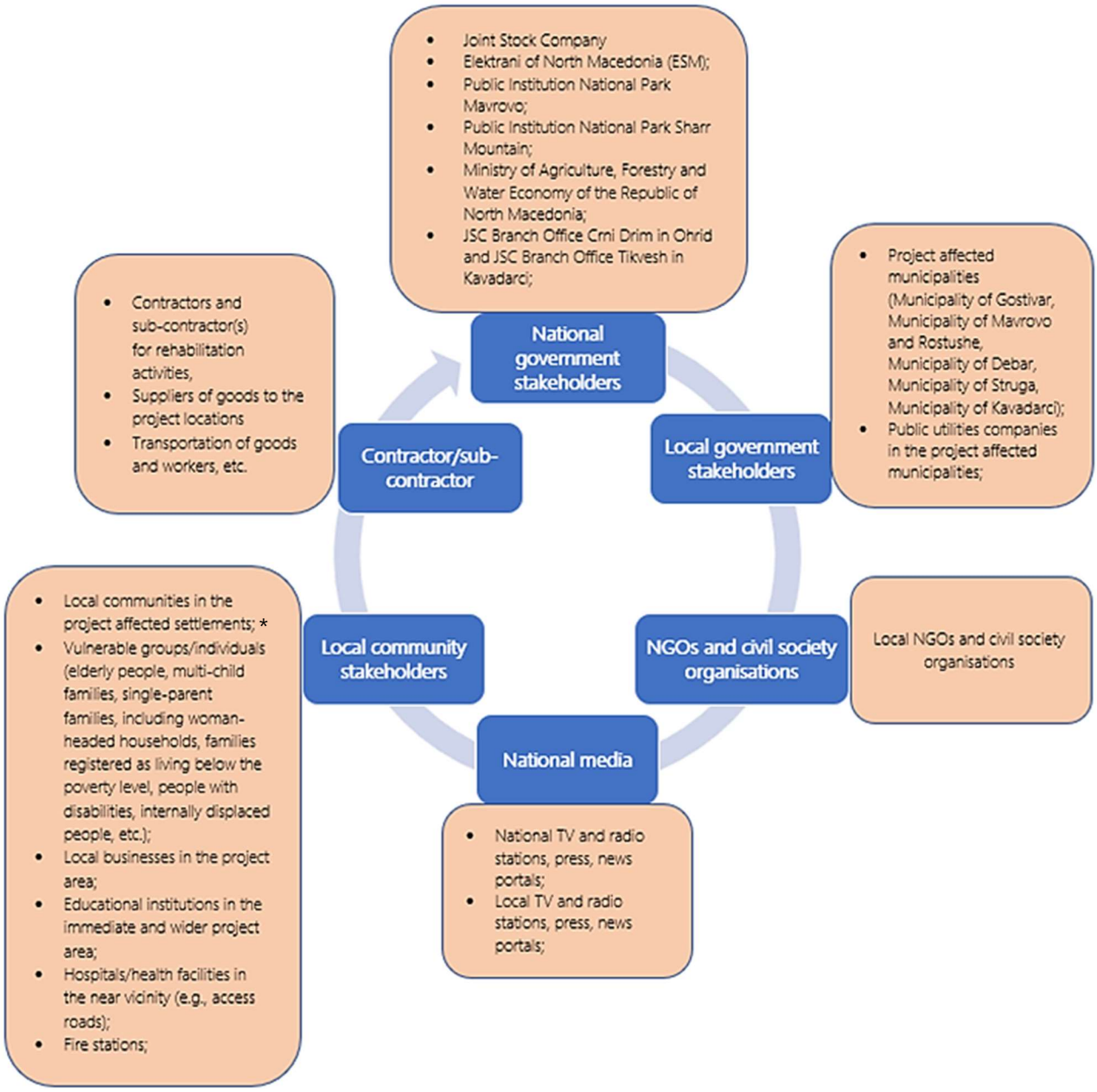
2.10 Public Consultations

Public consultations with directly affected, indirectly affected and interested stakeholders of the proposed Project were conducted from the 5th to the 9th of September 2022 (by the social team), through visits of all relevant stakeholders for each of the HPPs planned to be rehabilitated. Also, the environmental and technical team performed meetings with representatives from ESM and all relevant HPPs from 12 to 16 September 2022, including a consultation meeting with management of National Park Mavrovo. An online meeting with the representative from NP Shar Mountain was held on 25 October 2022, in order to discuss about the potential environmental risks that may arise from the implementation of the project activities (with emphasizing the location of the intake Mazdraca, located in the zone of strict protection in NP Shar Mountain).

To define a public communication process with the stakeholders, several groups that may be interested and/or affected by the project implementation have been identified and are presented in *NOTE: In the context of the Mavrovo electricity line some few farmers who illegally use plots of land which hampers the road access to the line corridor were identified as a group of directly affected individuals (see SEP).

Figure 6: *NOTE: In the context of the Mavrovo electricity line some few farmers who illegally use plots of land which hampers the road access to the line corridor were identified as a group of directly affected individuals (see SEP).

Figure 6: . Early understanding of the influences or connections of a stakeholder group to the project assists in the identification of the key objectives in engagement. In this regard a stakeholder mapping was undertaken to identify the importance of each stakeholder group, assess the influence that stakeholders have over the project and/or the way project activities will potentially affect stakeholders. As the project evolves, other stakeholder groups may be identified and engaged.



*NOTE: In the context of the Mavrovo electricity line some few farmers who illegally use plots of land which hampers the road access to the line corridor were identified as a group of directly affected individuals (see SEP).

Figure 6: Mapping and identification of relevant stakeholders for rehabilitation of 6 HPPs

A Stakeholder Engagement Plan (SEP) has been prepared (presented as separate document) for the project, where methods to disclose information to relevant stakeholders about the prepared project documentation (disclosure package: ESSRA, ESMP and ESCP) will be used.

Also, a specific grievance redress mechanism (GRM) will be developed for the project, with tools or forms for monitoring the impacts of the project implementation process in aspect of grievances reported by the affected persons and groups. ESM (specifically the Project Implementation Unit) will be responsible for the implementation of the GRM.

2.11 Study Limitations

The ESM provided relevant project documentation to the expert team of FICHTNER/GEING, who used it as a basis for preparation of the ESSRA document.

At the time of writing of this report, the following documentation was missing:

- laboratory testing of PCBs content in transformers oil
- records for provided biological minimum flow on the outlet of each intake in quantitative terms, as this is not required in the water permits.[2]
- documents related to the usage of ecosystem services in NP Mavrovo and NP Shar Planina
- signed Contracts for waste management with authorized companies for each waste type, including hazardous waste.

The expert team will take into account the public opinion, comments from all stakeholders during the disclosure process including the public hearing events, in order to understand better the public concerns (if any) and address them appropriately before the decision-making process by the KfW and ESM. This may imply for example updating the risk and impact assessment with issues raised during consultation; further adapting the GRM to better serve the needs of the local stakeholders; etc.

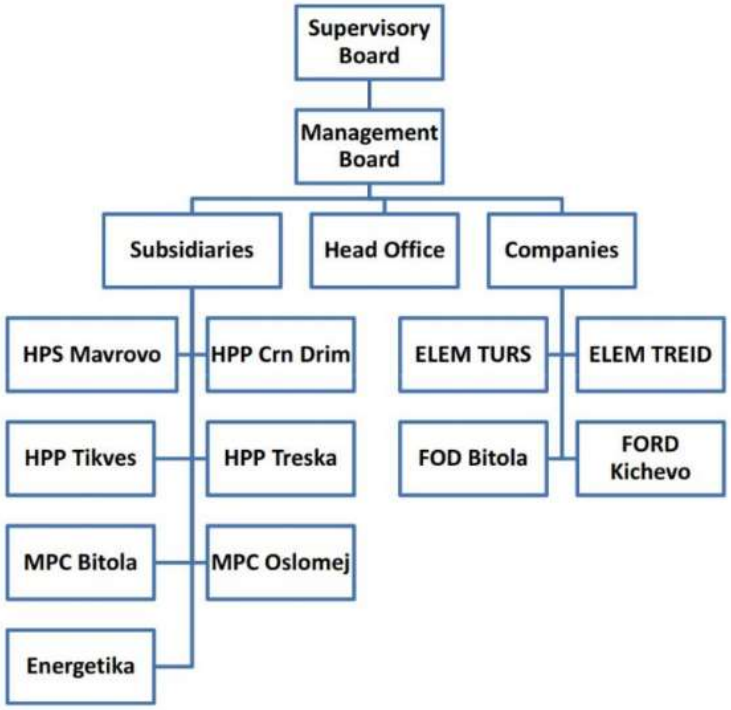
[2] Biological minimal flow, in water permit, is defined as 1/10 from the average multi–year flow for each water stream.

3 Project Details and Description

3.1 Site Description

JSC Power Plants of North Macedonia is a state-owned company whose main activity is production of electrical energy. The company operates 8 HPPs, organized in 4 subsidiaries, 2 MPC thermal plants organized in 2 subsidiaries and Energetika Subsidiary which deals with production of electrical energy, hot water and steam. The company possesses other companies which are not related to energy production.

The Organizational chart of the company is given in Figure 7.Figure 39



Source: ESM project team

Figure 7: ESM organizational Chart

The HPP subsidiaries cover HPPs based on the river confluence:

- HPS Mavrovo with HPPs Vrben, Vrutok and Raven
- HPP Crn Drim with HPPs Globocica and Spilje
- HPP Tikves
- HPP Treska with HPPs Kozjak and Sveta Petka.

Rehabilitation activities (stage 3) will be performed on all HPPs, and their infrastructure organized in HPS Mavrovo, HPP Crn Drim and HPP Tikves.

3.1.1 Mavrovo system

HES Mavrovo is composed of three hydro power plants: Vrutok, Vrben and Raven, the Mavrovo reservoir and dam, as well as the network of channels and tunnels for receiving the water from the neighboring mountain massifs.

Source: ESM project team

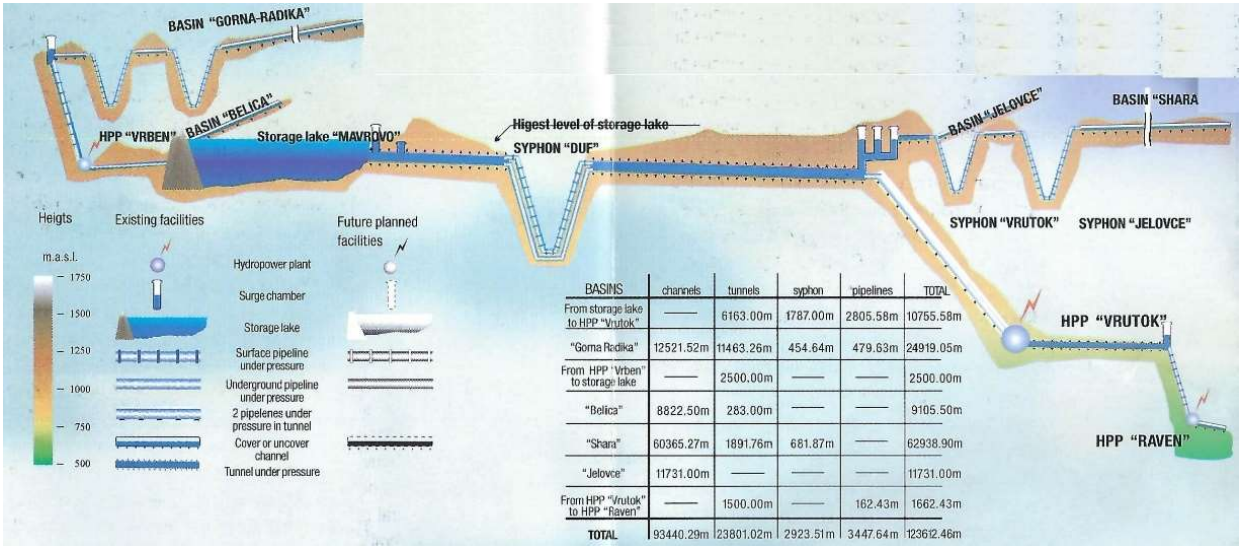
Figure 8: HES Mavrovo (HPP Vrben, HPP Raven and HPP Vrutok with all intakes from Sharski Vodi and Gorna Radika)

The initial stage of the system was constructed in the period 1948 – 1952, when the Mavrovo lake reservoir was for the first time filled with water. At this stage the system of channels and tunnels was constructed for water intake from the Basin of Gorna Radika.

In the second stage, in the period from 1960 to 1970, the new system of channels and tunnels were constructed to collect water from the Shar Planina water basin. The new system was constructed with two operation regimes:

1. Direct feed from Vrutok and Raven HPPs
2. Transfer of water to the Mavrovo reservoir.

The actual HES Mavrovo simplified flow chart with basic data is shown in the following figureFigure 9.



Source: ESM project team

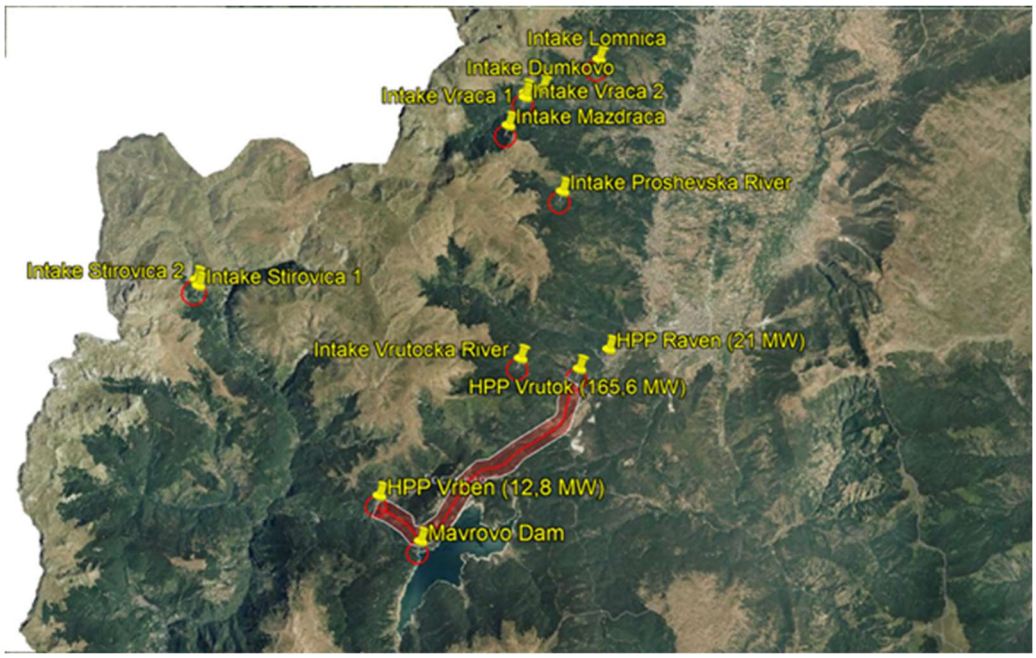
Figure 9: HES Mavrovo simplified flow chart

The areas of direct influence from the project activities in the HES Mavrovo, including the activities for conducting wire replacement on the 35 kV transmission line from the HPP Vrben to the HPP Vrutok are presented on the following map.

In the vicinity of the intakes (Stirovica from Gorna Radika and intakes from Sharski Vodi) there are no houses or other objects or facilities, except the warehouses related to each intake. In the area of direct influence of HPP Vrben, there are a few houses from the settlement Vrben.

Located within the area of influence of the existing 35 kV transmission line are the settlements of Mavrovi Anovi, Recane and Vrutok, as well as other objects (e.g. religious objects, cemeteries, local roads, river Vardar, part of NP Mavrovo). A site verification visit along the line and to the angle towers of the 35kV OHL was performed to identify potential risks related to the rehabilitation measures. The OHL runs a length of 13.85 km, starting from Vrutok HPP (tower #1) to Vrben HPP (tower #52). For approximately 6.5 km the OHL is crossing the Mavrovo National Park. A maintenance corridor (RoW) of 12m width (6m to each side of the line) and access to each tower is regularly cleaned from vegetation on bi-annual basis. The towers #6, #7 and #8 are located close to the village Recane and access to these towers is partly obstructed by illegal barriers and small temporary constructions erected by villagers. The RoW around these three towers is partly used as orchards. No other access issues to the towers were identified during the site visits.

In the direct area of influence of HPP Vrutok is the settlement Vrutok and in the direct area of influence of Raven is settlement Raven.



Source: OSSP katastar.gov.mk

Figure 10: Area of direct influence of HES Mavrovo (HPP Raven, HPP Vrutok, HPP Vrben, Mavrovo dam and transmission line) and Intake Stirovica (part of intake canal Gorna Radika)

3.1.1.1 Gorna Radika supply system

This system dams up waters from the upper part of the Radika River, in the region of Korab and Shara Mountains. Part of the waters, originally belonging to the Adriatic water basin, have been diverted to the Aegean basin through the Vardar River. It consists of the 6 main intakes: Stirovica, Crn Kamen, Agina Reka, Brodecka Reka, Krakornicka Reka and Bogdevska Reka. Intakes are located between 1495 and 1420 m.a.s.l.

The system is constructed with 12.5 km of channels, 11.5 km of tunnels, 0.4 km siphons and 0.5 km of pipelines or total of 24.9 km lines. The supply system is designed for flow of 13 m^3/s. The basin covers an area of 180 km^2 with an average yearly water inflow of 126 million m^3.

	GORNA RADIKA	y	x	HVL
1	HADJINA REKA	7,473,320.00	4.631.1 10.00	1520
2	SHTIROVICA	7,468,661.56	4.629.228.86	1453
3	CRN KAMEN	7,470,065.25	4.631.639.66	1453
4	BRODEC	7,474,264.67	4.626.681.914	1460
5	KRAKORNICA	7,475,247.31	4.623.622	1459
6	BOGDEVO	7,475,725.90	4.622.089.95	1426

Source: ESM project team

Figure 11: Gorna Radika Supplying System

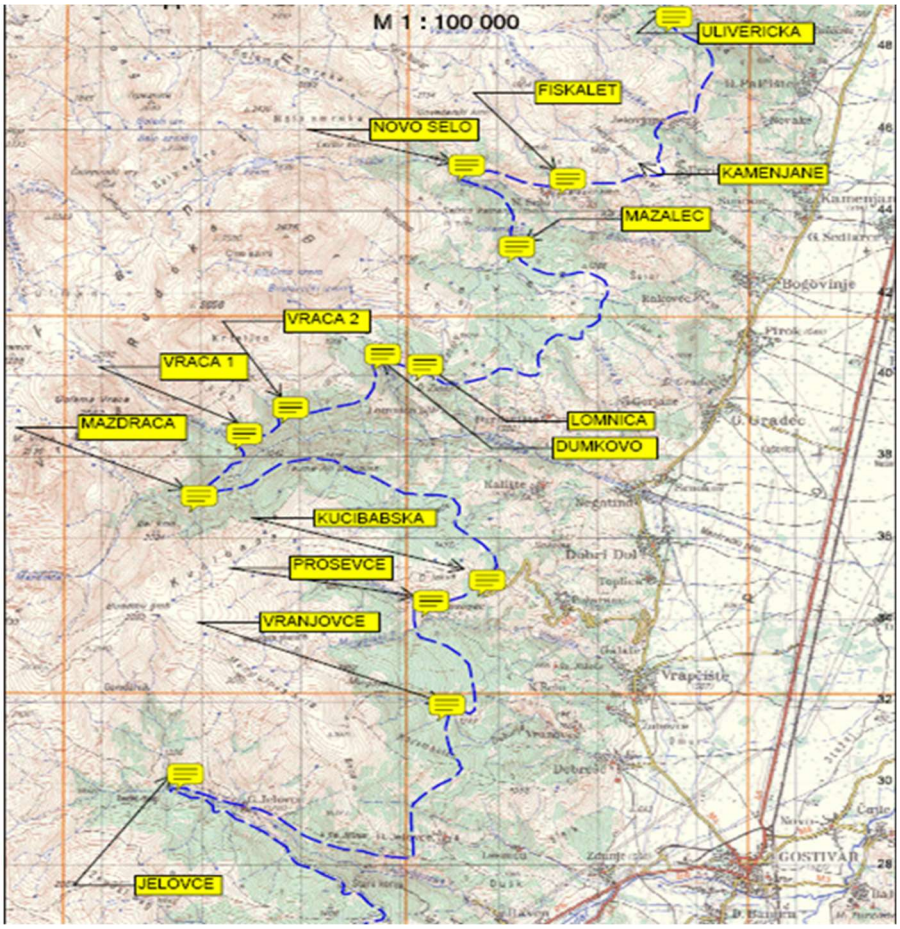
Water from the system is brought into the HPP Vrben Plant's surge chamber and after utilization, through an underground tunnel, the water is brought into the Mavrovo Lake.

3.1.1.2 Sharski Vodi supply system

The Sharski Vodi Supply System was constructed in the period 1960-1970. It collects waters from the Shara Mountain and consists of 13 main intakes, named according to the rivers: Ulivericka, Kamenjanska, Fiskajet, Novoselska, Mazalec, Lomnica, Dumkovo, Vraca 1 and 2, Mazdraca, Kucibabska, Proshevska, Vranjovska, and Nevestinska. All intakes are located between 1354 and 1236 m.a.s.l. The system is in Shar Planina/Mountain National Park was established at 30.6.2021.

The system is constructed with 60.4 km of channels, 1.9 km of tunnels and 0.7 km siphons. The supply system is designed for a flow of 17.4 m^3/s. The basin covers an area of 161 km^2 with an average yearly water inflow of 144 million m^3.

The water is transferred to the large surge chamber's sedimentation facility above the HPP Vrutok via the system of channels and tunnels.



Source: ESM project team

Figure 12: Sharski Vodi System

From this facility water is diverted to the Mavrovo Lake or is used by the HPP Vrutok depending on the needs.

The areas of direct influence from project activities on intakes of supplying system Sharski Vodi are presented on following map. Near the intakes from Sharski Vodi (Lomnica, Dumkovo, Vraca 1 and 2, Mazdraca, and Proshevska) there are no houses, structures or facilities, except the warehouses of each intake.

Figure 13: Area of direct influence of Sharski vodi System (part of HES Mavrovo)

3.1.1.3 Other water supply systems

HES Mavrovo has 2 additional smaller water supply systems: Belicki and Jelovski.

The **Belicki System** collects water from Bistra mountain's rivers, Belicica and Kicinica. It covers an area of 22 km^2 and collects an average yearly water quantity of 11 million m^3. Water is directly stored in the Mavrovo reservoir. The system has 8.8 km of channels and 0.3 km of tunnels.

The **Jelovski System** collects waters of the Vrutocka and Jelovska River and few other smaller intakes, bringing them to the Vrutok Plant's surge chamber. It covers an area of 49.4 km^2. This system collects water from the Shara Mountain with 11.7 km of channels, constructed for a flow of 4.5 m^3/s. The average yearly water inflow is 12.5 million m^3.

3.1.1.4 Mavrovo dam and reservoir

The **Mavrovo Dam** is a soil-dike dam. It is 61.9 m high with a crown length of 210 m and a width of 7 m. The dam's volume is 767,747 m^3 of land dike. The dam has a concrete overflow diversion tunnel and foundation outlet. The length of the concrete overflow diversion tunnel is 470 m. The dam was finalized in 1952 when the reservoir was filled.

Source: Fichtner, taken during site visits in September 2022

Figure 14: Mavrovo dam and reservoir

The **Mavrovo reservoir** is a major water storage facility for the HES Mavrovo. The reservoir covers an area of 13.2 km^2, at a height of 1,233 m.a.s.l. The maximal depth is 50 m. The storage capacity is 274.8 million m^3.

Filling of the lake started in 1952, while its exploitation began in 1957. When it was constructed the main purpose of the reservoir was electricity production, but nowadays it is used also for irrigation of more than 30,000 ha in Polog fields, as well as for maintaining the Vardar river's biological minimum flow in the area of Polog. The reservoir is also used for tourism. It is located in the Mavrovo national park established in 1949.

3.1.1.5 HPP Vrben

The HPP Vrben is located six kilometers north of the Mavrovo reservoir. The plant, a run-of-river type, utilizes water from the Gorna Radika system.

From the surge chamber the water is conveyed through steel pipelines to the HPP, where it is branched in two parts towards two 6.4 MW generator circuits. The generators are positioned horizontally and driven by Francis turbines. Both generators were put into operation in 1959. After being utilized, the water is brought to the lower surge chamber, from where it is discharged in the Mavrovo reservoir via the underground tunnel.

In spring, when higher water inflow occurs, about 1,5 m^3/s cannot not be utilized because of the turbines and generator constrains. The excess water is discharged trough a separate channel below the HPP Vrben, where it is mixed with the HPP water and discharged in the Mavrovo lake. The produced electricity in HPP Vrben through two 8 MVA block transformers (for each generator) is transformed into 35 kV and is connected to the HPP Vrutok main Power station via the 35 kV overhead transmission line. The average yearly electrical energy production is 38 GWh.

The HPP Raven also has a 10 kV switch yard which is used for electricity supply of the Mavrovo region. When interconnection with the HPP Vrutok fails, the HPP Vrben is operated in standalone regime to supply the Mavrovo region with electricity.

The areas of direct influence from the project activities in the HPP Vrben and the Mavrove o dam are presented in the following maps. In the area of direct influence of the HPP Vrben, there are a few houses from settlement Vrben. To the area of Mavrovo dam belongs part of the settlement Mavrovi Anovi.

Source: OSSP katastar.gov.mk

Figure 15: Area of influence of HPP Vrben and Mavrovo dam

3.1.1.6 HPP Vrutok

The HPP Vrutok is the main plant of the HES Mavrovo. It started operation in 1957-1958 with 2 generators and 2 others were added in 1973, when Sharski void supply system was built.

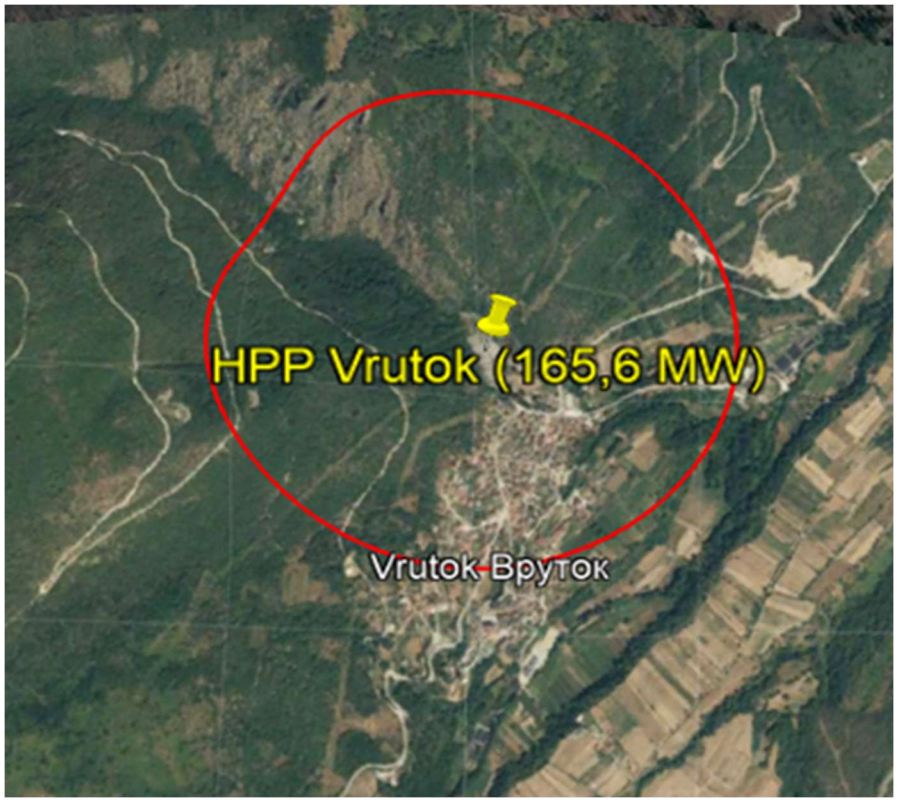
After a few rehabilitations, the initial generators' power increased from 37.5MW to 41.4 MW. The total installed power of the HPP Vrutok is 165.6 MW. The average yearly electricity production is 350 GWh.

The Vrutok plant with entire electromechanical equipment is situated in an underground cavern building. It is a derivational, storage type of plant. Supply of the Vrutok plant's lake begins from the entering facility. Water is transferred with an underground 3,163.5 m long tunnel with diameter of 3.2 m and two steel siphons, one underground and one above the ground. At the end of this line the plant's surge chamber is located. It is shaft type with a lower and upper chamber and an auxiliary shaft which serves to introduce the Shara and Jelovce supplying systems. The surge chamber is a location where water flow is controlled and according to the needs water from the Sara and Jelovce supplying systems water is directed to HPP Vrutok, or to Mavrovo reservoir.

From the surge chamber to HPP Vrutok. Water is transferred through tunnel follows with two metal pipelines to HPP where pipelines are branched in 4 lines for each generator.

Produced energy is delivered to the outside 110 kV switch yard. The switchyard is connected with two incoming 110 kV overhead lines and their outgoing overhead lines. It also includes a 35 kV switch yard to which the HPP Vrben and HPP Raven are connected.

Area of direct influence from project activities in HPP Vrutok is presented on following map (Figure 16Figure 16). The area where the HPP Vrutok performs the activities is near the settlement Vrutok that presents a mix area with individual houses, religious objects, and services.



Source: OSSP Katastar.gov.mk

Figure 16: Area of direct influence from project activities in HPP Vrutok

3.1.1.7 HPP Raven

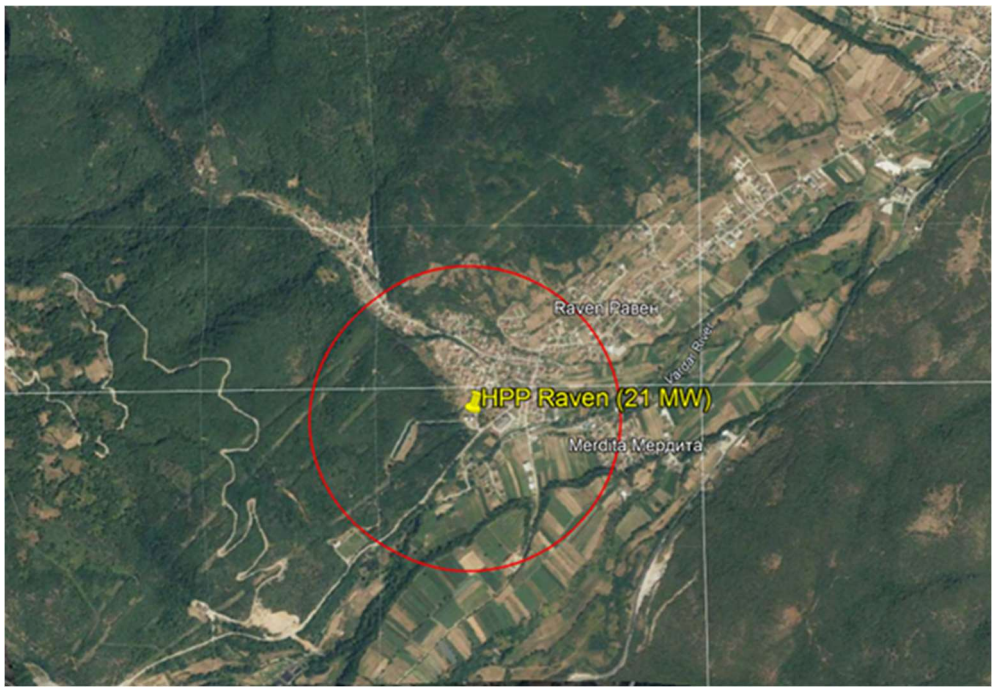
The water, once utilized in HPP Vrutok, with two tunnels is brought to HPP Raven's surge chamber.

HPP Raven is situated about 2 km downstream HPP Vrutok and because it has no own storage reservoir operations dependent on HPP Vrutok operating regime.

The Plant has 3 vertically mounted generators with power of 7 MW each, reach after few rehabilitations. Generators are driven with Francis turbines. The produced electricity in HPP Raven through three block transformers (for each generator) is transformed with 35 kV overhead transmission line is connected to the HPP Vrutok main power station. The average yearly production is 42 GWh electrical energy.

The utilized water is spilt in the Vardar River's bed from where it is further used for irrigation of the Polog Field.

Area of direct influence from project activities in HPP Raven is presented on following map (Figure 17). The area of the HPP Raven is in the vicinity of the settlement Raven, nearby individual houses, religious objects, cemetery, agricultural fields and river Vardar.



Source: OSSP Katastar.gov.mk

Figure 17: Area of direct influence from project activities in HPP Raven HPP Spilje

HPP Spilje is located near the city of Debar. Plant is operated since 1969.

HPP Spilje accumulation volume is 506 million m^3 water, with useful volume of 218 million m^3 water. The reservoir is mainly fed by Crn Drim and Radika rivers, so inflows regime depends on water flows from both rivers. The inflow from the Crn Drim River during the year is quite stabile due to existence of two water storages upstream: Ohrid Lake and Globocica reservoir. The inflows from the Radika River are variable due to the climate factors of the river basin.

HPP Spilje has a stone deposit dam with a height of 101 meters. The normal accumulation level is 580 m.a.s.l. and the minimal level is 560 m.a.s.l.

HPP Spilje has three generators with a total power of 84 MW. The generators are driven by Francis turbines with vertical axis. The average annual production is 272 GWh.

The produced power is transferred to the system with 110 kV switchgear plant located behind the HPP. HPP is connected by a system of 2 110 kV overhead lines.

Outflow from the HPP is returned to the riverbed. There is no irrigation system related to the plant, but reservoir banks are used for some tourism activities.

Area of direct influence from project activities in HPP Spilje is presented on the following map (Figure 18). The area of the HPP Spilje is outside the city of Debar (around 3 km) and there are no other settlements in the vicinity.

Source: OSSP Katastar.gov.mk

Figure 18: Area of direct influence from project activities in HPP Spilje

3.1.2 HPP Globocica

HPP Globocica is located upstream of HPP Spilje on the Crn Drim River. Plant is operated since 1965.

HPP Globocica reservoir volume is 55.3 million m^3 water, with useful volume of 13.2 million m^3 water. The reservoir is fed by Crn Drim with stabile inflow due to control of Ohrid Lake outflow. In addition, water from the Jablanska and Selecka rivers with channels are transferred to the reservoir.

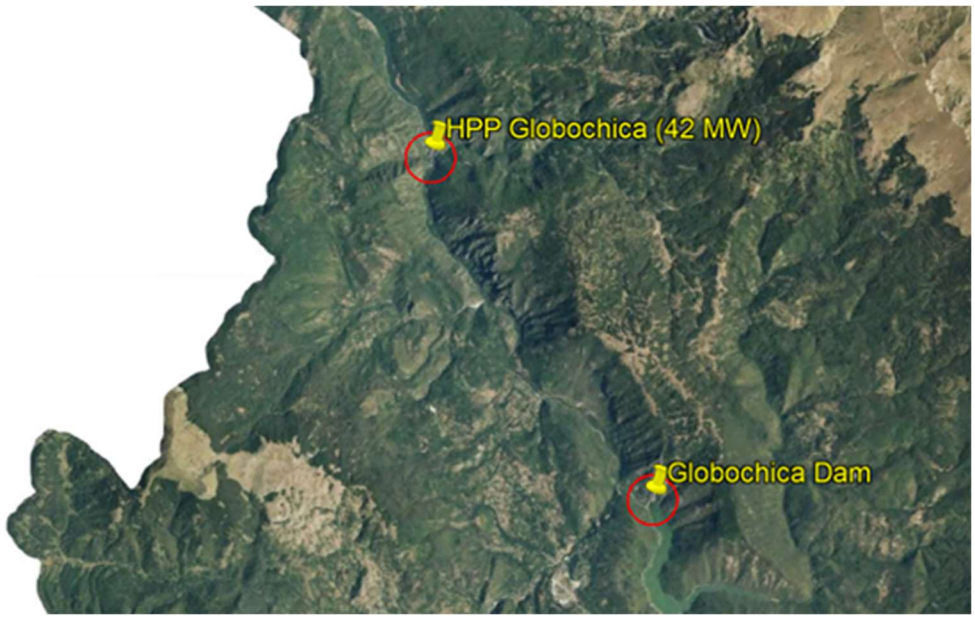
Due to its relatively small useful volume HPP can store water just for one week of operation and practically cannot be used for water regimes control.

HPP Globocica's powerhouse is located at the beginning of the Spilje reservoir. It has two generators with a total power of 42 MW. The generators are driven by Francis turbines with vertical axis. The average annual production is 180 GWh.

HPP Globocica dam is located about 7.8 km upstream from the powerhouse. It is a rock filled dam with height of 94.5 m. The normal designed operation level of the accumulation is 687.50 m.a.s.l., and the minimal level is 682.80 m.a.s.l.

The produced power is transferred to the system with 110 kV switchgear plant located at HPP. HPP is connected with the system through two 110 kV overhead lines. Outflow from the HPP is practically inflow from Spilje reservoir. There is no irrigation system related to the plant.

Areas of direct influence from project activities in HPP Globocica and Globocica dam are presented on following map (Figure 19). The area of the HPP Globocica and dam is outside the urban or rural area, no settlements in the vicinity.



Source: OSSP Katastar.gov.mk

Figure 19: Area of direct influence from project activities in HPP Globocica and Globocica dam

3.1.3 HPP Tikves

HPP Tikves is located on the river Crna, 27 km upstream of its inflow in Vardar River, near Kavadarci. The HPP started with operation in1968 with 2 generators. In 1981, two additional generators were installed.

HPP Tikves accumulation volume is 479 million m^3 water, with useful volume of 309 million m^3 water. The reservoir is fed by Crna reka river and inflow is variable due to the climate factors of the river basin.

HPP Tikves has rock filled with height of 113.5 m. Normal operation level of the reservoir is 265 m.a.s.l. and the minimal level is 233 m.a.s.l.

HPP Tikves has four generators with total power of 113 MW. The generators are driven by Francis turbines with vertical axis. The average annual production is 144 GWh. The produced power is transferred to the system with 110 kV switchgear plant located behind the HPP. HPP is connected with the system through 2 110 kV overhead lines.

Outflow from the HPP is returned to the riverbed of Crna Reka. HPP Tikves besides production of electric power is also used irrigation of Tikves fields, which are the warmest and driest regions in Macedonia. The irrigation system intake is located at 245 m.a.s.l.

On the reservoir banks there are a lot of weekend houses and some tourism activities. The Reservoir is a favorite place for sport fishing activities.

Area of direct influence from project activities in HPP Tikves and Tikves dam is presented on following map (Figure 20). The area of the HPP Tikves and dam is nearby settlement with weekend houses in the vicinity, but outside the borders of zone of direct influence.

Source: OSSP Katastar.gov.mk

Figure 20: Area of direct influence from project activities in HPP Tikveh and Tikveh dam

3.2 Other Areas affected by the Project

Taking into consideration the type of planned activities, there are no other areas significantly or permanently affected by the project. However, when transporting equipment on regional and local roads to and from the sites, short term traffic disruptions are possible and need to be properly managed. The Mavrovo citizens and visitors in that period can use the alternative route Bunec – Leunovo – Mavrovo. Based on the equipment size, which is not oversized, no special transport vehicles are required to be organized. At ad hoc times, during the Mavrovo dam construction activities, closure of the road from Mavrovi Anovi – Mavrovo for public traffic for a few hours at a time may become necessary.

3.3 Planned Rehabilitation Activities

The rehabilitation of the HPPs power plants depends on the previous activities, equipment conditions and expected benefits by ESM. In general project activities can be grouped as:

- electrical equipment related
- mechanical equipment related
- construction activities.

Of course, in each of these groups, also other activities are expected, but they are minor and are related to the main activities.

In this chapter, planned project activities are presented by location and type of activity.

3.3.1 HES Mavrovo

The activities in HES Mavrovo are not completely defined and there are possibilities for some changes to occur during the next stages of the rehabilitation project.

3.3.1.1 Gorna Radika Supply System

This intake system defines that hydromechanical equipment of the Stirovica intake should be replaced. The hydromechanical equipment is old with wooden gates and with a lot of issues with equipment operation. The current conditions of the gates and operational mechanism are given in Figure 21.

Source: Fichtner, taken during site visits in 2022

Figure 21: Stirovica gates and operational mechanism

The main goal of the project activities is to eliminate water losses and gates operation improvements. There are no other planned activities in this system. The rehabilitation works will not change the amount of water presently used.

3.3.1.2 Sharski vodi supply system

The main activity planned for Sharski vodi is also replacement of the hydromechanical equipment on selected intakes, that were shared with Fichtner by ESM before the site visits. During the site visit, however, ESM informed Fichtner that selection of intakes was not yet finalized. Seven intakes were visited and all of them have similar issues. The most damaged equipment was noticed on Mazdraca intake (Figure 22), where lots of bigger stones affected the whole intake and damaged gates.

Source: Fichtner, taken during site visits in 2022

Figure 22: Mazdraca intake

In this case, the main goal of the activity is to eliminate water losses and to improve gate operation. By doing so, the rehabilitation works will not change the volume of water presently used for operation, but instead allow for a more efficient control of the water flow. The water, which is currently spilled, will be diverted for generation of energy after rehabilitation of gates, as it was foreseen by the original design.

3.3.1.3 Mavrovo dam

Electrical works

The Mavrovo dam monitoring system was installed during construction and regularly monitored based on the legal requirements for monitoring of high dams. Some of the instruments have been renewed and upgraded with automated measuring equipment for technical monitoring.

With this activity, a system for automatic topographic observation and recording of the movements of the dams and control of the filtration body of the Mavrovo dam will be installed. The expected results are improvements in dam safety with online monitoring which will help for smooth use of the reservoir and safe operation of the power plant.

Construction works

For the Mavrovo dam the construction activities related to the Rehabilitation of the grout curtain are planned.

The Mavrovo Dam grout curtain is designed and constructed as a two-row with a depth of upstream boreholes. In 1978, some rehabilitation works were performed on the grout curtain with injection works at the place of water penetration in the control gallery. From then until today, no injection interventions have been performed on the injection curtain and the gallery.

Source: Fichtner, taken during site visits in 2022

Figure 23: Mavrovo Dam and Dam gallery

With the project it is expected improvements of the stability of the Mavrovo dam and reduction of the water infiltration. There are no planned electrical and mechanical work. The rehabilitation works will not change the water regime in the accumulation. With the planned rehabilitation works only the stability of the dam will be improved and thus, potential safety hazards reduced.

3.3.1.4 HPP Vrben

The main planned activity in the HPP Vrben is reconstruction of the turbine equipment of both units and conductor replacement on the 35 kV overhead line.

Mechanical works

Due to the long utilization, the existing turbine equipment is old and with depreciated mechanical structures, and the old material is a potential hazard for bigger malfunctions, that is, halt of the units and energy loss.

Also, the recent utilization is already in difficult conditions, with frequent interventions for repairing the malfunctions of the turbine equipment (replacing the labyrinth rings, glands - gaskets) of the turbine axle, weakened conductive blades and difficulties when adjusting the closing of the blades due to depreciation, as well as damages of the load-bearing bearings).

During the site visit, the engineer responsible for the project also noted that the replacement of the generators might be taken into consideration, because of the easier and cheaper equipment installation.

Source: Fichtner, taken during site visits in 2022

Figure 24: HPP Vrben Francis turbine

Main benefits of this activity are expected to be:

- reduction in maintenance costs;
- improvement in HPP reliability, which would result in additional electricity generation;
- improvement of efficiency which is expected to increase of around 8-10%;
- increased water flow utilization for 1.5 m^3/s (will be done by diverting these quantities from the discharge channel to the HPP) and power increase of 1.8 MW.

Electrical works

The rehabilitation activities related to the HPP Vrben, will also cover replacement of the conduction wires Al/Fe 150/50 mm^2 and protection wire with integrated optical fibers. This overhead line with length of 13.8 km is the main interconnection with HPP Vrutok and 110 kV switchgear.

Source: Fichtner, taken during site visits in 2022

Figure 25: Damaged conductors on 35 kV overhead transmission line near settlement Recane

The main reasons for this activity are the existing damages to the conductors, but also decreased mechanical properties of the wires confirmed with already performed analysis.

Because of this complete replacement of the wires of the transmission line is planned. Also, old protective wire will be replaced with a new one with integrated optical fibers.

The expected benefits are reliable functionality of the transmission line, no interruption of HPP Vrben production due to malfunction of the line and new reliable optical connection with Vrutok and Raven for faster and more reliable data transfer.

3.3.1.5 HPP Vrutok

Mechanical works

In the HPP Vrutok two main mechanical works are planned:

- replacement of the turbine bearings and turbine axle
- replacement of needles' servomotors of units C and D.

<u>Replacement of the turbine bearings and turbine axle on all units</u>

The existing design of the turbine bearings is outdated system, pillow block bearings. During the operation there are frequent malfunctions and oil leakages which require intensive maintenance under difficult working conditions.

In 2012, the whole system was replaced with spare bearings of all units, which cause HPP to be out of order for two months.

Installation of a new type of bearings is planned during this project. The new bearings will be segmented to allow more effective and safe access of a central line of the generator's axle during bearing replacement with adaptive mechanisms for adjusting the radiance.

The main benefits of this work will be improvement of the HPP reliability, lower maintenance costs and avoiding oil leakages.

Source: Fichtner, taken during site visits in 2022

Figure 26: One of the turbines in HPP Vrutok

Replacement of needles' servomotors of units C and D

In the last few years there have been frequent reliability issues of the servomotors with oil leakage and damaged cartridge cases which caused unreliable operation. The old equipment and the old solution also are root cause issues during unit synchronization which affects the speed stability and output power.

With the rehabilitation it is planned replacement of the servomotors on units C and with similar types as units A and B, which are more reliable. Also, servomotors' needles will be replaced.

With the investment the motor and needle reliability will be improved, which will result in elimination of synchronization, reduced maintenance cost and prevention of oil leakages.

Construction works

The planned construction activities are related to reconstruction repair of the joint chamber of the intake from sedimentation tank in HPP Vrutok surge chamber.

The works are required due to construction damage and a crack in the right winged wall caused by improper foundation of the facility, due to part of the chamber's foundation being on talus material, and part on hard rock.


Source: Fichtner, taken during site visits in 2022

Figure 27: Damaged sedimentation tank

The planned activity requires construction of the new facility founded on solid rock, changes in the supply channel and a new discharge gate from the chamber towards the downstream apron.

The main benefits of this activity will be stability and reliability of the facility, as well as safe operation of central settling basins and safety on the ground under the extinguisher.

The rehabilitation works will not change the amount of water presently used nor the water regime. Rehabilitation work will be performed on the sedimentation tank which is used for water settling and discharge to the river stream. This facility is not used for any water regime control.

3.3.1.6 HPP Raven

Electrical works

The planned electrical works during the rehabilitation in HHP Raven is replacement of poles and bearings on all three generators.

During the previous rehabilitation activities, the starters of all three generators were replaced, but rotors are still originally installed. Poles' insulation characteristics are worsened with low temperature class B and according to the technical documentation provided by ESM contain Asbestos, which is typical for this class B type of insulation materials.

ESM plan to replace poles, but also to introduce new technical solution for pole attachment on the shaft. This will allow dismantling the individual poles without dismantling of whole rotor. Because of technical constrains, there is possibility, that the shaft will also need to be replaced.

The generator bearings are also planned to be replaced with a new teflon based bearing solution.

With these activities, generators will be more reliable, with better tolerance to temperature (higher insulation class) and will eliminate current stops related to bearing or poles overheating.

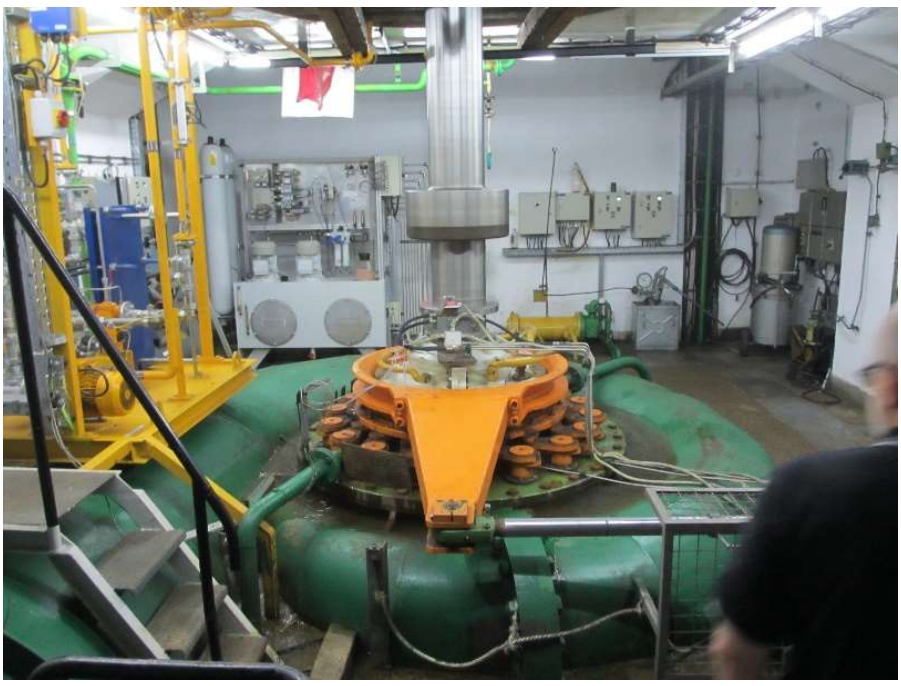
Source: Fichtner, taken during site visits in 2022

Figure 28: Generators in HPP Raven

Mechanical works

During the rehabilitation it is also planned the replacement of bearings and cartridge cases on the wicket gates. The installed ones are in operation since 2001 and after 20 years of operation of the turbines, due to the wear of the cartridge cases, the problems with breaking the fuses of the wicket gates became more frequent. This causes large vibration and limit openness which reduces turbine power.

With the proposed activity, equipment reliability will be improved, and improved designed turbine power will be reached.



Source: Fichtner, taken during site visits in 2022

Figure 29: One of the turbines in HPP Raven

The rehabilitation works will not change the amount of water presently used nor the water regime.

3.3.2 HPP Spilje

Electrical works

In the HPP Spilje there are a few different rehabilitation electrical activities planned:

- replacement of generator 1
- replacement of poles on generators 2 and 3
- replacement of all block transformers.

Replacement of generator 1

The generator has been installed in HPP since the beginning of the operation. In 1992 the main repair of the generator was performed, when. The stator's windings were replaced with a new one and the testing of the magnetic core was performed.

Since then, some regular maintenance activities on the stator, but higher values of partial discharges the insulation system were noticed, which indicates worn of installation.

The ESM plan to replace the generator with a new one with a larger power capacity of 31.5 MVA.

With this replacement the operation of the generator's reliability will be improved, electrical losses reduced and reduced maintenance costs.

Source: Fichtner, taken during site visits in 2022

Figure 30: One of generators in Spilje

Replacement of poles on generators 2 and 3

During the previous rehabilitation activities, the stators of the generators were replaced with new windings with better insulation, but there were no improvements on rotors windings. In operation in last period, there were frequent interruptions in the between-pole copper connections of the rotors and frequent reducing of the insulation resistance of the rotor winding.

ESM plans to replace poles (where according to the technical documentation provided by ESM, asbestos Class F insulation material is present), but also to introduce new technical solution for pole attachment on the shaft. This will allow dismantling the individual poles without dismantling of whole rotor. Because of technical constrains, there is possibility, also shaft to be replaced.

With these activities, generators will be more reliable, with better tolerance on temperature rise (higher insulation class) and will extend lifetime of rotors.

Replacement of all block transformers

Block transformers with power of 26 MVA are in operation since 1969 and presence of PCBs in transformer oils seems likely, as it is often the case in transformers installed in the 1960s-1970s. Regular maintenance was performed in the past according to ESM. Due to the increase of the generators, power block transformers were operated with higher power than designed (31.2 MVA), which led to overheating of the windings.

During regular maintenance, it was noticed that changes in oil chemistry had taken place which indicate that insulation is degraded. Because of this one of the transformers was replaced with a spare.

Source: Fichtner, taken during site visits in 2022

Figure 31: Block transformer in Spilje

Due to the long operation period the oil leakages were noticed caused by sealing material degradations.

With this activity new transformers with the required power will be installed, which will improve equipment reliability, reduce transformer losses and eliminate oil leakages.

Mechanical works

In the HPP Spilje there are two different rehabilitation mechanical works planned:

- replacement of cartridge cases from conductive blades from units 1, 2 and 3
- replacement of hydromechanical and electrical equipment of valve chamber.

Replacement of cartridge cases from conductive blades from units 1, 2 and 3

During the rehabilitation it planned replacement of cartridge cases on the wicket gates. The installed ones are in operation since 1998 and after more than 20 years of operation the wear of the cartridge cases is noticed and because of this there is a need for their replacement.

With the proposed activity, equipment reliability will be improved, and designed turbine power will be reached.

Replacement of hydromechanical and electrical equipment of valve chamber

The equipment is in operation since 1969. Due to the damages caused by corrosion in the previous period, parts of the pipe installation were replaced. The main issues with equipment are obsolete spare parts for the hydraulic system which caused difficulties for repair and equipment reliability. Because of this the replacements of hydraulic units and pipelines are planned. This also will require the installation of a new electric system for control and monitoring. During the reparation activities, also seal on the gate will be replaced.

Source: Fichtner, taken during site visits in 2022

Figure 32: Servo motor in valve chamber

With this investment, the issues with spare parts and reliability will be solved. This facility is used to control water release from the dam and to reduce unplanned water losses. The rehabilitation works will not change the water regime.

3.3.3 HPP Globocica

In the HPP Globocica electrical, mechanical and construction works are planned.

Electrical works

Replacement of generator A and B

The generators are installed in HPP Globocica since the beginning of the operation in 1965. In 1988 stators' windings were replaced with a new and the testing of the magnetic core was performed.

From those times, there are some regular maintenance activities on the stator. In 2005 the pole reinsulating was planned, but due to impossibility for dismantling the poles it was canceled. Also, higher values of partial discharges of the electrical properties of the insulation system of the generators were observed.

The ESM plan to replace generators with new ones that have the same power.

With this replacement the operation of the generator operations reliability will be improved, electrical losses reduction and reduced maintenance costs.

Source: Fichtner, taken during site visits in 2022

Figure 33: Generators in Globocica and generator nameplate

Mechanical works

The mechanical works are related to reconstruction of wicket gates of Francis turbines on both generators and replacement of hydromechanical and electrical equipment of valve chamber.

Reconstruction of wicket gates of Francis turbines

For that longer period, the split cavitation caused large damages of the lower and upper cartridge cases, as well as the tangent surfaces of the blades. These damages caused the loss of water to increase, due to leaking through the blades, and adjustment of the wicket gates is almost impossible. Damaged tangent surfaces of the blades cause difficulties when generator is braking.

Rehabilitation activities will cover replacement of the lower and upper cartridge cases with a new improved design and materials. Also repair works on the wicket blades and processing until will be performed.

Source: Fichtner, taken during site visits in 2022

Figure 34: Wicket gates of Francis turbine

The main benefits of these activities will be Increased reliability, reduced maintenance, reduced water losses, optimal unit operation during the start and stop regimes. Because of reduced water losses, additional energy can be produced.

Replacement of hydromechanical and electrical equipment of valve chamber

The equipment is in operation since 1965. The pipe installation is in ambient air with high humidity and is exposed to the effect of the water spraying where there are visible corrosion damages. Besides pipes corrosion maintenance has also issues with obsolete spare parts for hydraulic system. Because of this the replacements of hydraulic units and pipelines are planned. This also will require the installation of a new electric system for control and monitoring. During the reparation activities, also seal on the gate will be replaced.

Source: Fichtner, taken during site visits in 2022

Figure 35: Valve chamber house

With this investment, the issues with spare parts and reliability will be solved. This facility is used to control water release from the dam and to reduce unplanned water losses. The rehabilitation works will not change the water regime.

Construction works

The Globocica dam is constructed on a sediment layer instead of on solid rocks and because of that a three-row grout curtain was made. In 1974, the curtain was repaired. The actual monitoring of the piezometers shows increased pressure which indicates rinsing, i.e., weakening of the grout curtain and indicates necessity of curtain repairs.

The activities will cover reinforcement of the grout curtain.

Source: Fichtner, taken during site visits in 2022

Figure 36: Globocica dam

With the reinforcement dam stability will be increased and water filtration under the dam reduction.

The rehabilitation works will not change the water regime. With the planned rehabilitation works only the stability of the dam will be improved and thus, potential safety hazards reduced.

3.3.4 HPP Tikves

Electrical works

Planned electrical work during the rehabilitation will cover replacement of the block transformers of generator A and B.

Block transformers with power of 26 MVA are in operation since 1967, and presence of PCBs in transformer oils seems likely, as it is often the case in transformers installed in the 1960s-1970s.

Regular maintenance was performed in the past, according to ESM. Due to the increase of the generators, power block transformers were operated with higher power than designed (31.8 MVA), which was achieved with changes of cooling operation from ONAN (Oil Natural Air Natural) to ONAF (Oil Natural Air Forced). Because the transfer was placed south facing, changes in the cooling system are not sufficient during the summer period, limiting the generators to operate at 23 MW, instead of full power of 28.6 MW.

During the regular maintenance activities, similar to HPP Spilje, changes in oil chemistry were identified which indicate that insulation is degraded.

Source: Fichtner, taken during site visits in 2022

Figure 37: Block transformer in Tikves

Also due to the long operation period the oil leakages were noticed caused by sealing material degradations.

With this activity new transformers with the required power (31.5 MVA) will be installed, which will improve equipment reliability, HPP will operate with full power, reduce transformer losses and eliminate oil leakages.

Mechanical works

The only mechanical work at HPP Tikves will be replacement of hydromechanical and electrical equipment of dam bottom outlet valve.

The equipment is in operation since 1974. The main issue with maintenance is lack of spare parts which are obsolete for a longer period. Due to exposure on the moisture also corrosion damages are visible. The oil analysis shows higher than allowed quantiles of water. The gates appear to not properly close due to sealing issues.

Because of these reasons the planned activities will cover: replacement of the hydraulic system, new stainless-steel pipes, replacement of the sealing elements on plate gate, new anticorrosive protection of submersed parts, and inspection and repairs on servo motor.

Replacement of the hydraulic system will require installation of a new electric system for control and monitoring.

Source: Fichtner, taken during site visits in 2022

Figure 38: Valve chamber equipment at HPP Tikves

With this investment, the issues with spare parts and reliability will be solved. The proper sealing will reduce water losses and increase energy production.

The rehabilitation works will not change the water regime. This facility is used to control water release from the dam and to reduce unplanned water losses. The rehabilitation works will not change the water regime.

3.3.5 Hazardous materials

During the site inspections performed by the technical team together with experts from ESM the following hazardous materials were identified which need to be addressed under the scope of the planned rehabilitation activities:

- Asbestos
- PCBs
- Waste oils

In the past Asbestos was used as insulation material in generators. During the rehabilitation activities planned for this program Asbestos is expected to be found at HPP Raven and HPP Spilje (poles replacement), as well as during the generator replacement at HPP Spilje and HPP Globocica.

PCBs were added in the past to improve transformer oil characteristics. During the rehabilitation activities PCBs can possibly be encountered during the replacement of the transformers in HPP Spilje and HPP Tikves.

Waste oils are expected for the replacement of hydromechanical equipment, mainly in form of hydraulic oil, in all six HPPs under the scope of this program.

4 Regulatory and Administrative Framework

This chapter summarizes the national and international regulatory, policy, and institutional framework relevant to the proposed environmental and social risk assessment for the planned rehabilitation measures for the proposed project.

Relevant Standards related with the national legislation that are applicable for the project are the following: Law on water; Law on energy; Law on nature, Law on noise, Law on waste, Law on safety at work, Law on Labour, Law on occupational health and safety, Law on traffic road safety, as well as secondary legislation related with these laws.

ESM has implemented following ISO standards applicable for the project: ISO 9001, ISO 14001 and ISO 45001.

International standards applicable to the project are the World Bank Environmental and Social Standards (ESS1, ESS2; ESS3; ESS4; ESS6; ESS8; ESS10) that set out the mandatory requirements that apply to the projects.

The General EHS Guidelines from the WB Group applicable for the project are the following: environmental (hazardous material management, waste management and noise); OH&S (PPE, physical and chemical hazards; monitoring); community H&S (water quality and availability; structural safety of Project infrastructure; traffic safety; transport of hazardous materials); construction and decommissioning (environment; occupational H&S and community H&S).

Good Practice Note on Environmental, Health and Safety Approaches for Hydropower Projects and Good Practice Handbook on Environmental Flows for Hydropower Projects, as well as ILO Declaration on Fundamental Principles and Rights at Work and other core conventions are also applicable for the project.

The ESSRA is carried out taking into consideration KfW's general principles from the Sustainability Guideline of the KfW Development Bank (2022) on avoiding social and environmental impacts and risks.

4.1 Applicable National Plans, Policies and Strategies

The Republic of North Macedonia as a candidate-country for fully-fledged membership into the European Union (EU) is facing the challenges of efficient implementation of serious reforms in its societal system. The EU membership aspirations inevitably entail increased awareness about the need to fulfil the standards in several areas.

The principles of cooperation with the EU in the energy sector are envisioned to reflect the principles of market economy and the Energy Charter Treaty and to develop in the view to gradually integrate into the European energy markets related to energy issues on national level.

The Republic of North Macedonia is a signatory to the Energy Charter Treaty (ratified into Law in 1998). Along with the signing of the Energy Charter Treaty, the Protocol on Energy Efficiency and Related Environmental Aspects. The Protocol on Energy Efficiency and Related Environmental Aspects prescribes the obligations of the Contracting Parties for formulating clear political objectives on increasing energy efficiency and abatement of negative impact of energy processes on the environment.

The Republic of North Macedonia is also a party to the Energy Community Treaty. The Republic of North Macedonia ratified the United Nations (UN) Framework Convention on Climate Change (UNFCCC) in 1998 and ratified the Kyoto Protocol in 2004. Consequently, North Macedonia took part in the negotiations, signed and ratified the Paris Agreement of the UNFCCC which entered into force on 4 November 2016.

All the cited international agreements related to the energy sector signed by the Republic of North Macedonia clearly denote the aspiration and trajectory of development for this significant sector – full alignment of the legislative framework and economic and business conditions in the sector with those of the EU.

The Government has adopted several strategic documents over the past years that define the country's national energy policy. Among those are the **Strategy for Energy Development in the Republic of North Macedonia until 2040**, the **Strategy on Use of Renewable Energy Sources in the Republic of Macedonia until 2020**, the **Strategy for Improvement of the Energy Efficiency in the Republic of Macedonia until 2020**, the **Action Plan on use of Renewable Sources of the Republic of Macedonia until 2025 with a vision until 2030**, and the **Third National Energy Efficiency Action Plan until 2020**.

The Strategy for Energy Development of the Republic of North Macedonia until 2040 defines three scenarios – Reference, Moderate transition and Green. Each scenario has a different set of policies and strategic measures on how to achieve strategic goals. Developed policies and strategic measures are categorized along five energy pillars and provide answers on how to tackle current specific challenges and leverage on new opportunities:

1. Energy efficiency: the Strategy maximizes energy savings up to 51.8% of primary and 27.5% of final energy.

2. Integration and security of energy markets: the Strategy is aiming to ensure that North Macedonia is even stronger integrated into European markets, protect today's levels of energy dependence and provide necessary flexibility for higher RES integration. Current electricity consumption relies on ~30% import, with the rest supplied from domestic generation capacities, mainly lignite fired thermal power plants (TPP Bitola and TPP Oslomej) and large hydro power plants.

3. Decarbonization: In the Green scenario in 2040 the Strategy is to decrease GHG emissions up to 61.5% vs. 2005 or 72.8% vs. BAU, while strongly increasing the usage of RES in a sustainable manner up to 45% in gross final energy consumption. Even though North Macedonia has lower GHG emissions per capita by ~30% compared to EU, the GHG emissions per GDP are five times higher than EU in 2014. Two thirds of overall GHG emissions come from energy sector fuel combustion, with energy transformation, industry and transport sub-sectors having the highest share. In line with EU decarbonization policies, all scenarios assume that the country will enter in the Emission Trading System (ETS), but with different year of entrance and using different WEO 2017 scenarios of CO_2 price, with most progressive in the Green scenario.

4. R&I (Research & Innovation) and competitiveness: the Strategy minimizes total system costs based on least cost optimization taking into consideration country specific situation. The Strategy highlights the need to streamline energy transition technologies into national R&I priorities, and stimulate cooperation among policy makers, industry, utilities, municipalities, and associations.

5. Legal and regulatory aspects: the Strategy emphasizes full compliance with EnC directives. The Energy Law adopted in 2018 transposed the Third Energy Package in the electricity and natural gas sector, as well as RES Directive. In terms of EE, relevant obligations under the EnC Treaty to ensure compliance with the EE acquis are in different levels of implementation.

The policy framework for environment and sustainable development is centered around the 2010 National Strategy for Sustainable Development (NSSD) for the period 2010–2030 and the annually revised National Program for the Adoption of the Acquis Communautaire (NPAA).

Ensuring environmental sustainability is high on the agenda of the Republic of North Macedonia, which in the last twenty years has intensively accepted global strategies and policies in terms of environmental protection through ratification of the most important international conventions and protocols and has at the same time expressed its readiness for EU accession by developing relations with the EU and obtaining a candidate status.

Since 2005, the process of approximation of the EU legislation in the RNM in the field of environment has started by transposing the EU Directives in all sectors of the environment (waste, water, air, noise, chemicals, industrial pollution control, nature, horizontal legislation), and in the period 2006-2008, a National Strategy for approximation of the EU legislation in the national regulation was prepared. This Strategy provide a "route map" for a full and effective approximation process, including a sustainable, comprehensive framework of actions with associated costs needed for legal transposition and technical implementation in all ten environmental sectors. The transposition of the main obligations of the environmental EU Directives, EU standards and international organisation's standards into the national primary legislation started in 2003/2004 with the Law on Environment (Official Gazette of RM No. 53/05, 81/05, 24/07, 159/08, 83/2009, 124/2010, 51/2011, 123/12, 93/13, 163/13, 42/14, 44/15, 129/15, 146/15, 192/15, 39/16, 99/18 and 89/22). The Law on Environment contains the basic principles of environmental protection with both precautionary and "polluter pays" principles and provides the legal basis for issuing of necessary secondary legislation.

The EU environmental legislation has been transposed into the national legislation and, almost for all environmental sectors, the prescribed standards and emission limits, or waste management principles are the same.

The requirements of the Water Framework Directive (WFD) have been transposed in the Law on Waters and secondary legislation, but practical implementation is significantly lagging behind. All water bodies within the country have been identified including four river basins. These are: Vardar river basin; Strumica river basin; Crn Drim river basin and South Morava river basin, the River basin management plans have been prepared for the Vardar, Strumica and Crn Drim river basin, but still not adopted. Regular monitoring on surface and ground waters is performed by the authorities. Currently, National Environmental Monitoring Strategy is under preparation, which includes waters monitoring in line with the requirements of the WFD. The main requirement refers to the monitoring of good status of surface water which has been transposed trough the Decree on classification of surface waters, that will enter into force from January 2024.

The laws on waste management and special waste streams have been adopted, but the by-laws and practical implementation are still unsatisfactory. Waste management in the Republic of North Macedonia is regulated by the Law on Waste Management with focus on regional approach of the waste management: collection, transport, selection, and recycling of waste, as well as its treatment and utilization, establishment of a functional system for regional waste management and construction of regional landfills.

Republic of North Macedonia has an Extended Producers Responsibility (EPR) schemes in place for waste electrical and electronical equipment (WEEE), batteries, the law on electrical and electronic equipment management and waste electrical and electronic equipment; legally enforces the Directive of the Parliament and of the Council on waste electrical and electronic equipment, and Directive 2011/65 / EU of the Parliament and Council to limit the use of certain hazardous substances in electrical and electronic equipment. The Law entered into force in 2021 and contains extended producer responsibility (EPR) and obligations in line with the Law on Extended Liability of the Producer for Management of Special Waste Flows (Official Gazette number: 215/2021).

The status of transposition of the EU Directives pertaining to PCB or PCT Directives is 100% compliant, whilst for Landfill Directive is around 95% compliant. Directives on the specific waste types are transposed at the following rates: Packaging Waste - 95%, Batteries and Accumulators – 97%, Waste Electrical and Electronical Equipment (WEEE) - 55%, Restriction of Hazardous Substances in Electrical and Electronic Equipment Directive - 7% compliant.[3] There is one regional centre for handling PCB waste in the country - company "Rade Koncar – Service" which has installed a plant for the appropriate treatment and removal of waste transformer oil and equipment contaminated with PCB from electrical equipment.

The Law on Nature Protection includes provisions transposed from the two most important EU instruments for nature protection, namely: the Directive on the Conservation of Natural Habitats and Wild Fauna and Flora (92/43/EEC) and the Directive on the Conservation of Wild Birds (147/2009/EC). The Law also transposes the Regulation on the Protection of Species of Wild Fauna and Flora by Regulating Trade Therein (338/97/EC).

In accordance with the Directive on the Conservation of Natural Habitats and Wild Fauna and Flora (92/43/EEC), EU Member States are obliged to establish the European ecological network Natura 2000 and "Special Areas of Conservation". More than 50% of this Directive has been transposed into the national legislation including: proposed NATURA 2000 sites (http://natura2000.gov.mk/en/), identification of Important Bird Areas (IPAs), Key Biodiversity Areas (KBAs), Primary Butterfly Areas (PBAs), etc.[4]

In accordance with Directive on the Conservation of Wild Birds (147/2009/EC), EU Member States are obligated to take all necessary measures to maintain the population of bird species at a level appropriate primarily to the environmental, scientific and cultural requirements, taking into account economic and recreational requirements, or adapt the population of those species to that level. This Directive has been transposed into the national legislation including: identification of Important Bird Areas (IBAs), conducting monitoring activities of significant bird species (Egyptian vulture, golden eagle, etc.), establishing birds species as environmental bioindicators, etc.

In December 2019, North Macedonia prepared and adopted National Red List of flora and fauna. Total 46 species of herpetofauna (amphibians and reptiles) were identified and systematized, and an assessment was made of 14 plant species, which have international and national protection status[5].

[3] SEIS Country Report Republic of Macedonia (https://www.moepp.gov.mk/wp-content/uploads/2017/07/SEIS_Country-Report_-Republic-of-Macedonia_2018_Final.pdf)

[4] National Strategy for nature protection (2017-2027), MoEPP 2018.

[5] Source: http://redlist.moepp.gov.mk/pocetna/

The RNM has signed a number of international conventions, protocols and bilateral agreements at a global level and has received the status of a candidate country for EU accession. The RNM has adopted several policy strategic documents in several sectors of the environment, where the Government policy towards improving the environment is clearly defined (Long-Term Strategy for Climate Action with Action Plan, National Strategy for European Integration, National Environmental Action Plan II, National Waste Management Strategy, National Management Plan waste, National Water Management Strategy, National Plan for Ambient Air Protection, etc.).

Long-Term Strategy for Climate Action with Action Plan defines North Macedonia's contribution to the global effort, through a pathway towards green, low carbon and climate resilient development, based on the best available information and in the context of the country's accession to the EU. As a candidate for European Union (EU) membership, the Republic of North Macedonia is obliged to transpose the EU legal framework into its national legal system, namely the 2030 Climate and Energy Framework and the 2050 Long-term Strategy / European Green Deal.

With regards to policy documents, the Republic of North Macedonia prepared the main strategic documents for different areas: energy, environmental policy, waters, climate change, air, nature, waste, etc. The strategic documents adopted are listed in Table 1.

Table 1: Strategic Documents Adopted by the Government of the Republic of North Macedonia

ENERGY
The Strategy for Energy Development in the Republic of North Macedonia till 2040
National Action Plan for Energy Efficiency in the Republic of North Macedonia, 2021
ENVIRONMENTAL POLICY
National Strategy for Environmental Approximation 2008-2014, adopted 2008 by the Government of RM (updated in 2014)
National Strategy for environmental investments, 2009-2013, adopted in 2009 by the Government of RM
Second National Environmental Action Plan 2006-2012, adopted in 2006;
Environmental Monitoring Strategy, adopted in 2005 by the MoEPP
WATER
National Water Strategy (2012 – 2042), adopted by Government of RM
AIR
National Plan for Ambient Air Protection in Republic of Macedonia for the period from 2013 to 2018 (2012)
Program for the gradual reduction of emissions of certain pollutants at the level of the Republic of Macedonia with projections for the reduction from 2010 to 2020
NATURE
National Strategy for Nature Protection (2017 – 2027), adopted in 2018
National Biodiversity Strategy (2019 – 2023)
Fifth National Report to the Convention on Biological Diversity of the Republic of Macedonia, 2014;
CLIMATE CHANGE
Long-Term Strategy for Climate Action with Action Plan, 2021;
Third National Plan on Climate Change (2013)
WASTE
National Waste Management Strategy (2008-2020)
National Waste Management Plan (2021 – 2031)

4.2 Institutional Framework

In accordance with the Energy Law the main stakeholder in the creation of the energy policy is the **Government of the Republic of North Macedonia**, which adopts the Strategy for Energy Development, a five-year Program for Implementation of the Strategy, as well as the five-year Energy Balance. The implementation of the Energy Law, and of the laws on planning, investments and other regulations are under the jurisdiction of the Government.

Governmental institutions are mainly responsible for setting the regulations, preparation of policy making and planning documents, financial plans and proposing economic instruments, preparation of guidance and methodologies, providing trainings and dissemination of environmental information.

The Ministry of Economy oversees the country's energy sector on behalf of the Government of the Republic of North Macedonia. One of the bodies within the Ministry is the Department on Energy tasked with strategic planning, development of relevant legislation in the energy sector, implementation of energy policy including energy efficiency and RES, as well as the use of new technologies. This department is also responsible for relevant data related to energy production, supply and demand.

Part of the competencies related to energy belong to the **Ministry of Environment and Physical Planning and to the Ministry of Transport and Communications**. **The Ministry of Environment and Physical Planning (MoEPP)** is the competent state body regarding the development and implementation of policies for environmental protection and improvement in the different media and areas: air, water, soil, solid waste, biological diversity and other natural resources, and ozone layer protection. MoEPP is responsible for monitoring the condition of the environment; protection of water, soil, flora, fauna, air and the ozone layer against pollution; protection against noise, protection of biodiversity, national parks and protected areas; restoration of polluted areas in the environment; proposing measures for treatment of solid waste and other activities. Also, the MoEPP's tasks include alignment of legislation with the EU acquis, supervision and coordination of the work of LSGUs, international cooperation, management of climate change-related issues and raising public awareness and involving the public in decision-making on environmental issues.

The **Department for Nature** (part of the Administration for the Environment) is responsible for the development of policies and provision of technical expertise in the development of legislation and is in charge of implementation of policies and legislation in the fields of biodiversity and landscape diversity, protected areas, natural heritage, and Genetic Modified Organisms.

The **National Parks** have direct responsibilities for administering and managing the national parks, which function as self-financed public institutions (Public Institution Mavrovo National Park and Public Institution Shar Planina National Park). This includes monitoring and direct protection of the national park, implementation of management practices stipulated in the management plan, scientific research and other activities.

Since 2014, the **State Environmental Inspectorate** became a separate legal entity in field of environmental protection. With separation of SEI from the Ministry, North Macedonia formally separated inspection from policymaking and regulatory activities in the environmental field.

Since 2011, the only water-related responsibilities remaining with the **Ministry of Agriculture, Forestry and Water Economy** relate to irrigation and drainage.

The Ministry of Transport and Communications is in charge of the development of policies and legislation on all types of transport (road, railways and aviation) and related infrastructure. The Ministry also has large responsibilities in the field of communal affairs and infrastructure, issuing decisions and permits for construction.

The Ministry of Local Self-Government is responsible for decentralization policy and building a functional local self-government system, while at the same time promoting balanced regional development.

For providing support to the Government in the implementation of the energy policy, the **Energy Agency of North Macedonia** has been formed. It is tasked with drafting mid-term and long-term strategies and development plans, preparing long-term and short-term programs, energy efficiency and use of Renewable Energy Sources preparatory and coordinative activities for implementation of investment projects, regional cooperation and coordination of regional projects, drafting legislative proposals for primary and secondary legislation and technical regulations in the field of energy, and also discharges other activities in the area of energy supply, stipulated by law.

Matters relating to regulated energy activities provided by the Energy Law are conducted by the **Regulatory Commission for Energy and Water Services (ERC)** of the RNM. Some of the most important competences of the ERC include: monitoring the functioning of energy markets, adopting regulations and tariff systems and adopting or approving methodologies for establishing tariffs for regulated energy activities, adopting decisions on prices and tariffs, approving grid codes adopted by respective energy transmission and distribution system operators, adopting rules for electricity, heating energy and natural gas supply, adopting rules on the electricity market, adopting decisions for issuing, changing, transferring, suspending, seizure and termination of licenses for performing certain activities in the field of energy and monitoring their execution, approving development plans and plans for construction of transmission and distribution systems and monitoring their implementation.

JSC ESM (Power Plants of North Macedonia) is a state own company for electricity production from fossil fuels (thermal power plants) and renewable sources (hydro power plants, wind park and solar energy).

The **councils of municipalities and the Council of the City of Skopje** upon proposal of the mayor, and upon received opinion from the Ministry of Economy, are adopting an energy development program for the municipalities and the City of Skopje, respectively. These programs are adopted for five-year periods and shall be harmonized with the Strategy on Energy Development of the Republic of North Macedonia. They in particular stipulate the manner and conditions for conducting energy activities of public interest of local importance, the need and sources of funding for construction of new and reconstruction and promotion of existing buildings, facilities and installations for energy activities of public of local significance, the quantities of natural gas and heating needed for satisfying the needs of citizens and other customers on the territory of the municipalities and the City of Skopje and the measures and activities for increasing energy efficiency and production of energy from renewable sources.

4.3 Legal Framework

Relevant national legislation on energy and environment (water, ambient air quality, waste management, protected natural areas and biodiversity, noise and vibration, access to environmental information and public participation in the environmental decision-making process, as well as for the EIA procedure) is summarized in the following table.

Table 2: Relevant National Legislation and relevance for the Project

National relevant legislation	Relevance for the Project
Law on Energy (Official gazette of RNM no. 96/18, 96/19)	This law regulates: 1) the goals of the energy policy and the method of its realization; 2) energy activities and the method of regulation of energy activities; 3) the construction of energy facilities; 4) the status and competence of the Energy Regulatory Commission of Republic of Macedonia; 5) the electricity market, the natural gas market, the crude oil market oil, oil derivatives and fuels for transport and the thermal energy market; 6) the conditions for realizing energy efficiency and promotion of the use of renewable energy sources and 7) other issues of importance for energy. The law defines the rights and obligations for preferential producers of energy from renewable resources.
Law on Energy Efficiency (Official gazette of RNM no. 32/20, 110/21)	This law regulates: efficient use of energy; the energy efficiency policy; the competences of the Ministry in charge of matters in the field of energy and the Energy Agency for the implementation of this law; the obligations of the public sector in relation to energy efficiency and consumption energy; the binding scheme and alternative measures for energy efficiency; the energy controls of the big traders; energy efficiency during production, transmission, distribution and supply; the performance of energy services and the ways of financing measures to support the energy efficiency; energy efficiency of buildings; and the labelling of energy consumption and the eco design of products which use energy. One of the main aims of the energy efficiency policy is increasing the use of energy from renewable sources.
Environmental legislation	
Law on Environment (Official Gazette of RNM No. 53/05, 81/05, 24/07, 159/08, 83/09, 48/10, 124/10, 51/11, 123/12, 93/13, 187/13, 42/14, 44/15, 129/15, 192/15, 39/16, 99/18)	This Law regulates the principles of environmental protection and sustainable development, aspects for planning of environmental protection documents, entities and procedures for environmental protection, environmental monitoring and information system on the state of the environment. The law obliges all stakeholders who perform activities to adhere to the principles of high degree of protection, caution, prevention and the polluter pay in order to protect the environment. The procedure for EIA is regulated for projects that may cause impacts on the environmental media. First step of the EIA procedure is submission of the Notification Letter to the Ministry of Environment and Physical Planning (MEPP) and based on the type of project activities the decision will be made: a) either full ESIA should be carried out (ESIA Study) for large-scale projects or b) for small – scale projects only the EIA Report (Elaborate) should be prepared. Based on the submitted Notification Letter and type of the project activities (rehabilitation) the MoEPP issued the Decision no.11-3621/2 from 03.08.2021 that there is no need for preparation of the EIA Report for the Project.
Decree on determining projects and criteria on the basis of which the screening for EIA should be carried out (Official Gazette of RM no. 74/05, 109/09, 164/12 and 202/16)	This Decree defines projects for which an EIA procedure is mandatory and generally designated projects that could have a significant impact on the environment for which is determined the need for conducting an EIA procedure.
Rulebook on the information contained in the notification on the intent to implement the project and on the procedure for establishing the need for EIA of the project (Official Gazette no. 33/06)	The Rulebook defines the content of the notification for the intent to perform the project. The investor informs the competent authority of the intent to implement the Project to establish the need to conduct an EIA procedure.

National relevant legislation	Relevance for the Project
Decree on the activities for which preparation of EIA Report is mandatory and competent authority is the body of the state administration responsible for the environment (Official Gazette of RM no. 36/12)	This Decree defines the type of activities for which the EIA Report is required, and competent authority is the body of the state administration responsible for the environment. The approval of EIA Report is under jurisdiction of the Ministry of Environment and Physical Planning. HPPs until 10MW belongs to group V Energetics from this Decree for which EIA Report should be prepared. Taking into consideration that all the six HPP are more than 10 MW and are constructed more than 60 years ago, when there was no established EIA procedure, they are constructed without prepared EIA documentation. During the operation of the HPPs, the Operator has prepared EIA Reports (July 2010) for Mavrovo Hydro – System (HPP Vrutok, HPP Raven, HPP Vrben), which are adopted in November 2011 by MoEPP.
Rulebook on the form and contents of the EIA Report, the procedure for their approval, and manner of keeping the register of approved reports (Official Gazette of RM" No. 50/09, 44/13)	This Rulebook prescribes the form and content of the EIA Report Elaborate, which is the procedure for its approval, as well as the manner of keeping their register.
Water	
Law on Waters (Official Gazette of RNM No. 87/08, 6/09, 161/09, 83/10, 51/11, 44/12, 23/13, 163/13, 146/15, 52/16, 151/21) and bylaws related to limit values for emissions in surface waters and quality of surface waters.	The Law on Waters defines the principles for sustainable water management aimed at rational and efficient use of water, sustainable development of water resources, ***protection of water and protection of water against harmful impacts*****. The law defines the *general provisions for water use and obligations for water use, regulates the legal status and the manner of integrated water management, water infrastructure***, etc. Pursuant to Article 26, every legal or natural person acquires a water right on the basis of a ***water use permit and a water discharge permit.*** The permit is issued for a certain period of time depending on the type of water management facility, but not longer than ten years (Article 46). ESM has obtained Water use permits for HES Mavrovo (no.2083/1 from 22.3.2018), HPP Spilje (UP1-11- 27/16 from 22.3.2018), HPP Globocica (UP1 no.11-21-16 from 25.9.2017) and HPP Tikves (UP1 no.11-17/2016 from 15.3.2017) issued by MoEPP. Water permit for HES Mavrovo is valid 10 years, and remaining Water permits are valid 6 years. (Rights and obligations according to these water permits are addressed in more detail in Chapter 5.1.7.) When carrying out projects for construction of new or reconstruction or extension of existing facilities, located in or near surface waters, facilities that pass through or under surface waters or facilities located near surface waters or coastal lands, which may affect the water regime, a ***water management consent is required***, without which a construction permit for the facilities and plants may not be issued (according to Article 174). Water management consent at the written request of the investor is ***issued by the body of the state administration responsible for performing the activities in the field of environment***.
Decree on classification of waters (Official Gazette of RNM No. 18/99)	With the Decree on classification of waters, a classification of the surface and groundwater in the Republic of North Macedonia was performed based on the usage purposes and degree of purity in 5 classes.
Decree on categorisation of water streams, reservoirs, reservoirs and groundwater (Official Gazette No. 18/99, 71/99)	The Law on Waters and the Decree on categorisation of water streams, reservoirs, and groundwater (Official Gazette no. 18/99) classify the water in the accumulations Mavrovo, Tikves, Debar in category II, for which the class II limit values and concentrations of pollutants apply in accordance with the Regulation on classification of waters (Official Gazette of RM no. 18/99). Both Regulations relate to the quality standards of surface and groundwater, and they present standards for water quality of the water body, and not the discharge limit values for wastewater into the recipient.

National relevant legislation	Relevance for the Project
List of polluting substances (Official Gazette of RNM No. 122/11)	Substances that have a harmful effect on the aquatic environment, but which may be limited to a particular area, and which depend on the characteristics and location of the water in which they are discharged. It also contains a List of priority substances, including priority hazardous substances (*) which are identified on the basis of their risk to water bodies (e.g. mineral oils and hydrocarbons of petroleum origin which are not permanent).
Air	
Law on Ambient Air Quality (Official Gazette of the Republic of Macedonia No. 67/04, 92/07, 35/10, 47/11, 59/12, 163/13, 10/15 and 146/15 and Official Gazette of RNM no. 151/21)	This law establishes the principles of ambient air quality management and emission sources, defines the sources of pollution and prescribes limit values, target values and critical levels for types of pollutants in the ambient air, regulates the monitoring of air quality, measures for protection of air from stationary sources, air quality assessment. During the realization of the Project, the most important source of dust emission in the air will be dust generated during the reconstruction activities.
Decree on limit values and types of polluting substances in ambient air and alert thresholds, deadlines for reaching limit values, margins of tolerance for limit values, target values and long-term goals (Official Gazette of RNM no. 67/2004; 92/2007; 35/2010; 47/2011; 59/2012; 4/13, 183/17)	The Decree prescribes limit values for levels and types of pollutants in ambient air, alert thresholds, deadlines for reaching limit values, margins of tolerance for limit values, target values and long-term goals.
Rulebook on the criteria, methods and procedures for assessment of ambient air quality (Official Gazette no. 82/06; 169/13)	The Rulebook prescribes: criteria, methods and procedures for assessment of ambient air quality in relation to sulphur dioxide; nitrogen dioxide; nitric oxide; suspended particles up to 10 micrometres; lead; benzene; carbon monoxide and ozone. The air quality assessment takes the following into account: fixed measurements (continued and discontinued); indicative measurements; modelling technics and combination of the measurement and modelling technics; referent methods; additional data sources and Cadastre of polluting substances in the air.
Noise	
Law on Noise Protection (Official Gazette of the Republic of Macedonia No. 79/07, 124/10, 47/11 and 163/13 and 146/15, and Official Gazette of RNM no. 151/21)	The law regulates the rights and duties of legal entities in relation to noise management and protection against noise to create healthy living conditions for the people and to protect the environment against noise, avoidance, prevention, or reduction of the noise. Legal entities and individuals are obliged to monitor noise in accordance with the IPPC permits and to take measures for noise protection. The artificial, human made noise is the noise caused by unwanted or harmful outdoor sound created by human activities, which is imposed to the nearby environment causing nuisance and disturbance. The law establishes the need to reduce harmful effects that are consequence of exposure to noise in the media and the environment and to provide a basis for developing measures to reduce noise from all its sources. The ultimate objective is the protection of the health and wellbeing of the population. Article 19 prescribes measures for noise protection in the environment that should be taken by the legal entities and individuals (usage of low-level noise equipment, tools and vehicles; performing the construction activities, meeting noise protection standards, etc.).

National relevant legislation	Relevance for the Project
Rulebook on the limit values of the noise level in the environment (Official Gazette of RM no. 147/08)	The Rulebook defines the limit values for the level of environmental noise in the areas defined in accordance with the degree for noise protection defined in the Rulebook on the locations of measuring stations and measuring points (Official Gazette of RM no. 120/08). According to the degree for noise protection, limit values for the main noise indicators in the environment produced by different sources should not be above: 50 dBA (during the day and evenings) and 40 dBA during the night for the area of Ist degree of noise protection – for HPPs in national park Mavrovo (Vrben) and Shar Planina (Vrutok and Raven) as well as HPP on Tikves lake. 55 dBA (during the day and evenings) and 45 dBA during the night for the area of IInd degree of noise protection – for HPPs Globocica and Spilje.
Rulebook on the application of noise indicators, additional noise indicators, the manner of noise measurement and the methods for assessment with noise indicators in the environment (Official Gazette of RM no. 107/08)	The Rulebook defines the application of the noise indicators (L_d, L_e and L_n), the additional noise indicators, the method of measurement and the methods for evaluation with the environmental noise indicators. Methods for noise measurements using the noise indicators from this Rulebook should be in accordance with principles for determining the long-term average noise level in the environment according to the standards ISO 1996-2:1987 and ISO 1996: 1982.
Rulebook on the locations of measuring stations and measuring points (Official Gazette of RM no. 120/08)	The Rulebook prescribes the locations of the measuring stations and measuring points from which the impact of the noise sources in the environment will be monitored, depending on the degree of noise protection and the type of activities and the sensitivity of the population residing in them (divided into 4 areas for noise protection). Area of the Project belong to the Ith (Mavrovo system and Tikves HPP) and IInd degree of noise protection (Globocica and Spilje). ▪ Area with a first degree of noise protection includes areas of tourism and recreation, areas near health institutions for hospital treatment, and areas of national parks and natural reserves. ▪ Area with a second degree of noise protection includes areas primarily intended for residential use, residential districts, areas in the vicinity of educational institutions, educational facilities and social protection services for adults and children, and facilities for primary health care, playgrounds and public parks, green and recreational areas, and local parks.
Rulebook on the types of special noise sources, as well as the conditions that must be met by the plants, equipment, installations and devices used in open space in terms of emitted noise and noise protection standards (Official Gazette of RM no. 120/08)	The Rulebook prescribes the types of special noise sources, as well as the conditions that must be met by the plants, equipment, installations and devices used in open space in terms of emitted noise and noise protection standards. Annex 1 of the Rulebook describes the different types of equipment. Annex 3 presents the methods for noise measurements and the main standards for noise emissions (MKC EN ISO 3744:2010 and MKC EN ISO 3746:2011)
Waste	
Law on waste management (Official Gazette of RM No.216/2021)	The Law regulates waste management; waste management principles and objectives; the rights and obligations of legal entities and persons in relation to waste management; the manner and conditions under which the collection, transport, treatment, assessment of hazardous characteristics of the waste, storage, processing and disposal of the waste can be performed. The Law on Waste Management (Official Gazette of RSM No. 216/2021) harmonizes with Directive 2008/98 / EC of the European Parliament and of the Council of 19 November 2008 on the repeal of certain Directives (CELEX No. 32008L0098). Each Operator that generates more than 100 t/year of non-hazardous waste and/or 200 kg of hazardous waste, should prepare a Waste Management Program and submit it to the competent authority in accordance with the Law on Waste.

National relevant legislation	Relevance for the Project
List of waste types (Official Gazette of RM No. 100/05)	The List prescribes types of waste that are classified according to the source of creation and the characteristics. According to the List of waste types, wastes that are expected to be generated are classified as follows: Main group 17 - Construction and demolition wastes; subgroup 17 01 concrete, bricks, tiles and ceramics, 17 04 metals (including their alloys), 17 05 - soil (including excavated soil from contaminated sites), stones and dredging spoil, subgroup 17 06 insulation materials and asbestos-containing construction materials Main group 13 - Oil wastes and wastes of liquid fuels (except edible oils, and those in chapters 05, 12 and 19) subgroup 13 01 – waste hydraulic oils, subgroup 13 02 - waste engine, gear and lubricating oils; subgroup 13 07 - wastes of liquid fuels. Main group 15 - Waste packaging; absorbents, wiping cloths, filter materials and protective clothing not otherwise specified, subgroup 15 01 packaging (including separately collected municipal packaging waste) and 15 02 absorbents, filter materials, wiping cloths and protective clothing. Main group 16 - Wastes not otherwise specified in the list, subgroup 16 02 wastes from electrical and electronic equipment 20 Municipal wastes (household waste and similar commercial, industrial and institutional wastes) including separately collected fractions, subgroup 20 01 separately collected fractions (except 15 01), subgroup 20 03 other municipal wastes.
Law on Packaging and Packaging Waste Management (Official Gazette of RM no. 215/21)	This law regulates the requirements for protection of the environment and human health that must be met by the packaging during production, placing on the market putting into service and handling packaging waste including the obligations of the economic operators. During the reconstruction of the HPPs, packaging waste is expected to be produced from different construction materials packaging.
Law on Waste Management from Electrical and Electronic Equipment (Official Gazette of RM no. 176/21)	This Law regulates the requirements for environmental protection that must be fulfilled by legal entities and individuals who produce and placing on the market electrical and electronic equipment in RNM and who handle waste electrical and electronic equipment. Taking into consideration the project activities for reconstruction and replacement of electrical equipment it is expected to be generated WEEE and should be properly managed.
Law on Waste Batteries and Accumulators Management (Official Gazette of RM no. 176/21)	This law regulates the requirements for protection of the environment and human health that must be met during the production and marketing of batteries and accumulators, as well as in the case of waste batteries and accumulators, which refer to the obligations of economic operators and other entities participating in the production process and placing on the market of batteries and accumulators, special requirements for collection, processing and recycling, as well as other conditions for handling waste batteries and accumulators, reporting on achieving goals for collection, processing and recycling of waste batteries and batteries and economic instruments.
Law on nature protection	
Law on Nature Protection (Official Gazette of RM no. 67/04, 14/06, 84/07, 35/10, 47/11, 148/11, 59/12, 13/13, 163/13, 41 / 14, 146/15, 39/16, 63/16, 113/18, 151/21)	This law regulates the protection of nature through the protection of biological and landscape diversity and protection of the natural heritage, in the protected areas and outside the protected areas, as well as the protection of the natural rarities. Restrictions, permitting procedures and allowed activities within the protected areas according to this law are: ▪ Article 10 - It is forbidden to drive in nature/protected areas with motor vehicles except in settlements and on all types of roads, landscapes and driving ranges, to prevent the degradation of nature. This prohibition shall not apply in cases of performing agricultural, forestry, economic, scientific, conservation or other permitted activities, when this is in accordance with this law;

National relevant legislation	Relevance for the Project
	▪ Article 13 - Prohibition of the use of certain plant protection products for the purpose of nature protection ▪ Article 14 - In case of endangered condition of some species or habitat, MoEPP shall limit or completely will prohibit the use of natural resources while endangered conditions exposit. ▪ Article 21 - It is forbidden to perform following activities: - extinction of autochthone wild species - decreasing populations of wild species, habitats fragmentation etc. - disturbance of wildlife, especially during their breeding, growing or wintering/hibernation period - removing plants and fungi from their habitats, decreasing their population, or destroying them in any way; etc. Category Strict Nature Reserve is the *first category of protected area* (I-a) according to the Law on nature. Tikves belongs to this category. In the strict nature reserve, is forbidden to perform others activities, except: 1) protection and control in the strict nature reserve; 2) study visits in the function of scientific research; 3) movement of people along established paths and in established places in the boundaries of the area for educational purposes and 4) collection of seeds and seed material, wild plants, fungi and animals for the purpose of scientific research, as well as for the purpose of restoration the populations of another area, in a way and in a period that will not cause disruption of the ecosystem. Category National Park is the *second category of protected area* (II) according to the Law on nature. Article 104, 105, 106 and 107 from the Law on nature, define the four protected zones given below. I. Strict protection zone The strict protection zone is part of the protected area with the highest interest of protection, characterized by the original, unchanged characteristics of the ecosystems, or there are very small changes due to traditional management practices. In strict protection zone are permitted scientific research activities, if they are not in contradiction with the primary objectives of protection of the area. II. Zone for active management The active management zone is a zone of high concern for protection, which requires greater management interventions for the purpose of restoration, revitalization or rehabilitation of habitats, ecosystems and other elements of the landscape. In the zone for active management, are allowed economic activities which do not have a negative impact on the primary purpose of protection, such as ecotourism or traditionally extensive agriculture. III. Zone for sustainable use The zone for sustainable use is a significant part of the protected area that does not have high values for protection, where there are infrastructure facilities, cultural heritage sites, types of forest plantations that are not characteristic for the area, as well as settlements with surrounding agricultural land. IV. Buffer zone An area outside the protected area that has the role of protecting, where necessary, the zones from threats that originate outside the protected area. *Currently, the process of revalorization of the NP Mavrovo is ongoing. The Study for revalorization of the protected area Mavrovo is prepared in 2011 and new Spatial Plan for the NP is under preparation. These documents include changes in the borders of the protected zones within the NP and includes new map with extended protected zones, which still are not adopted.*

National relevant legislation	Relevance for the Project
	National Assembly of RNM proclaimed the part of Shar Planina/Mountain National Park on June 30, 2021. According to the Law of Nature Protection, 4 zones are designed and described: strict protection, active management, sustainable development and a buffer zone for the ski resort.
Law on proclamation of the ornithological locality Tikves in the gorge of the Crna reka for Strict Nature Reserve (Official Gazette of RM no. 35/97)	Define the borders of the Reserve Tikves and the area occupied (9.700 ha land area and 950 ha water surface). HPP Tikves is not in the borders of Strict Nature Reserve Tikves but is in the vicinity at distance of around 3km.
Rulebook for implementing protection measures in strict nature reserve Tikves in the gorge of Crna Reka (Official Gazette of RM no. 44/97)	Defines the measures for protection of the reserve including prevention of degradation of natural habitats, unproper usage of the natural heritage and unproper usage of the water in accumulation and coastline in the frames of the reserve. All defined measures for prevention of degradation of the habitats and protection of the reserve should be respected during the activities of reconstruction of HPP Tikves.
Law for declaring the forest areas around the Mavrovo lake for national park (Official Gazette of RM no. 10/49, 20/49, changes of the law 23/52, 16/65)	Define the borders of the NP Mavrovo and settlements that are in the borders of the National Park. Occupied area of NP Mavrovo is 73.088 ha. NP Mavrovo has its own management under the Ministry of agriculture, forestry and water economy. Currently there is a draft law for proclamation of Mavrovo for protected area in the category National Park (II category), prepared in 2015 but still not adopted. Based on the performed scientific analysis of natural heritage of Mavrovo and prepared Study for revalorization of the protected area Mavrovo in 2011, procedure for re-proclamation of NP Mavrovo is ongoing. HPP Vrben and Mavrovo dam are located in the frame of NP Mavrovo in the zone of active management. Also, part of 35kV transmission line that should be rehabilitated is in the border of the NP Mavrovo.
Law on proclamation of part of Shar Planina as National Park (Official Gazette of RM no. 151/21)	Part of Shar Planina is proclaimed as national park (category II) according to the Law on nature. Defines the borders of the national park and the total area with the four protection zones defined. *Part of 35kV transmission line from HPP Vrutok that should be rehabilitated is in the border of the NP Shar Planina. HPP Vrutok and HPP Raven are outside of the borders of NP Shar Planina, but intakes from Sharski Dovod are within the NP Shar Planina, in the zone od active management and sustainable use.*
Occupational Safety and Health	
Law on Occupational Safety and Health (Official Gazette of RM no. 92/07, 136/11, 23/13, 25/13, 137/13, 164/13, 158/14 15/15 and 192/15)	The law prescribes the obligations of the employer and the rights and obligations of the employees, preventive measures against occupational risks, elimination of risk factors for accidents, training of workers and their participation in the planning and undertaking of measures for occupational safety and health.
Rulebook on the minimum requirements for occupational safety and health (Official Gazette of RNM no. 154/2008, Art. 2);	Establishes the minimum requirements for safety and health of employees at the workplace. During the reconstruction activities all engaged workers should be provided with H&S trainings and appropriate PPE.
Rulebook on occupational safety and health of workers at risk of noise (Official Gazette of RNM no. 21/2008)	Establishes the minimum requirements for protection of employees against risks to their health and safety that arise or for which there is a possibility to arise from exposure to noise, and in particular against the risk to hearing. The provisions of this Rulebook apply to activities where employees are exposed or are at risk of being exposed to noise risks during their work.

National relevant legislation	Relevance for the Project
Community Health and Safety	
Law on Health Protection (Official Gazette of RM no. 43/12, 145/12, 87/13, 164/13, 39/14, 43/14, 132/14, 188/14, 10/15, 61/15, 154/15, 132/15, 154/15, 192/15, 37/16)	The Law on Health Protection regulates the matters related to the system and organization of health protection and the performance of healthcare activity, the guaranteed rights and the established needs and interests of the country in the provision of health protection, the healthcare institutions, the employment, rights and duties, responsibility, assessment, termination of employment, protection and decision-making regarding the rights and obligations of healthcare workers and healthcare co-workers, the quality and safety of the healthcare activity, the chambers and professional associations, the marketing and advertising of healthcare activity, the performance of healthcare activity in case of emergencies, and the supervision of the performance of the healthcare activity.
Law on Traffic Safety (Official Gazette of RM no. 169/15, 55/16)	This law regulates the safety and protection of roads, the basic principles and the mutual relations of the participants and other entities in road traffic, road traffic rules, the system of traffic signs, equipment and signalisation of roads, duties in case of traffic accident. All participant in the road traffic should follow the traffic rules and act according to the signalization of the roads during the project activities.
Law on Transport of Hazardous Materials (Official Gazette of RM No. 92/2007, 17/2011, 54/2011, 13/13, 163/13, 38/14, 164/14, 116/15, 193/15, 31/16)	This law regulates the conditions and the manner of transporting dangerous goods in the national and international road and rail traffic, the conditions to be met by the packaging and the means of transport, the duties of the persons participating in the transport of dangerous goods, appointment of a security advisor, training of persons participating in the transport of hazardous substances.
Construction	
Law on Construction (Official Gazette of RM No. 130/09, 124/10, 18/11, 36/11, 34/11, 59/11, 13/12, 39/12, 144/12, 25/13, 70/13, 79/13, 137/13, 163/13, 27/14, 28/14, 115/14, 149/14, 187/14 and 44/15, 129/15, 217/15, 226 / 15, 31/16, 39/16, 71/16, 103/16, 132/16, 35/18, 64/18, 168/18, 244/19, 18/20, 279/20)	The law prescribes the basic requirements for design and construction of buildings, the necessary project documentation for obtaining a building permit, the rights and obligations of the participants in the construction, the manner of use and maintenance of the building/facility. Pursuant to Article 57 for categorization of structures from the Law on Construction, all project's HPP belong to installations from Ist category and a building permit for these structures is issued by the state administration body responsible for works in the field of spatial planning. According to article 97 Usage of constructed object, conversion, adaptation and reconstruction, before performing the activities for reconstruction, the Operator should submit request for approval for reconstruction to the responsible authority (state administration body responsible for works in the field of spatial planning).
Chemicals	
Law on Chemicals (Official Gazette of RM No. 145/10, 53/11, 164/13, 116/15, 149/15, 37/16)	The Law on Chemicals regulates the classification, packaging and labelling of chemicals, the rights and obligations of legal entities that produce, market or use chemicals, keep a register of chemicals, restrict and prohibit the production, placing on the market and use of chemicals. The purpose of this law is to provide a high level of protection of the human health and the environment, including the introduction of alternative methods for assessing the dangers arising from substances.

Relevant Social Legislative Framework

Labor and Workforce

The main legal framework that covers labour and working conditions issues are following:

- Labour Law ("Official Gazette of the Republic of Macedonia" No. 62/05, 106/08, 161/08, 114/09, 130/09, 149/09, 50/10, 52/10, 124/10, 47/11, 11/12, 39/12, 13/13, 25/13, 170/13, 187/13, 113/14, 20/15, 33/15, 72/15, 129/15, 27/16, and 120/18, and "Official Gazette of the Republic of North Macedonia" No. 110/19, and 267/20)
- Law on Pensions and Disability Insurance ("Official Gazette of the Republic of Macedonia" No. 53/13, 170/13, 43/14, 44/14, 97/14, 113/14, 160/14, 188/14, 20/15, 61/15, 97/15, 129/15, 147/15, 154/15, 173/15, 217/15, 27/16, 120/16, 132/16, 35/18, 220/18, and 245/18, and "Official Gazette of the Republic of North Macedonia" No. 180/19, 275/19, 31/20, and 267/20)
- Law on Employment of Disabled Persons ("Official Gazette of the Republic of Macedonia" No. 44/00, 16/04, 62/05, 113/05, 29/07, 88/08, 16/08, 99/09, 136/11, 129/15, 147/15, 27/16, and 99/18)
- Law on Volunteering ("Official Gazette of the Republic of Macedonia" No. 85/07, 161/08, and 147/15, and "Official Gazette of the Republic of North Macedonia" No. 124/19, and 103/21)
- Law on Peaceful Community of Labour Disputes ("Official Gazette of the Republic of Macedonia" No. 85/07, 27/14, 102/14, and 30/16)
- Law on Employment and Work of Foreigners ("Official Gazette of the Republic of Macedonia" No. 217/15, and "Official Gazette of the Republic of North Macedonia" No. 163/21)
- Law on Minimum Wage ("Official Gazette of the Republic of Macedonia" No.11/12, 30/14, 180/14, 81/15, 129/15, 132/17, and 140/18, and "Official Gazette of the Republic of North Macedonia" No. 239/19)
- Law on Prevention and Protection from Violence Against Women and Domestic Violence ("Official Gazette of the Republic of North Macedonia" No. 24/21)
- Law on Protection from Harassment in the Workplace ("Official Gazette of the Republic of Macedonia" No. 79/13, and 147/15, and "Official Gazette of the Republic of North Macedonia" No. 103/21).

Health and Safety

Health and safety laws that are of particular interest relating to this project are:

- Law on Occupational Health and Safety ("Official Gazette of the Republic of Macedonia" No. 92/07, 136/11, 23/13, 25/13, 137/13, 164/13, 158/14, 15/15, 129/15, 192/15, 30/16, and "Official Gazette of the Republic of North Macedonia" No. 18/20)
- Law on Social Protection ("Official Gazette of the Republic of North Macedonia" No. 104/19)
- Law for Health Protection ("Official Gazette of the Republic of Macedonia" No. 43/12, 145/12, 87/13, 164/13, 39/14, 43/14, 132/14, 188/14, 10/15, 61/15, 154/15, 132/15, 154/15, 192/15, and 37/16); and
- Law on Public Health ("Official Gazette of the Republic of Macedonia" No. 22/10, 136/11, 144/14, 149/15, and 37/16). The Law on Public Health regulates the implementation of the basic functions and tasks of public health, the public health system, public health emergencies and public health financing

Other laws that cover Health and Safety domain are:

- Law on Sanitary and Health Inspection (OG of RM no. 71/06, 139/08, 88/10, 18/11, 53/11, 164/13, 43/14, 144/14, 51/15, 150/15 and 37/16)

- Law on Traffic Safety ("Official Gazette of the Republic of Macedonia" No. 169/15, 226/15, 55/16, 11/18, and 83/18, and "Official Gazette of the Republic of North Macedonia" No. 98/19)
- Law on Protection and Rescue ("Official Gazette of the Republic of Macedonia" No. 36/04, 49/04, 86/08, 124/10, 18/11, 93/12, 41/14, 129/15, 71/16, 106/16, and 83/18, and "Official Gazette of the Republic of North Macedonia" No. 215/21)
- Law on Public Works (95/212, 163/13, 42/14, 44/15, 147/15 and 31/16).

Gender Equality and non-discrimination

Gender equality and non-discrimination laws that are of particular interest relating to this project are:

- Law on Prevention and Protection from Violence Against Women and Domestic Violence ("Official Gazette of the Republic of North Macedonia" No. 24/21)
- Law on equal opportunities for men and women (Official Gazette of the Republic of Macedonia No. 06/12, 166/14, 150/15, 201/15)
- Law on Protection from Harassment in the Workplace ("Official Gazette of the Republic of Macedonia" No. 79/13, and 147/15, and "Official Gazette of the Republic of North Macedonia" No. 103/21).

4.4 International Conventions

RNM, parallel to the transposition of the EU legislation, has ratified several international conventions that are part of the national legislation and agreements:

- Convention on Access to Information, Public Participation in Decision-Making and Access to Justice in Environmental Matters. Adopted June 25, 1998 (Aarhus Convention)
- Kyoto Protocol on Climate Change (Kyoto, December 1997). Ratified by RNM on November 18, 2004 (entry into force on February 16, 2005)
- Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and their Disposal (Basel, 1995), ratified in 1997
- Convention on Biological Diversity (Rio de Janeiro, 1992), ratified in 1998
- Convention on the Conservation of European Wildlife and Natural Habitats, Bern, 1972 (Official Gazette of the Republic of Macedonia No. 49/97)
- Convention on the Conservation of Migratory Species of Wild Animals, Bonn, 1979 (Official Gazette of RM no. 38/99)
- Fungal species protected according to the European Red List of Fungi (Ing 1978)
- Agreement on the Conservation of European Bats (London, 1991), ratified in 1999 (Amendment to the Agreement ratified in 2002)
- United Nations Framework Convention on Climate Change (New York, May 9, 1992). Ratified by RNM on 28 January 1998 (entry into force on 28 April 1998)
- Convention on Environmental Impact Assessment in a Transboundary Context (ESPOO, February 1991).
- European Landscape Convention (Florence, 2000), ratified in 2003
- International Labour Organization Conventions: Macedonia has ratified many ILO conventions
- Convention on Biological Diversity (Rio de Janeiro). Macedonia has ratified it in 1997
- Convention on the Conservation of Migratory Species of Wild Animals (Bonn) Macedonia has ratified it in 1999
- Paris Agreement on Climate Change, Macedonia has ratified it in 2017

- Doha Amendment to the Kyoto Protocol to the United Nations Framework Convention on Climate Change, Macedonia has ratified it in 2019
- Kigali Amendment to the Montreal Protocol on Substances that Deplete the Ozone Layer, Macedonia has ratified it in 2020.

4.5 National EHS Standards

Many international standards are incorporated within the national laws. Most of the standards (ISO, EMAS, risk assessment) in relation with technical specification, measurement equipment are adopted and accepted as national standards. The Institute of Standardization of the Republic of North Macedonia (ISRSM) is a national standardization body that prepares and adopts international standards as national standards on voluntary base. (https://isrsm.gov.mk/mk/)

Institute for Accreditation of the Republic of Macedonia (IARM) as institution of public interest that has a mission to provide confidence in the results of conformity assessments through the implementation of harmonized accreditation activities in support of the Macedonian and world economy. IARM is performing the following activities and tasks: Accreditation of: - Testing and calibration laboratories; - Product certification bodies; - (Quality, environment, safety, security, etc.) management systems certification bodies; - Persons certification bodies; - Inspection bodies; and - Other conformity assessment bodies; Evaluation of the competency of conformity assessment bodies, including the surveillance over the fulfilment of requirements of bodies performing conformity assessment pursuant to a given regulation.

The JSC ESM currently operates under accredited ISO 14001, OHSAS 18001, and ISO 9000 management systems in managing its environmental, health & safety and quality performance. The JSC ESM currently has an environmental, health & safety and quality policies in place under its EHS and quality management system. However, the Company does not currently have a social policy in place.

4.6 International Standards and Guidelines

4.6.1 World Bank Environmental and Social Standards

As international standards relevant for the project are the World Bank Environmental and Social Standards (ESS) that set out the mandatory requirements that apply to the projects. They present a set of obligatory guidelines and instructions with the main objective to foster efficient and effective identification and mitigation of potentially adverse environmental and social impacts that may occur in the development projects, with proper stakeholder engagement and sustainable management. All of WB 10 ESS are applied in parallel to the national policies where, as a rule, the stricter one prevails.

ESS1 Assessment and management of environmental and social risks and impacts

ESS1 sets out the Clients responsibilities for accessing, managing, and monitoring, environmental and social risks and impacts associated with each of the project supported by the Bank through Invest Project Financing in order to achieve environmental and social outcomes consistent with the Environmental and Social Standards (ESS).

Main responsibilities of the Client is: to adopt a mitigation hierarchy approach; to adopt differentiated measures so that adverse impacts do not fall disproportionately on the disadvantaged or vulnerable, and they are not disadvantaged in sharing development benefits and opportunities resulting from the project; to utilize national environmental and social Institutions, systems, laws, regulations and procedures in the assessment, development and implementation of projects, whenever appropriate; to promote improved environmental and social performance, in ways which recognize and enhance Client capacity.

According to the WB ESS, the 6 HPPs rehabilitation project falls into the category of projects with *substantial risk* (which corresponds to the KfW's Category B+ as depicted in the KfW's Sustainability Guideline of February 2022). This classification is based on the fact that the project rehabilitation activities may have single significantly adverse risk and impacts on human populations and/or the environment in environmentally or socially sensitive areas (NP Shar Planina and NP Mavrovo). Impacts are expected to be site-specific and can be addressed through conventional mitigation and management measures. The potential risks and impacts are predictable and expected to be temporary and/or reversible; low to medium in magnitude; site-specific, without likelihood of impacts beyond the actual footprint of the Projects. These impacts most commonly include possible dust nuisance, and gaseous emissions, potential pollution of soil and water resources, brief disturbance to biotope, and momentary interference to neighboring settlements through various operation activities.

ESS2 labor and working conditions.

ESS2 defines Client obligations related by providing project safe and healthy working conditions by treating workers in a fair manner to pursuit poverty reduction and inclusive economic growth.

The Client should promote safety and health at work; promote the fair treatment, non-discrimination and equal opportunity of project workers; protect project workers, including vulnerable workers such as women, persons with disabilities, children (of working age, in accordance with this ESS) and migrant workers, contracted workers, community workers and primary supply workers, as appropriate; prevent the use of all forms of forced labour and child labour; support the principles of freedom of association and collective bargaining of project workers in a manner consistent with national law; provide project workers with accessible means to raise workplace concerns.

The workers involved in the project will be contracted workers hired by the contracting companies, as well as their subcontractors. Contractors will have to apply the Labor and Working Condition Standards. A Labor Management Plan will be prepared based on the assessment of how compliant Macedonian law on Labor Relations is as well as Law on Safety and Health at work with the Labor and Working Condition Standard. The plan will propose how to overcome aspects that do not meet the objectives of the Standard.

ESS3 Resource efficiency and pollution prevention and management

This ESS sets out the requirements to address resource efficiency and pollution prevention and management throughout the project life cycle. More often economic activity and urbanization generate pollution of air, water, and soil, and consume finite resources that may threaten people, ecosystem services and the environment at the local, regional, and global levels.

Main responsibilities of the Client are to promote the sustainable use of resources, including energy, water and raw materials; avoid or minimise adverse impacts on human health and the environment by avoiding or minimizing pollution from project activities; avoid or minimize project related emissions of short and long-lived climate pollutants; avoid or minimize generation of hazardous and non-hazardous waste.

The ESS 3 is relevant to the project because the rehabilitation works will include the use of a range of materials like concrete, pipes, conductors, turbines and other construction waste. The project activities for rehabilitation of 6 HPPs will not be a significant user of energy or water resources. Construction and demolition waste are expected, e.g., old turbines will be removed and replaced with new ones. Ideally construction waste would be reused where feasible, while unusable fractions will be disposed of at dedicated sites agreed with the respective Municipality. Through the implementation of procedures and measures stated in the site-specific ESMPs, the Contractor will avoid or minimize the release of pollutants and assure compliance with the Environmental, Health and Safety Guidelines and Good construction practice. Mitigation measures will also ensure the appropriate handling, storage, use and disposal of hazardous and non-hazardous materials and wastes; those measures will be included in the ESMPs.

In operational phase there will be no changes in water regimes as is explained in Chapter 3. All rehabilitation activities will lead to more efficient water utilization without changes in used water volumes. The replacement of outdated electrical and hydromechanical equipment with more efficient new equipment is expected to reduce present water losses, to allow for better water utilization and increase of electricity generation.

ESS4 Community health and safety

ESS 4 addresses the health, safety, and security risk and impacts on project-affected communities and the corresponding responsibility of JSC Power Plants of North Macedonia (ESM) to avoid or minimize such risks and impacts, with particular attention to people who, because of their particular circumstances, may be vulnerable.

Based on WB Environmental and Social Framework ESS4, ESM should implement all necessary measures in order to avoid or minimise community exposure to project -related traffic and road safety risks, diseases and hazardous materials; have in place effective measures to address emergency events; ensure that the safeguarding of personnel and property is carried out in a manner that avoids or minimizes risks to the project - affected communities.

Proper signaling will be installed and mitigation measures to control excessive noise and dust levels will be ensured through a robust mitigation and management plan in the proposed site-specific ESMPs.

The Traffic Management Plan will be prepared by the Contractor prior to the commencing with rehabilitation activities. It is also necessary to prepare the Emergency Response Plans with procedures to respond to accidental leaks, spills, emissions, fires, and other unforeseen crisis events.

ESS5 Land Acquisition, Restrictions on Land Use and Involuntary Resettlement

ESS5 prescribes that involuntary resettlement should be avoided. Where involuntary resettlement is unavoidable, it will be minimized and appropriate measures to mitigate adverse impacts on displaced persons (and on host communities receiving displaced persons) will be carefully planned and implemented.

In order to be in compliance with ESS5, ESM should implement all necessary measures such as: restrictions on land use by: (a) providing timely compensation for loss of assets at replacement cost and (b) assisting displaced persons in their efforts to improve, or at least restore, their livelihoods and living standards, in real terms, to pre -displacement levels or to levels prevailing prior to the beginning of project implementation, whichever is higher; improve living conditions of poor or vulnerable persons who are physically displaced, through provision of adequate housing, access to services and facilities, and security of tenure.

The project will finance rehabilitation of the existing HPPs in rural areas. The interventions will not cause any additional land take impacts. There will be no need for resettlement under the present scope nor any expected impacts to livelihoods.

ESS6 Biodiversity conservation and sustainable management of living natural resources

ESS6 recognizes that protecting and conserving biodiversity and sustainably managing living natural resources are fundamental to sustainable development and it recognizes the importance of maintaining core ecological functions of habitats, including forests, and the biodiversity they support. ESS6 also addresses sustainable management of primary production and harvesting of living natural resources and recognizes the need to consider the livelihood of project-affected parties, including Indigenous Peoples, whose access to, or use of, biodiversity or living natural resources may be affected by a project.

ESM shall implement all necessary measures in order to: protect and conserve biodiversity and habitats; to apply the mitigation hierarchy and the precautionary approach in the design and implementation of projects that could have an impact on biodiversity; to promote the sustainable management of living natural resources; to support livelihoods of local communities, and inclusive economic development, through the adoption of practices that integrate conservation needs and development priorities.

HPP Vrben is located in the NP Mavrovo, HPP Vrutok and Raven are near the border of the NP Shar Planina (all intakes are in the NP) and HPP Tikves is in the surroundings of the Strict Nature Reserve Tikves. According to the letter received from the MoEPP (no.11-6400/4 from 23.9.2022), HPP Globocica is located within the proposed protected area Jablanica (the Notification letter from MoEPP is presented in Annex 8.4). Potential impacts on habitats are expected to be limited within the vicinity of each location of the HPPs. The potential impacts will be addressed for each HPP in the site-specific documentation.

The project activities of the planned rehabilitation program will not significantly affect the surrounding biodiversity (e.g., local terrestrial flora and fauna species) nor their habitats. Works will only be performed in and at existing structures and by using existing road network and infrastructure. Site activities will be of short duration of a couple of working days at each site.

During construction phase and in operational phase there will be no changes in water regimes as is explained in Chapter 3 and thus, no significant risks for aquatic species are expected related with the planned rehabilitation program activities. The rehabilitation program will lead to more efficient water utilization without changes in the currently used water volumes.

For each project HPP, the Environmental Specialist & Biodiversity Expert performed site visits in September 2022. During the site visits, the location of the project activities in relation to protected areas was assessed and the current environmental baseline conditions (including the presence of significant habitats/species) was determined.

ESS7 Indigenous People

ESS7 sets out measures designed to protect Indigenous peoples, since they may be particularly vulnerable to the adverse impacts associated with project development, including risk of impoverishment and loss of identity, culture, and natural resource-based livelihoods.

In the scope of the present rehabilitation program no indigenous people are affected, thus ESS7 is not addressed any further.

ESS8 Cultural heritage

ESS8 sets out measures designed to protect cultural heritage throughout the project life cycle as cultural heritage provides continuity in tangible and intangible forms between the past, present and future. ESS8 sets out measures designed to protect cultural heritage throughout the project life cycle.

Through the environmental and social assessment, the Borrower will determine the potential risks and impacts of the proposed activities of the project on cultural heritage. The Borrower will avoid impacts on cultural heritage. When avoidance of impacts is not possible, the Borrower will identify and implement measures to address impacts on cultural heritage in accordance with the mitigation hierarchy.

Although the proposed project activities will not require construction of new objects, physical works excavations, movement of earth, quarrying and impounding and associated civil works will be undertaken which typically includes the risk of chance finds. For that reason, the site-specific documentation includes provisions on chance finds and required practices. However, given the location and experiences from previous works at site it appears unlikely that there will be intangible cultural heritage impacted by this project.

ESS9 Financial Intermediaries

ESS9 recognizes that strong domestic capital and financial markets and access to finance are important for economic development, growth and poverty reduction. The ESS9 is only applicable for financial institutions and thus, not relevant for the present rehabilitation program.

ESS10 Stakeholder engagement and information disclosure

ESS10 recognizes the importance of open and transparent engagement between the Client and project stakeholders as an essential element of good international practice. Effective stakeholder engagement can improve the environmental and social sustainability of projects, enhance project acceptance, and make a significant contribution to successful project design and implementation.

Main responsibilities of the Client is to: establish a systematic approach to stakeholder engagement that will help the Client to identify stakeholders and build and maintain a constructive relationship with them, in particular project-affected parties; assess the level of stakeholder interest and support for the project and to enable stakeholders' views to be taken into account in project design and environmental and social performance; promote and provide means for effective and inclusive engagement with project-affected parties throughout the project life cycle on issues that could potentially affect them; ensure that appropriate project information on environmental and social risks and impacts is disclosed to stakeholders in a timely, understandable, accessible and appropriate manner and format; provide project-

affected parties with accessible and inclusive means to raise issues and grievances, and allow Client to respond to and manage such grievances.

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.

Direct beneficiaries of the sub-projects will be the communities living near the HPPs as potential workers for the rehabilitation activities. The stakeholder engagement plan will define the institutional stakeholders direct and indirect and will propose how communication on the institutional level will be managed during the project implementation. The Stakeholder Engagement Plan will assess and provide strategies for the engagement of the communities during the rehabilitation works.

4.6.2 Environmental, Health and Safety (EHS) Guidelines of the World Bank Group

The Environmental, Health, and Safety (EHS) Guidelines are technical reference documents with general and industry-specific examples of Good International Industry Practice (GIIP).

The application of the EHS Guidelines to existing facilities provides the foundation of site-specific targets, with a suitable timetable for achieving them. The applicability of the EHS Guidelines needs to be personalized to the hazards and risks established for each project on the basis of the results of an environmental assessment in which site-specific variables (as host country context, assimilative capacity of the environment, and other project factors) are taken into account. The applicability of specific technical recommendations should be based on the professional opinion of qualified and experienced personnel. When the regulations of a host country differ from the levels and measures existing in the EHS Guidelines, projects are expected to achieve whichever is more stringent. If less strict levels or measures than those provided in these EHS Guidelines are appropriate, in view of specific project circumstances, a full and detailed justification for any proposed alternatives is needed in the site-specific environmental assessment. This justification should validate that the choice for any alternate performance levels is protective of human health and the environment.

4.6.3 Good Practice Note on Environmental, Health, and Safety Approaches for Hydropower Projects

GOOD PRACTICE NOTE Environmental, Health, and Safety Approaches for Hydropower Projects provides guidance to help implement EHS-related requirements contained in the Performance Standards. Hydropower has a very important role in the energy sector and support is needed for further development of this energy resource in the developing countries.

Water quality (including aspects such as water temperature, dissolved oxygen, total dissolved gases, contaminants, salinity, nutrients and minerals, and turbidity) should be managed on a project-specific basis according to the water quality objectives of the reservoir and the river system. The monitoring protocol should include key indicator species, as well as basic fish assemblies and invertebrates, aquatic insects, and benthonic assemblies. Environmental monitoring programs for this sector should be implemented to address all activities that have been identified to have potentially significant impacts on the environment, during the rehabilitation activities. Monitoring frequency should be sufficient to provide representative data for the parameter being monitored. Trained individuals should conduct the

monitoring following science-based methods and record-keeping procedures and using properly calibrated and maintained equipment. Monitoring data should be analyzed and reviewed at regular intervals and compared with operating standards so that any necessary corrective actions can be taken. The project should explore opportunities to develop monitoring programs related to water quality, aquatic, and terrestrial biodiversity, and river uses that involve the active participation of affected communities and other relevant stakeholders. This participation can provide additional validation and legitimacy to the assessment process.

Monitoring of occupational health and safety performance should cover all workers, including those of the developer, contractors, and subcontractors. Reports on performance should provide summary data. The working environment should be monitored for occupational hazards relevant to the specific project.

4.6.4 Good Practice Handbook on Environmental Flows for Hydropower Projects

GOOD PRACTICE HANDBOOK - Environmental Flows for Hydropower Projects Guidance for the Private Sector in Emerging Markets is providing support to practitioners on selecting an appropriate environmental flows assessment level for hydropower project developments and taking rigorous and consistent approaches to assess hydropower project impacts on downstream river ecosystems and people and determine their Environmental Flows commitments.

The specific approach that should be implemented can be summarized as follows: understand the context of river functioning and the provision of ecosystem values and services into which environmental Flows will be introduced; understand the potential downstream impacts associated with hydropower development and how these can be mitigated; understand the kinds of information provided by environmental flows assessments; apply a context-appropriate Environmental Flows Assessment method; conduct a comprehensive and appropriate stakeholder engagement program leading to a decision on Environmental Flows and other mitigation measures based on the outcome of the assessment; compile an Environmental Flows Management Plan.

Taking into consideration that all 6 HPPs are operational the approach will be applied strictly to the rehabilitation activities and impacts that will arise during their implementation.

4.6.5 Guidelines on Incorporating Human Rights Standards and Principles, Including Gender, in Program Proposals for Bilateral German Technical and Financial Cooperation

KfW stipulates compliance with the regulations of the German Federal Ministry for Economic Cooperation and Development (BMZ). The BMZ Strategy Paper 'Human Rights in German Development Policy' (2011) is obligatory for all institutions involved in bilateral German development cooperation. The paper provides mainstreaming of the human rights-based approach throughout all priority areas and sectors of development cooperation. The human rights-based approach requires that civil and political, economic, social and cultural rights and human rights standards and principles are systematically referred to. As it is prescribed by international human rights law, the human rights-based approach comprises special protection and targeted support for disadvantaged or marginalized groups. Mostly these are people living in poverty, women, children and youth, indigenous peoples, sexual minorities and persons with disabilities.

4.6.6 The Fundamental Conventions of the International Labor Organization (ILO)

The ILO Declaration on Fundamental Principles and Rights at Work, adopted in 1998 and amended in 2022, is a statement of commitment by governments, employers and workers organizations to maintain basic human values. It affirms the obligations and commitments that are inherent in membership of the ILO, namely:

- freedom of association and the effective recognition of the right to collective bargaining
- the elimination of all forms of forced or compulsory labor
- the effective abolition of child labor
- the elimination of discrimination in respect of employment and occupation; and
- a safe and healthy working environment.

Republic of North Macedonia has ratified 79 ILO conventions.

Core Conventions are:

- Freedom of Association and Protection of the Right to Organize Convention, 1948
- Right to Organize and Collective Bargaining Convention, 1949
- Forced Labour Convention, 1930
- Abolition of Forced Labour Convention, 1957
- Minimum Age Convention, 1973
- Worst Forms of Child Labour Convention, 1999
- Equal Remuneration Convention, 1951
- Discrimination (Employment and Occupation) Convention, 1958
- Occupational Safety and Health Convention, 1981 (No.155)
- Promotional Framework for Occupational Safety and Health Convention, 2006 (No. 187)

The contractors and sub-contractors should adhere to obligations and commitments for the rehabilitation of the six HPPs. When employing workers, the contractors and subcontractors take caution not to employ children under 18 years of age. The workers should have protection against any act prejudicial to them, including dismissal, based on their status or activities as a workers' representative or on union membership or participation in union activities. The employer (contractor or the sub-contractor) must provide a safe and healthy working environment for all employees.

4.6.6.1 KfW Sustainability Guideline (2022)

The Sustainability Guideline of the KfW Development Bank (2022) represents the essential elements for the anticipation and appraisal of foreseeable environmental and social project impacts and risks, their prevention or minimization on an acceptable level and the introduction of compensation measures if the adverse impacts are inevitable but still tolerable. The ESSRA is carried out taking into consideration KfW's general principles on avoiding social and environmental impacts and risks:

- to avoid, reduce or limit environmental pollution and environmental damage including climate-damaging emissions and pollution
- to preserve and protect biodiversity and tropical rainforests and to sustainably manage natural resources
- to consider probable and foreseeable impacts of climate change including utilizing the potential to adapt to climate change

- to avoid adverse impact upon the living conditions of communities, indigenous people and other vulnerable groups, as well as to ensure the rights, living conditions and values of indigenous people
- to avoid and minimize involuntary resettlement and forced eviction of people and their living space as well as to mitigate adverse social and economic impacts through changes in land use by reinstating the previous living conditions of the affected population
- to prevent forced labour and child labour, ban discrimination in respect of employment as well as occupation and support the freedom of association and the right to collective bargaining
- to support the Executing Agency in the management and monitoring of possible adverse environmental, social and climatic impacts as well as risks within the framework of the project.

4.7 Gap Analysis between North Macedonian and International Standards

According to North Macedonian Law on Environment, potential environmental impacts of the project must be evaluated during the Environmental Impact Assessment (EIA) process and documented in an Environmental Impact Assessment Report.

In North Macedonian Law on environment, requirements of the EU EIA Directive (85/337/EEC amended) have been transposed; however, there is mainly a gap for social assessment required by international financial institutions and only EIA required by North Macedonian law. The comparison of the North Macedonian EIA process/requirements and the international/KfW ESIA process/requirements are provided in Table 3 and 4. Gaps between national and international requirements regarding water, waste and Nature Conservation & Biodiversity are shown in Table 6. Further gaps identified regarding stakeholder engagement and GRM can be consulted in the separate Stakeholder Engagement Plan.

Table 3: Comparison of International and North Macedonian EIA Process/Requirements

Subject	North Macedonian Requirements	International Requirements (KfW/WB)
Screening	EIA Legislation has 2 Lists in the annexes: List 1 – Projects required to go through full EIA Procedure and develop an EIA Study List 2- Generally determined project for which MoEPP decide upon the submitted Notification Letter if is required to develop an EIA Study or Elaborate	Screening is based on type, location, sensitivity, and scale of the proposed project, identifying key issues including any resettlement and cultural property concerns. There are four categories: A, B, B+ and C (KfW Development Bank – Sustainability Guideline, 2022)
Categorization and Environmental Assessment documentation content	Category 1 (large scale projects with significant impact) List 1 (from Decree) Projects are required to go through full EIA procedure (EIA Study). The EIA Study should be prepared, and it also must incorporate the comments and suggestions of governmental and non-governmental agencies and results of public consultation during scoping/ public hearing events. List 2 (from Decree) Projects (with moderate impact), based on Notification Letter the MoEPP decide whether EIA Study is needed or only EIA Report should be prepared. Category 3 (low or no impact) No EIA Report or EIA Elaborate is required. This	*Category A:* Category A projects imply potentially diverse significant adverse or irreversible impacts or risks to human health, the environment or the climate. KfW requires comprehensive environmental and social impact studies for category A projects. *Category B/B+:* Significant adverse environmental or social impacts or risks may also arise from category B projects, but these are less severe and can usually be mitigated with state-of-the-art measures or standard solutions. For category B projects, the scope, focus and depth of assessment are defined according to specific characteristics of the project or investment. The main result of the assessment

Subject	North Macedonian Requirements	International Requirements (KfW/WB)
	type of Projects will proceed with provision of other relevant permits. Based on the submitted Notification Letter and type of the project activities (rehabilitation) the MoEPP issued the Decision no.11-3621/2 from 03.08.2021 that there is no need for preparation of the EIA Report for the Project.	is an environmental and social management plan that defines measures to be adopted by the project partner or the financed enterprise to protect the environment and human health in order to prevent undesirable impacts, to reduce them to an acceptable level, or to offset them. *Category C:* No or only minor adverse effects are expected from category C projects. No action is required after screening.
Public consultation and disclosure	Public consultations are the responsibility of the competent institutions. Public consultation will be held after draft EIA Study is submitted to the competent authority and the draft version of the Study has been announced at web page of the MoEPP and the local community. The public disclosure of EIA Study is 30 days and within this period, the public hearing event should be organized inviting all relevant stakeholders and the announcement for the public hearing event should be published in one newspaper and on the web page of the MoEPP and the local community. For the projects with low impact (the EIA Elaborate has been prepared) there is no need to organize the public hearing event.	According to the WB ESF, the Bank will require the ESM to provide sufficient information about the potential risks and impacts of the project for the ESM's consultations with its stakeholders. Such information will be disclosed in a timely manner, in an accessible place, and in a form and language understandable to project-affected parties and other interested parties, so they can provide meaningful input into project design and mitigation measures. The Bank will disclose documentation relating to the environmental and social risks and impacts of High Risk and Substantial Risk projects prior to project appraisal. This documentation will reflect the environmental and social assessment of the project and be provided in draft or final form (if available). The documentation will address, in an adequate manner, the key risks and impacts of the project, and will provide sufficient detail to inform stakeholder engagement and Bank decision making. Final or updated documentation will be disclosed when available. For High Risk and Substantial Risk projects, the Bank will indicate in the Project Appraisal Document the project-related documents that will be prepared and disclosed after Board approval. For each key document, the Bank will provide, where possible, the following details: the objectives and proposed content of the document; the rationale for the timing of preparation; the estimated costs associated with the preparation of the document and its implementation; the source of funding; and the arrangements for preparation. These details and the timing for delivery of the document will be set out in the ESCP, as appropriate.

Subject	North Macedonian Requirements	International Requirements (KfW/WB)
Environmental Assessment review and approval	The Competent Authority shall decide on granting the approval or rejecting the application for approval of the EIA Study based on the Report and adequacy of the EIA Study and proposals of the EIA Commission (established in the MoEPP). The Competent Authority is obliged to inform the organizations and public concerned about its decision with announcement of the decision in one newspaper and on its web page.	Before formal clearance of environmental and social aspects of the project, KfW reviews the results of the ESSRA, ESMP and ESCP, ensuring that they are consistent with the Terms of Reference (ToR)
Mitigation and monitoring	For projects requiring full EIA, mitigation measures and monitoring are described in the EIA study. For projects requiring EIA elaborate mitigation and monitoring measures are included in the Program for environmental improvement.	Mitigation measures and monitoring plan are included in the ESMP. Obligation to carry out the ESMP and additional measures contained in the ESMP need to be included in the tender documentation/ contract.

According to the national legislation, Ministry of Environment and Physical Planning during the ESIA procedure is required to conduct a public hearing on the draft EIA Study and to ensure availability of information needed to the public and public participation in the public hearing event.

Table 4: Comparison of International and North Macedonian Requirements for Labour, OHS, community H&S

Subject	North Macedonian Requirements	International Requirements (KfW/WB)
Workers' rights	All issued related to employment are defined in line with the Law on Labour. The provisions of the Law are in line with ILO conventions related to forced labor, discrimination, child labor, and equal remuneration, freedom of association, right to organize and collective bargaining. During all project phases, both the Company and the contractors are required to implement the provisions of this Law.	ESM will develop and implement written labor management procedures applicable to the project. These procedures will set out the way in which project workers will be managed, in accordance with the requirements of national law and this ESS2. The procedures will address the way in which ESS2 will apply to the contracted workers that will be hired by the ESM and the way in which the ESM will require companies to manage their workers in accordance with ESS2.
Community health and safety	The Law on Road Traffic Safety defines that contractors are required to set up a temporary special regime for road use and transport during construction activities, in coordination with the police. Based on this legislation, the Company will require from contractors to comply with the national legislation regarding community health and safety in the construction phase.	ESS4 addresses health, safety, and security risks and impacts on project-affected communities and the corresponding responsibility of Client to avoid or minimize such risks and impacts, with particular attention to people who, because of their circumstances, may be vulnerable. Contractor should prepare and implement Traffic Management Plan and is obliged to meet the community safety requirements according to WB ESS 4, during and upon completion of project activities to ensure community safety within the settlements in the project area of influence.

Occupational Health and safety	OHS on national level is well regulated by a set of national laws and by-laws. The Law on Safety at Work is the key law that defines measures and obligations in the field of OHS. Its by-laws include: ▪ Rulebook on Preparation of the Health and Safety Statement defines mandatory health and safety statements for each workplace; engagement of an authorized H&S officer and official medical institution; adopting fire protection, first aid and evacuation measures; providing trainings on first aid, fire protection, rescue and evacuation; providing periodical medical examinations for staff. ▪ Regulation on PPE defines mandatory provision of PPE for workers. ▪ Regulation on Use of Work Equipment defines mandatory periodical testing of work equipment. ▪ Regulation on OHS in Use of Work Equipment defines that adequate and safe work equipment must be available to workers; employers must take measures to minimize risks, including providing appropriate notices and written guidelines for workers, as well as providing training on risks. ▪ Regulation on Minimum OHS Requirements in Temporary Mobile Sites defines the obligation of contractors to develop an OHS Plan. ▪ Regulation on Minimum OHS Requirements at Workplaces defines the following obligations of employers: providing clear routes to emergency exits; carrying out technical maintenance of the workplace, equipment and devices; keeping the workplace, equipment and devices at an adequate level of hygiene; providing first aid rooms fitted with essential first aid installations and equipment; taking into consideration the needs of disabled workers. ▪ Regulation on Form and Content of Report on Start of Work Activities defines that contractor are required to notify the State Labour Inspectorate about the construction site, ▪ Regulation on Health and Safety of Workers Exposed to Noise Pollution defines mandatory measurement of noise levels at workplaces, prohibits work on locally recognized days of rest, outside of the normal working hours or in extreme weather conditions.	According to the WB requirements employers and supervisors are obliged to implement all reasonable precautions to protect the health and safety of workers. Companies should hire Contractors that have the technical capability to manage the occupational health and safety issues of their employees, extending the application of the hazard management activities through formal procurement agreements. Preventive and protective measures should be introduced according to the following order of priority: ▪ Eliminating the hazard by removing the activity from the work process; ▪ Controlling the hazard at its source through use of engineering controls. Examples include local exhaust ventilation, isolation rooms, machine guarding, acoustic insulating, etc; ▪ Minimizing the hazard through design of safe work systems and administrative or institutional control measures. Examples include job rotation, training safe work procedures, lock-out and tag-out, workplace monitoring, limiting exposure or work duration, etc. ▪ Providing appropriate personal protective equipment (PPE) in conjunction with training, use, and maintenance of the PPE. The Contractor must be obliged to meet the OHS requirements according to the WB on, before, during and upon completion of project activities. The OHS Plan should contain guidelines for using Personnel Protective Equipment (PPE) during the civil works, proper prevention from possible injuries of the workers and local population during the construction phase. The Plan should contain guidelines for the use of PPE.

Subject	North Macedonian Requirements	International Requirements (KfW/WB)
	▪ Regulation on OHS Signs defines mandatory health and safety signs for any hazardous work activities and providing suitable instructions to workers. ▪ The Company will require from contractors, through the public procurement procedure, to comply with the legal requirements on OHS during rehabilitation works. In addition, safety during rehabilitation works and documentation needed at sites are regulated by the Law on Construction which states that Contractors must implement measures for protection and safety at construction/rehabilitation sites.	

Table 5: Gaps between International and North Macedonian EIA Procedures

Issue	EU/KfW Requirements	Provisions of the North Macedonian Law	Gap	Strategy to close the gap
ESIA procedure	The EIA EU Directive applies to a wide range of defined public and private projects and requires EIA to be prepared for all projects who have significant effects on the environment KfW, WB and other IFIs require an evaluation of the proposed project through an Environmental and Social Impact Assessment (ESIA) and ESMP that meets applicable international guidelines and requirements. IFC Environmental and Social Safeguard Policies and Disclosure Policy articulates commitment to sustainable development and is an integral part of the approach to risk management.	According to North Macedonian Law on environment, potential environmental impacts of the project must be evaluated by an Environmental Impact Assessment (EIA) process and documented in an environmental impact assessment Study/Report.	In North Macedonian Law on environment, requirements of the EU EIA Directive (85/337/EEC amended) have been transposed, however social impact assessment is not explicitly specified in the North Macedonian Law creating a gap with international requirements on ESIA. Based on the submitted Notification Letter and type of the project activities (rehabilitation) the MoEPP issued the Decision no.11-3621/2 from 03.08.2021 that there is no need for preparation of the EIA Report for the Project.	ESSRA is prepared, including social aspects.

Issue	EU/KfW Requirements	Provisions of the North Macedonian Law	Gap	Strategy to close the gap
Access to environmental information and public participation in environmental decision-making process	EU directives cover access to environmental information, for public participation for drawing up of certain plans and programs relating to the environment (public participation and access to justice) The IFC Environmental and Social Policy and Policy on Disclosure of Information considers stakeholder engagement as an essential part of good business practices, in particular effective community engagement is central to the successful management of risks and impacts on communities affected by project as well as achieving enhanced community benefits. Borrowers will engage with stakeholders throughout the project life cycle, commencing such engagement as early as possible in the project development process and in a timeframe that enables meaningful consultations with stakeholders on project design. The nature, scope and frequency of stakeholder engagement will be proportionate to the nature and scale of the project and its potential risks and impacts (WB ESS 10). An important element […] is to involve the affected communities and keep the public in the partner country informed (KfW, February 2022).	North Macedonian law on Environment stipulates that public participation in the EIA process is obligatory when the draft EIA Study has been developed. For the EIA Report no public participation is required.	North Macedonian law covers access to environmental information and public participation in environmental decision-making process, but public consultation is required only once after the preparation of the draft EIA and period required for public disclosure is 30 days according to North Macedonian law. The WB requests engagement with stakeholders during project preparation and implementation. The KfW requires stakeholder engagement e.g., in the form of public hearings, to be scheduled for the scoping phase of the ESIA process and for the presentation of the draft ESIA report.	To follow WB requirements. To meet WB requirements for public disclosure needs to be developed.

Table 6: Gaps between International and North Macedonian Laws regarding Water, Waste and Nature Conservation & Biodiversity

EU/ KfW Requirements	Provisions of the North Macedonian Law	Gap	Strategy to close the gap
Hydrology (Surface Water) & Hydrogeology (Groundwater)			
EU directives establish the list of priority substances in the field of water policy, on environmental quality standards in the field of water policy, on pollution caused by certain dangerous substances discharged into the aquatic environment, urban wastewater treatment, nitrates, dangerous substances to water discharges, quality of water intended for human consumption, protection of ground water against pollution caused by certain dangerous substances			Follow national legislation, which is in compliance with EU legislation. Issues that still need to be covered (in outstanding degrees) are to be covered with relevant EU legislation and international standards. The stricter thresholds shall apply.
General IFC`s EHS Guidelines apply to projects that have either direct or indirect discharge of process wastewater, wastewater from utility operations or storm water to the environment. Projects with potential to generate process wastewater, sanitary (domestic) sewage or stormwater should incorporate the necessary precautions to avoid, minimize and control adverse impacts to humans' health, safety or the environment. The wastewater management including water conservation, wastewater treatment, stormwater management and wastewater and water quality monitoring are also required to be met.			With regards to environmental flow specific volumes shall be assessed and estimated for each of the HPPs in quantitative terms. Specify monitoring criteria and ensure monitoring in the ESMP.

The WB requires implementation of pollution prevention and abatement measures, as signatory of European principles for the environment the WB requires compliance with relevant EU environmental standards on water. Aspects of Environmental Flow (E-Flow) are reflected across the World Bank Environmental and Social Standards (ESS), and most recently provided in the IFC´s "Good Practice Handbook, Environmental Flows for Hydropower Projects" (2018), which set out good international practice for development projects. An E-Flow assessment requires the use of a method that provides an appropriate level of detail to guide sustainable development and to provide predictions for the full upstream and downstream extent of influence related to alterations in river flow.	The most important aspects of legislation of the Republic of Macedonia in the field of water management and water permits are already established within the horizontal environmental legislation and the Law on Waters (Official Gazette of RNM No. 87/08, 6/09, 161/09, 83/10, 51/11, 44/12, 23/13, 163/13, 146/15, 52/16, 151/21). The determination of the water quality status of the main surface watercourses is prescribed by the Law on Water and Decree on classification of waterways, lakes, accumulations and ground waters (Official Gazette No. 18/99, 71/99). As established in the national legislation, there is a list of parameters that need to be analyzed, and reports to be prepared annually by the Ministry of Environment and Physical Planning. Law on waters prescribes the conditions for providing the water permit and validity of the permit (max 10 years).	At this point legislation in the field of water management, which is already or will be transposed, is in compliance with the European Union water legislation. The following degrees are prepared within the Law on Waters: ▪ degree on criteria for determination of the good ecological status of the surface water's physical/chemical, biological and morphological conditions ▪ degree on criteria for determination of the good ecological status of the ground water's physical/chemical, biological and morphological conditions ▪ degree in classification and categorization of waters; and ▪ rulebooks on the determination of sensitive water zones and water bodies. ESM has achieved water permits for all HPPs with biological minimum flow requirements. Biological minimum flow is not quantified in water permits for HPP Spilje, HPP Globocica and HES Mavrovo system. ESM is not obliged to measure the biological minimum flow. Permit is not based on analysis of biological minimal flow.

EU/ KfW Requirements	Provisions of the North Macedonian Law	Gap	Strategy to close the gap
Hydrology (Surface Water) & Hydrogeology (Groundwater)			
Waste Management			
EU directives regulate waste management, establishes list of wastes and list of hazardous waste, disposal of waste oil, landfill, labelling the equipment that contains PCBs EU PCBs and waste oils. EIB Environmental and Social practices Handbook requires that a project must comply with EU standards in potential candidate country as is it Macedonia, the benchmark is EU standards. Where EU standards are more stringent than national standards, higher EU standards are required if practical and feasible. The WB Policy requires implementation of pollution prevention and abatement measures, such as signatory of European principles for the environment the WB requires compliance with relevant EU environmental standards on waste management. Project must be designated to comply with relevant EU environmental requirements as well as with applicable national law and will be operated in accordance with these laws and requirements.	With regards to policy documents, the Republic of Macedonia prepared the main strategic documents: ▪ Waste Management Strategy of the Republic of Macedonia (2008 – 2020), Government of the Republic of Macedonia, 2008 ▪ National Waste Management Plan (2021 – 2031) of the Republic of Macedonia, Ministry of Environment and Physical Planning, 2021. In Macedonia, the main national legislation regarding waste management sector is the Law on Waste Management (Official Gazette No. 216/21,) as well as laws for other waste streams: Law on Packaging and Packaging Waste Management (Official Gazette of RM no. 215/21), Law on Waste Management from Electrical and Electronic Equipment (Official Gazette of RM no. 176/21), Law on Waste Batteries and Accumulators Management (Official Gazette of RM no. 176/21) and Law on Management of Additional Waste Flows (Official Gazette of RM no. 216/21). The Law on Waste Management significantly contributes to the approximation process in establishing a	National legislation follows the recommendations of international organizations such as IFC EHS General Guidelines (waste oils, batteries & accumulators, oil leakage, packaging and packaging waste).	National legislation is in full compliance with EU requirements. On issue which are not covered with relevant laws EU legislation will be relevant and the stricter thresholds shall apply.

EU/ KfW Requirements	Provisions of the North Macedonian Law	Gap	Strategy to close the gap
Hydrology (Surface Water) & Hydrogeology (Groundwater)			
	modern and comprehensive waste management system based on the main EU directives on different waste streams including hazardous waste.		
Nature Conservation & Biodiversity			
EU directives cover conservation of natural habitats and wild fauna and flora, wild birds, protection of species of wild fauna and flora. WB ESS 6 Biodiversity Conservation and Sustainable Management of living natural resources main objectives are: -to protect and conserve biodiversity and habitats; -to apply the mitigation hierarchy and the precautionary approach in the design and implementation of projects that could have an impact on biodiversity; -to promote the sustainable management of living natural resources; -to support livelihoods of local communities and inclusive economic development, through the adoption of practices that integrate conservation needs and development priorities.	The basic law in the area of nature protection is the Law on Nature Protection (Official Gazette of RM no. 67/04, 14/06, 84/07, 35/10, 47/11, 148/11, 59/12, 13/13, 163/13, 41 / 14, 146/15, 39/16, 63/16, 113/18, 151/21)	Most of the EU legislation on nature conservation has been transposed into this Law, which also contains obligations from relevant ratified international agree-ments. Full implement-tation of the Law is still to be achieved with the adoption of several by-laws. Thus, with regards to the trans-position of the two directives that comprise the corner-stones of EU nature protection policy, the Habitats Directive (92/43/EEC) and the Wild Birds Directive (79/409/EEC), there are still many require-ments pending on full transposition.	Requirements which are still pending to be transposed in National Law are to be covered by relevant EU legislation and WB ESS6 Requirements, which apply in the context of this given rehabilitation program during rehabilitation and operational phase of the project.

Table 7: Gaps between International and North Macedonian Laws regarding requirements for Labour and Health & Safety

EU/ KfW Requirements	Provisions of the North Macedonian Law	Gap	Strategy to close the gap
Workers' Rights			
WB ESS 2 prescribes the development and implementation of written labor management procedures applicable to the project. These procedures shall set out the way in which project workers will be managed, in accordance with the requirements of national law and this ESS. The procedures shall address the way	The national law regulates most aspects associated with labor relations and working conditions. It is important to underline that some segments of ESS2 (such as grievances mechanism)	Under the national law clients are not required to develop separate human resources policies or worker relations management procedures. Most labor relations management issues addressed in ESS2 are regulated by	ESSRA Report is prepared, incl. social aspects, to follow WB and KfW requirements. Public disclosure of the ESSRA needs to be provided. In the framework of the SEP the

EU/ KfW Requirements	Provisions of the North Macedonian Law	Gap	Strategy to close the gap
in which this ESS will apply to different categories of project workers, and the way in which the Client will require third parties to manage their workers in accordance with ESS2. The ESS2 will apply to the contracted workers. EU labor law covers the following main areas: working conditions, working hours, part-time & fixed-term work, posting of workers, informing & consulting workers about collective redundancies, transfers of companies, etc. EU labor law also benefits employers and society by providing a clear framework of rights and obligations in the workplace, protecting the health of the workforce, and promoting sustainable economic growth. The two ILO Conventions on child labour are Convention No.138 on Minimum Age and Convention No. 182 on the Worst Forms of Child Labour. All ILO member States have an obligation to respect, promote and realize the abolition of child labour, even if they have not ratified the Conventions in question.	are not part of the national law regulation. The 2016-2020 National Equality and Non-Discrimination Strategy defines the goals, measures, indicators, and key policy makers in designing the policy for promotion of rights and equal opportunities in various areas of social life, defining as well responsible implementing agencies and all stakeholders in attaining equality and non-discrimination in the Republic of North Macedonia. (Non-Discrimination and Equal Opportunity). ILO Convention No. 138 and No. 182 were ratified by North Macedonia; minimum age specified is 15 years.	the national legislation. (Human Resource Policies and Working Relationships) According to the national legislation, employment for children under the age of 15 or a child that did not complete a compulsory education is prohibited, except for activities specified in the law, but not exceeding four hours a day (Child and Forced Labour).	stakeholders were identified, and a Grievance Mechanism is incorporated. The stricter regulations shall apply, that means that no child under the age of 15 is allowed to work on sites.
Community Health & Safety			
WB policy requires identification and requirements evaluation of the risks and potential impacts to the health and safety of the affected community during the design, construction and operation of the project, establishing preventive measures and plans to address them in a manner commensurate with the identified risks and impacts. These measures to favor prevention or avoidance of risks and impacts over minimization and reduction.	Macedonian legislation which covers this issue are: the Law on road safety, Law for health protection, Law for transport of hazardous materials, Law for preventing the spreading of infectious diseases. Issues related with community health and safety are covered as well under other topics like noise and vibrations, labour and working conditions, air quality and hydrology.	Relevant national legislation covers all issues related with community health and safety	To follow national legislation which is in full compliance with relevant WB requirements. The environmental and health impacts as well as the possible emergency situations are emphasized and properly addressed within the ESSRA.

EU/ KfW Requirements	Provisions of the North Macedonian Law	Gap	Strategy to close the gap
Occupational Health & Safety			
EU directives regulate workforce requirements concerning the minimum safety and health requirements for the workplace, covers the minimum health and safety requirements regarding exposure of workers to the risks arising from physical agents, and introduction of measures for encouraging improvements in the safety and health of workers at work. IFC`s policy on social and environmental sustainability requires that employers and supervisors are obliged to implement all reasonable precautions to protect the health and safety of workers. IFC provides guidance and examples of reasonable precautions to implement in managing principal risks to occupational health and safety. Although the focus is placed on the operational phase of project, much of the guidance also applies to construction phase.	North Macedonian Law on Occupational Health and Safety and secondary legislation requires: employers will take all the necessary measures and maintain acceptable working conditions. Employees are under the obligation to obey and observe all the measures Taken to ensure acceptable occupational health and safety. Employers must inform the employees of the occupational risks and preventative measures that must be taken to address these risks. The employer must inform employees of their legal rights and obligations and must provide the employees with the necessary training on occupational health and safety. The Employer is responsible for the provision of a safe working environment and must provide workers all the required personal protective equipment. The employer must regularly check this and all other health and safety equipment and ensure that it is in good working order.	North Macedonian law Macedonian legislation is in line with WB/EU/EIB/IFC requirements.	To follow national legislation which is in full compliance with relevant requirements. Occupational health and safety issues are covered within the ESSRA.

5 Baseline: Environmental and Social Conditions

The Consultant's expert conducted site visits to the project locations of all 6 HPPs and their vicinity (12.9.22 – 16.9.22). During the site visits, following aspects were observed, in order to identified the baseline conditions of the project sites and possible risks that may arise from the project implementation: 1) type of terrain; 2) technical characteristics and current condition of each HPPs; 3) achievement of national OH&S requirements; 4) presence of vegetation type; 5) habitat identification; 6) identification of significant flora and fauna species; 7) nearby settlements; 8) access roads; nearest surface water streams and their intakes, presence of cultural sites, etc.

As e result of the above-mentioned activities the following ESHS baseline conditions were identified:

- Provided documentation, studies, maps and reports are mainly in Macedonian language and of poor quality and cannot be considered as appropriate baseline information for the ESSRA process.
- Even though ESM and Hydro Electrical Systems (HESs) under the management of ESM are/were certified for ISO 9001, ISO 14001 and ISO 45001, ISO requirements and standards are not practically implemented in all concerned project Systems (Mavrovo HES, Crn Drim HES, Tikves HPP). The ESHS management system and related documentation were not updated and/or missing at sites, and most of the employees seem not to be trained in ESHS MS procedures and requirements. Considering that rehabilitation and reconstruction works shall be done in parallel with operations this may create a high risk for the public and employees alike of both HESs and Construction Contractor's staff.
- Despite the announced ISO standards implementation and Certification provided by ESM, the HPP working areas were not properly organized, especially firefighting equipment (fire extinguishers) were not maintained, and the last inspection was done in 2018 according to the labelling. Hazardous materials storages (oils, lubricants, cylindric gases etc.) were not properly organized, ventilation, firefighting materials, MSDS were absent in some storage areas. LOTO systems were not applied to the electrical systems. The sanitary and hygienic conditions of the kitchen, toilets, and washrooms were found to be very poor. Evacuation plans and emergency signs were partially installed. No spill kits, first aid kits, proper PPEs were provided to the workers.
- Despite of the fact that Mavrovo HES operates mainly in Shar Planina and Mavrovo National Parks areas, there is no written evidence of communication and cooperation with NPs Authorities, which can lead to the conclusion that a conflictual situation between ESM and NPs Authorities may exists and may affect the time frame of the project implementation.
- Hazardous materials/substances and/or chemicals, as well hazardous waste handling system at all HESs is not in place (no contracts, evidence provided of proper handling, disposal of waste yet) and storage conditions are very poor at all project sites, which can create high risks during the project implementation considering the fact that rehabilitation and reconstruction works shall be done in parallel to operations.
- Asbestos containing materials (ACM, Class B and F insulation in poles, klingrit gaskets/insulations for pipes) were identified in two HPPs where insulation in poles is planned to be replaced.
- PCB presence in transformer oils is likely, as the Transformers to be replaced date to the 1960-1970s.
- The necessity of vegetation cleaning and bush cutting in small areas is likely to get access to the intakes at Shar Planina NP, which will require special permit or authorization from NPs or MoEPP.

- No major impacts are identified on Mavrovo and Shar Planina NPs areas during the project implementation phases, all likely impacts will be short-term and manageable with proper site-specific environmental Management and Monitoring Plans implementation.
- No major impacts are identified on terrestrial or aquatic ecosystems during the project implementation phases, as all likely impacts will be of short-term duration of few days only and manageable with proper site-specific Environmental Management and Monitoring Plans.
- No major impacts are identified for public H&S and Security during the project implementation, as all likely impacts can be managed by the appropriate site-specific traffic management plans.

5.1 Bio-physical Environment

Rehabilitation activities within the project will be performed within the three Hydro Energy Systems (HES Mavrovo. HES Crn Drim and HES Tikves).

HES Mavrovo bio – physical area of influence

HES Mavrovo is composed of three hydro power plants: Vrutok, Vrben and Raven, the Mavrovo reservoir and dam, 35 kV transmission line as well as the network of channels and tunnels for receiving the water from the neighboring mountain massifs (Sharski vodi intakes and intake Shtirovica from Gorna Radika are relevant for project activities).

Sharski vodi system catches the waters of the Shar Mountain through following water intakes: Proshevska, Kuchibabaska, Mazdraca, Vraca I, Vraca II, Dumkovo, Lomnica, etc. All these intakes are located on mountainous rivers at an altitude between 1,236 to 1,354 m a.s.l. within the NP Shar Mountain, in the zone of active management and zone of sustainable use (*except intake Mazdraca which is located in zone of strict protection*). From these intakes, the water is discharged into the HPP Raven and HPP Vrutok for electricity production or in Mavrovo accumulation, depending on the needs and conditions defined in the Water Permit for HES Mavrovo. Water from Sharski dovod is used predominantly for electricity production (HPP Raven and HPP Vrutok), but also for irrigation purposes of agricultural fields in Polog valley and for recreation and tourism activities e.g. fishing in Mavrovo lake. After the usage of the waters for hydro energy production, the water is discharged in the Vardar River.

Gorna Radika water system as part of the HES Mavrovo, collects waters from the upper water stream of the Radika River, from the mountain peaks of Korab, located within the NP Mavrovo. This system has several intakes, which one of them is Stirovica (located at 1,450 m.a.s.l.), From this intake, water goes to the HPP Vrben and is afterwards discharged in the Mavrovo accumulation. The nearest populated area, relevant for the Gorna Radika system, is the settlement Vrben, near the HPP Vrben. The water is used predominantly for electricity production (HPP Vrben) and for recreation and tourism activities. Indirectly the water is used for irrigation purposes trough the final water recipient (the Vardar River).

Mavrovo accumulation, HPP Vrben and intake Stirovica are located within the NP Mavrovo, while the intakes from Sharski vodi are located in the NP Shar Planina. The existing 35 kV transmission line from HPP Vrben to HPP Vrutok is located in the NP Mavrovo and NP Shar Planina.

HES Crn Drim bio – physical area of influence

HES Crn Drim consists of two dams and the HPP Spilje and HPP Globocica.

HPP Spilje is the largest storage hydropower plant in the catchment area of the Crn Drim river near Debar. The hydropower plant is located at the confluence of the Crn Drim and Radika rivers, so the inflow regime in the reservoir depends on the regime of the two rivers. The City of Debar is located nearby. The water from the reservoir in Spilje is used mostly for electricity production, for recreation and tourism activities (fishing in Spilje lake).

HPP Globocica is located on the Crn Drim river at the joint spot of the two rivers Crn Drim and Radika, about 30 km north of city of Struga. This HPP is located within Emerald site "Jablanica". Lake Ohrid and River Crn Drim are regulatory facilities for water level control in Globocica reservoir. In addition, water from the Jablanska and Selecka rivers are transferred to the reservoir via channels. Several populated areas are located in the wider surroundings of Globocica dam (settlements Piskupshtina, Nerezi and Selci). Water from reservoir Globocica is used for electricity production and then continues towards the Spilje accumulation.

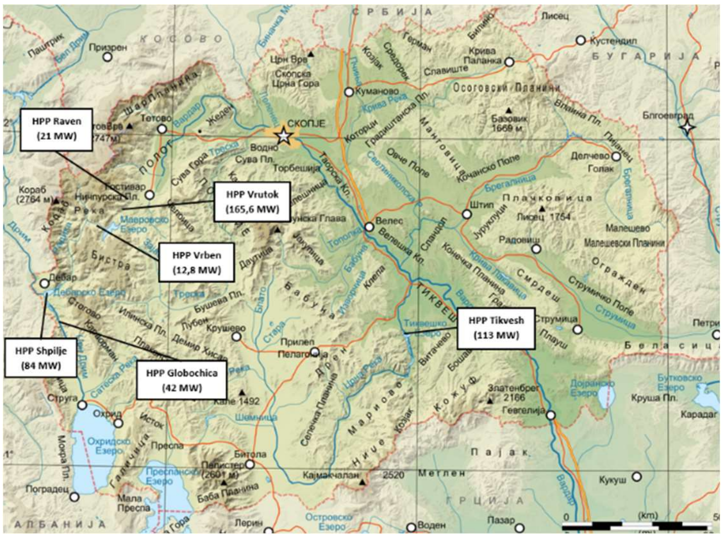
HES Tikves bio – physical area of influence

HPP Tikves is located in the Crna river near Kavadarci, 27 km upstream of its inflow in Vardar River. Crna River is the largest right tributary of Vardar River. In Vardar, the river follows into the Tikveska Valley, at an altitude of 129 m a.s.l. Compared to the catchment area and the amount of water that it brings into the Vardar River, it is its largest tributary. Strict nature reserve Tikves is in the wider surrounding of the Tikves reservoir, but the HPP is located outside the borders of this reserve.

On the banks of Tikves reservoir there are a several private houses, used for leisure activities at the weekends. The Reservoir is also a favourite place for sport fishing activities. The water is used mostly for electricity production (HPP Tikves), for recreation and tourism activities (fishing in Tikves lake) and for irrigation purposes for the agricultural fields (mostly wine yards) within the Tikves region and beyond.

5.1.1 Topography

Hydro system (HPP) Mavrovo (HPP Vrben, HPP Raven, HPP Vrutok and accumulation Mavrovo) is located in the north-western part of the country, in the Municipalities Mavrovo and Rostuse and Municipality of Gostivar. HPP Spilje, located within the Municipality of Debar and HPP Globocica in Municipality of Struga belongs to the western part of the country. HPP Tikves is located in the south part of the country (Figure 39).



Source:
https://upload.wikimedia.org/wikipedia/commons/thumb/7/7e/Map_of_the_rivers_in_Macedonia_mk.svg/1200px-Map_of_the_rivers_in_Macedonia_mk.svg.png

Figure 39: Location of all 6 HPPs presented on topographic map of Republic of North Macedonia

HPP Vrben is located near the village Vrben and is at the southern slope of the mountain Vraca, in the upper basin of Radika River, making it one of the dams at the highest altitude. HPP Vrben and Mavrovo accumulation are within the NP Mavrovo, while HPP Vrutok and HPP Raven are part of the NP Shar Planina. The relief in Mavrovo National Park is complex and diverse. This complexity arises due to the different geological composition and complex tectonic movements that took place in the geological past of the terrain of Western Macedonia, which includes Mavrovo National Park, as well as under the influence of external factors. Mountains on the territory of the NP Mavrovo are higher than 2,000 m.a.s.l. and some of them are higher than 2,500 m. The Shar Planina are a large highland massif extending over an area of north-western part of the country. To the east and southeast, the range descends to the Polog Valley.

HPP Spilje is in the western part of the Republic of North Macedonia, on the border with the Republic of Albania. The municipality extends in Debar valley, between the slopes of the Deshat Mountain, Debar accumulation and River Valley of Crn Drim, which also fills the lake with the river Radika. The Municipality of Debar belongs to the Southwest planning region. Debar valley is spread over an average altitude of 610 m. Debar accumulation where is located HPP Spilje, is formed in the valley of the river Radika and Crn Drim.

HPP Globocica is located on river Crn Drim, 22 km north of the town of Struga, in Municipality of Struga. River Crn Drim is adjacent to HPP Spilje. The waters are also brought from the rivers Jablanska and Selecka River.

HPP Tikves is located on Tikves accumulation, in Tikves valley, in the Skocivir gorge, along the river Crna Reka, 10 south west from City of KavadarciFigure 39.

5.1.2 Climate and Meteorological Conditions

According to the geographical location of the 6 HPP's, they have different climatic characteristics.

Within the NP Mavrovo, depending on the altitude, there are few climatic zones. Area of the HPP Vrben is characterized by the cold continental climate. The winters are long, the spring is moderate, the summer is dry, and the autumn is moderately cold. The average annual temperature is 7.1°C. The coldest month is January, with an average temperature of –2.2°C and warmest months are July with a temperature of 16.3°C and August with a temperature of 16°C. When in the spring, when snow is melted, starts severe drainage and erosion processes. The intensity of rain is crucial for incidental occurrences of strong erosive processes.

HPP Raven and HPP Vrutok are located in the region with moderate continental and cold winters and hot and rainy summers. The average annual temperature is 10.6°C. The coldest month is January with an average temperature of -1.6°C, and the warmest is July with an average temperature of 21.1°C. The winters are quite cold, while the summers are warm and with cool summer nights, which is a reflection of the immediate influence of the high mountain ranges of the Shar Mountain. Annual precipitation reaches 500 mm and has a continental regime, with maximum values in the period from November to February and minimum values in the period from July to September. The rainiest month is November with an average of 156 mm, and the least rainfall is August.

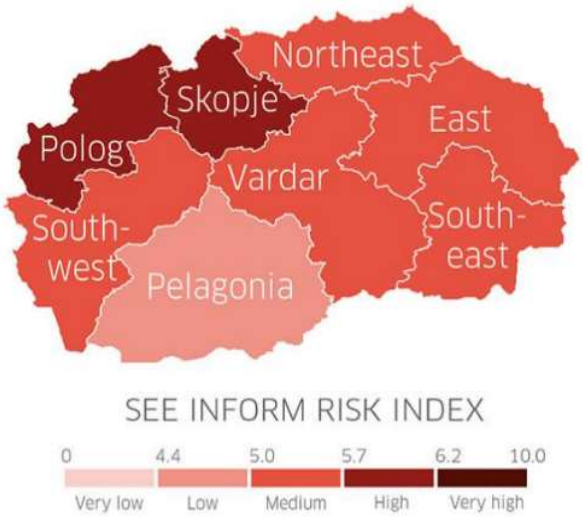
The Debar valley (HPP Spilje) is characterized by specific climatic characteristics, because of the terrain configuration and the valley is protected by the surrounding mountains. The average annual temperature is 11.8^0 C. The coldest month is January with an average temperature of 0.7^0C and the warmest month is July with 22.2^0C. The annual distribution of precipitation is uneven. Precipitation is maximum in the autumn months and early winter months, while in the summer months the precipitation is minimal. Cloudiness is highest in the winter months and lowest in the summer months.

HPP Globocica belongs in area with dominated moderate-continental climate, to some extent modified, because of the influence from the Adriatic Sea through the river Crn Drim. The average annual temperature is 11°C, with maximum average monthly temperatures in July of 21.2° C and 34.4°C in August and the lowest average monthly temperature recorded in January at -17.2°C. The average annual rainfall is 703 mm per year.

Tikves region (HPP Tikves)is characterized with modified Mediterranean climate, and continental climate in some areas. Average monthly temperature is 13.6°C. Average number of rainy days is 96 with average precipitation of 420.5 mm. August is the driest month with highest relative humidity of 55%.

5.1.3 Climate and climate vulnerability

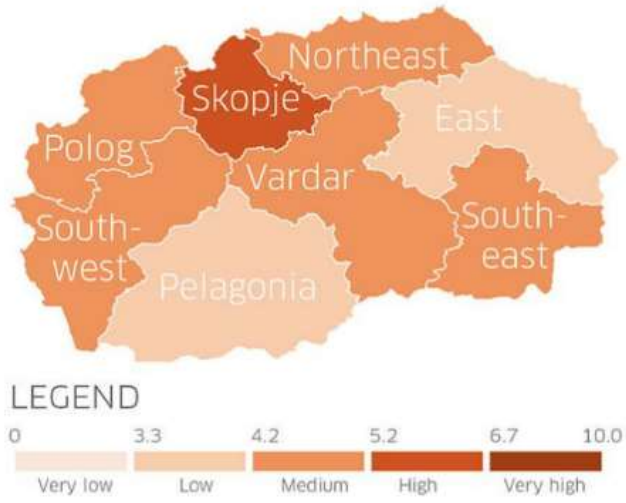
According the NFORM's risk analysis North Macedonia is at risk from various natural hazards, including earthquakes, floods, torrents, landslides, rockfalls, avalanches, droughts, as well as heatwaves and cold snaps. However, due to a higher risk ranking in the Hazard & Exposure and Coping Capacity dimensions, Skopje and Polog are regions classified as high risk (see Figure 40 below).



Source: https://northmacedonia.un.org/en/173663-open-source-inform-index-provides-overview-disaster-risk-north-macedonia

Figure 40: Hazard and exposure risk map for the regions in the country

Related to the Hazard & Exposure dimension in North Macedonia, this dimension is driven by natural hazards, mainly drought across all regions. When combined with earthquake risks in the Skopje and Polog regions alongside nationwide landslide exposure, North Macedonia has an overall high risk of Hazard & Exposure (Figure 41).



Source: https://northmacedonia.un.org/en/173663-open-source-inform-index-provides-overview-disaster-risk-north-macedonia

Figure 41: Natural hazards exposure risk map for the regions in the country

The climate of the territory of the Polog region, where the HPP Vrutok, HPP Raven and HPP Vrben are located, differs according to the high mountain and valley relief. Altitude differences contribute to the diversity of the climate in certain parts of the region. The fact that this territory belongs to the Shar mountain range in which the river valleys are mild, allows the climate in these areas to deviate from the Central European climate, which is why there is less precipitation throughout the year. In the parts of the region where the height above sea level is higher than 2,000 m, the influence of the alpine climate can be observed,

and therefore the number of rainy days during the year is higher. The area where HPP Vrutok and HPP Raven are located is prone to fog and the area where HPP Vrben is prone to active landslides.

The climate of the territory of the Southwest region, where the HPPs Spilje and Globocica are built is continental. It is characterized by cold winters and where the dams are located the water does not let the air become very hot during the summer and gets too cold during the winter. The winter in the region is characterized by heavy snow fall. Due to the high mountains, the Adriatic influence and the existence of the artificial lake, spring and autumn are characterized by high humidity and precipitation, while summers are characterized by pleasant coolness. The area where HPP Spilje is located is prone to active landslides and high possibility of forests fires and the area where HPP Globocica is prone to active landslides.

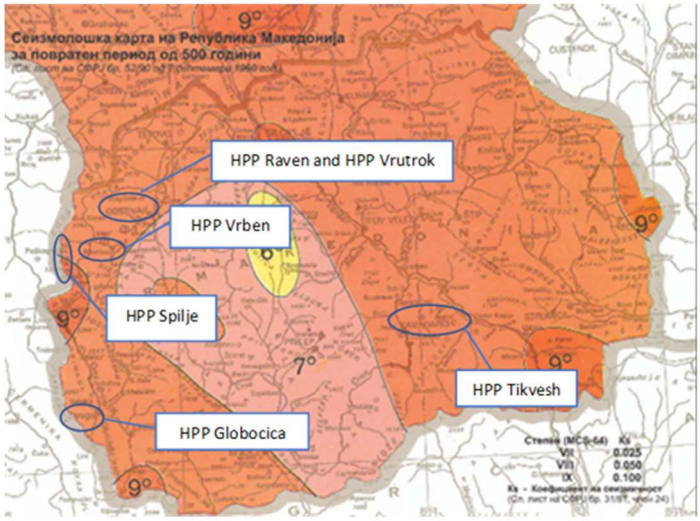
The climate of the territory of the Vardar region, where HPP Tikves is located, is characterized by certain Mediterranean influences. The average annual air temperature is 13.8 degrees. The average annual amount of precipitation is about 500 mm, so this region is considered one of the warmest and driest in the country. The area where HPP Tikves is located is prone to fog, precipitation up to 700mm and high possibility of forests fires. In the past decades it could be observed that annual rainfall was decreasing, and the Vardar region is becoming more and more prone to drought, presumably caused by global warming and climate change.

The Report on climate change projections and changes in climate extremes for the Republic of North Macedonia (2019)[6] was prepared as part of the Macedonia's Fourth National Communication and the Third Biennial Update Report[7] on Climate Change under the UNFCCC. According to this Report, North Macedonia will face hotter and drier climate in the future. Amplitude of this change will primarily be related to the future concentration of GHG. Associated with hotter climate in future, increase in hot extremes and decrease in cold extremes are expected. Even drier condition is expected on average on annual level, with potential increase in daily extreme precipitation that will introduce higher risk of flash floods in some parts of the country. On the other hand, expected decrease in summer precipitation and extension in duration of consecutive dry days, will increase the risk of drought.

5.1.4 Seismic conditions

According to the tectonic regionalization of the Republic of North Macedonia, project areas belong to Vardar River tectonic zone (HPP Tikves) and western Macedonian tectonic zone (HPP Vrutok, HPP Raven, HPP Vrben, HPP Spilje and HPP Globocica). According to the previous seismic activity and obtained data on national level, almost all project locations are located on terrains with frequent and strong earthquakes caused by the wider distant epicenters (Debar - Struga in the western part and epicenter in Valandovo (relevant for HPP Tikves)), belong to the seismic zone with maximum intensity of earthquake of VIII° per MKS (Figure 42).

[6] klimatskipromeni.mk
[7] 217569_North Macedonia-BUR3-1-1 TBUR_EN_f.pdf (unfccc.int)



Source: https://msz.iziis.ukim.edu.mk/Docs/MK-PP500.jpg

Figure 42: Seismological Map of RNM and location of all 6 HPPs

Municipality of Mavrovo and Rostuse, where HPP Vrben is located, belongs to the area with frequent and strong earthquakes, caused from local and distant epicentral hotspots. Earthquakes with magnitude VIII° are possible in this area.

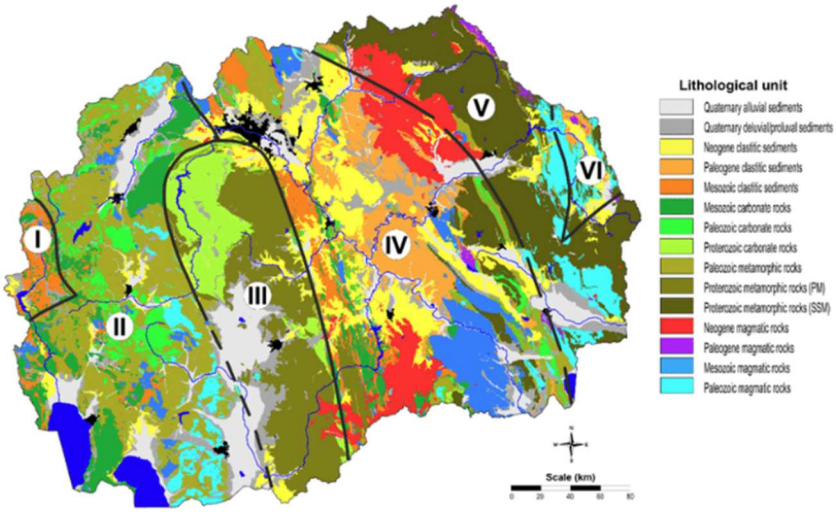
Municipality of Gostivar (HPP Raven and HPP Vrutok), according to the seismic activity, belongs to the Western Macedonian zone, characterized by low to medium seismic activity (with earthquake magnitude VII-VIII° per MKS).

Municipality of Debar (HPP Spilje) belongs in seismic area where earthquakes of IX° per MKS can occur. According to the seismic activity, the Municipality of Struga, where the HPP Globocica is located belongs to seismic zone with maximum intensity of earthquake of VIII° per MKS.

According to the seismic activity, the Municipality of Kavadarci, where the project location HPP Tikves belongs to the areas subject to frequent earthquakes, caused by local and more distant epicentral hotspots. Earthquakes with a magnitude of VIII° per MKS are possible in this area.

5.1.5 Geology

From a geological point of view, territory of National Park Mavrovo belongs to the West – Macedonian geotectonic unit. The rock masses, which are of different age and mineralogical composition, can be grouped into three geological formations: Paleozoic metamorphic and igneous rocks; Mesozoic sedimentary rocks and Quaternary deposits. Larger morphotectonic forms were created under the action of tectonic movements, namely: mountains, valleys, mountain peaks, high mountain passes, tectonic sections, while various geomorphological forms were created under the action of external forces. The largest part of this massif is made of carbonate rocks, while silicate rocks are represented to a lesser extent. From the carbonate rocks, dolomites and marbleized limestones are the most widespread, while carbonate shale is represented to a lesser extent. Silicate rocks or shale are found on smaller areas in the northern, northwestern, northeastern and extreme southern parts. Riverbeds with canyons and underground karst relief forms caves are one of the most significant relief forms created as a result of external forces.



Source: Simplified geological map of the Republic of Macedonia Tectonic units (according to Arsovski, 1997): I -Cukali-Krasta zone (CKZ), II -West-Macedonian zone (WMZ), III -Pelagonian massif (PM). IV -Vardar zone (VZ), V -Serbo-Macedonian massif (SMM), VI -Kraishtide zone (KZ).

Figure 43: Geological map of Republic of North Macedonia

The geological composition of the terrain of the municipality of Debar is very diverse. The following geological formations are encountered: Pliocene, Eocene, Proluvium and Flysch. Eocene sediments have been found in the extreme western part of the valley, consisting of clays, sandstones and laprovite clays. The Pliocene was developed in the Debar basin and is composed of sands and poorly developed conglomerates. These sediments lie on top of old formations, with horizontal layering. Proluvium is represented by semi-rounded or non-rounded material, these formations are located immediately on Mount Deshat, while the flysch occurs on the slopes of Mount Deshat composed of clays, sandstones, limestones and limestones.

The geological structure of the wider area of Municipality of Struga is consists predominantly of alluvial formations, semi-vial sediments, spread in the plain part. Alluvial deposits in terms of engineering-geological characteristics are mostly labile terrains with low values of physical-mechanical properties. The following geological formations are distinguished in this region: Paleozoic, Triassic, Cretaceous, Neogene,

Quaternary. From the igneous rocks in the region are represented: granites, sienites, gabbro, diorites, diabase, trachites, serpentinites and dunnites.

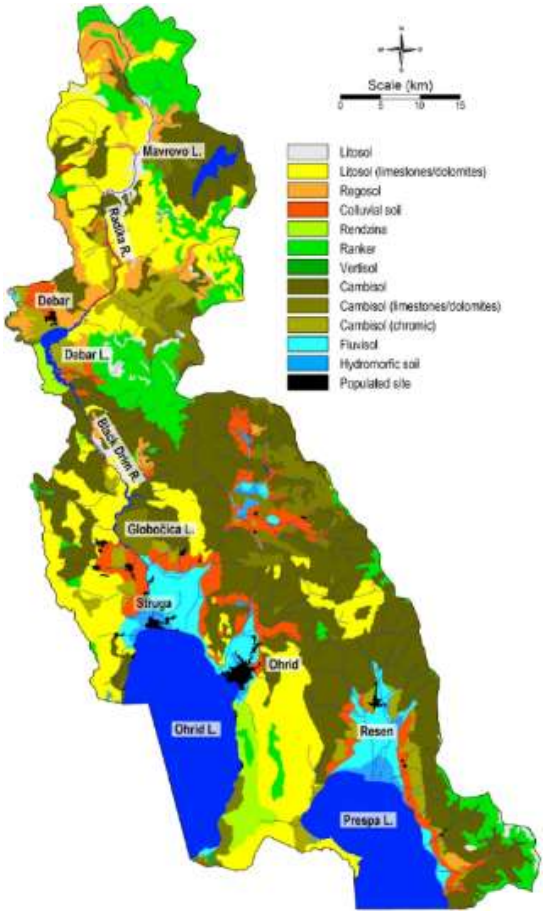
In the area of HPP Tikves, the most common are Paleozoic and Mesozoic rocks which are characteristic for the southwestern and western part of the Tikves area.

5.1.6 Soils

The pedological composition of the soils in the surrounding HPPs Raven and Vrutok is represented by alluvial soils along the river courses, semi-valley in the lowest part of the valley, and cement soils along the undulating hilly terrains. The most common soil types in the mountainous areas are silicate (Shar Mountain) and carbonate soils (Suva Gora). On the carbonate rocks, there are limestones, brown limestone-dolomite soils, bare limestone walls, sepoys and boulders. Above them, with the high mountain belt, renkers meet. All mountain soils are distinguished by low productivity, while soils suitable for agricultural cultivation in the municipality are spread in the Polog valley. Around Mavrovo accumulation, mainly the Cambisol soil is dominates, and a small part of the mountains Jablanica and Korab.

Various types of soils are represented in the Debar Valley: colluvial, chromicambisol, regosol, fluvial and cambisol. Fields in Debar and Struga consist of quaternary alluvial and diluvial/proluvial sediment, and the upper zones of the respective valleys consist of Neogene clastic sediment. The cement soils that develop on the lake route of the former Lake Debar, on the thick deposits of Neogene sediments. It is characteristic of them that they are subject to erosion. In the area of the cinnamon soils, the poluvial-deluvial soils on which the city of Debar lies are developed. These soils have a heterogeneous composition, where anthropogenic action is felt. Alluvial soils develop in a narrow strip along the Crn Drim valley, and are represented by several varieties.

Soil complex from regosols and litsols in the Tikves area appear in fields that are characterized by higher slope, west of the Tikves Lake in the areas of the villages Debrishte, Kamen Dol and Krusevica and northwest to the village of Dolno Chichevo. In the Tikves area the places under resins are set aside as an independent soil type. They are prevalent in the vicinity of the villages Ribarci, Trstenik and Vozarci and north of Kavadarci.

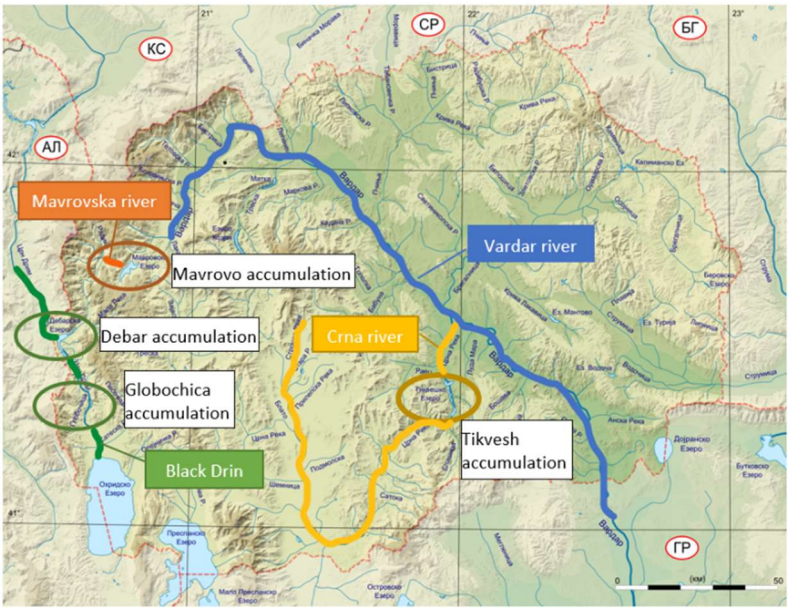


Source: http://www.maksoil.ukim.mk/masis/

Figure 44: Soil types in the project area

5.1.7 Water

Water streams relevant for the project, belong mainly to two watersheds: Vardar river and river Crn Drim. HPP Vrben, Vrutok, Raven and Tikves are located on waterstreams that belong in watershed of Vardar River. HPP Vrben is located on the water streams from the watershed of river Radika, where trough this HPP the water are directed towards the Mavrovo accumulation and from there towards the HPP Vrutok and HPP Raven directed to river Vardar. Waters from HPP Spilje (river Radika and river Crn Drim) and HPP Globocica (river Crn Drim) belong to the watershed of river Crn Drim.



Source: https://upload.wikimedia.org/wikipedia/commons/thumb/7/7e/Map_of_the_rivers_in_Macedonia_mk.svg/1200px-Map_of_the_rivers_in_Macedonia_mk.svg.png

Figure 45: Water bodies in the surrounding of all 6 HPPs that will be rehabilitated

ESM has obtained water use permits for HES Mavrovo (including HPP Vrutok, HPP Vrben, HPP Raven, intakes and Mavrovo accumulation), HPP Spilje, HPP Globocica and HPP Tikves issued by MoEPP.

Water permit for HES Mavrovo defines coordinates of each intake and the water catchment quantities for each of the main intakes (Gorna Radika, Jelovski, Belicica, Sharski Vodi and Mavrovo accumulation). In the Water Permit the biological minimal flow is generally defined as 1/10 from the average multi-year flow for the respective water stream and ESM should ensure this continuous biological minimal flow. However, the biological minimal flow is not quantified in m^3/s in the permits and ESM is not obliged to perform measurements of the actual biological minimal flow. For each **intake system** only the maximal flow which can be taken by ESM is defined in the permit. For this, ESM is obliged to perform continuous measurements of the caught water quantities on each intake on daily basis. Because there is no quantification of biological minimum and no measurement of the biological minimum flow is required by the permit or undertaken by ESM, it is not possible to quantify actually released water quantities. From the period May to September, water regime of Mavrovo accumulation should be managed according to the needs for irrigation of the Polog region and fishpond Vrutok. Discharged water in the river Vardar is defined as 36 m^3/s (about 68,235,836 m^3 annually).

HPP Vrben is a continuous-flow plant which uses the waters of Gorna Radika. The total length of the Radika River course is 64.7 km, while the total length of all water flows (Radika River and its tributaries) in the Radika River watershed is 763.4 km. The headwaters of the Radika River are represented by a small mountain stream of the mountain peak Golema Vratsa, at an elevation of 2,260 m a.s.l. They are not composed of a single spring, but of a large number of small mountain streams that spring up at the slopes and the bottom of the cirque Gorni Def-Velin Beg. Beside Radika river, several intakes (Stirovica, Crn Kamen, Brodec, etc.) of smaller rivers are are directed towards HPP Vrben: river Stirovica, Hadzina river, Vrbenska river, etc.

HPP Vrutok and HPP Vrben are provided with water from the cannal intake called Srarski vodi, located in the upper parts of mountain Sar Planina. Some relevant small rivers that are included within the intake Sharski vodi are: Proshevska river, Vrutocka river, Kucibapska river, etc. Some site vist photos, (taken 12.9-14.9) near HPP Vrben, HPP Vrutok, HPP Raven and intakes Stirovica, Lomnica, etc.

Source: Geing/EcoMosaic team, taken 12.9-14.9

Figure 46: *Site visit photos, near HPP Vrben, HPP Vrutok, HPP Raven and intakes Stirovica, Lomnica*

In Table 8 are presented the intakes of Gorna Radika and intakes of Sharski vodi with coordinates and altitude.

Table 8: *Intakes of Gorna Radika and Sharski vodi with coordinates*

Intakes of Gorna Radika

Name of intake	Coordinates		Altitude (m.a.s.l.)
Intake Hadzina river	7.473.320,00	4.631.110,00	1,520.00
Intake Stirovica 1	7.468.661,56	4.629.228,86	1,453.00
Intake Stirovica 2	7.468.550,00	4.629.510,00	1,453.00
Intake Crn Kamen	7.470.100,00	4.631.600,00	1,453.00
Intake Brodec 1	7.474.247,55	4.626.681,85	1,460.00
Intake Brodec 2	7.474.434,32	4.627.126,39	1,450.00
Intake Krakornica 1	7.475.212,00	4.623.581,35	1,459.00
Intake Krakornica 2	7.475.212,00	4.623.581,35	1,459.00
Intake Bogdevska river	7.475.751,51	4.622.064,17	1,426.00
Intake Vrbenska river	7.477.926,92	4.619.669,33	1,320.00

Intakes of Sharski vodi

Name of intake	Coordinates		Altitude (m a.s.l.)
1 Intake Ulevericka river	7.490.824,61	4.649.148,31	1,359.80
2 Intake Kamenjanska river	7.490.371,65	4.645.955,86	1,348.00
3 Intake Mazales	7.488.080,00	4.647.855,00	1,335.00
4 Intake Novoselska river	7.487.680,00	4.644.960,00	1,333.00
5 Intake Fiskaet	7.488.976,59	4.644.949,73	1,343.00
6 Intake Lomnica	7.486.317,63	4.640.195,87	1,343.00
7 Intake Dumkovo	7.483.481,11	4.638.788,77	1,314.87
8 Intake Vraca 1	7.482.800,00	4.638.550,00	1,320.00
9 Intake Vraca 2	7.482.770,00	4.638.600,00	1,320.00
10 Intake Mazdraca	7.481.955,45	4.437.043,90	1,310.01
11 Intake Kucibabska	7.484.960,00	4.634.500,00	1,290.00
12 Intake Proshevska river	7.486.165,00	4.633.710,00	1,291.00

During the site visit, the expert's team has visit the intakes Shtirovica from Gorna Radika and 7 intakes from Sharski Vodi: Lomnica, Dumkovo, Vracha 1 and 2, Mazdraca, Kucibabska and Proshevska river. When intensive snow melts in springs, catchments help in prevention of floods.

The reservoir Mavrovo (Figure 47) is an anthropogenic hydrological object, built at the entrance of the Mavrovska river to the Mavrovska valley, at an altitude of 1,233 m a.s.l. The reservoir has an area of 13.7 km^2, maximum length of 10 km, with capacity of 357 million m^3 of water. Water from the Mavrovo dam is used for electricity production.

The water in Mavrovo system is collected and transferred to HPP or Mavrovo basin through the artificial channels. The water from HPP Vrben is released in the Mavrovo reservoir through artificial channels. HPP Vrutok and HPP Raven are connected with pipelines, so that the water from HPP Vrutok flows directly to HPP Raven and after that is released in the Vardar riverbed. The Vardar Basin is in the central part of the Balkan Peninsula, bordered to the North by Serbia and Kosovo, to the East by Bulgaria, to the South by Greece and to the West by Albania. The Vardar River Basin represents about 80 % of the territory of the Republic of Macedonia. The Vardar River is the utmost important water resources and supplies 75 % of the country. It is heavily influenced and polluted by untreated urban and industrial wastewater. After passing through North Macedonia, the river flows south into Greece, entering the Aegean Sea near Thessaloniki. The Vardar River Basin contains 8 sub-Basins, which are: Vardar upstream, Middle Vardar, Vardar downstream, Lepenec, Pchinja, Bregalnica, Crna River and Treska. The main pressures on the quality of the Vardar River Basin are due to domestic, industrial, and agricultural activities, stemming from both diffuse and point sources[8].

The utilized water flow from HPP Globocica is released directly in Crn Drim riverbed. The Drin River (Basin) comprises of the watersheds of the Prespa, Ohrid and Skadar/Shkoder Lakes and Drin and Buna/Bojana Rivers. The water bodies and their watersheds are spread across a geographical area that covers parts of Albania, Greece, Montenegro, North Macedonia and Kosovo. The Drin River is the 'connecting body' of this complex water system, linking the international lakes, wetlands, shared rivers

[8] Source: https://docplayer.net/159472077-Technical-report-draft-vardar-river-basin-management-plan-vrbmp.html

and other aquatic habitats into a single ecosystem. Each of the Drin sub-Basins is of ecological importance as it hosts unique biotopes with many indigenous species, which are important from a European and international conservation perspective. The Basin encounters diverse and unsustainable management approaches; this leads to ecosystems' degradation and inhibits sustainable development[9].

The utilized water flow from HPP Tikves is realised directly to Crna Reka riverbed. The area of the Crna Reka basin is an area that extends into two states: in the south-western part of the Republic of N. Macedonia and the northern part of the Republic of Greece. Its total length is 207 km with the total area of the catchment area in both countries of 5775 km2. The spring of the river of Crna Reka is located in the district of the town of Demir Hisar, and it consists of two rivers: Ilinska and Cerska. Before village of Zeleznec they merge and continue to flow under the common name Crna Reka. In its lower stream, Crna Reka flows into the artificial Tikves Lake, and after it flows into the river of Vardar, near the village Gradsko.

Source: Fichtner/EcoMosaic team, taken during the site visit at the project locations of 6 HPPs (13.9.22 from Geing/EcoMosaic team)

Figure 47: Mavrovo dam

HPP Spilje (Figure 48) is a part of HES Crn Drim as the main source for electricity production. It is the largest accumulative HPP in the river basin of the river Crn Drim located nearby Debar on the river Crn Drim. Crn Drim source is in Sveti Naum, and from there is flows through Lake Ohrid and comes out of it at the City of Struga at an altitude of 695 m a.s.l. HPP Spilje has accumulation with volume of 506 million m^3 water, out of which useful volume is 218 million m^3 water. The HPP Spilje is located on the junction of the rivers Crn Drim and Radika, therefore the regime of the inflows in the accumulation depends of the regime of both the rivers. The inflows from the Crn Drim River during the year are quite equable due to existence of two accumulations upstream: Ohrid Lake (natural) and Globocica (artifical) accumulation. The inflows from the Radika River are quite variable which is due to the natural factors of the river basin.

Water permit for HPP Spilje defines coordinates of joint chamber, intake tunnel and HPP, and maximum flow for water usage 108 m^3/s. ESM is obliged to perform continuous measurements of the caught water quantities on daily basis and should provide continuous biological minimal flow that is generally 1/10 from the average multi-year flow of the river Radika and Crn Drim. However, the biological minimal flow is not quantified in m^3/s in the permits and ESM is not obliged to perform measurements of the actual biological minimal flow. Because there is no quantification of biological minimum and no measurement of the biological minimum flow is required by the permit or undertaken by ESM, it is not possible to quantify actually released water quantities.

[9] Source: drin_tda_ex-summary_macedonian_web-spreads.pdf (gwp.org)

From the period 15 May to 15 September, the level of the Spilje accumulation should not drop below the intake of the hydro melioration system (not less than 570 m.a.s.l.) and maximum level of 585 m.a.s.l. for the 10,000 yearly waters. The average monthly and average annual discharge of the HPP Spilje for the period 1969-2017 is defined as 45.68 m^3/s. In the low water period (from July to November) low discharged quantities are much lower than the rest of the year. The river Crn Drim, after the water discharges from HPP Spilje, is regulated by artificial banks for about 100 m, after which it flows in its natural riverbed again (see site visit photos below).

Source: Fichtner/EcoMosaic team, taken during the site visit at the project locations of 6 HPPs (15.9.22 from Geing/EcoMosaic team)

Figure 48: HPP Spilje

After village Tasmarunista, the river Crn Drim forms the accumulation Globocica. HPP Globocica is located in the western part of North Macedonia on the river Crn Drim, about 30 km north from City of Struga. The accumulation has volume of 55,300,000 m^3 water. Into the Globocica accumulation through special canals inflows the waters from the rivers Jablanska and Selecka.

Water permit for HPP Globocica defines the coordinates of all intakes, intake tunnel, HPP Globocica, joint chamber. Maximum flow for water usage is defined as 50m3/s. ESM is obliged to perform continuous measurements of the water flow before the intakes: Selecka reka, Jablanska reka, regulation object Ohrid lake on 0+000 m.a.s.l and regulation object St.Petka at 0+840.00 m.a.s.l and to make regular evidence.

ESM should provide continuous biological minimal flow in the water streams that is 1/10 from the average multi – year flow of the river. The biological minimal flow is not quantified in m^3/s. ESM is not obliged to perform measurements of the biological minimal flow. ESM is obliged to perform continuous measurements of the caught water quantities and to maintain records. Because there is no quantification of biological minimum and no measurement of the biological minimum flow is required by the permit or undertaken by ESM, it is not possible to quantify actually released water quantities.

The average monthly and average annual discharge of the HPP Globocica for the period 1965-2017 is defined as 26.14 m^3/s. The regime of water usage in accumulation should be done between the levels 682.00 and 687.50 m.a.s.l. Maximum level of water in accumulation during the occurrence of 1,000 yearly waters is 691.05 m.a.sl.

After water discharges from HPP Globocica, the river Crn Drim is regulated by artificial banks for about 100 m, after which it flows in its natural riverbed again (see site visit photos below).

Source: Fichtner/EcoMosaic team taken during the site visit at the project locations of 6 HPPs (15.9.22 from Geing/EcoMosaic team)

Figure 49: HPP Globocica

HPP Tikves (Figure 50) is located on Crna Reka, that is the biggest west tributary of river Vardar. The artificial acumulation Tikvesko lake was created in 1968, after the construction of the Crna Reka dam, near the village of Vozarci, about 10 km from City of Kavadarci. Tikvesko lake is located at a height of 260 m a.s.l. The lake is 26 km long, with an area of 14 km^2 and a volume of 475 million m^3 of water. The springs of river Crna are from the source Crna Dupka near the village of Zheleznec (Demir Hisar) at an altitude of 760 m a.s.l. The total length of the river course is 207 km, with an average slope of 3.1‰. In the entire basin, Crna Reka has 20 tributaries, each with a length greater than 10 km or with a total length of 471 km. It flows into the Vardar River near the archaeological site of Stobi, at a height of 129 m a.s.l. After water discharges from HPP Tikves, Crna Reka is regulated with artificial banks for about 50 m after which it flows in its natural riverbed (see site visit photos below).Water permit for HPP Tikves defines the coordinates on intake on river Crna Reka and define the biological minimal flow that should be 2 m^3/s. However, ESM is not obliged to perform measurements of the actual biological minimal flow, but only on the allowed maximum amounts taken for operation. Hence, it is not possible to quantify actually released water quantities. Specific conditions for providing the water for irrigation ($95x10^6$ m^3) are defined according to the monthly regime for the irrigation needs of Water Economy Tikves – Kavadarci. During the vegetation period, the minimum water level in accumulation is defined as 245.00 m.a.s.l. for proper functioning of the system. ESM is obliged to perform continuous measurements of the water quantities on intakes on daily base.

Source: Fichtner/EcoMosaic team taken during the site visit at the project locations of 6 HPPs (taken 16.9 from Geing/EcoMosaic team)

Figure 50: HPP Tikves

Surface water quality

The determination of the water quality status of the main surface watercourses is prescribed by the Law on Water, the Decree on categorization of waterways, lakes, accumulations and ground waters (Official Gazette No.18/99, 71/99) and the Decree on water classification (Official Gazette No. 71/99). According the purpose and degree of cleanless, surface waters are classified into five classes (Class I is the best quality water, Class V is the worst) (Table 9). Monitoring of surface water quality is performed by the Hydro Meteorological Service (HMS).

Table 9: Definition of water classes

Class I	This is very clean, oligotrophic water, which in its natural state, with possible disinfecting, can be used for drinking and production and processing of food products and is suitable for mating and cultivation of noble types of fish (*salmonidae*). The buffering capacity of the water is very good. It is constantly saturated with oxygen, with low content of nutrients and bacteria, contains very slight, occasional anthropogenic pollution with organic matters (but not with inorganic matters).
Class II	This is a very clean, mesotrophic water, which in its natural state can be used for bathing and recreation, water sports, production of other types of fish (*Cypriniformes*), or which can be used - after usual methods of purification (coagulation, filtration, disinfection, etc.) - for drinking and production and processing of food products. The buffering capacity and oxygen saturation present throughout the years are good. The loadings may lead to slightly increased primary productivity.

Class III	This is a moderately euthrophic water, which in its natural state can be used for irrigation, and after usual purification methods (conditioning) for industries which do not require drinking water quality. The Buffering capacity of the water is low, but it maintains the (pH value) acidity at a level still suitable for most fish. In hypolimnion occasionally oxygen deficit occurs. The level of primary production is considerable, and some changes in community structure, including fish species, can be observed. The load of harmful substances is evident as well as microbial pollution. The concentration of the harmful substances varies from natural levels to levels of chronic toxicity for aquatic life
Class IV	This is a strongly eutrophic, polluted water, which in its natural state can be used for other purposes only after certain processing. The buffering capacity is exceeded, which leads to higher levels of acidity, and which affects the development of the offspring. In the epilimnion there is oxygen saturation, and in hypolimnion there is oxygen deficit. Algal blooming is common. Increased decomposition of organic matter simultaneous with water stratification can cause anaerobic conditions and pestilence of fish. Mass occurrences of more tolerant species fish populations may happen, and benthic organisms can be affected. Microbiologic pollution does not allow the water to be used for recreation. Harmful substances emitted or released from the sediment (deposits) can affect the quality of aquatic life. The concentration of harmful substances can vary from levels of chronic to acute toxicity to aquatic life.
Class V	This is a severely polluted, hipertrophic water, which in its natural state can be used for other purposes. The water has no buffer capacity, and its acidity (pH value) is harmful for many fish species. Large problems occur with the oxygen regime, namely saturation in hypolimnion; absence of oxygen leads to anaerobic conditions in hypolimnion. Decomposers dominate over producers. Fish and benthic species are systematically not present. Concentration of harmful substances exceeds acute toxicity levels for aquatic life.

According to the Decree on categorization of waterways, lakes, accumulations and ground waters, relevant rivers and accumulations for the 6 HPPs are categorized in following classes:

River/lake	Category
River Radika from s. Rostuse until the inlet in Debar lake	II
Mavrovo lake	II
River Crn Drim from Struga until border with Albania	II
Debar lake	II
Crna Reka	II
Tikves lake	II

All of the Project's surface watercources belong to the II class of water.

ESM performs regular water monitoring on the inlet and outlet of the intakes of the relevant 6 HPPs. Monitoring is carried out by accredited laboratories for sampling and analysis of surface water.

According to the received monitoring report for surface water quality on **Vrben HPP**, the following parameters have been monitored: pH, dissolved oxygen, COD, BOD, nitrites, nitrates, TSS, color, odor, turbidity, visible waste materials, Cl, SO4, NH4, total solids, alkalinity, Fe, Mn, Cr, Zn, Ca, Mg. Water quality parameters on inlet of turbine do not fully comply with the national limit values for surface water quality for following parameters: pH, dissolved oxygen, COD, nitrites. Water quality on the outlet of turbine in Vrben is the same quality as on the inlet.

Based on the received monitoring report (date of water laboratory analysis 10.12.2020) for surface water quality on **HPP Vrutok** (before the turbine and on outlet of turbine), following parameters have been monitored: pH, dissolved oxygen, COD, BOD, nitrites, nitrates, TSS, color, odor, turbidity, visible waste materials, Cl, SO_4, NH4, total solids, alkalinity, Fe, Mn, Cr, Zn, Ca, Mg. According to the monitoring report (before the turbine of HPP Vrutok), the water quality parameters do not fully comply with the national limit values for surface water quality for following parameters: pH, dissolved oxygen, COD, nitrites. Water quality on the outlet of turbine in HPP Vrutok and inlet in HPP Raven is almost the same quality as on inlet as per monitoring report, so it could be concluded from those measured parameters that HPPs activities do not have impacts on surface water quality.

Based on the monitoring report for water quality in **Tikves** lake on intake and outlet (date of water laboratory analysis sampling 23.12.2020), the following parameters have been monitored: turbidity, COD, total solids, conductivity, pH, dissolved oxygen, BOD, TSS, total phosphorus, ammonia, nitrites, nitrates, chlorides, sulphates, Fe, Mn, oxygen saturation. Also, microbiological analysis (coliforms bacteria, *enterococcus* and *Escherichia coli*) has been performed on the surface water. Water quality parameters do not fully comply with the national limit values for surface water quality for following parameters: turbidity and phosphorus (that correspond with the IV class of water quality) and for the remaining parameters the water belongs in II – I class of water.

Based on the received monitoring report (date of water laboratory analysis 02.11.2022) for surface water quality on **HPP Spilje** (before the turbine and on outlet of turbine), following parameters have been monitored: pH, potassium permanganate demand, dissolved oxygen, conductivity, BOD, nitrites, nitrates, color, odor, turbidity, Cl, SO_4, NH_4, alkalinity, Fe, Mn, Ca, Mg, oxygen saturation, total water hardness and microbiological parameter (most probable number of coliform bacteria). According to the received monitoring report, the water quality parameters do not fully comply with the national limit values for surface water quality for the following parameters: pH, dissolved oxygen and potassium permanganate demand. Water quality on the inlet and outlet of HPP Spilje shows the same quality and values in similar ranges.

Based on the received monitoring report (date of water laboratory analysis 02.11.2022) for surface water quality on **HPP Globocica** (before the turbine and on outlet of turbine), following parameters have been monitored: pH, potassium permanganate demand, dissolved oxygen, conductivity, BOD, nitrites, nitrates, color, odor, turbidity, Cl, SO_4, NH_4, alkalinity, Fe, Mn, Ca, Mg, oxygen saturation, total water hardness and microbiological parameter - most probable number of coliform bacteria. According to the received monitoring report, the water quality parameters do not fully comply with the national limit values for surface water quality for following parameters: pH, dissolved oxygen, potassium permanganate demand and total water hardness. Water quality on the inlet and outlet of HPP Globocica is with the same quality.

The monitoring reports provided to the Consultant demonstrate similar levels of the respective measured parameters before and after the turbine, so it could be concluded that HPPs activities do not have impacts on surface water quality. However, it needs to be mentioned, that hydrocarbons have not been monitored in the past and thus, potential contamination from oil spills or the like are not recorded, and measurements shall be conducted in the future. During the site visits by the Consultant in September 2022 no visible traces of contamination by Hydrocarbons were observed.

Nevertheless, impact on the surface water quality is likely in case of incidents with major spills of hazardous materials and wastes (oil, chemicals) at the HPP sites during the operations and rehabilitation works, as in all HPPs and facilities existing water drainage systems are collecting the surface water run-off from all areas, and it is directly discharged into the outflow canal of the HPPs without prior treatment. From there the waters flows into the natural riverbeds. Thus, in case of spillage of hazardous substances there is a risk of surface water contamination. With this respect, hazardous materials and waste management plans and accident/incident and/or emergency preparedness and response plan would be required, and to be applied in case of major spills. However, during the site visits visible traces of contamination by Hydrocarbons (oils), chemicals or wastes were not observed. Additional water quality parameters monitoring specific to the spillage shall be required and shall be done in case of major incidents/accidents. The potential risk for surface water pollution with oily water discharge from equipment washing on intake sites will be addressed in the risk assessment and respective ESMP.

Competing water uses

During the mission of the social team, two disputes about water usage became evident. One dispute (i.) was identified in the context of the Mavrovo-HPP system and the Sharski Vodi water channel scheme. A second dispute (ii.) was identified regarding the Tikves HPP and in this context with the Varda based irrigation scheme in the Tikves area. A third potential dispute concerning the lower Drim river water management scheme and the HPP turned out to be irrelevant as less than 1% of the water of the Drim is used for irrigation purposes.

(i) The Sharski Vodi water channel system is used for three months during summer for irrigation purposes. In addition, ESM has obtained a water permit for the operation of its HPPs. The permit for Mavrovo defines the coordinates of each intake and the water catchment quantities for each of the main intakes (Gorna Radika, Jelovski, Belicica, Sharski Vodi and Mavrovo accumulation). ESM is obliged to carry out continuous measurements of the water quantities on the intake level on daily basis and to provide the biological minimum flow that is 1/10 from the average multi–year flow for each water stream. From the period of May until September, the water regime of the Mavrovo accumulation should be managed according to the needs for irrigation of the Polog region and fishponds of Vrutok. Discharged water in the river Vardar is defined as 36 m^3/s.

The reported problem in this context is that farmers feel that the water quantity available for irrigation during the three months is less than agreed upon by the water permit. This fact cannot be proved by the Consultant for the ESSRA elaboration, as no quantitative measurements of water volumes are done, neither by ESM, nor any authorities or the respective farmers. However, it must be noted that especially in dry summer months, when water is needed for irrigation, the required biological minimum flow of 1/10 of the average multi-year flow can result in lack of water availability for irrigation purposes. It is recommended to follow up the issue during rehabilitation works by ESM by means of proper stakeholder engagement and communication to affected parties. The planned rehabilitation works will not change the water volumes used for operation of the HPPs or affect the content of the water permits. Pro-active communication and information from ESM on the planned works are required, as well as respective cooperation on political level with representatives from municipalities and farmers, to ensure the stakeholder's different needs are balanced and respected.

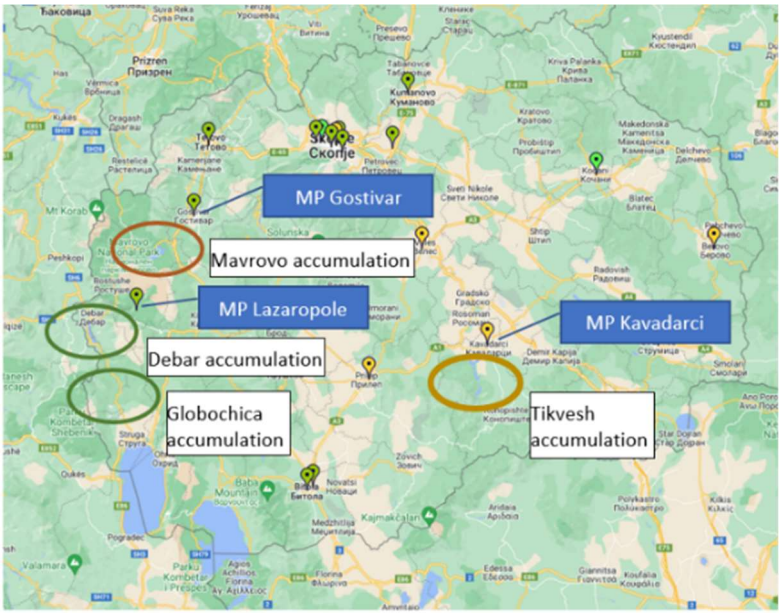
(ii) For the Tikves HPP and in this context the Varda based irrigation scheme in the Tikves area the social team for the elaboration of the ESSRA collected the information that also here farmers complain that the HPP consumes much more water than agreed upon by the water permit.

The water permit for HPP Tikves defines the coordinates of the intake on the river Crna Reka and defines the biological minimum flow that should be 2m^3/s. Also, the specific conditions for providing the irrigation water are defined by the permit: 95x10^6 m^3 according to the monthly regime for the irrigation needs of the responsible Water Economy Tikves-Kavadarci (WETK) institution. The minimum water level in the accumulation is defined as 245 m.a.s.l. and ESM is obliged to perform continuous measurements of the water quantities on the intakes.

However, the identified problem according to the information provided by WETK and a consulted NGO in Kavardaci is that the intake of the irrigation channel initially has been placed on a relatively high level of the lake shore (near the dam). In the years when the dam and the channel were planned and constructed the water carried by the river and the annual level of the lake allowed for a continuous water supply of the channel. With climate change and the decrease of the annual average availability of precipitation the water level of the lake - even when the HPP does not run at its peak capacity - does not reach the intake of the channel. So, our conclusion is that if the requirements of the water permit are respected the problem of the water availability for the irrigation scheme is not a result of the HPP operation but of the location (level of the intake).

5.1.8 Air quality

Monitoring of ambient air quality on national level is performed by the Ministry of Environment and Physical Planning (MoEPP), which manages the State automatic air quality system composed of 18 stationary and 2 mobile measuring stations of which 5 are located in City of Skopje. The closest monitoring stations for air quality to the project locations are the monitoring stations in: City of Gostivar (relevant for HPP Vrutok, HPP Raven and HPP Vrben), village Lazaropole (HPP Spile and HPP Globocica), and City of Kavadarci (HPP Tikves).



Source: https://air.moepp.gov.mk/

Figure 51: The closest monitoring stations for air quality in RNM in relation to the project sites of 6 HPPs

The monitoring station in Lazaropole is closest to the project locations of HPP Spilje in Debar and HPP Globocica in Struga. It is located 17 km northeast of the HPP Spilje; 18.3 km and 22.7 km north of the HPP Globocica and Globocica Dam. This air quality monitoring station measures following parameters: sulphur dioxide, nitrogen dioxide, ozone and suspended particles with a size of 10 μm (PM_{10}). The monitoring station is located in a rural area.

The monitoring station in Gostivar is located at about 5.1 km and 6.78 km to the northeast of the HPP Raven and HPP Vrutok respectively, and 18.3 km and 20.1 km to the south of HPP Vrben and Mavrovo Dam respectively, in the Municipality of Mavrovo.

The monitoring station for air quality in the City of Kavadarci is located at about 7.2 km to the northeast of the HPP Tikves.

Two air quality measuring stations in City of Gostivar and City of Kavadarci, measures following parameters: sulphur dioxide, nitrogen dioxide, ozone, carbon monoxide and suspended particles with a size of 10 μm (PM_{10}) and 2,5 μm ($PM_{2.5}$). The monitoring stations are located in urban areas.

The sources of suspended particles are burning of fossil fuels and biofuels, different industrial processes, traffic, incineration of waste and wildfires. One of the most important sources is heating of homes and administrative capacities, mainly due to the incomplete incineration of wood in the old furnaces.

The average daily threshold limit value of PM_{10} at the Lazaropole, Gostivar and Kavadarci monitoring points in 2021 was exceeded for 8 days, 118 days and 175 days respectively.

Ground-level ozone is not emitted directly, but results from chemical reactions between oxides of nitrogen (NOx) and volatile organic compounds (VOCs) in sunlight. The maximum daily 8-hour average threshold values for the ozone concentration at the monitoring stations Lazaropole, Gostivar and Kavadarci in 2021 have been exceed 5 times, 24 times and 1 time respectively.

It is not expected that the project activities will significantly impact the air quality in the vicinity of each of the 6 HPPs.

5.1.9 Noise

Noise is a matter of nuisance and therefore, noise sensitive receptors are usually considered those where people live or gather for certain purposes (schools, churches, working places, sport centres, etc.) although wildlife is sensitive to noise as well. The biggest sources of noise disturbance come from the transport sector - road vehicles and construction activities, especially in sensitive areas.

The Law on Noise Protection prescribes the need to reduce harmful effects from exposure to noise and to provide a basis for developing measures to reduce noise while protecting the health and wellbeing of the population. Noise measurement and monitoring are necessary for achieving and maintaining environmental noise levels within the limits that the regulations have defined for four types of areas in accordance with their human activity uses and the degree of protection against noise deemed necessary for each of those uses.

The project locations of HPP Vrben, HPP Raven, HPP Vrutok and HPP Tikves belongs to an area of *first (I) degree of noise protection* considering that they are within the boundaries of the protected areas (National Park Mavrovo, National Park Shar Mountain and Strict Nature Reserve Tikves. These includes areas of tourism and recreation, areas near health institutions for hospital treatment, and areas of

national parks and natural reserves. The activities that will take place at this project sites should observe the limit values of the noise level according to WB EHS General Guidelines.

The project locations of HPP Spilje and HPP Globocica are located in *second (II) degree of noise protection* area. These includes areas in the vicinity of educational institutions, educational facilities and social protection services for adults and children, and facilities for primary health care, playgrounds and public park. The activities that will take place at this project sites should observe the limit values of the noise level according to WB EHS General Guidelines.

5.1.10 Biodiversity and protected areas

5.1.10.1 Protected areas

In article 66 from the Law on nature protection ("Official Gazette" of RM No. 67/04, 14/06, 84/07, 35/10, 47/11, 148/11, 59/12, 13/13, 163/13, 41/14, 146/15, 39/16 and 63/16) six (6) categories of protected areas are identified which are in accordance with IUCN's categorization of protected areas:

- Ia. Strict Nature Reserve/Ib. Wilderness Area
- National Park (NP)
- Natural Monument
- Nature Park
- Protected Landscape
- Multi-Purpose Area.

The HPP Vrben as part of Mavrovo System is located in the NP Mavrovo; the HPPs Vrutok and Raven border the NP Shar Planina (all intakes are within the NP); and HPP Tikves is located in the surroundings of the Strict Nature Reserve Tikves. According to the letter received from the MoEPP (no.11-6400/4 from 23.9.2022), HPP Globocica is located within the proposed protected area Jablanica (Notification letter from MoEPP is presented in Annex 9.4). The Nature Park "Drenacka River" and the Important Plant Area (IPA) "Crn Drim gorge" are located near the HPP Globocica. No protected areas are identified near the HPP Spilje.

National Park (NP) Mavrovo

The NP Mavrovo is established by law of the National Assembly of Republic of Macedonia in 1949. It is located in the western part of RNM and occupies an area of 73,088 hectares. The territory of the NP Mavrovo belongs to 2 (two) municipalities, Municipality of "Mavrovo and Rostuse" and the Municipality of "Gostivar". The boundaries of the park include the mountains: Korab, Desat, the southwestern branches of Shar Planina, most of Bistra and the northern parts of Krcin. The central part of the national park covers the valley and the river basin of the river Radika. The artificial lake Mavrovo is also part of the national park. Currently, the process of revalorization of the NP Mavrovo is ongoing. The Study for revalorization of the protected area Mavrovo was prepared in 2011 and new Spatial Plan for the NP Mavrovo is under preparation. These documents include changes in the borders of the protected zones within the NP and include a new map with extended protected zones, which still are not adopted.

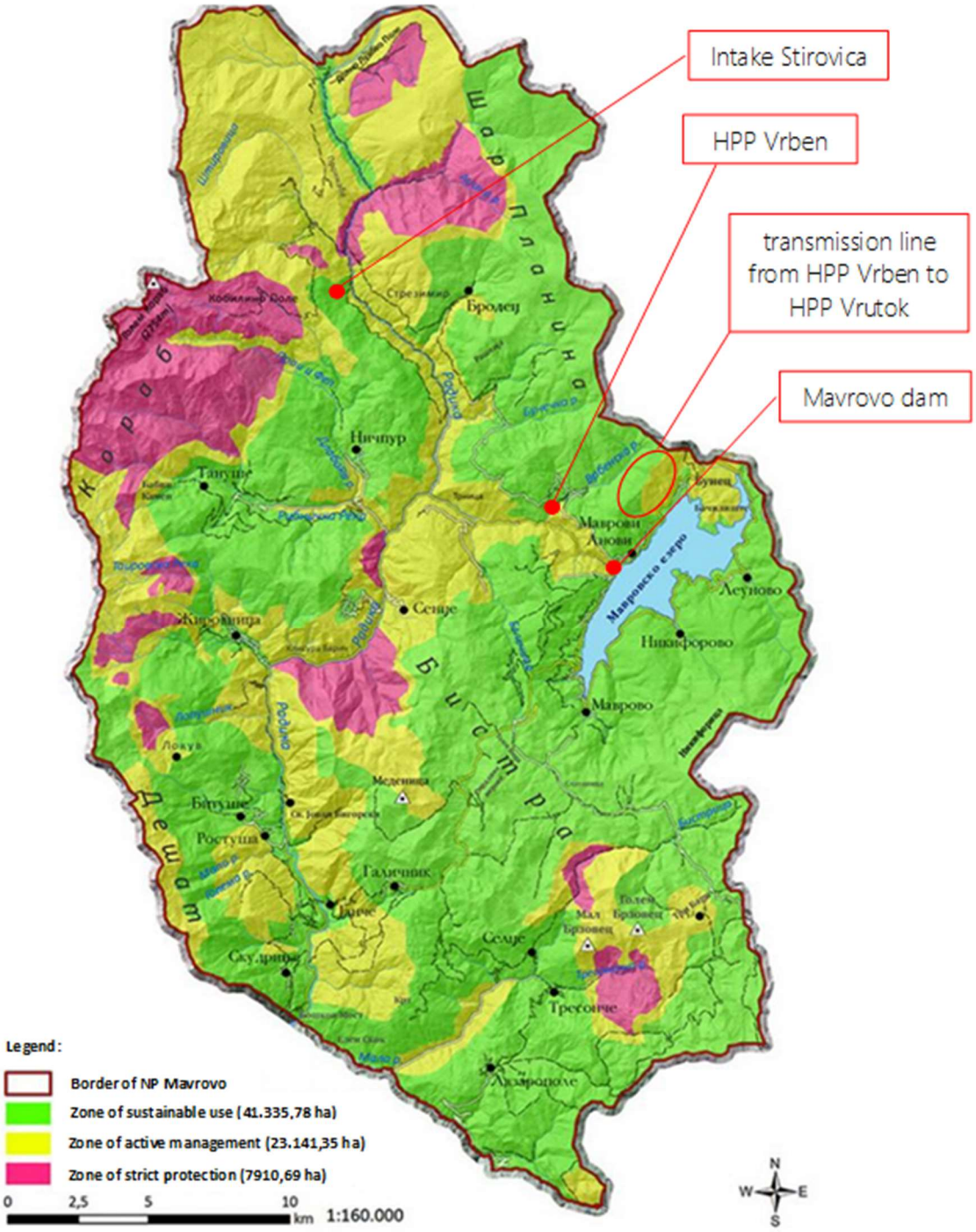
The most striking feature of biodiversity in the National Park Mavrovo is its high degree of species diversity. Floral and faunal elements with Ponto-Mediterranean (Eastern-Mediterranean) biogeographic origin are dominant, followed by the complex of species with Boreal (Siberian) and Oreo-Tundral (Arctic-Mountain) origin, of which the Palaeo-Mountain (relict-mountain) sub-complex is more frequent and

abundant in comparison with species of the sub-complex with of Arctic (tundral) origin. The Complex of species with Eremial (steppes, semi deserts/deserts) origin is less represented.

The current zoning of the Mavrovo National Park includes the following zones:

- Zone of Strict Protection - this zone is part of the NP with the highest interest of protection, that is characterized by original and unchanged ecosystem characteristics, or has quite small changes as a result of traditional management practices. Within this zone, two sub-zones can be distinguished:
  - originally natural areas, without any human intervention
  - limited intervention areas, where the traditional way of managing (management) is still present and serves to maintain the natural values of the zone.
- Zone of Active Management - This area is a zone of high interest for protection, requiring greater management interventions to restore or revitalize habitats, ecosystems and other landscape elements. In the Zone of Active Management, the allowed management activities are related to: manipulation of habitats and species manipulation Within the Zone of Active Management, activities that do not adversely affect the primary purpose of protection are permitted (such as ecotourism or traditional extensive farming/agriculture). Taking into account the permitted activities, this zone is also known as meliorative zone of NP Mavrovo.
- Zone of Sustainable Use - The Zone of Sustainable Use is a significant part of the NP, which does not have high conservation values, which include infrastructure facilities, cultural heritage sites, types of forest stand not characteristic of the area, as well as populated areas with surrounding agricultural land. Within this zone, several tourist-recreational zones can be found: Tourist-Recreational Zone Mavrovo Lake, Tourist-Recreational Zone Radika, Tourist-Recreational, Zone Bistra and zone of Touristic Sites and Landscapes for short visits and excursions.

Figure 52 shows the locations of HPP Vrben, Mavrovo dam and transmission line from HPP Vrben to HPP Vrutok regarding the zoning map of NP Mavrovo.

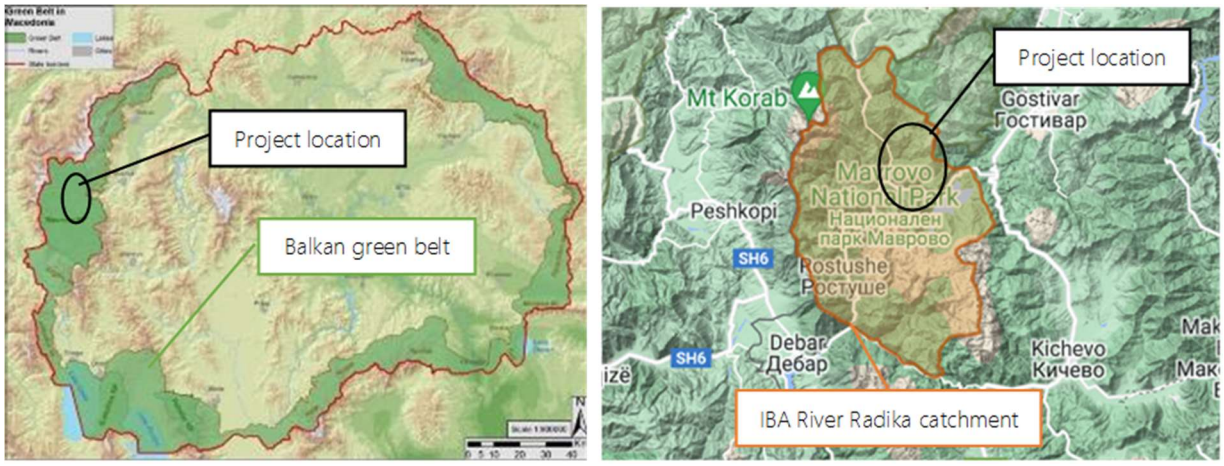


Source: https://npmavrovo.org.mk/en/mapa/

Figure 52: Location of HPP Vrben, Mavrovo dam and transmission line from HPP Vrben to HPP Vrutok, regarding zoning of NP Mavrovo

According to the existing zoning of the NP Mavrovo, the project area of HPP Vrben and Mavrovo dam belong to the *zone of active management*. The transmission line from HPP Vrben to HPP Vrutok is located in the *zone of active management* and *zone of sustainable use*. Intake Stirovica is located in *zone of sustainable use* in NP Mavrovo.

National Park Mavrovo is also designated as: Emerald Site Mavrovo; Important Bird Area (IBA) River Radika catchment; Important Plant Areas (IPAs) Korab-Deshat, Bistra Mountains and Mavrovo; and Prime Butterfly Area (PBA) Radika River canyon. Also, NP Mavrovo is part of Balkan green belt. Some of these international protected areas regarding the project location (Mavrovo dam and HPP Vrben) are given in Figure 53.



Source: https://www.eea.europa.eu/soer/2010/countries/mk/nature-protection-and-biodiversity-state/nature-protection-and-biodiversity-state-3/map-2-green-belt-part-1/image_landscape

Source: http://datazone.birdlife.org/site/factsheet/132

Figure 53: Location of HPP Vrben and Mavrovo dam regarding the IBA River Radika catchment and Balkan green belt

National Park (NP) Shar Planina

The Shar Mountains are a large highland massif extending over an area of north-western North Macedonia and southern Kosovo. Within its natural borders it covers an area of 2,480 km^2 of which 881 km^2 or 35.5% fall within the Republic of North Macedonia. The part of the Shar Mountains that is subject to this management plan[10] has an area of 627 km^2. The mountains are characterized by a large number of peaks above 2,000 m.a.s.l. The glacial and fluvial relief has produced an area with a high density of valleys and gorges, including short canyons cut into limestone, quartzite and granitoid rock, as well as outstanding geological diversity. Many of the rivers on the Macedonian side descend steeply with great longitudinal fall, giving rise to numerous rapids.

With the Law on proclamation part of Shar Planina has been declared a National Park in July 2021 for the protection of exceptional natural beauty and values, diversity and wealth of biodiversity, geodiversity, hydrological features, landscape and other values, as goods and public interest. NP Shar Mountain is located in the western part of RNM and occupies an area of 62,705 ha.

According to the Draft Management plan NP Shar Planina for the period 2022-2031 (not adopted yet as per status September 2022), the proposed zonation of the protected area is:

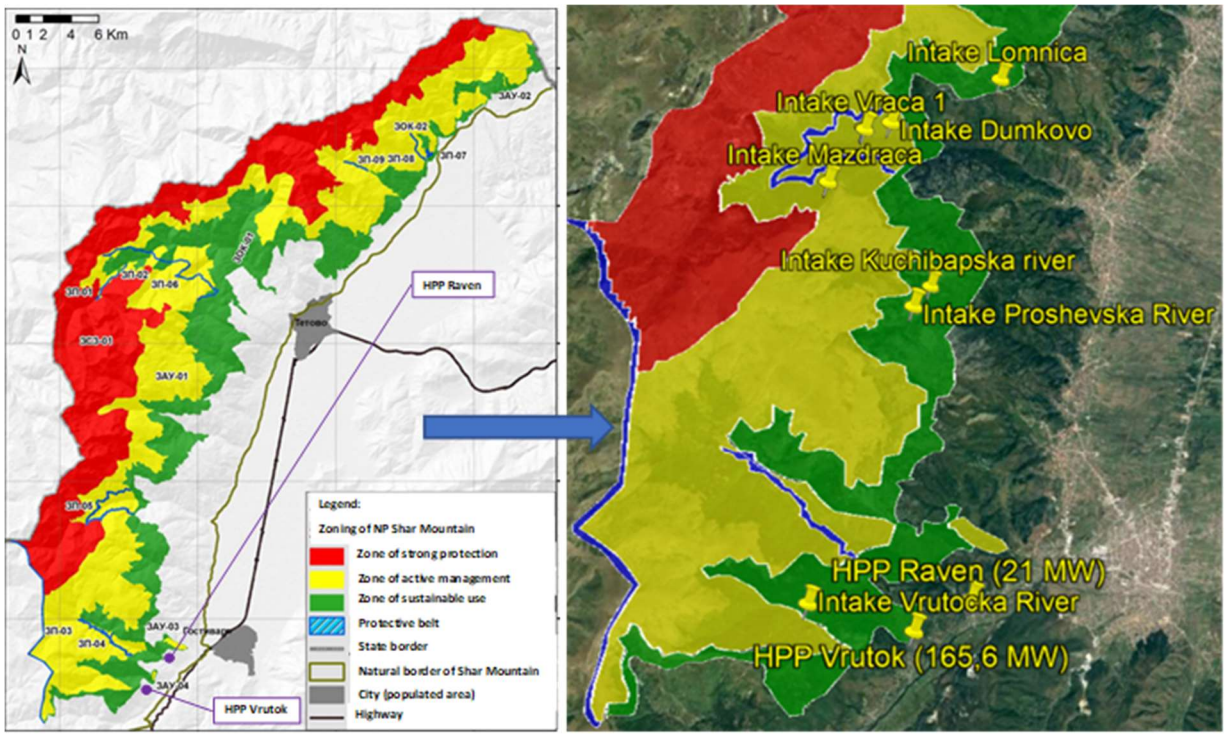
- Strict Protection (SP) with area 16,651 ha - This is the area with the highest interest in protection, which is characterized by original, unchanged characteristics of ecosystems or has very little change as a result of traditional management practices. The zone for strict protection is composed of 5 special units, and it covers the highest parts of Shar Mountain bordering Republic of Kosovo, e.g., Shar

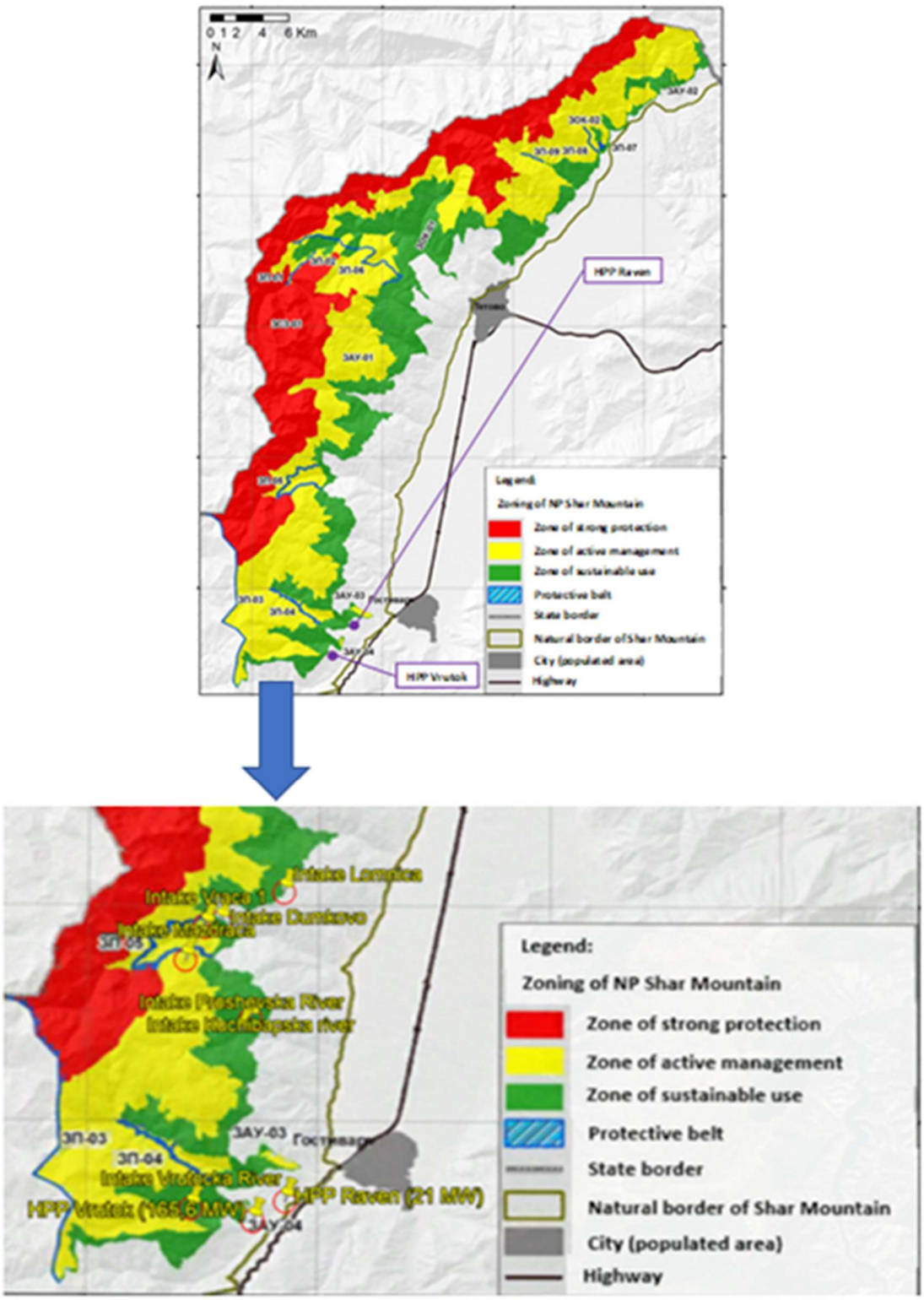
[10] Draft Management plan NP Shar mountains 2022-2031 (source: https://www.moepp.gov.mk/wp-content/uploads/2020/07/Management-plan-NP-Shar-mountains_EN-final.pdf)

National Park in Kosovo. In this zone are located the most important ecosystems and habitats: glacial lakes, peatlands, high mountain pastures, alpine rocky areas, blueberry heaths, the most important forest ecosystems; as well as significant areas and most of the important species, especially vascular plants, diatoms, diurnal butterflies, etc.

- Active Management (AM) with area 30,763 ha - It is a zone of high interest for protection, in which management interventions are needed in order to restore and maintain, revitalize or rehabilitate habitats, ecosystems and other elements of the landscape. The active management zone includes natural and seminatural pastures on which traditional grazing takes place, and important forest ecosystems on Shar Mountain, primarily preserved beech forests, spruce and fir forests or mixed forests of evergreen and deciduous species, as well as chestnuts forests and some refugial forest structures.
- Sustainable Development (SD) with area 13,805 ha - It is a significant part of the protected area that does not have high values for protection, which includes infrastructure facilities, cultural heritage sites, types of forests that are affected by human activities and mountainous settlements with the surrounding agricultural land. This zone has a high potential for habitat revitalization.
- Buffer Zone (BZ) with area 1,484 ha - The buffer zone is located around the "Popova Shapka" Ski Center. It aims to enable controlled development of the Ski Center in the future, and at the same time to mitigate the impact of infrastructure facilities on the National Park.

In Figure 54 locations of HPP Raven, HPP Vrutok and site visited water intakes from Sharski vodi, regarding zoning map of NP Shar Planina are given.





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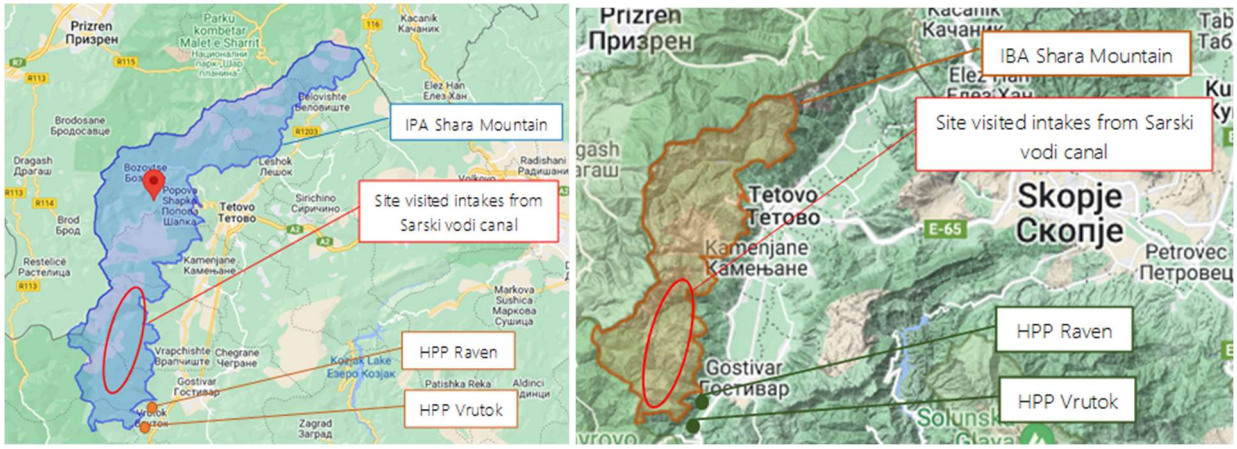
https://www.google.com/url?sa=t&rct=j&q=&esrc=s&source=web&cd=&ved=2ahUKEwjhrMm16Lv5AhU0RuUKHW9zBq4QFnoECBMQAQ&url=https%3A%2F%2Fwww.moepp.gov.mk%2Fwp-content%2Fuploads%2F2020%2F07%2FZakon_NP_Sara_17.9.-makedonski-jazik-1.pdf&usg=AOvVaw35etnOqfL9v50QHEgQ0CmR

Figure 54: Location of HPP Raven, HPP Vrutok and site visited intakes of Sharski vodi, regarding protection zones of NP Shar Mountain

According to zoning map of NP Shar Planina, project areas of HPP Vrutok and HPP Raven are outside of the boundaries of NP Shar Planina. The site visited water intakes from Sharski vodi belongs to two zones: *zone of active management* and *zone of sustainable development*.

National Park Shar Planina is also designated as: Emerald Site Shar Planina; Important Bird Area (IBA) Shar Planina; Important Plant Areas (IPAs) Shar Planina; and Prime Butterfly Area (PBA) Shar Planina. Also, NP Shar Planina is part of the Balkan green belt. Some of these international protected areas regarding the project location (HPP Vrutok, HPP Raven and site visited intakes from Sharski vodi canal) are given in Figure 55.



Source: http://datazone.birdlife.org/site/factsheet/120 and https://www.plantlifeipa.org/site/factsheet/960

Figure 55: Location of HPP Raven, HPP Vrutok and site visited intakes, regarding protection zones of NP Shar Mountain

Strict nature reserve Tikves

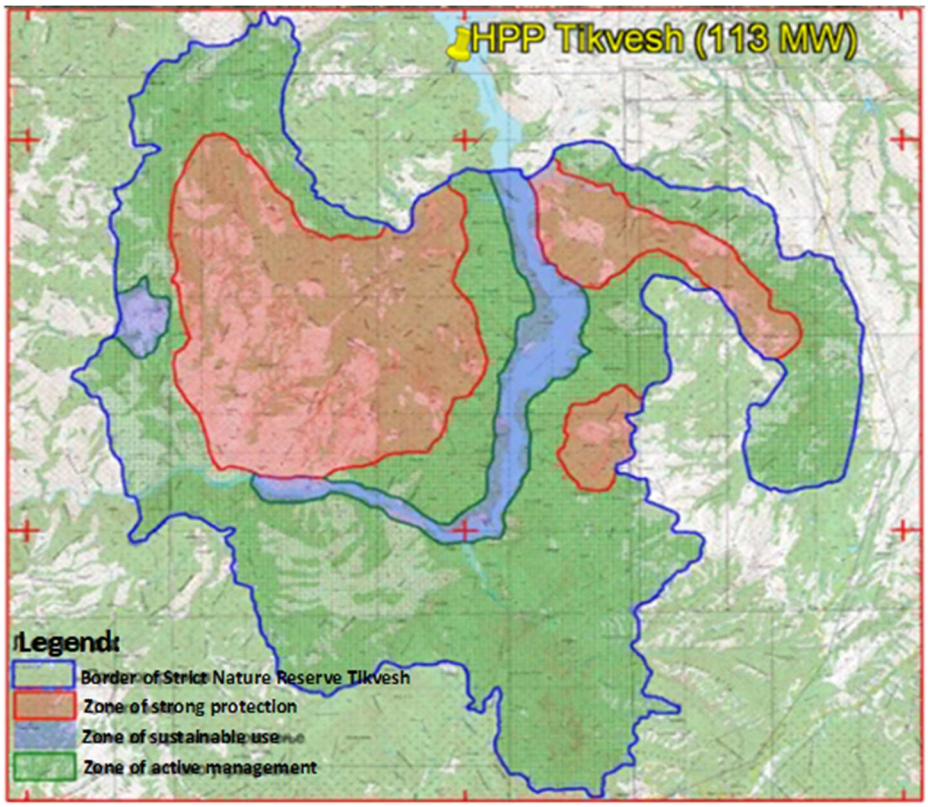
The diversity and the presence of several species of birds of prey at the Tikves location, in the Crna Reka gorge, were the main reason for the Parliament of the Republic of North Macedonia in 1997 to adopt the Law on the Proclamation of the ornithological site "Tikves" for Strict Nature Reserve - protected area with I category (according to IUCN criteria).

The natural values of the Tikves lake derive from the wide diversity and richness of species, above all of the representatives of the avifauna. Of special importance for the area is the presence of endangered and rare bird raptors, some species of which nest in this area. At the international level, the area of the Crna River gorge and the wider surroundings has been identified as one of the important ornithological localities, with global significance. 57 species of birds represented in the territory of the Tikves Lake protected area, are included in Annex I of the Birds Directive, which means species that need special protection of their habitats. According to IUCN Red List of Globally Threatened Species, some of significant bird species relevant for the protected area, has following status: Egyptian Vulture (*Neophron percnopterus*) is included in Endangered (EN) category; Imperial Eagle (*Aquila heliaca*) is included in Vulnerable (VU) category; and Steppe Kestrel (*Falco naumanni*) is included in Vulnerable (VU) category. Three other species of birds: the blue crow (*Coracias garrulus*), the black vulture (*Aegypius monachus*) and the black furrier (*Aythya nyroca*) are included in the Near Concerned (NT) category. (Source: Study for the revalorization of natural values of the protected area Strict Nature Reserve "Tikves", October 2010)

This protected area consists of 3 types of zones:

- Zone of strict protection – this includes areas with relict and endemic species in order to preserve their natural habitats and populations. This is the part that includes Koturski Dol, the peaks of Orle and Galchin and Pravednicka Stena, which are of the greatest importance for the protection of birds of prey. Important geomorphological forms are also placed in the zone of strict protection, with the aim of preservation of their natural characteristics.
- Zone of active management - In this zone, economic activities are allowed that will not have a negative impact on the primary goal of protection. Some parts of the protected area are used by PE National Forests subsidiary "Bor" Kavadarci.
- Zone of sustainable use – Parts of the protected area which includes infrastructure facilities, weekend houses, as well areas used for traditional agriculture and places used for tourist and recreational activities.

In Figure 56 are given project location HPP Tikves, regarding zoning map of Strict nature reserve Tikves.



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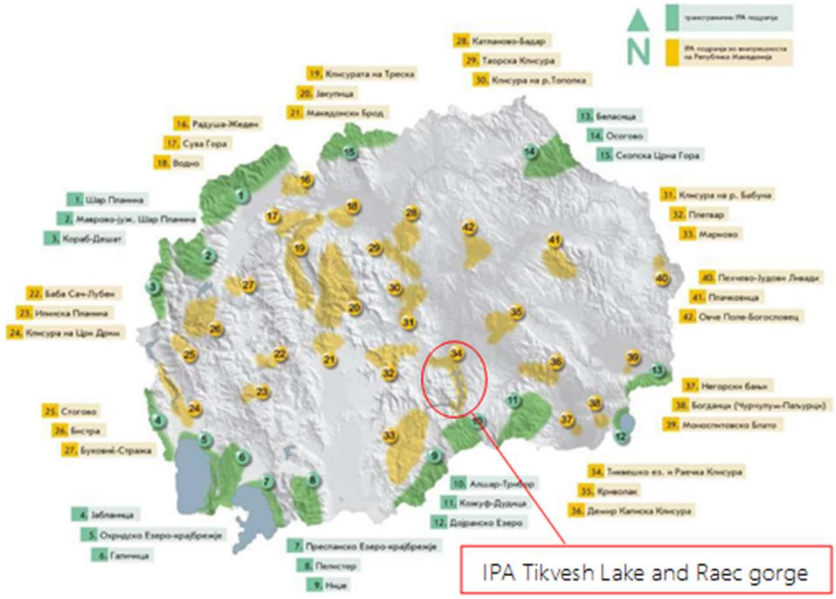
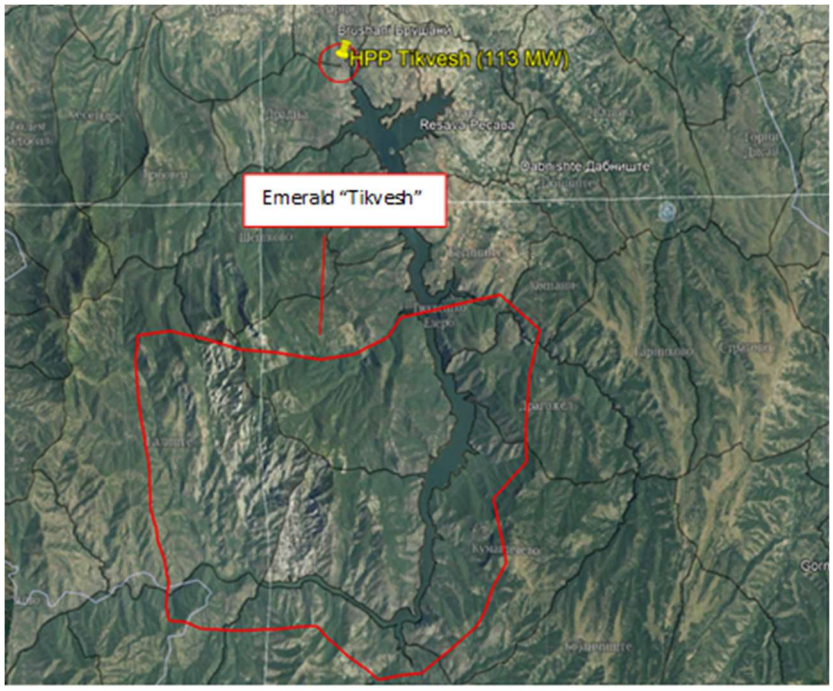
https://www.google.com/url?sa=t&rct=j&q=&esrc=s&source=web&cd=&cad=rja&uact=8&ved=2ahUKEwjo6byVlLz5AhVZi_0HHViBDj0QFnoECAsQAQ&url=http%3A%2F%2Fwww.moepp.gov.mk%2Fwp-content%2Fuploads%2F2015%2F01%2FStudija-za-TIKVES.pdf&usg=AOvVaw2OJwco0HyeIhHYd4goHWHW

Figure 56: Location of HPP Tikves regarding zoning of Strict Nature Reserve Tikves

Strict nature reserve Tikves is also designated as: Emerald Site Tikves; Important Bird Area (IBA) Tikves; Important Plant Area (IPA) Tikves Lake and Raec gorge. Some of these international protected areas regarding the project location (HPP Tikves) are given in Figure 57.





Source: https://encrypted-tbn0.gstatic.com/images?q=tbn:ANd9GcQkrmfjUqMN-WI0I-KlgObzZLWIi-2wQwr7Hg&usqp=CAU and OSSP (katastar.gov.mk)

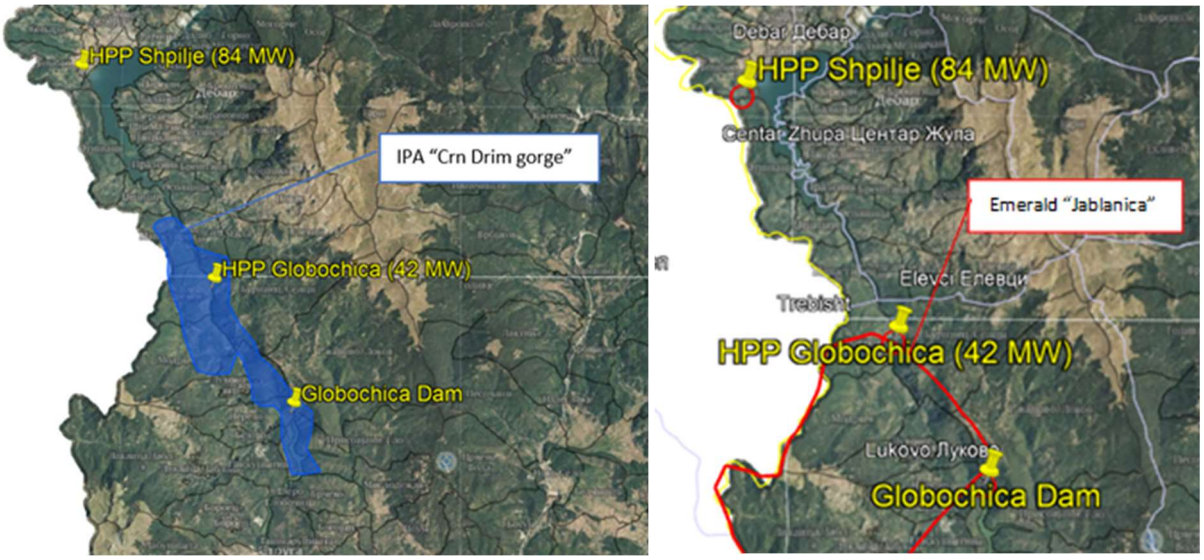
Figure 57: Location of IPA Tikves and Emerald site Tikes regarding HPP Tikves

Important Plant Area "Crn Drim gorge" (Globocica – Lukovo – Debar)

Important Plant Areas (IPA) is globally significant plant habitat areas for conservation. They are identified according to predetermined criteria, such as the presence of endangered plant species or the presence of European endangered habitats. So far, in the Republic of North Macedonia, 42 important plant areas have been identified, where their total area covers 459,425 ha, which is 17.9% of the total territory of the country.

The area of IPA "Crn Drm Gorge" Figure 58stretches in the southwestern part of North Macedonia. It extends at an altitude of 600 to 1,300 m a.s.l. This IPA covers mainly thermophilic chestnut oak forests. Limestone vegetation is represented on a small scale (plant species: *Campanula debarensis*, *Ramonda serbica* - Serbian ramonda; *Melampyrum heracleoticum,* etc.), and this is the main reason for designating

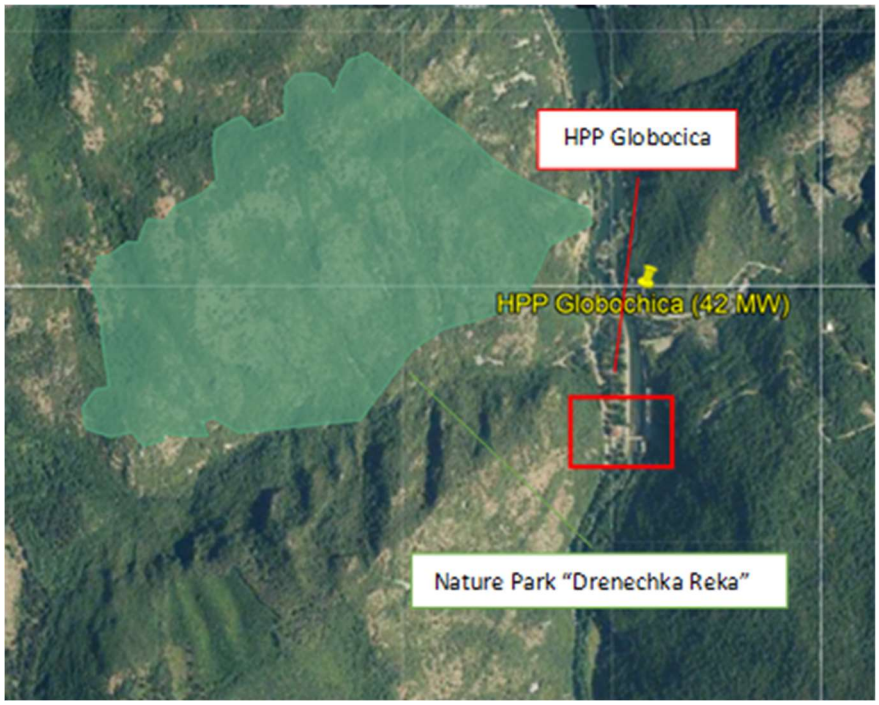
this area as Important Plant Area. There is a small, protected area in Nature Park "Drenachka Reka" - VI Category according to IUCN, but no protection measures are implemented.



Source: https://ossp.katastar.gov.mk/OSSP/

Figure 58: Location of HPP Spilje, HPP Globocica and Globocica dam regards IPA "Crn Drim gorge" and Emerald site "Jablanica"

According to the letter received from the MoEPP (no.11-6400/4 from 23.9.2022), HPP Globocica is located within the proposed protected area Emerald site Jablanica which is not yet proclaimed) (Notification letter from MoEPP is presented in Annex 9.4). The proclamation of this protected area will not have negative implications on the project in the future.



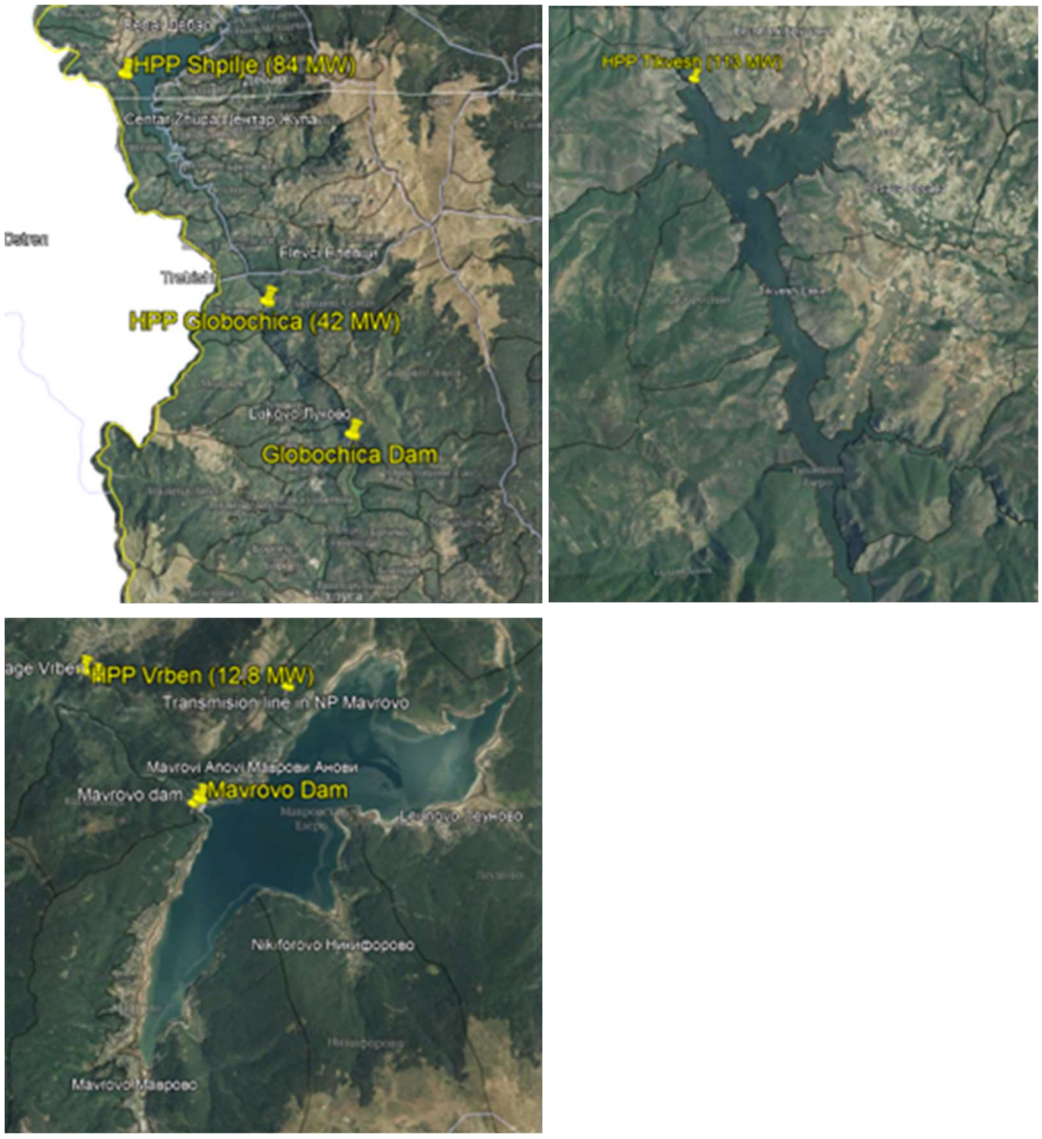
Source: https://ossp.katastar.gov.mk/OSSP/

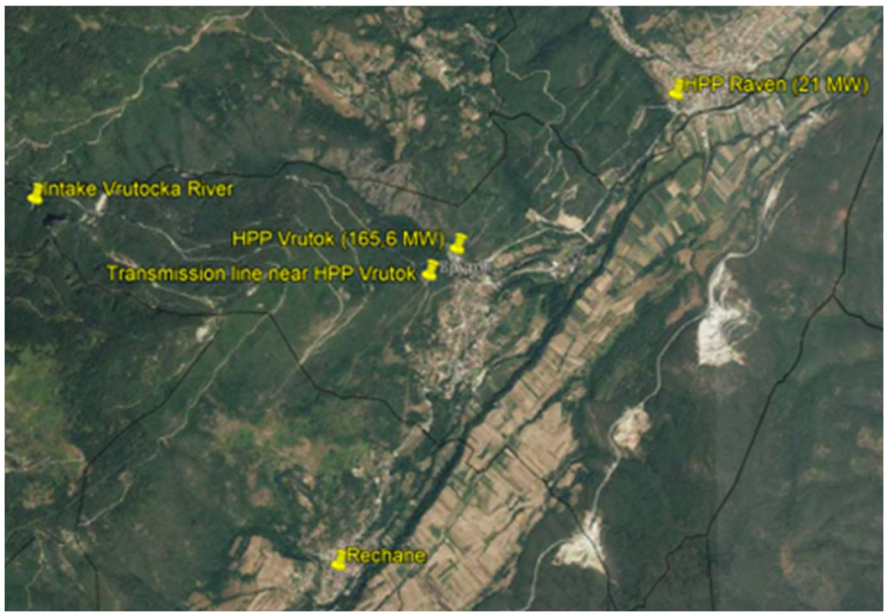
Figure 59: Location of HPP Globocica regards Nature Park "Drenachka Reka"

Nature Park "Drenachka Reka" will not be affected by the implementation of the project activities near HPP Globocica.

5.1.10.2 Current situation of biodiversity at project location

According to the site visits conducted (12.9.22-16.9.22) of all 6 HPPs, several observation points were performed for each HPP. The following maps with the observation points (which includes intakes, near settlements, part of transmission lines, dams, etc.) of the relevant project locations are given in Figure 60.





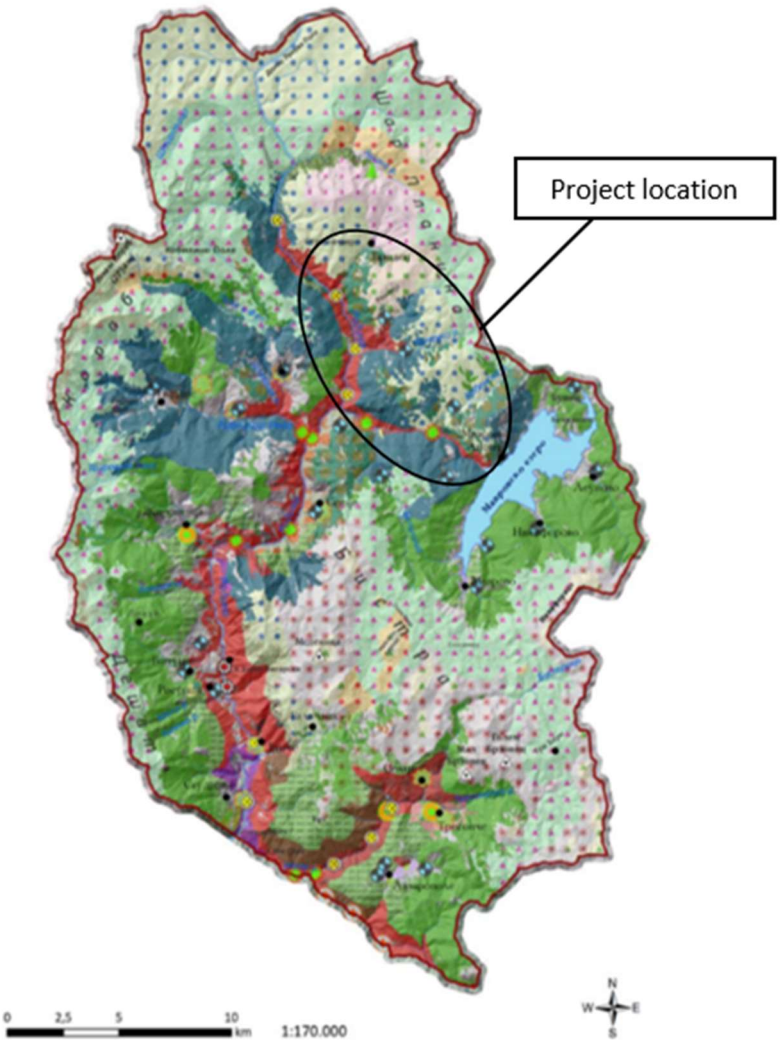
Source: https://ossp.katastar.gov.mk/OSSP/

Figure 60: Observation points within the project locations of 6 HPPs

Key findings for HES Mavrovo (HPP Raven, HPP Vrutok and HPP Vrben)

Habitats

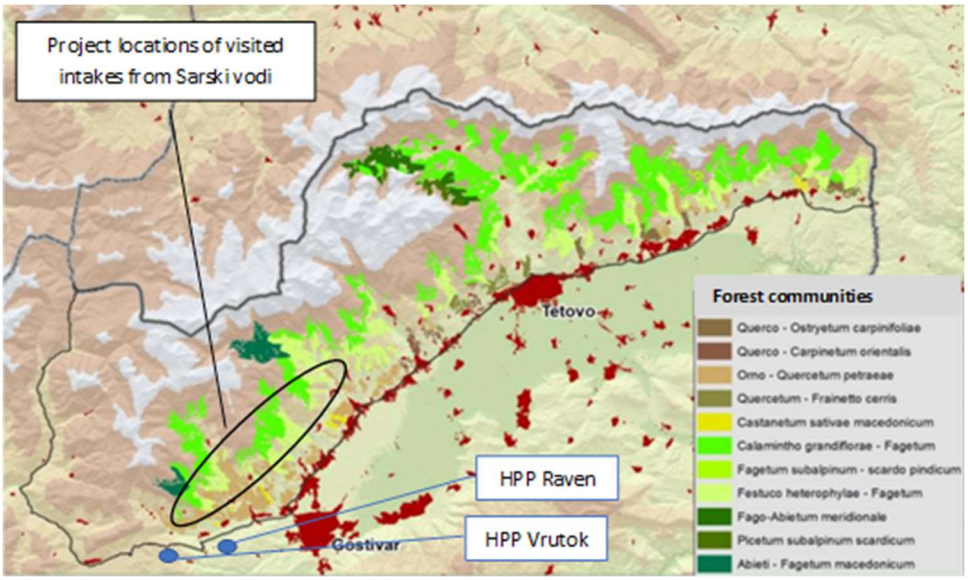
According to the site visit performed, the most dominant habitat was forests vegetation and riparian vegetation (along the water intakes). Forest communities represented in the wider vicinity of the project location Mavrovo Hydro system and HPP Vrben are represented by *ass. Abieti-Fgetum macedonicum* - community of beech (*Fagus sylvatica ssp. moesiaca*) and fir (*Abies borisii-regis*); *ass. Festuco heterophylale* - community of Podgorska beech forest at 1200 m a.s.l.; and *ass. Querco-Ostreyetum carpinifoliae* - forest community of white oak (*Quercus pubescens*) and black hornbeam (*Ostrya carpinifolia*) is represented in the immediate vicinity of the Mavrovo dam, to the left and right of the main road to Debar. The vegetation cover varies and is closely correlated with local habitat conditions. Location of Mavrovo dam and HPP Vrben with regards to respective vegetation is presented in Figure 61.


Project location
0
2,5
5
10
km
1:170.000
N
W
E
S

Source:
https://www.google.com/url?sa=t&rct=j&q=&esrc=s&source=web&cd=&cad=rja&uact=8&ved=2ahUKEwiR4Omgz-76AhXDqqQKHYmOA7kQFnoECBYQAQ&url=http%3A%2F%2Fwww.moepp.gov.mk%2Fwp-content%2Fuploads%2F2015%2F01%2FStudy-Mavrovo-Final-7.pdf&usg=AOvVaw0avA_shMpc191ijYfgOIF4

Figure 61: Project location of Mavrovo Hydro system and HPP Vrben, regarding the vegetation map of the NP Mavrovo

According to the project locations of HPP Raven and HPP Vrutok the following forest communities are represented *ass. Orno-Quercetum petraea* represents a community of oak forests, *ass. Festuco heterophyllae Fagetum* represents a community of submontane beech forest and *ass. Calamintho grandiflorae – Fagetum* represents a mountain beech forest community. In Figure 62 is presented the project location of Sharski vodi intake canal, HPP Raven and HPP Vrutok, regarding the vegetation map of NP Shar Planina.



Source:
https://www.google.com/url?sa=t&rct=j&q=&esrc=s&source=web&cd=&cad=rja&uact=8&ved=2ahUKEwiR4Omgz-76AhXDqqQKHYmOA7kQFnoECB4QAQ&url=https%3A%2F%2Fwww.moepp.gov.mk%2Fwp-content%2Fuploads%2F2015%2F01%2FStudija-za-valorizacija-na-Shar-Planina_konecna-verzija-mart-2020.pdf&usg=AOvVaw28UOW4HYFgkMu0P4JA_yhl

Figure 62: Project location of Sharski vodi canal, HPP Raven and HPP Vrutok, regarding the vegetation map of NP Shar Planina

Flora and fauna

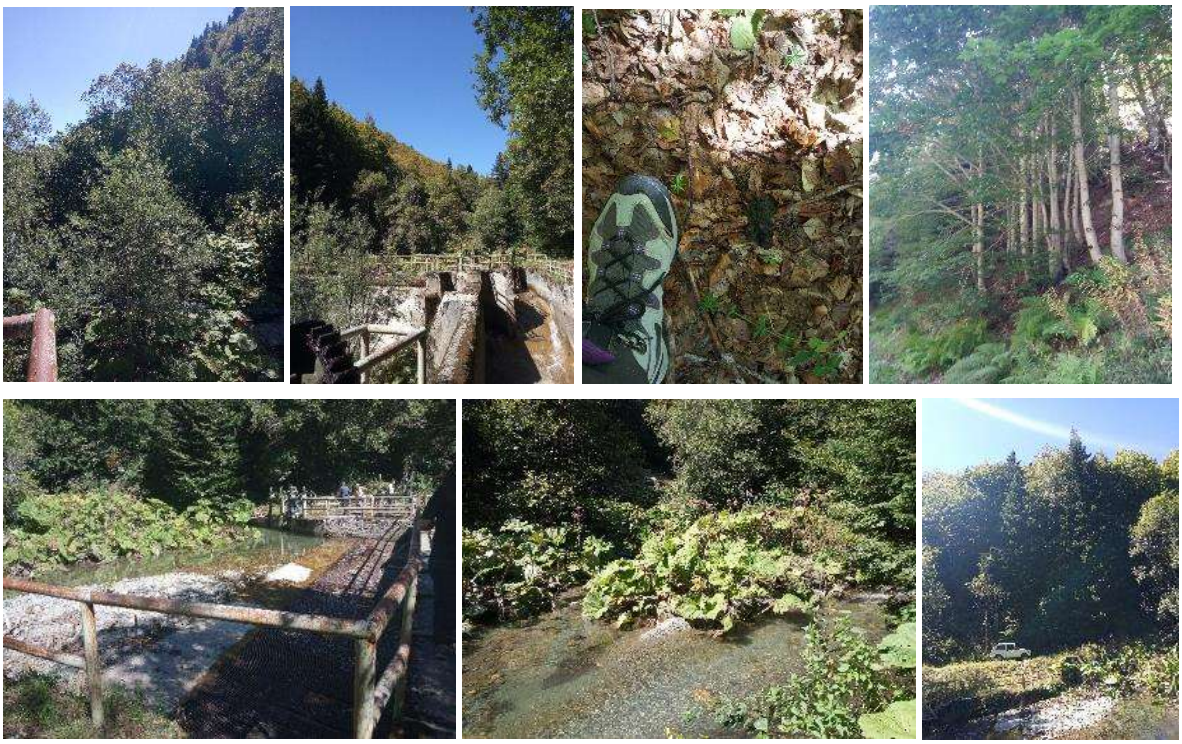
Some identified flora and fauna species and identified types of habitats relevant for HES Mavrovo (HPP Raven, HPP Vrutok, HPP Vrben, Sharski vodi canal and intake Stirovica) are presented below. The photos were taken from observation points for HES Mavrovo.

Source: Geing/ Fichtner Project team, taken 12-14.9.22

Figure 63: Site visit photos of Sharski vodi canal

Source: Geing/ Fichtner Project team, taken 12-14.9.22

Figure 64: Site visit photos of HES Mavrovo (HPP "Vrben", HPP "Raven" and HPP "Vrutok")



Source: Geing/ Fichtner Project team, taken 14.9.22

Figure 65: Site visit photos of intake Stirovica

Key findings for HPP Spilje and HPP Globocica

Habitats

As per the site visit, the most dominant habitat was forests vegetation and riparian vegetation (along the Crn Drim). Within the HPP Spilje and HPP Globocica, some of the dominant forest communities are: *ass. Querco - Carpinetum orientalis* (dominated by downy oak and white hornbeam); *ass. Quercettum frainetto-cerris* – Italian -Austrian oak forests); etc. Along river Crn Drim, riparian vegetation occurs.

Flora and fauna

Some identified flora, fauna species and identified types of habitats relevant for HPP Spilje and HPP Globocica, are presented below. The presented photos are taken from observation points for HPP Spilje and HPP Globocica.





Source: Geing/ Fichtner Project team, taken 15.9.22

Figure 66: Site visit photos of HPP Spilje

Source: Geing/ Fichtner Project team, taken 15.9.22

Figure 67: Site visit photos of HPP Globocica

Key findings for HPP Tikves

Habitats

According to the site visit performed, the most dominant habitat was forests vegetation and agricultural fields (near Tikves dam). Some of the most dominant forest communities in wider surrounding of HPP Tikves are: ass. *Querco-Caprinetum orientalis macedoniicum; ass. Phillyreo-Caprinetum orientalis Em, 1957; assn. Pruno webbii-Junipetum excelsae Em, 1962; ass. Phyllireo-Juniperetum excelsae Em, 1962*

(1985); ass. Orno-Quercetum petraeae Em, 1968); assn. Querco-Ostryetum carpinifoliae Ht.; assn. Quercetum trojanae macedonicum Em. & Ht.(1950), 1965), etc.

Flora and fauna

Some identified flora, fauna species and identified types of habitats relevant for HPP Tikves are presented below. The presented photos are taken from observation points for HPP Tikves.

Figure 68: Site visit photos of HPP Tikves, taken 16.9.22 from Geing/ Fichtner Project team

Determination and valorization of some registered site visit flora and fauna species, according to IUCN list, National Red list for flora and fauna of RNM (ichthyofauna and avifauna are not included in this Red list) and EU Habitats Directive (Annex II and Annex IV), is shown in the following table.

Table 10: Valorization of species Mavrovo hydro system, HPP Raven, HPP Vrutok, HPP Vrben

Registered species	Status according to IUCN	Reference to National Red List of flora and fauna of RNM	Reference to EU Habitats Directive (Annex II, Annex IV and Annex V)
Quercus cerris (turkey oak)	Least Concern (LC)	Not included	Not included
Fagus sylvatica (European beech)	Least Concern (LC)	Not included	Not included
Corylus avellana (common hazel)	Least Concern (LC)	Not included	Not included
Sambucus nigra (Elderberry)	Least Concern (LC)	Not included	Not included
Prunus spinosa (blackthorn)	Least Concern (LC)	Not included	Not included
Rubus fruticosus (Blackberry)	Least Concern (LC)	Not included	Not included
Achillea millefolium (Yarrow)	Least Concern (LC)	Not included	Not included
Hypericum perforatum (St. John's-wort)	Least Concern (LC)	Not included	Not included
Rosa canina (Dog rose)	Least Concern (LC)	Not included	Not included
Cichorium intybus (common chicory)	Least Concern (LC)	Not included	Not included
Fragaria vesca (Strawberry)	Least Concern (LC)	Not included	Not included

Registered species	Status according to IUCN	Reference to National Red List of flora and fauna of RNM	Reference to EU Habitats Directive (Annex II, Annex IV and Annex V)
Carpinus betulus (oriental hornbeam)	Least Concern (LC)	Not included	Not included
Salix alba (willow)	Least Concern (LC)	Not included	Not included
Populus tremula (poplar)	Least Concern (LC)	Not included	Not included
Cyclamen hederifolium (ivy-leaved cyclamen)	Least Concern (LC)	Not included	Not included
Cygnus cignus (Swan)	Least Concern (LC)	Not included	Not included
Buteo buteo (common buzzard)	Least Concern (LC)	Not included	Not included
Corvus corax (common raven)	Least Concern (LC)	Least Concern (LC)	Not included
Black-headed Gull (Larus ridibundus)	Least Concern (LC)	Not included	Not included
*Phalacrocorax pygmaeus (*Pygmy Cormorant*)*	Least Concern (LC)	Not included	Not included
Podarcis muralis (common wall lizard)	Least Concern (LC)	Least Concern (LC)	Not included
Ardea cinerea (grey heron)	Least Concern (LC)	Least Concern (LC)	Not included
***Ursus arctos* (brown bear)**	Least Concern (LC)	**Vulnerable (VU)**	Not included
***Lynx lynx balcanicus* (Balkan lynx)**	Least Concern (LC)	**Critically endangered (CR)**	Not included
***Anguilla Anguilla* (European Eel)**	**Critically endangered (CR)**	Not included	Not included
*Fomes fomentarius (*Tinder fungus)	Not included	Not included	Not included
Ramaria sp.	\	\	\

Registered fauna within the 6 HPPs

HES Mavrovo (intake Stirovica and NP Mavrovo)

The vulnerable (VU) brown bear was registered at site through the presence of feces in several locations: intake Stirovica, part of a transmission line in NP Mavrovo, etc. The Critically Endangered (CR) lynx was not registered during the field visit. During the meeting with the representatives from NP Mavrovo on 14.09.2022, they pointed out that the lynx population will not be affected by the implementation of the project activities along the transmission line in NP Mavrovo, taking into consideration: 1) the type of the project activities (vegetation pruning of small branches of trees only, regular maintenance activity is already regularly performed by ESM); 2) their duration (short-term of some days only and only during daytime); and 3) lynx behavior (which is known through tracking by GPS collar-solitary). The lynx is a very active species, mainly nocturnal, with a large area of distribution cross-bordering to Albania and Kosovo and generally avoiding encounters with humans. If any appearance occurs during rehabilitation activities along the transmission line in NP Mavrovo, the NP Supervisors will take appropriate measures in coordination with the ESM/Contractor. Also, they clearly stated that the recently introduced young deer population near the transmission line will not be affected by the implementation of the project activities, taking into consideration the type of the project activities (vegetation pruning) and their duration (short-term within <1 week).

HES Mavrovo (Sharski vodi canal, HPP Vrutok and HPP Raven)

The vulnerable (VU) brown bear was also registered within NP Shar Planina, through the presence of feces in several locations: intake Proshevce, near HPP Vrutok, etc. The Critically Endangered (CR) lynx was not registered during the field visit in NP Shar Planina. During the meeting with the representative from NP Shar Planina on 25.10.2022, pointed out that the implementation of the project activities will not cause adverse impact on brown bear and lynx, because: 1) they appear in the higher altitude of Shar Planina and they are easily scared by noise; 2) taking into consideration the type of project activities (e.g. replacing the gates of several intakes); and 3) their duration (short-term and daytime). Near HPP Vrutok few bird species were identified: common raven and common buzzard.

HPP Spilje

During the site visit of HPP Spilje (15.9.22), common wall lizard, black-headed gull and pygmy cormorant were identified as fauna species.

HPP Tikves

During the site visit of HPP Tikves (16.9.22), grey heron was identified near Tikves dam.

HPP Globocica

After the construction of the two hydroelectric plants Spilje and Globocica as well as additional 4 HPPs on Albanian ground, the natural path of the Critically Endangered (CR) Eel from Ohrid Lake to the Sea is closed. Lake Ohrid is the only open lake in Europe that is artificially stocked with eels for preserving the population of eel in the lake. It is one of the most important species of fish that inhabit Lake Ohrid and is a significant element of biological diversity with its specific role in maintaining the balance of the ecosystem. ESM implemented the practice of stock the Ohrid lake with eel (every two years in the period of July to October). According to the Valorization Study of Ohrid Lake (December 2021), from HPP Globocica until the locality named Divjak Struga fishing of eel is allowed according to the Law on fisheries and aquaculture. Near Struga on the Crn Drim river is built the facility Daljan with the purpose for commercial eel fishing. The method of commercial fishing at the "Daljan" facility is regulated in the fishing basis for Lake Ohrid (2016 – 2022).

The main conclusion and recommendations for the biodiversity aspect related to this project are presented in Chapter 6.

5.2 Socio-Economic Baseline

This chapter provides a general description of the socio-economic environment in the project's area of influence. This chapter is divided mainly into two levels: at a wider level (the data on the social environment is presented on the municipality level), and at a local level (the presented data is site specific or on the level of project affected settlements).

Area of influence

The wider area of influence is defined by the level of the municipality. In that context there are five project affected municipalities within three statistical regions. The municipalities of Gostivar (HPP Raven and Vriutok) and Mavrovo and Rostushe (HPP Vrben and Mavrovo dam) belong to the Polog Region, the municipalities of Debar (HPP Spilje) and Struga (HPP Globocica) belong to the Southwest Region and the municipality of Kavadarci (HPP Tikves) belongs to the Vardar Region.

The municipalities within the project area of influence with key data related to the comparation of the two last censuses of the population are given in the next table.

Table 11: Table Population of the project affected municipalities

Municipality		Total number of the population		Difference between the Census in 2002 and the Census in 2021		Gender structure Census in 2021	
		2002 Census[11]	2021 Census[12]			Male	Female
1.	The municipality of Gostivar	81,042	59,770	21 272	26.25%	29 321	30 449
2.	The municipality of Mavrovo and Rostushe	8,618	5,042	3 576	41.49%	2 486	2 556
3.	The municipality of Debar	19,542	15,412	4 130	21.13%	7 677	7 735
4.	The municipality of Struga	63,376	50,980	12 396	19.56%	25 355	25 625
5.	The municipality of Kavadarci	38,741	35,733	3 008	7.76%	17 908	17 825
	TOTAL	211,319	166,937	44 382	21.00%	82 747	84 190

Data source: State Statistical Office (2002) Census of Population, Households and Dwellings in the Republic of Macedonia, and (2021) Census of Population, Households and Dwellings in the Republic of North Macedonia, http://www.stat.gov.mk/.

The total number of people in the municipalities within the project area of influence was 166,937 inhabitants (by September 2022). According to the comparative analysis of the databases of the two last censuses in Macedonia, the total population in the project affected municipalities decreased for ~21.0% or by 44.382 residents. These regions are known as emigration regions and the number of inhabitants has decreased significantly over the past years. The situation appears even more dramatic in the municipality of Mavrovo and Rostushe, where the number of inhabitants decreased by ~42% between the last two censuses.

The project affected settlements are given below in the following tables. It is important to highlight that the key data related to the population of the settlements are taken from the 2002 Census, because the final data on the level of settlement from the 2021 Census are not yet officially published. The total number of the affected population by the rehabilitation of HS Mavrovo is 4,126 inhabitants, and the total number of households is 877. The average number of members in a household is 4.7 members.

Table 12: Key data related to the project affected settlements within Hydro System Mavrovo

[11]The 2002 Census was the last census carried out in the Republic of North Macedonia using the traditional method.
[12] The 2021 Census was conducted by applying a new, so-called combined census method and new technological approach with entry of census data on handheld computers, laptops, and using data from the created pre-census database.

Settlement		Total population	Households	Dwellings	Gender structure	
					Male	Female
1.	Raven	1,615	344	380	783	832
2.	Vrutok	1,127	242	266	550	577
3.	Mirdita[13]	-	-	-	-	-
4.	Rechane	1,054	190	192	538	515
5.	Vrben	142	38	66	82	60
6.	Mavrovi Anovi	167	54	336	78	89
7.	Bogdevo	5	1	13	3	2
8.	Leunovo	6	3	209	4	2
9.	Nikiforovo	10	5	81	6	4
10.	Kichinica	-	-	8	-	-
	TOTAL	4126	877	1,551	2,044	2,081

Data source: State Statistical Office (2002) Census of Population, Households and Dwellings in the Republic of Macedonia, http://www.stat.gov.mk/.

HPP Spilje is located within the municipality of Debar, however far away of the settlements. The settlements located along the river Crn Drim are Dzepishte and Otishani. The total number of the affected population by the rehabilitation of HPP Spilje is 1,029. The total number of households is 187 and the average number of members in household is 5.5 members.

Table 13: Key data related to the project affected settlements within HPP Spilje

Settlement		Total population	Households	Dwellings	Gender structure	
					Male	Female
1.	Otishani	530	100	115	283	247
2.	Dzepishte	499	87	100	266	233
	TOTAL	1,029	187	215	549	480

Data source: State Statistical Office (2002) Census of Population, Households and Dwellings in the Republic of Macedonia, http://www.stat.gov.mk/

HPP Globocica and Globocca dam are located within the municipality of Struga. The total number of the affected population by the rehabilitation of the HPP Globocca is 896 inhabitants. The total number of households is 256 and the average number of members in household is 3.5 members.

Table 14: Key data related to the project affected settlements within HPP Globocica

Settlement		Total population	Households	Dwellings	Gender structure	
					Male	Female
1.	Piskupshtina	182	50	71	95	87
2.	Nerezi	213	66	130	111	102
3.	Bezovo	54	18	42	26	28
4.	Lukovo	447	122	205	240	207
	TOTAL	896	256	448	472	424

Data source: State Statistical Office (2002) Census of Population, Households and Dwellings in the Republic of Macedonia, http://www.stat.gov.mk/.

HPP Tikves and Tikves dams are located in the municipality of Kavadarci. The total population in the project affected settlements is 1,065 inhabitants. The total number of households is 355 and the average number of members in household is 3 members. However, the water of Tikves lake is used for irrigation.

[13] There is no separate data for settlement Mirdita. The data for settlement Mirdita are inserted in the settlement Vrutok. Since 2012, separate data have been kept for the village of Mirdita.

The main sector of the economic life of the inhabitants of the Tikves region and the bearer of economic development in the entire region is agriculture, that is, viticulture. The vineyards in the municipality of Kavadarci cover an area of 8,000 ha. The Tikves region is the largest wine region in Macedonia. The irrigation of the vineyards from the water of Tikves Lake is crucial for the agriculture of this region.

Table 15: Key data related to the project affected settlements within HPP Tikves

Settlement		Total population	Households	Dwellings	Gender structure	
					Male	Female
1.	Vozarci	910	292	399	490	420
2.	Brusani	2	1	242	1	1
3.	Resava	144	58	170	65	79
4.	Dradnja	3	1	105	1	2
5.	Dobrotino	2	1	39	1	1
6.	Seskovo	4	2	43	2	2
	TOTAL	1,065	355	998	560	505

Data source: State Statistical Office (2002) Census of Population, Households and Dwellings in the Republic of Macedonia, http://www.stat.gov.mk/.

Education

According to the statistical databases, in the territory of the project affected municipalities there are a number of pre-school educational units, elementary schools and high schools.

Table 16: Education in the project affected municipalities

Municipality		Total number of schools			Total number of enrolled students at the beginning of the school year								
					Preschool education[15]			Primary schools[16]			High schools		
		Preschool education[14]	Elementary schools	High schools	Pupils / Students	Male	Female	Students	Male	Female	Students	Male	Female
1.	The municipality of Gostivar	1	11[17]	5	625	317	308	6,135	3,121	3,014	3,139	1,705	1,434
2.	The municipality of Mavrovo and Rostuse	-	4[18]	1	-	-	-	446	220	226	112	54	58
3.	The municipality of Debar	1	3[19]	2	259	135	124	1,976	1,013	963	608	297	311

[14] The kindergartens have their clones on several locations.
[15] The data of the number of students is for 2007, MakStat base.
[16] The data related to the enrolled students in primary and lower secondary school in 2021/2022 school year.
[17] There is an elementary school in the project affected settlement Vrutok.
[18] One primary school is in the project affected settlement Mavrovi Anovi.
[19] There are two regional schools, one is in the project affected settlement Dzepishte.

Municipality		Total number of schools			Total number of enrolled students at the beginning of the school year								
					Preschool education[15]			Primary schools[16]			High schools		
		Preschool education[14]	Elementary schools	High schools	Pupils / Students	Male	Female	Students	Male	Female	Students	Male	Female
4.	The municipality of Struga	1	11	4	539	295	244	5,485	2,823	2,662	2,243	1,052	1,191
5.	The municipality of Kavadarci	1	7	4	956	525	431	3,167	1,624	1,543	1,445	754	691
	TOTAL	4	36	16	2,379	1,272	1,107	17,209	8,801	8,408	7,547	3,862	3,685

Data source: State Statistical Office in the Republic of Macedonia, http://www.stat.gov.mk/.

There is an International University in Struga. The International Vision University is located in Gostivar. Departments of state and private universities are opened in the project affected municipalities.

Health

Based on the analyzed data related to the health institution in the project affected municipalities there are the following health units presented in Table 17.

Table 17: Health Institutions in the Project affected health region

Health Region		Health Center	General Hospital	Center for Treatment and Rehabilitation
1.	Health region - Gostivar[20]	2	1	-
2.	The municipality of Debar	1	1	-
3.	The municipality of Struga	2	1	1
4.	The municipality of Kavadarci	1	1	-
	TOTAL	6	4	1

Data source: Health Map of the North Macedonia (2018), http://iph.mk/wp-content/uploads/2014/09/ZK-EN-2019.pdf.

The medical units are located in the bigger settlements within the project affected municipalities.

Road infrastructure

Through the territory of the project affected municipalities there are motorways, regional roads of first, second and R29 category and local roads as shown in the following tables.

Table 18: Road infrastructure connected with the Mavrovo HPP system

	Road	Road section
Motorway		
1.	A2	Border with Bugaria (BC Deve Bair)-Kriva Palanka-Stracin-Romanovce-(Kumanovo)-Miladinovce-Ring Road Skopje- Tetovo-Gostivar-Kichevo-Trebenishte-Struga-border with Albania (BC Kafasan)

[20] The Health region of Gostivar also covers the municipality of Mavrovo and Rostuse.

	Road	Road section
Regional Road – Category I		
2.	R1202	Connection with A2 – Mavrovi Anovi – Debar – Border with Albania (BC Blato) and the road section to the monastery St. Jovan Bigorski
Regional Road – Category II		
3.	R2235	Mavrovi Anovi (Connection with R1202) – Mavrovo – Leunovo – Bunec (connection with R1202)
4.	R2238	Mavrovo (Connection with R2235)-Galicnik-Selce-Tresonce-Lazaropole-Connection with R2246
5.	R2246	Boškov most (Connection with R1202) – Izvor (Connection with A2) and road section to Gari
Regional Road – R29		
6.	R29279	Zdunje - (Connection with A2) - Vrutok
Local Road		
7.	-	The road connection to the HPP Vrben is reconstructed local road form Mavrovi Anovi (connection with R1202)

Table 19: Road infrastructure connected with HPP Spilje

	Road	Road section
Regional Road – Category I		
1.	R1201	Struga (Connection with A2) – Debar (Connection with R1202) and road section Dzhepiste – Border with Albania (BC Dzhepiste)
2.	R1202	Connection with A2 – Mavrovi Anovi – Debar – Border with Albania (BC Blato) and the road section to the monastery St. Jovan Bigorski
Regional Road – Category II		
3.	R2249	Melnicki Most (Connection with R1102) – Papradnik – Brestani – Selce (Connection with R2243)
Regional Road – R29		
4.	R29280	Connection with R2246 - Mogorce

Table 20: Road infrastructure connected with HPP Globocica

	Road	Road section
Regional Road – Category I		
1.	R1201	Struga (Connection with A2) – Debar (Connection with R1202) and road section Dzhepiste – Border with Albania (BC Dzhepiste)
Regional Road – Category II		
2.	R2240	Connection with R1201 – Vevcani – Oktisi - Connection with A2
3.	R2241	Connection with R1201 (Globocica)- Jablanica – Border with Albania (BC Lakavica)
4.	R2243	Struga (Connection with R1201) – Drslajca – Dolno Tateshi – Mislodežda – Lokov – Burinec – Connection with R1201
Local Road		
5.	L31246	Globocica - Connection with R2243
6.	L31217	Globocica - Connection with R2241

	Road	Road section
7.	L31218	Lukovo – Connection with R1201
8.	L31219	Modric – Connection with R1201
9.	L31268	Drenok - Modric – Connection with R1201

Table 21: Road infrastructure connected with HPP Tikves

	Road	Road section
Regional Road – Category I		
1.	R1103	Lakavica (connection with A4) -Negotino (connection with A1) -Kavadarci-Drenovo (connection with A1)
Local Road		
2.	-	Vozarci – Dradnja (Tikves dam)
3.	-	Vozarci – Brusani (Tikves dam)

Regarding the local road network, there is a need for more information about the load capacity of the bridge over the Black River in Vozarci. In fact, this bridge is the only crossing over the Crna Reka. All previous transport for the construction and maintenance of the HPP Tikves took place over this bridge. Based on site visit observation, the bridge is corroded, and it is necessary to check it's carrying capacity and possible need for its repair. This bridge will be used for transport of electro parts and materials.

Economy

The total number of economic entities in 2021 in the municipality of Gostivar was 2,508. The economic branches in which the economic entities operate are wholesale and retail trade (874); manufacturing (316); construction (241); etc. The economic picture of the Municipality of Gostivar shows a diverse economic structure. The municipality is dominated by the small and medium economy: small and medium enterprises that comprise over 90% of the total number of enterprises. These enterprises provide most of the employment.

The total number of economic entities in 2021 in the municipality of Mavrovo and Rostuse was 124. The most popular is the sector related to the accommodation and food services activities and wholesale and retail trade. The territory of the Municipality abounds with energy possibilities and sources. HPP Mavrovo is the largest hydro system in Macedonia.

The total number of business entities in the municipality of Debar in 2021 was 519. The largest number of business entities are oriented in wholesale and retail trade, construction and accommodation and food services activities.

In the municipality of Struga, in 2021 were active in total 2,198 business entities. One third of the total business entities are active in the wholesale and retail sector trade, and less in construction and accommodation and food service activities.

The total number of active business entities in the municipality of Kavadarci in 2021 were 1,691. The biggest number of business entities are in the wholesale and retail sector trade, and less in transport and storage and manufacturing.

Cultural Heritage

The territory of the project affected municipalities and settlements is very rich. However, the rehabilitation of the hydro power plants does not require entering or disturbing new plots where archaeological or cultural finds are expected happen. There is no need for permanent or temporary land acquisition for implementation of the proposed project. It is important to note that within the area of the HPPs Vrutok and Globocica there are works of art by prominent artists that have artistic value (Figure 69). These are mosaics maintained in relatively good condition.

Figure 69: Mosaics in HPP Vrutok and HPP Globocica

6 Assessment of E&S and H&S Risks

The present Chapter presents the Environmental and Social Site Risk Assessment undertaken for the rehabilitation of the 6 HPP and TL. The risk assessment includes consideration of occupational and community health and safety issues as well.

The E&S and H&E risk assessment allows to **identify and prioritize the main negative and positive risks and associated impacts** related to the works to be undertaken at the rehabilitation sites so that appropriate strategies to address these can be developed.

6.1 Approach and Methodology

The methodology chosen for the risk assessment is based on the one recommended by IFC in the publication "ESMS Implementation Handbook - General", supported by the respective "ESMS Toolkit - General" (both from November 2015). Fichtner considers the approach designed by IFC in these documents to be applicable to the present project as it allows a broad risk assessment but at the same time keeps the exercise straight forward and simple to understand.

The methodology follows a 6-step approach:

1. Identify the activities potentially causing risk - focus is placed on construction activities
2. Identify the E&S and H&S **risks**
3. Identify the **probability** that the risk will occur and cause negative impacts (low, medium, high and extreme)
4. Identify the associated **negative impact** that will be verified if the risk occurs
5. Classify the **significance** of the impact (low, medium, high and extreme) - the impacts associated with the risks are classified based on the consultant's expertise and knowledge of the situation at site. A detailed multi-criteria evaluation and classification of impacts (as is done in the context of full-scale international ESIAs) is not applicable nor deemed necessary to achieve the objectives of the assignment.
6. **Prioritize the risks** (low, medium, high and critical) based on the following matrix (Figure 70).

Risk Prioritization Matrix		Significance of the impact			
		Extreme	High	Medium	Low
Probability of occurrence of the risk	*Low*	High risk	Medium risk	Low risk	Low risk
	Medium	High risk	High risk	Medium risk	Low risk
	High	Critical risk	High risk	High risk	Medium risk
	Extreme	Critical risk	Critical risk	High risk	High risk

Figure 70: Risk prioritization matrix

6.2 Identification of Risk Activities

Table 22 presents the project activities capable of generating E&S and/or H&S risk. For each project activity for the relevant HPP an appropriate code system is given in order to provide site specific risk assessment in following text and tables.

Table 22: Project activities for rehabilitation of 6 HPPs (III phase) and OHL

Relevant HES	HPP	Project activity	Code of project activities
HES Mavrovo	HPP Raven	▪ Replacement of poles and bearings of units (plus possibly shaft)	HPP Raven A1
		▪ Replacement of cartridge cases from conductive blades from units 1, 2 and 3	HPP Raven A2
	HPP Vrutok	▪ Wire (Vrutok-Vrben) replacement Al/Fe 150/50 mm^2 and classic protection wire type Fe II35 with protection wire with integrated optical fibers at 35 kV conductor	HPP Vrutok A1
		▪ Replacement of the turbine bearings and turbine shaft ▪ Replacement of needles' servomotors of units 3 and 4	HPP Vrutok A2
		▪ Repair, rehabilitation of the joint chamber of the intake from sedimentation tank and the rapid flow based on prepared rehabilitation report	HPP Vrutok A3
	HPP Vrben	▪ Reconstruction of the turbine equipment of the units	HPP Vrben A1
	Dam Mavrovo	▪ Reconstruction, rehabilitation of grout curtain dam "Mavrovo" based on the rehabilitation decision	Mavrovo A1
		▪ Upgrade of the dam monitoring system	Mavrovo A2
		▪ Measuring devices for water levels per intake	Mavrovo A3
	Shara region, Gorna Radika region	▪ Reconstruction of the plate valve chambers in the intake organs of the Shara Region and Gorna Radika	Intakes A1
HES Crn Drim	HPP Spilje	▪ Procurement, delivery, installation and commissioning of synchronous generator 1	HPP Spilje A1
		▪ Replacement of poles	HPP Spilje A2
		▪ Block transformers – replacement	HPP Spilje A3
		▪ Replacement of cartridge cases from conductive blades from units 1, 2 and 3	HPP Spilje A4
		▪ Replacement of hydromechanical and electrical equipment of valve chamber	HPP Spilje A5
	HPP Globocica	▪ Procurement, delivery, installation and commissioning of synchronous generators A&B	HPP Globocica A1

Relevant HES	HPP	Project activity	Code of project activities
		▪ Reconstruction of wicket gates for Francis turbine TF 1.65/213-13 of units 1 and 2	HPP Globocica A2
		▪ Replacement of hydromechanical and electrical equipment of valve chamber	HPP Globocica A3
		▪ Reconstruction of grout curtain of the dam "Globocica"	HPP Globocica A4
HPP Tikves	HPP Tikves	▪ Block transformers – replacement	HPP Tikves A1
		▪ Replacement of hydromechanical and electrical equipment of valve chamber	HPP Tikves A2

6.3 Identification and Prioritization of Risks

Table 23 presents the identified potential E&S and H&S risks through relevance to which HPP refers to (with appropriate code of project activity), their probability of occurrence, the associated negative impacts, the significance of the impacts, the risk prioritization, and the associated legal and policy framework.

Table 23: Risk prioritization

Risk code	Theme	Risk	Relevance to HPPs	Probability of Occurrence of the Risk	Associated Impacts	Significance of the Impacts	Risk Prioriti-zation	Applicable framework
		What is the risk that has been identified?	*Code of the Project activity*	*What is the likelihood that this risk will occur and create negative impacts?*		*How severe would the potential impacts be if the risk should occur?*	*Based on the matrix*	
Environmental Risks and Negative Impacts								
E1	Water and Soil Quality	Leaks/spills of pollutants (oils, greases and fuels) in the water and soil	Intakes A1 HPP Vrutok A2 HPP Vrben A1 HPP Spilje A3 HPP Tikves A1	Medium	Surface, groundwater, and soil pollution	High	High	ESS1 and ESS3 Law on water and secondary legislation
E2		Improper waste disposal in the vicinity of water resources (rivers, lakes) and in the soil	Intakes A1 HPP Vrutok A3 HPP Spilje A3 HPP Spilje A4 HPP Spilje A5 HPP Tikves A1 HPP Globocica A3 HPP Tikves A2	Medium	Surface, groundwater and soil pollution	Medium	Medium	
E3	Water management	The biological minimum flow in the rivers after the intakes is not respected	Intakes A1 (especially at intake Mazdraca, regarding wet habitats)	Extreme	Loss/decrease of riverine biodiversity	High	Critical	ESS1 and ESS3 Law on water and secondary legislation Water Permits
E4		No monitoring of the biological minimum flow is done	Intakes A1	Extreme	Loss/decrease of riverine biodiversity	High	Critical	
E5		Decreased quantities of available water for usage due to climate change	Intakes A1 All HPPs	High	Inability to provide water for irrigation / hydro meliorative systems according to the Water Permits	Medium	High	

Risk code	Theme	Risk	Relevance to HPPs	Probability of Occurrence of the Risk	Associated Impacts	Significance of the Impacts	Risk Prioriti-zation	Applicable framework
		What is the risk that has been identified?	*Code of the Project activity*	*What is the likelihood that this risk will occur and create negative impacts?*		*How severe would the potential impacts be if the risk should occur?*	*Based on the matrix*	
E6	Waste, hazardous waste and hazardous materials management	Unproper management of non-hazardous waste: construction waste, worker's domestic waste, excavated inert materials, plant debris.	HPP Vrutok A1 HPP Vrutok A3 Mavrovo A1 Intakes A1 HPP Globocica A2 HPP Globocica A4	Medium	Surface water, underground water and soil pollution	Medium	Medium	ESS1 and ESS3 Law on chemicals Law on waste Secondary legislation for management with each type of generated waste
E7		Unproper storage of used oils, paints, lubricants and other hazardous materials, as well as of the respective empty containers, for example by not providing retention tanks	HPP Raven A1 HPP Raven A2 HPP Vrutok A2 HPP Spilje A2 HPP Spilje A3 HPP Spilje A4 HPP Tikves A1	Medium	Surface water, underground water, and soil pollution	High	High	
E8		Presence of asbestos in poles of old generators	HPP Spilje A2 HPP Raven A1	Extreme	Long-term and long-distance contamination of air, water, and soil especially in and around NP Mavrovo and NP Shar Planina. Acute or chronic exposure is known to cause lung cancer, fibrosis and other health problems in animals[21]	High	Critical	

[21] C:\SCANSOUTH\ATSDR\wpd\Asbestos.wpd (cdc.gov)

Risk code	Theme	Risk	Relevance to HPPs	Probability of Occurrence of the Risk	Associated Impacts	Significance of the Impacts	Risk Prioriti-zation	Applicable framework
		What is the risk that has been identified?	*Code of the Project activity*	*What is the likelihood that this risk will occur and create negative impacts?*		*How severe would the potential impacts be if the risk should occur?*	*Based on the matrix*	
E9		Presence of PCBs in transformers' oil	HPP Tikves A1 HPP Spilje A3	Extreme	Long-term and long-distance contamination of air, water and soil especially in and around NP Mavrovo and NP Shar Planina. PCBs have very low potential for producing acute toxic effects [22], but chronic exposure to PCBs affects animals` immune, reproductive, nervous and endocrine systems, and causes cancer and other health effects.	High	Critical	
E10	Noise and vibrations	Increased noise and vibration levels during the rehabilitation activities above regulatory limits	HPP Vrutok A1 HPP Vrutok A3 Intakes A1	Medium	Direct disturbance of local fauna during nesting, breeding, migration and other activities	Medium	Medium	ESS1, ESS2, ESS3, ESS4 and EES6 Law for noise protection and related bylaws

[22] https://www.atsdr.cdc.gov/csem/polychlorinated-biphenyls/assessment.html

Risk code	Theme	Risk	Relevance to HPPs	Probability of Occurrence of the Risk	Associated Impacts	Significance of the Impacts	Risk Prioriti-zation	Applicable framework
		What is the risk that has been identified?	*Code of the Project activity*	*What is the likelihood that this risk will occur and create negative impacts?*		*How severe would the potential impacts be if the risk should occur?*	*Based on the matrix*	
E11	Air emissions	Increased concentration of particulate matter and gases from fuel combustion on sites above regulatory limits during transportation of materials and equipment, as well as during the performing the rehabilitation activities	HPP Raven A1 HPP Raven A2 HPP Vrutok A1 HPP Vrutok A2 HPP Vrutok A3 HPP Vrben A1 Mavrovo A1 Intakes A1 HPP Spilje A1 HPP Spilje A2 HPP Spilje A3 HPP Globocica A1	Medium	Direct disturbance of local fauna during nesting, breeding, migration and other activities	Low	Low	ESS1, ESS2, ESS3, ESS4 and EES6 Law on ambient air quality
E12	Biodiversity	The non-existence of fish paths or any other fish protection systems in the existing and the planned technical set-up may lead to further decrease of riverine biodiversity. However, after 50-60 years of existence of the systems, it can be assumed the riverine biodiversity has evolved and adapted.	Intakes A1 All HPPs	Medium	Loss of riverine biodiversity	Medium	Medium	ESS6 Law on Fisheries and Aquaculture Law on nature protection Law on proclamation of NP Mavrovo Law on proclamation of NP Shar Planina
E13		Pruning of high vegetation (regular maintenance work) from the Right of Way of the 35 kV OHL from HPP Vrben to HPP Vrutok in NP Mavrovo and NP Shar Planina	HPP Vrutok A1	Medium	Disturbance of local flora and fauna in NP Mavrovo and NP Shar Planina	Low	Low	

Risk code	Theme	Risk	Relevance to HPPs	Probability of Occurrence of the Risk	Associated Impacts	Significance of the Impacts	Risk Prioriti-zation	Applicable framework
		What is the risk that has been identified?	*Code of the Project activity*	*What is the likelihood that this risk will occur and create negative impacts?*		*How severe would the potential impacts be if the risk should occur?*	*Based on the matrix*	
E14		Project's activities (construction noise, vehicular movement etc.) may deter and affect the breeding period of terrestrial fauna species: brown bear (in NP Mavrovo and NP Shar Planina), Balkan lynx and deer (introduced young population in NP Mavrovo).	HPP Vrutok A1 Intakes A1	Medium	Disturbance of local fauna	Low	Low	ESS6 Law on nature protection Law on proclamation of NP Mavrovo Law on proclamation of NP Shar Planina
		Risk on breeding period of aquatic fauna species	Not related to HPP rehabilitation activities, but depended on correct operation according to permit requirements	Medium	Disturbance of local fauna	Low	Low	ESS6 Law on nature protection Law on Fisheries and Aquaculture
E15		Risk of uncontrolled movement of workers during rehabilitation works on the intake Mazdraca (located in zone of strict protection in NP Shar Planina)	Intakes A1 (especially at intake Mazdraca)	Low	Uncontrolled, prohibited collection of plants (wet habitats)	High	Medium	Law on nature protection Law on hunting ESS6 Law on proclamation of NP Shar Planina
				Low	Poaching of endangered and/or protected species.	High	Medium	

Risk code	Theme	Risk	Relevance to HPPs	Probability of Occurrence of the Risk	Associated Impacts	Significance of the Impacts	Risk Prioriti-zation	Applicable framework
		What is the risk that has been identified?	*Code of the Project activity*	*What is the likelihood that this risk will occur and create negative impacts?*		*How severe would the potential impacts be if the risk should occur?*	*Based on the matrix*	
E16	Environmental and H&S management Implemented ISO systems (ISO 9001; ISO 14001; ISO 45001)	Workers from each HPP are not fully informed about their obligations and responsibilities within the management systems, creating risk during the construction which will be done in parallel to the operations	All HPPs	High	Poor EHS management on the sites leading to all of the impacts above and in addition will create additional risks for Contractor.	Medium	High	ESS1 and ESS2 On voluntary base
E17		Lack of specific training for each working place in all HPPs, creating risk during the construction which will be done in parallel to the operations	All HPPs	High	Poor EHS management on the sites leading to all of the impacts above and in addition will create additional risks for Contractor.	Medium	High	
E18	Environmental documentation	Insufficient monitoring reports of surrounding biodiversity (flora and fauna): no records for re-fishing, with associated risk of missing information and protection measures for some species.	All HPPs	Extreme	Loss of riverine biodiversity, recidivism/recurrence of the impacts	Medium	High	ESS1 and ESS6 On voluntary base
E19		Biodiversity management plan (BMP) is not prepared to define the actions and measures necessary for the overall management of biodiversity.	HPP Vrutok A1 Intakes A1	Medium	Disturbance of local flora and fauna in NP Mavrovo and NP Shar Planina	High	High	ESS6 Law on nature protection Law on proclamation of NP Mavrovo and NP Shar Planina
E20		No available information regarding the Plan for	All HPPs	Extreme	Soil, water and air contamination,	Medium	High	ESS1 and ESS3

Risk code	Theme	Risk	Relevance to HPPs	Probability of Occurrence of the Risk	Associated Impacts	Significance of the Impacts	Risk Prioriti-zation	Applicable framework
		What is the risk that has been identified?	*Code of the Project activity*	*What is the likelihood that this risk will occur and create negative impacts?*		*How severe would the potential impacts be if the risk should occur?*	*Based on the matrix*	
		Hazardous Materials Management with associated risk of missing information and handling measures for some HazMats			recidivism/recurrence of the impacts			Law on waste Secondary legislation for management with each type of generated waste
E21		No information regarding the Waste Management Program as required by the national legislation with associated risk of legal non-compliance for proper handling of some wastes.	All HPPs	Extreme	Soil, water and air contamination, recidivism/recurrence of the impacts	Medium	High	ESS1 and ESS3 Law on waste Secondary legislation for management with each type of generated waste
E22		Lack of documentation regarding signed contracts with authorized companies for managing different types of waste (especially for waste oils) with associated risk of legal non-compliance for proper handling of some wastes.	All HPPs	Extreme	Soil, water and air contamination, recidivism/recurrence of the impacts	Medium	High	ESS1 and ESS3 Law on waste Secondary legislation for management with each type of generated waste

Risk code	Theme	Risk	Relevance to HPPs	Probability of Occurrence of the Risk	Associated Impacts	Significance of the Impacts	Risk Prioriti-zation	Applicable framework
		What is the risk that has been identified?	*Code of the Project activity*	*What is the likelihood that this risk will occur and create negative impacts?*		*How severe would the potential impacts be if the risk should occur?*	*Based on the matrix*	
E23		Lack of records for the different waste types generated during the project activities, with associated risk of missing information and handling measures for some HazMats	All HPPs	Extreme	Soil, water and air contamination, recidivism/recurrence of the impacts	Medium	High	ESS1 and ESS3 Law on waste Secondary legislation for management with each type of generated waste
Occupational H&S Risks and Negative Impacts								
O1	PPE	Lack of appropriate PPE for each workplace (helmets, gloves, earplugs, etc.)	All HPPs HPP Vrutok A1	Medium	Worker injury or loss of life (life-threatening trauma)	Extreme	High	ESS1 and ESS2 Law for Occupational Health and Safety
O2	Working at heights	Fall when working at heights	HPP Raven A1 HPP Vrutok A1 HPP Spilje A2 HPP Spilje A3 HPP Tikves A1	Medium	Worker injury or loss of life (life-threatening trauma)	Extreme	High	ESS1 and ESS2 Law for Occupational Health and Safety
O3	Noise and vibrations	Exposure to high or excessive noise and vibration levels	All HPPs HPP Vrutok A1	Medium	Loss of hearing	Medium	Medium	ESS1 and ESS2 Law for noise protection and related bylaws Law for Occupational Health and Safety

Risk code	Theme	Risk	Relevance to HPPs	Probability of Occurrence of the Risk	Associated Impacts	Significance of the Impacts	Risk Prioriti-zation	Applicable framework
		What is the risk that has been identified?	*Code of the Project activity*	*What is the likelihood that this risk will occur and create negative impacts?*		*How severe would the potential impacts be if the risk should occur?*	*Based on the matrix*	
O4	Traffic management and road safety	Accidents due to bad conditions of the access roads to HPPs (cracks, holes in the asphalt layer, etc.) in HPP Vrben (settlement Vrben), HPP Splije (City of Debar) and HPP Tikves (settlement Vozarci and local population near Tikves lake) access roads to Dam Mavrovo and Dam Globocica. Accidents due to non-appropriate driving	All HPPs and Dam Mavrovo and Dam Globocica	Medium	Worker injury or loss of life (life-threatening trauma) residents (e.g. school children)	Extreme	High	ESS1 and ESS4 Law on traffic safety Law for Occupational Health and Safety
O5	Suspended loads	Exposure to suspended loads	All HPPs Intakes A1 HPP Vrutok A1	Medium	Worker injury or loss of life (life-threatening trauma	Extreme	High	ESS1 and ESS2 Law for Occupational Health and Safety
O6	Slips, trips, and falls	Slips, trips, and falls	All HPPs Intakes A1 HPP Vrutok A1	Medium	Worker injury (sprains, strains, fractures)	Medium	Medium	ESS1 and ESS2 Law for Occupational Health and Safety
O7	Electrical hazards	Contact with exposed or faulty electrical wires	All HPPs HPP Vrutok A1	Medium	Worker injury or loss of life (electrocution)	Extreme	High	ESS1 and ESS2 Law for Occupational Health and Safety
O8	Machinery	Caught in by improperly enclosed, unguarded or moving machinery	All HPPs HPP Vrutok A1	Medium	Worker injury or loss of life (cuts, traumatic amputation)	Extreme	High	ESS1 and ESS2 Law for Occupational Health and Safety
O9	Usage of tools	Inappropriate use of tools	All HPPs Intakes A1	Medium	Worker injury (cuts, bruises)	Medium	Medium	ESS1 and ESS2

Risk code	Theme	Risk	Relevance to HPPs	Probability of Occurrence of the Risk	Associated Impacts	Significance of the Impacts	Risk Prioriti-zation	Applicable framework
		What is the risk that has been identified?	*Code of the Project activity*	*What is the likelihood that this risk will occur and create negative impacts?*		*How severe would the potential impacts be if the risk should occur?*	*Based on the matrix*	
			HPP Vrutok A1					Law for Occupational Health and Safety
O10	Floods	Floods originating from cracks or ruptures in pipes	All HPPs Intakes A1	Medium	Drowning	Extreme	High	ESS1 and ESS2 Law for Occupational Health and Safety
O11	Extreme weather	Exposure to excessive heat or other extreme weather scenarios	All HPPs Intakes A1 HPP Vrutok A1	Low	Hypothermia, heat stress, dehydration	High	Medium	ESS1 and ESS2 Law for Occupational Health and Safety
O12	Fire events	Inadequate maintenance of equipment or incident leading to fire	All HPPs HPP Vrutok A1	Medium	Worker injury or loss of life	Extreme	High	ESS1 and ESS2 Law for protection and rescue Law for Occupational Health and Safety
O13		Lack of training on health and safety regarding fire and explosion	All HPPs Intakes A1 HPP Vrutok A1	Medium		Extreme	High	
O14		Absence of firefighting first intervention equipment	All HPPs HPP Vrutok A1	Medium		Extreme	High	
O15	Chemical hazards	Presence of asbestos in poles of old generators	HPP Spilje A2 HPP Raven A1	Extreme	Acute or chronic exposure is known to cause lung cancer, Mesothelioma and asbestosis in humans	High	Critical	ESS1, ESS2 and ESS3 Law on chemicals

Risk code	Theme	Risk	Relevance to HPPs	Probability of Occurrence of the Risk	Associated Impacts	Significance of the Impacts	Risk Prioriti-zation	Applicable framework
		What is the risk that has been identified?	*Code of the Project activity*	*What is the likelihood that this risk will occur and create negative impacts?*		*How severe would the potential impacts be if the risk should occur?*	*Based on the matrix*	
O16		Presence of PCBs in transformers' oil	HPP Tikves A1 HPP Spilje A3	Extreme	Long-term and long-distance contamination of air, water and soil especially in and around NP Mavrovo and NP Shar Planina. PCBs have very low potential for producing acute toxic effects 22, but chronic exposure to PCBs causes cancer and non-cancer health effects on humans.	High	Critical	Law for Occupational Health and Safety
O17	H&S documentation and permitting	Lack of specific training (records) for each working place in all HPPs	All HPPs Intakes A1 HPP Vrutok A1	Medium	Poor H&S management on the sites leading to all the impacts above	Medium	Medium	ESS1 and ESS2 Law for Occupational Health and Safety
O18	Natural Hazards (rock falls and landslides)	Rock falls and small landslides activation at intakes system	Intakes A1 HPP Vrben A1	High	Injuries (LTI, fatality) of workers, damage to the equipment, vehicles, heavy machinery accidents and incidents risk	Extreme	Critical	ESS1 and ESS2 Law for Occupational Health and Safety
O19	The presence of wild animals (bears, wolves, snacks, foxes)	Exposure to wild animals	All HPPs Intakes A1 HPP Vrutok A1	Medium	Injures by bites, fractures etc. of workers (LTI, fatalities)	High	High	ESS1, ESS2 and ESS6 Law for Occupational Health and Safety
O20	Minimum leaving, security and	Exposure to diseases, incidents, accidents (fire, Slips, trips, and falls,	All HPPs Intakes A1	Medium	Worker's illness,	High	High	ESS1 and ESS2

Risk code	Theme	Risk	Relevance to HPPs	Probability of Occurrence of the Risk	Associated Impacts	Significance of the Impacts	Risk Prioriti-zation	Applicable framework
		What is the risk that has been identified?	*Code of the Project activity*	*What is the likelihood that this risk will occur and create negative impacts?*		*How severe would the potential impacts be if the risk should occur?*	*Based on the matrix*	
	H&S/sanitary conditions							Law for Occupational Health and Safety
O21	Occupational H&S management (documentation Staff OHS knowledge)	Rehabilitation works in parallel with operations	All HPPs Intakes A1 HPP Vrutok A1	Medium	Incidents/Accident, MTI, LTI, Fatalities, non-proper registers and reporting	High	High	ESS1 and ESS2 Law for Occupational Health and Safety, ISO 45001
O22	Hazardous materials (asbestos containing insulation materials)	Exposure to Asbestos (friable and non-friable) Containing Materials (ACMs)	HPP Spilje A2 HPP Raven A1	Medium	Every occupational exposure to asbestos can cause injury of disease; every occupational exposure to asbestos contributes to the risk of getting an asbestos related disease. Asbestos exposures as short in duration as a few days can cause mesothelioma in humans.	High	High	ESS1, ESS2 and ESS3 Law for Occupational Health and Safety EU Directive 2009/148/EC on the protection of workers from the risks related to exposure to asbestos at work Also, OSHA, US EPA, British standards can be applied.
O23	Hazardous waste management (used oils,	Exposure to hazardous waste	HPP Vrutok A1 HPP Vrutok A3 Mavrovo A1 Intakes A1 HPP Globocica A2	High	Skin or eyes Irritation, difficulties to breathe, headaches and nausea, or can result in other types of serious illness,	High	High	ESS1, ESS2 and ESS3

Risk code	Theme	Risk	Relevance to HPPs	Probability of Occurrence of the Risk	Associated Impacts	Significance of the Impacts	Risk Prioriti-zation	Applicable framework
		What is the risk that has been identified?	*Code of the Project activity*	*What is the likelihood that this risk will occur and create negative impacts?*		*How severe would the potential impacts be if the risk should occur?*	*Based on the matrix*	
	gases other Chemicals)		HPP Globocica A4 HPP Raven A1 HPP Raven A2 HPP Vrutok A2 HPP Spilje A2 HPP Spilje A3 HPP Spilje A4 HPP Tikves A1		MTI, LTI, fatalities.			Law for Occupational Health and Safety,
Social And Community H&S Risks and Negative Impacts								
S1	Influx of workers	Spread of diseases	All HPPs	Low	Negative impacts on the community's health	Medium	Low	ESS1 and ESS2 Labour Law of RNM Code of Conduct of workers
S2		Social conflicts	All HPPs	Low	Disturbance of local community	Low	Low	
S3		Increase in gender-based violence and harassment	All HPPs	Low	Disturbance of local community	High	Medium	
S4	Child labor	Children recruited for simple works	All HPPs	Low	Endanger working climates, effects of children	If detected during rehabilitation high	Low	ESS1 and ESS2 Law on labour ILO Convention ratified in RNM
S5	Drugs, alcohol, prostitution	Work accidents, spread of diseases	All HPPs	Medium	Endanger working environment	Medium	Medium	ESS1 and ESS2 Work safety regulations Law on labour
S6	Corruption	Loss of financial means, low quality equipment and materials	All HPPs	Medium	Endangers project outputs and impacts	Medium	Medium	Law on Prevention of Corruption and

Risk code	Theme	Risk	Relevance to HPPs	Probability of Occurrence of the Risk	Associated Impacts	Significance of the Impacts	Risk Prioriti-zation	Applicable framework
		What is the risk that has been identified?	*Code of the Project activity*	*What is the likelihood that this risk will occur and create negative impacts?*		*How severe would the potential impacts be if the risk should occur?*	*Based on the matrix*	
								Conflict of Interest[23]
S7	Stakeholders' information and engagement	Lack of communication of the project's schedule and planned activities	All HPPs	Medium	Lack of understanding and acceptance of the project by local communities	Low	Low	ESS10
S8	Traffic	Excessive or unregulated vehicle traffic near the HPPs and through communities at inappropriate times	All HPPs and Dam Mavrovo and Dam Globocica	Medium	Injury/death of community members due to vehicular accidents	Extreme	High	ESS4 Law on traffic safety
S9	Access to the construction sites	Movement of the local people near and/or within the construction sites	All HPPs and Dam Mavrovo and Dam Globocica	Medium	Injury/death of community members	Extreme	High	ESS1 and ESS2 Work safety regulations Law on labour
S10	Cultural Heritage	Transporting of parts to the HPPs Vrutok and Globocica	HPP Vrutok HPP Globocica Dam Globocica Dam Mavrovo	Low	Losses or severe damages to the art works located on the entrance of the HPPs	Medium	Low	ESS8 Law on preserve of the cultural heritage
S11	Access to the Towers of the 35kV OHL	Access limitation by illegal temporary structures (barriers, shelter) and cultivated land from encroachers	HPP Vrutok A1	Medium	Damage to the temporary constructions and harvest	Medium	Medium	ESS1, ESS5, ESS5
S12	Water management:	Conflict and dispute about quantities of water used for irrigation under Sharski Vodi and Tikves	All Mavrovo HPPs Impact is not related to HPP rehabilitation	Medium	Conflict with farmers, bad reputation or negative perception of the program by Stakeholders in surrounding municipalities,	Medium	Medium	-

[23]There is also, Annual plan for the prevention of corruption for 2022 of JSC Power Plants of the Republic of North Macedonia and Rulebook for reporting irregularities and suspicions of fraud or corruption of JSC Power Plants of the Republic of North Macedonia.

Risk code	Theme	Risk	Relevance to HPPs	Probability of Occurrence of the Risk	Associated Impacts	Significance of the Impacts	Risk Prioriti-zation	Applicable framework
		What is the risk that has been identified?	*Code of the Project activity*	*What is the likelihood that this risk will occur and create negative impacts?*		*How severe would the potential impacts be if the risk should occur?*	*Based on the matrix*	
			activities, but to miscommunication of the program's goals		protest against the project implementation			

Table 24: Summary table for identified risk for each project activities by HPPs

HPP	Project activity	Risk code
HPP Raven	▪ Replacement of poles and bearings of units (plus possibly shaft)	E7; E8; E11; E17; E18; E20; E21; E22; E23; O1; O2; O3; O5; O6; O7; O15; O22; O23; S1-S6;
	▪ Replacement of cartridge cases from conductive blades from units 1, 2 and 3	E7; E11; E17; E18; E20; E21; E22; E23; O1; O3; O5; O6; O7;O23; S1-S6;
HPP Vrutok	▪ Wire (Vrutok-Vrben) replacement Al/Fe 150/50 mm^2 and classic protection wire type Fe II35 with protection wire with integrated optical fibers at 35 kV conductor	E6; E10; E11; E13; E15; E17; E18; O1; O2; O3; O8; O9; O12; O13; O14; O21; O23; S1-S6;
	▪ Replacement of the turbine bearings and turbine shaft ▪ Replacement of needles' servomotors of units 3 and 4	E1; E7; E11; E17; E18; E20; E21; E22; E23; O1; O3; O5; O6; O7; O8; O9; O12; O13; O14; O21; O23; S1-S6;
	▪ Repair, rehabilitation of the joint chamber of the intake from sedimentation tank and the rapid flow based on prepared rehabilitation report	E2; E6; E10; E11; E17; E18; E20; E21; E22; E23; O1; O3; O5; O6; O7; O8; O9; O12; O13; O14; O21; O23; S1-S6;
HPP Vrben	▪ Reconstruction of the turbine equipment of the units	E1; E11; E17; E18; E20; E21; E22; E23; O1; O3; O4; O5; O6; O7; O8; O9; O12; O13; O14; O18; O21; O23; S1-S6;
Dam Mavrovo	▪ Reconstruction, rehabilitation of grout curtain dam "Mavrovo" based on the rehabilitation decision	E6; E11; E17; E18; O1; O3; O8; O9; O12; O13; O14; O21; O23; S1-S6; S8; S9; S10;
	▪ Upgrade of the dam monitoring system	E14; E17; E18; O1; O3; O8; O9; O12; O13; O14; O21; O23; S1-S6; S8; S9; S10;
	▪ Measuring devices for water levels per intake	E17; E18; O1; O3; O8; O9; O12; O13; O14; O21; O23; S1-S6; S8; S9; S10;

HPP	Project activity	Risk code
Shara region, Gorna Radika region	▪ Reconstruction of the plate valve chambers in the intake organs of the Shara Region and Gorna Radika	E1; E2; E3; E4; E5; E6; E10; E11; E12; E15; E16; E17; E18; E21; O5; O6; O9; O10; O11; O13; O17; O18; O19; O20; O21; O23;
HPP Spilje	▪ Procurement, delivery, installation and commissioning of synchronous generator 1	E11; E17; E18; E20; E21; E22; E23; O1; O3; O5; O6; O7; O8; O9; O12; O13; O14; O21; O23; S1-S6;
	▪ Replacement of poles	E7; E8; E17; E18; E20; E21; E22; E23; O1; O2; O3; O5; O6; O7; O8; O9; O12; O13; O15; O14; O21; O22; O23; S1-S6;
	▪ Block transformers – replacement	E1; E2; E7; E9; E11; E17; E18; E20; E21; E22; E23; O1; O2; O3; O5; O6; O7; O8; O9; O12; O13; O14; O16; O21; O23; S1-S6;
	▪ Replacement of cartridge cases from conductive blades from units 1, 2 and 3	E2; E7; E11; E17; E18; E20; E21; E22; E23; O1; O3; O5; O6; O7; O8; O9; O12; O13; O14; O21; O23; S1-S6;
	▪ Replacement of hydromechanical and electrical equipment of valve chamber	E2; E17; E18; E20; E21; E22; E23; O1; O3; O5; O6; O7; O8; O9; O12; O13; O14; O21; O23; S1-S6;
HPP Globocica	▪ Procurement, delivery, installation and commissioning of synchronous generators A&B	E11; E17; E18; E20; E21; E22; E23; O1; O3; O5; O6; O7; O8; O9; O12; O13; O14; O21; O23; S1-S6;
	▪ Reconstruction of wicket gates for Francis turbine TF 1.65/213-13 of units 1 and 2	E6; E17; E18; E20; E21; E22; E23; O1; O3; O5; O6; O7; O8; O9; O12; O13; O14; O21; O23; S1-S6;
	▪ Replacement of hydromechanical and electrical equipment of valve chamber	E2; E17; E18; E20; E21; E22; E23; O1; O3; O5; O6; O7; O8; O9; O12; O13; O14; O21; O23; S1-S6;
	▪ Reconstruction of grout curtain of the dam "Globocica"	E6; E17; E18; O1; O3; O8; O9; O12; O13; O14; O21; O23; S1-S6; S8; S9; S10;
HPP Tikves	▪ Block transformers – replacement	E1; E2; E7; E9; E17; E18; E20; E21; E22; E23; O1; O2; O3; O5; O6; O7; O8; O9; O12; O13; O14; O16; O21; O23; S1-S6;
	▪ Replacement of hydromechanical and electrical equipment of valve chamber	E17; E2; E18; E20; E21; E22; E23; O1; O3; O5; O6; O7; O8; O9; O12; O13; O14; O21; O23; S1-S6;

6.4 Summary of High and Critical Risks

The findings of the site visits and the documentation evaluation allowed FICHTNER/GEING the perception that some of the identified risks have a "high" and others an "extreme" probability of occurring. Examples are the lack of monitoring of the biological minimum flow, or the presence of asbestos and PCBs. Additionally, the significance of the impacts related to these particular risks is in many cases classified as "high" and "extreme" because human life and national parks would be placed in danger in case such risks occur. Consequently, most of the identified negative E&S and H&S risks are prioritized as "high" and some are even considered to be "critical".

In summary, **critical risks** are:

- the biological minimum flow continues not to be monitored as it is not defined in quantitative terms in the related permits; hence, it cannot be verified by the Consultant if the legal requirements are respected. In addition, famers raised their concerns about lack of water for irrigation purposed in the summer months. The rehabilitation program will not change the volumes of water needed, but instead make more efficient use of the available streams. However, with the current operation scheme of the HPPs and without specific efforts of the operator in this direction, the present risk of potential non-adequate biological minimum flow will remain.
- the presence of asbestos and PCBs on site can cause environmental impacts and health problems for the workers and the communities, due to potential contamination by these substances.
- possible rock falls and small landslides activation at intakes system as natural hazards identified in the area of intakes from Sharski Vodi and Gorna Radika can cause injuries of workers or damage of equipment.

In summary, **high risks** are:

- all those risks related to possible water contamination: since the works of the rehabilitation program are to be undertaken in and close to an aquatic environment during normal operation of the HPPs, the significance of any potential water quality impacts caused by accidental spills or leaks is always considered to be "high".
- poor EHS management systems of the HPPs: the document evaluation concluded that training records, specific management plans and monitoring reports are not available on sites at present, and it can be assumed, that employees are little trained or informed about appropriate behavior to reduce personal health risks as well as negative impacts on the environment. Workers from each HPP appeared not to be fully informed about their obligations and responsibilities, which may create risks during the rehabilitation phase, which will be done during normal operation times.
- waste management: poor environmental documentation for all HPPs, especially the lack of documentation regarding waste management (e.g., no signed contracts with authorized companies for handling and disposal of hazardous waste, waste oils, etc.), together with site inspection findings lead to the conclusion that waste management is not satisfyingly implemented on sites. Handling, storage and disposal of waste may pose a risk of potential contamination of soils and water, as well as a health risks to employees, especially for hazardous materials.
- all of those that can cause harm or even loss of life of workers and/or community members (not classified as "critical" because the probability of such risks occurring is classified mostly as "medium"). Lack of knowledge regarding e.g., emergency procedures, or lack of PPE on site may lead to injuries of

workers on site. Faulty or missing equipment, e.g., for firefighting, can lead to major incidents or even loss of life. Unregulated, poor traffic management may cause nuisance but also risks on local communities close to the construction sites.

- High risks are also imposed on workers by the surrounding environment e.g., by encounters with potentially dangerous wild animals. Also, since the terrain is in parts quite steep, the local geography may lead to landslides and rock falls, posing a risk to vehicles on the access roads.

With the preventive and mitigation measures proposed in the related ESMP, the critical and high risks will be reduced to acceptable low level.

The above evaluation does not withstand two important factors:

- the **construction works are limited in time**, leading to the fact that some of the impacts will be of short-term duration (for example, disturbance to local fauna due to noise emissions);
- the risk assessment is made for **pre-mitigation risks and impacts**: the construction contractor and the project owner shall develop management plans to tackle the above-identified risks and impacts; after the plans are available and put into practice, the risks and impacts can be reduced, and some may even become insignificant.

7 Final Considerations

7.1 Conclusion & Outlook

The project "Rehabilitation of six Hydropower Plants (HPP)" encompasses the rehabilitation of the six hydropower plants Vrben, Raven, Vrutok, Spilje, Globocica and Tikves by ESM. The interventions in the Project are exclusively for the replacement or improvement of existing facilities/equipment. The project also involves the renewal of the conductors of a 13.85 km long 35 kV transmission line between the Vrben HPP and Vrutok HPP and the rehabilitation of some water intakes of the water channels/tunnels system. The main goal of the project is to eliminate water losses, improve the dams' safety and improve the installed equipment's performance.

The overall project is initially categorized as Category B+ (substantial risk) due to the location of part of the works in or nearby protected areas (some of the facilities from HES Mavrovo are located within the National Park (NP) Mavrovo and NP Shar Planina, and HPP Tikves is located near the Strict Nature Reserve). The potential impacts of the Project are mainly site specific and mostly reversible and mitigatory measures are needed to prevent, minimize, mitigate, or compensate for adverse impacts and improve environmental performance.

The Project has already defined the main goals of the rehabilitation in each HPP. There is a detailed description of what ESM wants to achieve with each activity provided by ESM, but still there are some doubts about some details and targeted equipment. For example, it is not yet strictly defined which of the intakes will be rehabilitated from the Sharski Vodi system. During the site visits of HPPs and intakes, there were discussions about other ideas for more efficient revitalization of equipment, which indicates the possibility of some changes in project activities. The discussed changes will not have significant impact in overall rehabilitation activities, just will improve some tasks.

It should be emphasized that the planned interruptions in the operation of each HPP will not lead to changes in the present water regime nor to additional water diversion for power generation that could have a negative impact on existing aquatic and terrestrial ecosystems. During the construction there will be no water catchment in the channel and all the water will pass through the water stream.

Taking into consideration that no data were received for the monitoring of the minimum ecological flow in the water streams after the intakes, and based on visual checks during the site visits, it seems that the minimum ecological flow is not maintained in the rivers after the intakes, despite ESM's verbal confirmation that this would be done. The Water Permits for each hydro system oblige ESM to assure a biological minimum flow of 1/10 of the average multi-year flow for each water stream. Specifically for HES Tikves this flow is quantified ($2m^3/s$). For each hydro system, there are specific conditions defined for providing water for irrigation in each accumulation. However, there are no measurements or reporting done to the respective authorities which would allow the Consultant to confirm the same.

During the rehabilitation activities in Mavrovo dam, closure of the local road for a few hours can happen, but the citizens and visitors in that period can use an alternative route.

ESM performs regular water quality monitoring on inlet and outlet of the intakes of the relevant 6 HPPs. Monitoring is carried out by accredited laboratories for sampling and analysis of surface water. According to the received monitoring report for surface water quality the water quality parameters from the inlet of the turbines do not fully comply with the national limit values for surface water quality for the following parameters: pH, dissolved oxygen, COD, nitrites (HPP Vrutok, HPP Vrben, HPP Spilje), turbidity and phosphorus (Tikves Lake) and potassium permanganate demand (HPP Spilje). The monitoring reports provided to the Consultant demonstrate similar levels of the respective measured parameters before and after the HPPs, so it could be concluded that HPPs' activities do not have negative impacts on surface water quality. However, it needs to be mentioned, that hydrocarbons have not been monitored in the past and thus, potential contamination from oil spills or the like are not recorded. In all HPPs and related facilities the existing water drainage systems are collecting the surface run-off water from all areas, which is discharged into the outflow canal of the HPPs without prior treatment; from there the water flows directly into the natural riverbeds. Thus, in case of spillages of hazardous substances there is a risk of surface water contamination. With this respect, hazardous materials and waste management plans and accident/incident and/or emergency preparedness and response plan are required. Monitoring of additional water quality parameters (such as hydrocarbons) shall be done in case of major incidents/ accidents according to the Incident/accident management actions (ESM existing procedures) and based on elaborated Emergency Response Plan.

In terms of biodiversity aspect, related to this project, according to the conducted site visit activities by the project team, the main findings show that no significant type of habitat is registered within the project locations, that could be affected from the project activities for rehabilitation for 6 HPPs. The brown bear, the lynx and the eel have been identified as important and significant species that should not be affected by the implementation of the project activities because:

- The duration of project activities will be limited to day-time hours only and will be short in duration of time. The level of noise will not be significant enough to disturb the animals (brown bear and lynx) to cause them to move away permanently and seek new habitats but will deter them enough to not enter the project site during the works.
- Due to short duration of activities the lynx and the bear will after activities seize re-enter the area to continue with their natural behavior.
- Both animal species, the brown bear and the lynx, inhabit large area of distribution and are normally avoiding encounters with humans. According to the NP Authorities, there are no fixed migration routes or corridors, instead the animals follow potential prey or food sources (seasonal) and/or mating partners within their vast habitats and territories, that also stretch cross-border to Kosovo and Albania.
- The rehabilitation activities will not cause interruption on eel's breeding migration route since both the HPPs Spilje and Globocica are already in operation for decades and the project will not alter the operational conditions nor the civil structures of these HPPs.

The brown bear was registered through the presence of feces in several locations: intake Stirovica, part of a transmission line in NP Mavrovo, intake Proshevce in NP Shar Planina, etc. According to the National Red List of endangered flora and fauna, this species has Vulnerable (VU) status. Also, according to the National Red List of endangered flora and fauna, the lynx is categorized as Critically Endangered (CR). This species was not registered during the field visit as it is a solitary predator with large area of distribution. Its status as rare has been determined by being tracked with a GPS collar (several individuals which were caught and released in the wild by Macedonian Ecological Society in collaboration with

national and international experts for fauna conservation) to gather more understanding of their appearance and movement. The eel, according to the Global Red List of Endangered Species (IUCN) has status of Critically endangered (CR) species. The rehabilitation Project activities will be organized within the ESM facilities in each HPP in shorth time period (one week) and there are no expected impacts on local fauna and above-mentioned vulnerable species.

During the meeting within the premises of NP Mavrovo, with the representatives from NP Mavrovo (14.9.2022), pointed out that the lynx population will not be affected by the implementation of the project activities along the transmission line in NP Mavrovo (section HPP Vrben - HPP Vrutok), taking into consideration the type of project activities (vegetation pruning of higher branches of trees as regular maintenance activity, which is performed on every 3 years period) and their duration (short-term). Also, they clearly stated that the recently introduced young deer population near the relevant transmission line will not be affected by the implementation of the project activities taking into consideration the type of the project activities (vegetation pruning) and their duration (short-term).

In terms of Occupational Health and Safety (OHS), based on the site inspection visit the following findings were identified:

Practically all visited intakes are under the high risk of rock fall caused by the geological structure on site. Protection barriers and concrete structures are in parts already damaged by fallen rocks, which create high risk of injures and accidents for employees and workers on site.

The potential presence of wild animals (e.g., bears, wolves, snakes) at the proximity of the intake areas was mentioned by ESM personnel. which creates a risk of incidents for employees, although it needs to be stated that most of the animals are nocturnal and naturally avoiding interaction with humans.

Minimum security, H&S and sanitary conditions were found to be missing at all facilities, and the provided drinking water by pipe was of bad quality with lots of suspended particles. No adequate fire protection is in place. During the construction works appropriate H&S measures must be ensured by Contractors and ESM, as will be included in the related ESMP.

Occupational H&S management system implementation (e.g., ISO 45001 standards and local requirements) is not at the required level, which can create high risks when construction works are performed during operation times.

Handling and management of hazardous substances was found to be very poor and needs to be improved to avoid environmental and Occupational H&S incidents and accidents.

At the storage area asbestos containing insulation materials (gaskets), stored together with other materials and B and F category asbestos insulation at the overhead line were identified. The risk of exposure of employees to ASMs is high during the rehabilitation works which can result in serious illnesses among the workers who will have direct contact especially with friable asbestos insulation in the poles section of the overhead line.

ESM employees (including management staff) did not seem to have the required level of Occupational H&S procedures knowledge, which may expose all workers in the project certain H&S high risk, as rehabilitation works will be implemented in parallel to the operations.

No waste management and handling procedures are in place. It was announced by ESM, that wastes would be collected and removed by specialized and licensed companies, but no evidence (contract, agreement) has been provided to the Consultant.

Based on the above-mentioned OHS findings and in order to improve OHS requirements (local and international) and to minimize the risks of ESHS performance/compliance the following immediate actions are recommended to be implemented by ESM prior to the commencement of the project:

- Continue to improve implementation of ISO 9001, 14001 and 45001 standards and International ESHS best practices at all HESs under the ESM management and get ESHS compliance required by IFIs prior to the project start. This improvement will concern but not be limited to:
  - regular inspection of firefighting equipment (fire extinguishers),
  - Relevant firefighting means at each working and auxiliary facility,
  - Hazardous materials (oils, lubricants, cylindric gases etc.): proper handling, including storage conditions (ventilation, firefighting means, secondary containments, spill kits, compatibility, labeling, documentation, PPEs), transportation (tools, equipment), regular inspection (storage compatibility, emissions/spills, containment, validity) according to the Material Safety Data Sheets (MSDS),
  - LOTO systems application at least to all high voltage electrical systems (control panels, cables, wires, grids),
  - Wellbeing of workers including the sanitary and hygienic conditions of facilities for workers, including kitchen, toilets, washrooms and rest areas,
  - Full, comprehensive and visible evacuation plans and signs at all HPPs and related facilities,
  - First aid kits and certified for first aid personnel.
- Establish good communication and cooperation with Mavrovo and Shar Planina National Parks authorities and identify their concerns and requirements relevant to the project. Get all required permits and authorization/agreements before rehabilitation activities start.
- Establish the proper hazardous substances and waste headlining systems/procedure for better management. Elaborate and train employees on HazMat and hazardous waste handling. Identify licensed/authorized organizations and establish the contracts for final removal and disposal of hazardous wastes.
- Start the process of Asbestos, asbestos containing materials (ACMs) and PCBs identification at all HESs through the sampling and analysis at licensed laboratories. Identify all ACM and PCB containing materials/substances before the start of the project.

Based on the site visits it could be concluded that all generated waste oils are temporarily stored in separate parts from the storage areas, but there are no storage tanks below the barrels with waste oils and other stored chemicals. Currently, ESM is in the procedure of contracting an authorized Company for collection, transportation and treatment of generated waste oils, as well as for other waste types. No available data for prepared Waste Management Program as requirement from national legislation, taking into account the type of waste and annual quantities generated.

The whole prepared documentation for the Project (ESSRA, SEP, ESMP and ESCP) will be made available to the public. The project documentation will be prepared in English and Macedonian language and be available upon their official approval. Project-related information for persons with disabilities (mainly blind) will also be made accessible (e.g., as a summary lecture available on the homepage of ESM).

Documents will remain disclosed for the period of 30 days. All affected and interested parties can submit a comment on the disclosed project documentation for the period of 30 days.

A Grievance redress mechanism (GRM) will be developed for the project, with tools or forms for monitoring the impacts of the project implementation process in aspect of grievances reported by the affected persons and groups. The PIU will be responsible for managing the grievance process and will register all compliances in the Register. ESM will provide information about the complaints and their processing and the results within the frame of regular (for instance quarterly) reports which will be posted on its website.

The draft version of the ESSRA should, after obtaining the no-objection from KfW, be publicly disclosed on the website of the ESM-PIU and on the websites of the project affected municipalities. After the public hearing and "no objection" by KfW Development Bank a final version should be disclosed.

Although not part of the risk assessment, it is pertinent to highlight the expected significant positive impacts of the project such as an improvement of the current conditions of the energy system of ESM, not only at the local but also at the regional and national level of the country. The meetings of the social study team with several mayors during the missions in Macedonia clearly showed that improved stability of the electricity supply would be highly appreciated by the affected municipalities. The project will significantly enhance the efficiency of the HPP's performance, and thus, meeting the expectations of the local stakeholders. Additional positive social benefits would be that construction helpers, security staff, cleaning personnel, etc. could be recruited locally and for the supply of constructions materials like bricks, timber etc. local suppliers should be considered. Also, water management will be improved on all rehabilitated intakes and HPPs facilities, with optimization of the water usage for electricity production and providing of necessary quantities of waters for other purposes (irrigation, other usage).

From an environmental point of view, the following benefits can be expected: with the new, improved technical equipment, water losses will be reduced and will allow more efficient water utilization considering future changes and potential decrease of precipitation patterns caused by climate change. Replacement of catchments' hydrotechnical equipment will allow for better water flow management and control of the required biological minimum. Dam related activities will reduce water seepage and thus, will reduce water loss further as well will improve dams' stability.

The replacement of the generators and insulators on the overhead line will reduce the risk for employees to be exposed to hazardous substances such as asbestos. The replacement of old transformer will reduce the risk of oil spillages and leaks and thus, reduce potential release of PCBs into the environment.

According to the prepared Study for revitalization of LHPP III phase*, owned by JSC ESM, Skopje, June 2021,* the following benefits are expected from the revitalization project:

- Additional power (capacity)
- Additional production from additionally installed capacity and reduced losses
- Savings of CO_2 from the additional production calculated in accordance with the official documents.

7.2 Recommendations

Based on the performed analysis of all received documents relevant for preparation of the ESSRA report, performed site visits on each HPPs and associate facilities, identified baseline E&S conditions and identified risks and impacts from proposed project activities, mitigation measures to avoid or minimize potential risks and impacts to an acceptable limit are presented in the Environmental and Social Management Plan (ESMP, separate document). In addition, the following recommendations are proposed by the FICHTNER/GEING Project Team to be implemented by ESM:

- continuous monitoring of average multi-year flow for each water stream before the intakes and continuous guaranteeing of the minimal ecological flow (that is 1/10 from the average multi-year flow) in the water streams after intakes for each water stream;
- providing analysis of concentration of PCBs in transformers oils from the external accredited laboratory;
- providing proper and easy access to towers from 35 kV transmission line in NP Mavrovo (the presence of supervisors from NP Mavrovo is obligatory);
- improving OH&S performance of the HPPs employees through ESHS Management System implementation based on ISO 45001, 9001 and 14001 requirements, including Policy, strategy, Management, Monitoring and Action Plans, specific toolbox meetings, ESHS trainings, drills, procedures (PtW, JSA, working on height, confined spaces etc.), reporting and communication, including regular reporting of OH&S performance, accident/incident reporting and Rout Cause Analyses (RCA) etc. according to each construction site, working place and activities to be implemented;
- continuous maintenance of the access roads to the intakes, for safe movement of heavy equipment;
- providing mitigation measures for rehabilitation stone collapses near the intakes;
- providing ACM analysis of poles of generators from accredited laboratory before the project activities (the analysis report should be part of the tender documentation for the Contractor);
- contracting an authorized company for collection of all temporary stored barrels with waste oils, transportation and treatment, as well as for other waste types;
- preparation of Waste Management Program for ESM.

During the rehabilitation activities, the Contractor must fulfill and respect the mitigation measures, proposed in the related project documentation (*ESMP - yet to be prepared and to be added to the final version of this report*) for biodiversity: to prevent noise disturbance, to avoid breeding period of fauna species (from April to June), etc. Also, during the implementation of the project activities, a competent person (e.g. biologist) shall monitor any impacts delivered on flora and fauna near the project locations and propose compensation measures if necessary.

In the future, it is recommended that ESM conducts regular monitoring of the species of flora and fauna characteristic of the project locations, in order to monitor and compare their status, and also to identify any changes in the habitats or ecosystems affected by the operation of the 6 HPPs.

According to the ESSRA requirements for defining the need for further studies, the following studies/plans shall be prepared by ESM as part of the documentation for the Contractor:

- preparation, approval and implementation of Community Safety Plan (for s. Vozarci near Tikves and s. Raven, Recane, Vrben, Vrutok, Mavrovi Anovi for HES Mavrovo) prior start of rehabilitation activities (which should provide maximum safety for local population during project activities

- preparation, approval and implementation of Waste Management Plan (with reuse/recycling, storage, disposal and treatment activities included) prior start up rehabilitation activities
- preparation, approval and implementation of Traffic Management Plan (provide proper transportation of goods and people within project sites, with directions for re-routing the traffic especially at Mavrovo dam)
- preparation, approval and implementation of Hazardous Materials Management Plan (with measures for proper management of hazardous materials: PCBs, asbestos, etc.).

ESM PIU shall use appropriate methods to disclose information about the Project, consult with stakeholders on potential benefits and risks of the planned activities and potential mitigation measures.

The preparation and releasing of Information note/press from the municipalities should be performed also before the start of the project activities with detailed information about the type of rehabilitation activities and their duration (announced via municipalities web pages and municipality boards).

8 References

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- Environmental Impact Assessment Report (Elaborate) for JSC North Macedonia Power plants branch HPP "Raven", by Tehnolab Ltd. Skopje, 2010
- Environmental Impact Assessment Report (Elaborate) for JSC North Macedonia Power plants branch HPP "Vrben", by Tehnolab Ltd. Skopje, 2010
- Environmental Impact Assessment Report (Elaborate) for JSC North Macedonia Power plants branch HPP "Vrutok", by Tehnolab Ltd. Skopje, 2010

Review of ISO documentation of ESM

1. List of procedures according to the implemented ISO 9001
2. List of procedures according to the implemented ISO 14001
3. List of procedures according to the implemented ISO 45001
4. Request for the establishment of a working group for the implementation of the project "Revitalization of 6 GHE – Phase III"
5. ESM Corporative structure
6. Water permit for electricity production of JSC North Macedonia Power plants, branch HPP "Globocica", Ministry of Environment and Physical Planning, UP 1 no. 11-21/16, date 25.09.2017
7. Water permit for electricity production of JSC North Macedonia Power plants branch HPP "Spilje", Ministry of Environment and Physical Planning, UP 1 no. 11-27/16, date 22.03.2018
8. Water permit for electricity production of JSC North Macedonia Power plants branch HPP "Tikves", Ministry of Environment and Physical Planning, UP 1 no. 11-17/16, date 15.03.2017
9. Water permit for electricity production of JSC North Macedonia Power plants branch HPP "Mavrovo", Ministry of Environment and Physical Planning, UP 1 no. 11-17/16, date 15.03.2017
10. Elaboration of the performed geotechnical investigations and testing for rapid flow and spillway at the water station of HPP "Vrutok", by the Faculty of Civil Engineering, Skopje, July 2010
11. Maps of intakes of Sharski vodi
12. Map of intakes of Gorna Radika
13. Map of 35 KV transmission line
14. Laboratory Report for water monitoring no. 538/20 – Water sample taken at inlet of HPP Vrben, by Tehnolab Ltd. Skopje
15. Laboratory Report for water monitoring no. 538/20 – Water sample taken at inlet of HPP Vrben and at outlet of HPP Raven, by Tehnolab Ltd. Skopje
16. Environmental Impact Assessment Study – Project: Revitalization of HPP Spilje, as part of the Project for Revitalization of the 6 large hydro power plants: (HPP Vrutok, HPP Raven and HPP Vrben, HPP Globocica, HPP Spilje and HPP Tikves), II Phase, JSC Macedonian Power Plants, Development and Investment Sector, Skopje, 17.08.2007
17. Environmental Impact Assessment Study – Project: Revitalization of HPP Tikves, as part of the Project for Revitalization of the 6 large hydro power plants: (HPP Vrutok, HPP Raven and HPP Vrben, HPP Globocica, HPP Spilje and HPP Tikves), II Phase, JSC Macedonian Power Plants, Development and Investment Sector, Skopje, 17.08.2007

18. Environmental Impact Assessment Study – Project: Revitalization of Mavrovo Hydro-System (HPP Vrutok, HPP Raven and HPP Vrben), As part of the Project for Revitalization of the 6 large hydro power plants: (HPP Vrutok, HPP Raven and HPP Vrben, HPP Globocica, HPP Spilje and HPP Tikves), II Phase JSC Macedonian Power Plants, Development and Investment Sector, Skopje, 17.08.2007
19. Study for revitalization of large Hydropower plants (LHPP), Phase III, by JSC ESM, Skopje, June 2021
20. Social policy – PVPP Oslomej, JSC Power Plants of North Macedonia – Skopje, September 2019,
21. Strategic Environmental Assessment Report of the draft strategy for energy development in the Republic of North Macedonia until 2040 – Nontechnical summary
22. Ten years network development plan period 2021-2030, Strategic Planning and Development Analyses Unit Connections Unit, MEPSO, Investment and Development Division, October 2020
23. Environmental policies and guidelines, JSC ESM – Skopje according to the ISO 9001:2015, ISO 14001:2015 and OHSAS 18001:2007, 31.05.2021
24. Environmental protection study for the project: Wind Park "Bogdanci stage II", JSC "Powe Plants of North Macedonia", Skopje, 2020
25. Procedure Physical – Technical Security, P-0714-106, Modification: 3
26. Environmental Management Manual, ESM, Skopje, 14.09.2018
27. Project Grievance Form and leaflet
28. Environmental policy according to the ISO 14001:2015, A.D. "Power Plants of North Macedonia", Skopje, January 2020
29. Opinion, no. 11-3621/2, 03.0.2021, Ministry of Environment and Physical Planning
30. Notice of intent to perform the project, Project: Rehabilitation of 6 HPP – III phase (HPP Vrutok, HPP Raven and hpp Vrben, HPP Globocica, HPP Spilje and HPP Tikves), Skopje, July 2021
31. Checklists – Scoping of the Environmental Impact Assessment: Questions about the project characteristics, Project: Rehabilitation of 6 HPP – III phase (HPP Vrutok, HPP Raven and hpp Vrben, HPP Globocica, HPP Spilje and HPP Tikves), Skopje, July 2021
32. Excel table for Replacement of hydromechanical and electrical equipment of valve chamber
33. Excel table for ESSRA project – data and information, Q&A List
34. EIA Report Approval No. 11-7980/2, 18.11.2010, Ministry of Environment and Physical Planning
35. Study for revalorization of Strict Nature Reservoir „Tikves", October 2010
36. Study for revalorization of protected area Mavrovo, Oxfam Italy 2012
37. Study for revalorization of NP Sharr Mountain, Tetovo-Skopje, 2020
38. Draft Management plan NP Shar mountains (2022-2031) Draft Version, July 2022.

9 Annexes

9.1 Key Findings from the Site Visit (12.9.2022 - 16.9.2022)

Date	Institution / Location	Involved Parties / Attendees	Notes	Photo documentation
12.09.2022	Kick off meeting in the premises of ESM in City of Skopje	ESM team: Darko Mickoski - Coordinator (Electricity Production Department); Nevenka Jakimova Filipovska - Deputy Coordinator (Electricity Production Department); Julija Siljanovska – Environmental Engineer; GEING team: Tanja Nikolovska - EIA Expert; Zdravko Andonov - Energy Expert; Jelena Sekulovska - Biodiversity Expert; Fichtner team: Otar Gavasheli - International HPP Expert; Armen Bodoyan - International Environmental Expert;	At the beginning of the meeting, all members of the project teams were introduced and the type of project activities for the rehabilitation of 6 HPPs for III phase was discussed. It was also discussed about the necessary documentation that should be submitted by the ESM team to the GEING and Fichtner teams: ▪ water permits for relevant HPPs ▪ presence of PCBs in the transformer oils and their analysis/monitoring ▪ contracts with licensed subjects for waste management and treatment ▪ certificates for ISO 14001 and ISO 45001 and relevant ISO documentation (procedures, manuals, formulars, etc.) for environmental and OH&S management ▪ environmental and OH&S policy ▪ presence of ACM (asbestos containing material) in HPPs equipment ▪ water quality monitoring of HPPs (before the intake and at the dam/accumulation)	  

Date	Institution / Location	Involved Parties / Attendees	Notes	Photo documentation
			▪ providing a minimum ecological flow ▪ regime of operation of relevant HPPs ▪ fish protection, fish passes, etc. After the meeting, the project teams conducted site visit of the relevant project locations of HPPs.	 Source: photos taken by Fichtner/EcoMosaic team during the site visit at the project locations of 6 HPPs
	HPS (hydropower system) Mavrovo, subsidiary of ESM, located in City of Gostivar/ site visit of total 7 intakes: Proshevce, Kuchibapska river, Vraca 1, Vraca 2, Mazdracha, Dumkovo and Lomnica.	<u>HPS Mavrovo team:</u> Ejup Bekiri - Technical Manager; Tomce Janevski - Head of Civil Department; Zoran Ilievski – Head of Production Department; Zoran Angelov - mechanical maintenance engineer; Ruzica Milosheska Brchioska – electro engineer; Petar Jovanovski – responsible for OH&S issues; Gazmend? <u>GEING team:</u> Tanja Nikolovska - EIA Expert; Zdravko Andonov - Energy Expert; Jelena Sekulovska - Biodiversity Expert; <u>Fichtner team:</u> Otar Gavasheli - International HPP Expert; Armen Bodoyan - International Environmental Expert;	At the meeting the structure of HPS Mavrovo was discussed, which contains three HPPs and one accumulation: HPP Vrutok, HPP Raven, HPP Vrben and Mavrovo dam. The intake system of HPS Mavrovo is called Sharski vodi, which contains a total of 13 intakes. After the meeting, the project teams conducted a site visit in total in 7 intakes: Prosevce, Kucibapska river, Vraca 1, Vraca 2, Mazdraca, Dumkovo and Lomnica.	 

Date	Institution / Location	Involved Parties / Attendees	Notes	Photo documentation
				 Source: photos taken by Fichtner/EcoMosaic team during the site visit at the project locations of 6 HPPs
13.09.2022	HPP Raven, HPP Vrutok, HPP Vrben, intake of Vrutochka river, transmission line (towers near village Rechane and NP Mavrovo) and Mavrovo dam	<u>HPS Mavrovo team:</u> Ejup Bekiri - Technical Manager; Tomche Janevski - Head of Civil Department; Zoran Ilievski – Head of Production Department; Ruzica Milosheska Brchioska – electro engineer; <u>GEING Team:</u> Tanja Nikolovska - EIA Expert; Zdravko Andonov - Energy Expert; Jelena Sekulovska - Biodiversity Expert; <u>Fichtner team:</u> Otar Gavasheli - International HPP Expert; Armen Bodoyan - International Environmental Expert;	A site visit was conducted at: HPP Raven, HPP Vrutok, HPP Vrben, intake of Vrutochka river, transmission line (towers near village Recane and NP Mavrovo) and Mavrovo dam. During the side visit, the following was considered: transmission line (35 kV) where project activities will be performed, intakes, manholes, nearest settlements, identification of the surrounding biodiversity, visit of the body of the Mavrovo dam, etc.	   

Date	Institution / Location	Involved Parties / Attendees	Notes	Photo documentation
				  Source: photos taken by Fichtner/EcoMosaic team during the site visit at the project locations of 6 HPPs
14.09.2022	Premises of NP Mavrovo/Intake Stirovica	<u>NP Mavrovo team:</u> Tomo Gjorgjievski – Head of department of protection; Zafket Veapi – Head of department of sustainable use; Ikmet Ejupi - Protection and control officer; <u>HPS Mavrovo team**:**</u> Tomche Janevski - Head of Civil Department; Zoran Ilievski – Head of Production Department; Gazmend Fetahi – Manager of HPP Raven	At the meeting with the representatives from NP Mavrovo the type of project activities and their duration was discussed. Also, the following issues were considered: ▪ zoning of NP Mavrovo; ▪ adoption of Management Plan of NP Mavrovo ▪ current status of lynx population: During the meeting with the representatives from NP Mavrovo (14.9.2022), it was pointed out that the lynx population will not be affected by the implementation of the	 

Date	Institution / Location	Involved Parties / Attendees	Notes	Photo documentation
		GEING Team: Tanja Nikolovska - EIA Expert; Zdravko Andonov - Energy Expert; Jelena Sekulovska - Biodiversity Expert; Fichtner team: Otar Gavasheli - International HPP Expert; Armen Bodoyan - International Environmental Expert;	project activities along the transmission line in NP Mavrovo, taking into consideration the type of the project activities (vegetation pruning) and their duration (short-term, day-time). ▪ Also, the NP representatives clearly stated that the recently introduced young deer population near the relevant transmission line will not be affected by the implementation of the project activities taking into consideration the type of the project activities (vegetation pruning) and their duration (short-term). ▪ generation of transformer oils from project activities (presence of PCBs) ▪ presence of ACM (asbestos containing material) in HPPs equipment ▪ water quality monitoring of HPPs (before the intake and at the dam/accumulation) ▪ providing a minimum ecological flow ▪ fish protection, fishpasses, etc. After the meeting, the project teams conducted a site visit of Intake Stirovica.	 Source: photos taken by Fichtner/EcoMosaic team during the site visit at the project locations of 6 HPPs

Date	Institution / Location	Involved Parties / Attendees	Notes	Photo documentation
15.09.2022	HPS Crn Drin - HPP Spilje, Debar/HPP Globocica, Struga	HPS Crn Drin team**:** Gligor Jauleski - Head of Electro-Mechanical Maintenance; Marijan Glavicevski – responsible for ISO 14001 for HPP Spilje and HPP Globocica; Slavko Milevski – Safety Manager; Zoran Manojlovic – responsible for environmental issues in HPP Spilje. GEING Team: Tanja Nikolovska - EIA Expert; Zdravko Andonov - Energy Expert; Jelena Sekulovska - Biodiversity Expert; Fichtner team**:** Otar Gavasheli - International HPP Expert; Armen Bodoyan - International Environmental Expert;	At the meeting, the type of project activities for HPP Spilje and HPP Globocica was discussed. Also, the following issues were considered: ▪ Contracts with licensed subjects for waste management and treatment ▪ Certificates for ISO 14001 and ISO 45001 and relevant ISO documentation (procedures, manuals, formulars, etc.) for environmental and OH&S management ▪ Environmental and OH&S policy ▪ Generation of transformer oils from project activities (presence of PCBs) ▪ Presence of ACM (asbestos containing material) in HPPs equipment ▪ Water quality monitoring of HPPs (before the intake and at the dam/accumulation) ▪ Providing a minimum ecological flow ▪ Fish protection etc. After the meeting, the project teams conducted a site visit at HPP Spilje where the following was considered: technical characteristics of each HPP, warehouse facilities, nearest settlements, identification of the surrounding biodiversity, etc.	   

Date	Institution / Location	Involved Parties / Attendees	Notes	Photo documentation
				  Source: photos taken by Fichtner/EcoMosaic team during the site visit at the project locations of 6 HPPs
16.09.2022	HPP Tikves and Tikves dam, Kavadarci	HPP Tikves team: Trajche Tefov – Technical Manager Gjoko Tashev – Manager at HPP "Tikves", Leader of team in: ISO 9001, ISO 14001 and ISO 45001. GEING Team**:** Tanja Nikolovska - EIA Expert; Zdravko Andonov - Energy Expert; Jelena Sekulovska - Biodiversity Expert; Fichtner team**:** Otar Gavasheli - International HPP Expert; Armen Bodoyan - International Environmental Expert;	At the meeting, the type of project activities for HPP Tikves was discussed. Also, the following issues were considered: ▪ certificates for ISO 14001 and ISO 45001 and relevant ISO documentation (procedures, manuals, formulars, etc.) for environmental and OH&S management ▪ environmental and OH&S policy ▪ water quality monitoring of HPPs (before the intake and at the dam/accumulation) ▪ providing a minimum ecological flow ▪ fish protection	 

Date	Institution / Location	Involved Parties / Attendees	Notes	Photo documentation
			▪ presence of protected area – Strict Nature Reserve "Tikves" ▪ usage of ecosystem services (fishing, etc.) ▪ conducting a meeting with relevant stakeholders (NGOs, relevant ministries and municipalities, etc.), etc. After the meeting, the project teams conducted a site visit at HPP Tikves, where the following was considered: technical characteristics of HPP, warehouse facilities, nearest settlements, identification of the surrounding biodiversity, etc.	    Source: photos taken by Fichtner/EcoMosaic team during the site visit at the project locations of 6 HPPs

Date	Institution / Location	Involved Parties / Attendees	Notes	Photo documentation
	Wrap up meeting in the premises of ESM in City of Skopje	ESM team: Dushko Dimitrovski – Senior Supervising Engineer; Nevenka Jakimova Filipovska - Deputy Coordinator (Electricity Production Department); GEING Team: Tanja Nikolovska - EIA Expert; Zdravko Andonov - Energy Expert; Jelena Sekulovska - Biodiversity Expert; Fichtner team: Otar Gavasheli - International HPP Expert; Armen Bodoyan - International Environmental Expert;	During the wrap-up meeting the following issues and key findings were summarized: ▪ analysis of presence of ACM in the HPPs equipment ▪ analysis of presence PCB in transformation oils ▪ review of procedures (ISO documentation) for incidents in accordance with ISO 14001 and ISO 45001 ▪ access to the tower of transmission line near the populated area (especially near village Recane) ▪ proximity to populated areas ▪ providing ecological minimum according to the national legislation ▪ presence of significant flora and fauna within the project sites ▪ conducting a meeting with representatives from NP Sar Planina, etc. After preliminary environmental and social risks assessment from the site visit, the consultant project team will propose appropriate mitigation measures and also will prepare project documentation according to ToR requirements.	 Source: photos taken by Fichtner/GEING/EcoMosaic team during the site visit at the project locations of 6 HPPs

Date	Institution / Location	Involved Parties / Attendees	Notes	Photo documentation
25.10.2022	Zoom meeting with representative from NP Shar Mountain	NP Shar Mountain team: Anela Stavrevska - Panajotova GEING Team: Tanja Nikolovska - EIA Expert; Jelena Sekulovska - Biodiversity Expert; Fichtner team: Melanie Siems – Project Manager Armen Bodoyan - International Environmental Expert;	At the zoom meeting with the representative from NP Shar Planina the following issues were discussed and considered: Description of the main aim of the project, type of project activities and their duration; Presentation of the key findings from the conducted site visit of intakes from Sharski vodi system by GEING and Fichtner team; Presentation of the zones of NP Shar Planina regarding the locations of the visited intakes by Ms. Anela; Restrictions of implementation of project activities within the zones of NP Shar Planina according to national law of nature protection, especially along intake Mazdraca, which is located within the zone of strict protection; Map presentation with sensitive habitats (wet habitats) within the water intakes, especially along intake Mazdraca, which is located within the zone of strict protection etc. The emphasize of the meeting was one of the main challenges for recently proclaimed NP Shar Planina that need to be solved: Providing ecological flow or biological minimum of water intakes from Sharski vodi system: Ms. Anela pointed out that this is one of the main issues within the	No photos from zoom meeting. The main information on the NP Shar Planina can be found at https://www.moepp.gov.mk/%d0%b4%d0%b0-%d1%98%d0%b0-%d0%b7%d0%b0%d1%87%d1%83%d0%b2%d0%b0%d0%bc%d0%b5-%d1%88%d0%b0%d1%80%d0%b0/

Date	Institution / Location	Involved Parties / Attendees	Notes	Photo documentation
			NP Shar Planina, that need to be solved in near future, in order to provide: 1) water quantities needed for water supply and irrigation near Polog valley; and 2) water quantities needed for wet habitats along the intake Mazdraca. Also Ms. Anela pointed out that a methodology for determination of ecological flow of water intakes within Sharski vodi system, is in ongoing preparation by NGO "Ekosvest"; To establish a mechanism for good cooperation and communication with JSC ESM: This can be achieved through Protocol for cooperation with stakeholders (e.g., PE National Forests of RNM) prepared by ESM, which will specify how and in what way activities related to the maintenance of the existing infrastructure of Sharski Vodi of ESM will be carried out. Ms. Anela said that this type of document is existing and has not been yet shared with them; High risk of landslides: Ms. Anela confirmed that nowadays she and her colleagues faced with this type of risk on their regular site visit at NP Shar Mountain; Lack of finances for proper functioning of NP Shar Planina: The NP Shar Mountain receives financial resources mainly from own budget, etc.;	

Date	Institution / Location	Involved Parties / Attendees	Notes	Photo documentation
			Main mitigation measures and recommendations for the project activities relevant for NP Shar Mountain, by Fichtner/GEING expert team will be given in ESMP for rehabilitation of 6 HPPs.	

9.2 Water Permits for HPP Globocica, HPP Mavrovo, HPP Spilje and HPP Tikves (only cover page)

Република Македонија
Министерство за животна средина
и просторно планирање

СЕРТИФИКАТ
МКС EN ISO 9001:2009

АКЦИОНЕРСКО ДРУШТВО ЗА ПРОИЗВОДСТВО НА ЕЛЕКТРИЧНА ЕНЕРГИЈА ЕЛЕКТРАНИ НА МАКЕДОНИЈА ВО ДРЖАВНА СОПСТВЕНОСТ СКОПЈЕ
Примено: 27-11-2017
Орг. Един. 08 | Број: 6662/1 | Прилог: | Вредност:

Република Македонија
Министерство за животна средина и просторно планирање

Бул."Гоце Делчев" бр.18,
1000 Скопје,
Република Македонија
Тел. (02) 3251 400
Факс. (02) 3220 165
Е-пошта:
infoeko@moepp.gov.mk
Сајт: www.moepp.gov.mk

УП1 бр 11-21/16
Дата: 25. 09. 2017

ДО: АД Електрани на Македонија
Ул. 11 Октомври, 9
1000 Скопје

Предмет: Доставување на решение за Дозвола за користење на вода за производство на електрична енергија

АКЦИОНЕРСКО ДРУШТВО ЗА ПРОИЗВОДСТВО НА ЕЛЕКТРИЧНА ЕНЕРГИЈА, ЕЛЕКТРАНИ НА МАКЕДОНИЈА, ВО ДРЖАВНА СОПСТВЕНОСТ, СКОПЈЕ
ПОДРУЖНИЦА ХЕС ЦРН ДРИМ - СТРУГА
Примено: 24. 11. 2017
Орг. Един. | Број: 08-968/1 | Прилог: | Вредност:

Почитувани,

Во прилог на овој допис, Ви го доставуваме Решението за издавање на Дозволата за користење на вода за производство на електрична енергија на Хидроцентрала „Глобочица" со придружните објекти.

Со почит,

МИНИСТЕР

Sadulla Duraki

Изработил: Љупка Д. Зајков
Одобрил: Илбер Мирта
Согласен: Билјана Зефиќ
в.д. директор на УЖС

Во прилог: Дозволата со бр. УП1 бр.11-21/16

ЕЛЕМ
ЕЛЕКТРАНИ НА МАКЕДОНИЈА

АКЦИОНЕРСКО ДРУШТВО ЗА ПРОИЗВОДСТВО НА ЕЛЕКТРИЧНА ЕНЕРГИЈА, ЕЛЕКТРАНИ НА МАКЕДОНИЈА, ВО ДРЖАВНА СОПСТВЕНОСТ, СКОПЈЕ
ПОДРУЖНИЦА ХЕС ЦРН ДРИМ - СТРУГА

АД ЕЛЕКТРАНИ НА МАКЕДОНИЈА - СКОПЈЕ, ДИРЕКЦИЈА

Примено: 27. 03. 2018			
Орг. Един.	Број:	Прилог:	Вредност:
09	404/2		

3-553-101.01

02-1583/2
26.03.18

До
Подружница ХЕЦ „Црн Дрим" - Струга
Струга

Предмет: Достава на Дозвола за користење на вода за производство на електрична енергија за ХЕЦ „Шпиље"

Почитувани,

Во прилог на овој допис Ви ја доставуваме Дозволата за користење на вода за производство на електрична енергија и управување со браната и деривационата хидроцентрала „Шпиље"со придружните објекти од 23.06.2017 година, која е со важност од 6 (шест) години.

Прилог: Оригинален примерок од Дозвола за користење на вода за ХЕЦ „Шпиље"

Изработил:
Контролирал/Одобрил:

ГЕНЕРАЛЕН ДИРЕКТОР
Д-р Драган Миновски

АКЦИОНЕРСКО ДРУШТВО ЗА ПРОИЗВОДСТВО НА ЕЛЕКТРИЧНА ЕНЕРГИЈА ЕЛЕКТРАНИ НА МАКЕДОНИЈА ВО ДРЖАВНА СОПСТВЕНОСТ СКОПЈЕ

КО:
- Сектор за производство на електрична енергија
- Сектор за развој
- Архива

ЕЛЕМ
ЕЛЕКТРАНИ НА МАКЕДОНИЈА

АД ЕЛЕКТРАНИ НА МАКЕДОНИЈА - СКОПЈЕ, ДИРЕКЦИЈА

3-553-101.01

Архивски знак: _____
Рок на чување: _____ год.
26-03-2018 201___ година
Потпис, _____

02-1582/2
26-03-2018

До
Подружница ХЕС „Маврово" - Гостивар
Гостивар

Предмет: Достава на Решение за Дозвола за користење на вода за производство на електрична енергија за ХЕС „Маврово"

Почитувани,

Во прилог на овој допис Ви доставуваме Решение за Дозвола за користење на вода за производство на електрична енергија од акумулацијата Маврово и Шарски води и употреба на брана Маврово и брана Леуново, деривационите хидроцентрали ХЕЦ Врутоk, ХЕЦ Равен и ХЕЦ Врбен со придружните објекти од 22.03.2018 година, која е со важност од 10 (десет) години.

Прилог: Оригинален примерок од Дозвола за користење на вода за ХЕС „Маврово"

Изработил:
Контролирал/Одобрил:

ГЕНЕРАЛЕН ДИРЕКТОР
Д-р Драган Миновски

КО:
- Сектор за производство на електрична енергија
- Сектор за развој
- Архива

...

Република Македонија
Министерство за животна средина
и просторно планирање

Архивски број:
Рок на чување: год.
201 година
Потпис,

МКД СЕРТИФИКАТ
МКС EN ISO 9001:2009

Република Македонија
Министерство за животна средина и просторно планирање

Бул."Гоце Делчев" бр.18,
1000 Скопје,
Република Македонија
Тел. (02) 3251 400
Факс. (02) 3220 165
Е-пошта:
infoeko@moepp.gov.mk
Сајт: www. moepp.gov.mk

Архивски бр. УП1 бр. 11-17/2016
Дата:
15. 03. 2017

АКЦИОНЕРСКО ДРУШТВО ЗА ПРОИЗВОДСТВО НА ЕЛЕКТРИЧНА ЕНЕРГИЈА ЕЛЕКТРАНИ НА МАКЕДОНИЈА ВО ДРЖАВНА СОПСТВЕНОСТ СКОПЈЕ
Примено: 21-03-2017
Орг. Един. | Број | Прилог | Вредност
09 | 1681/1 | |

До
АД ЕЛЕКТРАНИ НА МАКЕДОНИЈА,
во државна сопственост Скопје
Дирекција
Ул 11 Октомври бр.9
1000 Скопје

Предмет: Доставување на решение за издавање на Дозвола за користење на вода за производство на електрична енергија

Почитувани,

Во прилог на овој допис, Ви го доставуваме Решението за издавање на Дозвола за користење на вода за производство на електрична енергија од река Црна и употреба на браната ХЕЦ Тиквеш, акумулацијата Тиквеш со придружните објекти на локалитет КО Драдња на КП 17 и КП 19, општина Кавадарци, Вардарско сливно подрачје

Со почит,

МИНИСТЕР
Bashkim Ameti

Изработил: Снежана Мартулкова
Одобрил: Илбер Мирта
Согласен: Даниел Ефтимов
в.д. Директор на УЖС

Прилог: Решение бр. УП1 бр. 11-17/2016

9.3 Opinion from the MoEPP that EIA Report is not needed for the Project (Archive nr. 11-3621/2, 3.8.2021)

Letter head: Ministry of Environment and Physical Planning

Administration of Environment

Archive nr. 11-3621/2

Date: 03.08.2021

Recipient: JSC ESM

Subject: Opinion

Reference to: your number 08-3141/1 from 13.07.2021

In relation to the Information from your side concerning project implementation nr. 11-3621/1 from 13.07.2021 which concerns the Project: "Revitalization of the 6 big HPP's Phase 3 (HPP Vrutok, HPP Raven, HPP Vrben, HPP Globochica, HPP Spilje and HPP Tikves) in the municipalities Gostivar, Debar, Mavrovo and Rostusha, Struga and Kavadarci and for the needs of the Investor JSC ESM from Skopje, the Administration of Environment from the Ministry of Environment and Physical Planning is submitting its following:

OPINION

In accordance with the "Law on Environment" (Official Gazette of the Republic of Macedonia nr. 53/2005, 81/2005, 24/2007, 159/2008, 83/2009, 48/2010, 124/2010, 51/2011, 123/2012, 93/2013, 187/2013, 42/2014, 44/2015, 129/2015, 192/2015, 39/2016 and 99/2018) and in accordance with the "Decree determining the projects and criteria on the basis of which the requirement for environmental impact assessment procedure is established" (Official Gazette of the Republic of Macedonia nr. 74/2005, 109/2009, 164/2012, 201/2016, in accordance with the "Decree on the activities for which an Elaborate must be prepared and whose approval depends on the competent authority for performing professional activities in the field of environment" (Official Gazette nr. 80/2009 and 36/2012), for the abovementioned project, Elaborate for Environmental Protection is not needed.Administration of Environment

Director

Hisen Xhemaili

9.4 Letter from MoEPP about nearest protected areas relevant for the Project (Archive nr. 11-6400/4, 23.9.2022)

Република Северна Македонија
Министерство за животна средина и просторно планирање

Republika e Maqedonisë së Veriut
Ministria e Mjedisit Jetësor dhe Planifikimit Hapësinor

УПРАВА ЗА ЖИВОТНА СРЕДИНА - DREJTORIA PËR MJEDIS JETËSOR

СЕКТОР ЗА ПРИРОДА - SEKTORI I NATYRËS

Арх. Бр./Nr.Arh. 11-6400/4

Дата/Data: 23-09-2022 г./viti

ДО/DERI TE: ЕКОМОЗАИК ДООЕЛ

Ул. Бриселска бр.4а

1000 Скопје

ПРЕДМЕТ/LENDA: Известување

Почитувани,
I nderuar,

Во врска со доставениот допис со акт бр. 11-6400/1 од 22.08.2022 година доставено од страна на ЕкоМозаик ДООЕЛ од Скопје кое се однесува на барање на податоци и информации за 6 постоечки ХЕЦ Врбен, Равен, Вруток, Шпиље, Глопочица и Тиквеш НП Маврово, Република Северна Македонија.
Секторот за природа при Управата за животна средина како орган во состав на Министерството за животна средина и просторно планирање од аспект на своите надлежности од областа на заштита на природата и увидот на доставената документација, Ве известува за следното:

Врз основа на приложената документација од Ваша страна – мапа со финално усвоени граници на НП Маврово и мислењето од страна на Службата за просторен информативен систем (допис бр. 16-6400/3 од 13.09.2022), констатирано е дека ХЕЦ Врбен е во НП Маврово во предложена зона за одржливо користење, ХЕЦ Глобочица е внатре во предложено подрајче за заштита Јабланица а останатите предметни ХЕЦ (Равен, Вруток, Шпиље и Тиквеш) се надвор од границите на заштитено подрајче во Република Северна Македонија.
Со почит,
Me respekt

Управа за животна средина/Drejtoria për mjedis jetësor
Директор /Drejtor
Hisen Xhemaili

Изработил/Përpiloi: Isuf Fetai
Контролирал/Kontrolloi: м-р Сашка Јорданова
Одобрил/Aprovoi: М-р Влатко Трпески

[i] During the virtual meeting, presentation of the zones of NP Shar Planina regarding the locations of the visited intakes was performed by Ms. Anela, representative from NP Shar Planina. Three types of zones were presented: zone of strict protection (marked with dark green color), zone of active management (marked with medium light green color) and zone of sustainable use (light green color). From all visited intakes, she pointed out the location of the intake Mazdraca, which is located within the zone of strict protection. Also, as sensitive biodiversity issue she presented the location of sensitive habitats (wet habitats, which were marked with red color), within the water intake Mazdraca. According to national law of nature protection, the implementation of project activities within the zone of strict protection of NP Shar Planina, especially along intake Mazdraca, are restricted. The main conclusion on this issue was given that the functioning of the Sharski Vodi system is of national interest for electricity production based on water flow, access for maintenance and rehabilitation of its infrastructure is allowed with a permission of MoEPP and National Park administration.