TERMS OF REFERENCE

RESERVOIR IN THE KIKE-KREMENATA SYSTEM
Phase 1: Site investigations and Basic Design

BACKGROUND

The Government of Kosovo has applied for a credit totaling EUR 40 million from the International Development Association (IDA), to finance the Kosovo Fostering and Leveraging Opportunities for Water Security (FLOW) Project.
The Ministry of Environment and Spatial Planning (MESP) has overall responsibility for the Project and is responsible for the implementation of the Project through its Project Management Team(PMT).

The objective of the Project is to strengthen national capacity for managing Kosovo's water resources for water security, and in selected basin areas, improve integrated land and water resource management practices and services, in a resilient manner. The programmatic approach is built around two pillars of a) foundational measures for long-term transformation and b) catalytic investments that address the immediate investment needs, deliver implementation lessons and catalyse additional integrated interventions in water security.

The project will implement both the basin specific investments as well as the national investment planning. It includes a number of activities and implement investments that show readiness and are proof-of-concept and/or provide learning opportunities. The project will be flexibly designed to adapt to priorities emerging from the basin planning process, and overall support water security, climate change adaptation and preparing investments for future programmatic and larger scale investments. A number of activities that are best approached through civil society initiatives and private sector (a number of activities related to agro-environment, watershed, water-saving, afforestation, irrigation efficiency improvements, tourism) will be supported through targeted and mainstreamed grant financing and sub-projects.
These Terms of References describe the requirements for studies for the realization of the multipurpose reservoir; Phase 1: covering site investigations at both Kremenate and Desivojce sites and preparation of a Basic Design for the preferred alternative

CONTEXT

Based on the Law on Water and the policy of the Ministry for the construction of hydro-technical works for drinking water supply, the idea was presented of designing and building a multipurpose reservoir to:

- supply drinking water to the city of Kamenica and beyond,
- protect against floods,
- supply water for irrigation of agricultural lands in the municipality of Kamenica,
- use of water for economic purposes, recreation and industry

The idea for the study of this project stemmed from the Master Water Plan and the document Kosovo Water Hydro economics of 1985 and other strategic water documents.
Based on the terrain topography and terrain reconnaissance in the Desivojca River Basin, three alternative sites for the realization of a water reservoir were identified:

i. Kremenate,
ii. Desivojce, and

iii. Hogosht.

The following map illustrates the location of the three sites.

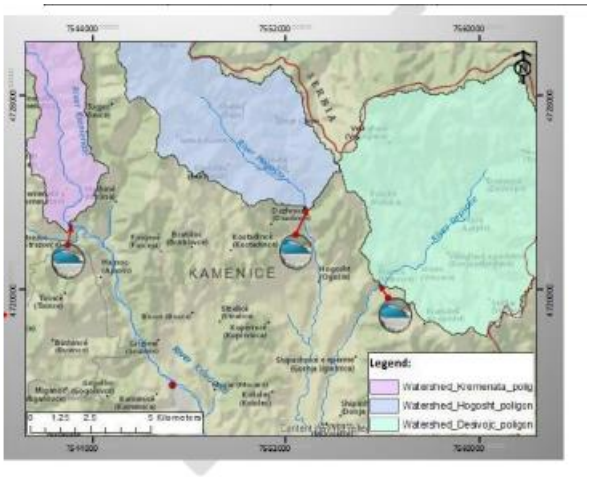

Figure 1 - Abstract for the presentation of Engineer. Mr. Shigeri .Dermaku, MSc titled "Hidrosistemi "Kike Kremenata"

Table 1 – proposed dams and reservoirs

DAM	Height	Water Catchment Area	Water Accumulated
Hogosht	44m	47km^2	8,987,760 m^3
Kremenata	52m	52km^2	10,170,360 m^3
Desivojce	55m	77km^2	14,900,760 m^3

The 1985 Master Plan had identified Kremenate as the preferred option, and a feasibility study was prepared for a dam at that site.
In the year 2019, a MESP's Consultant carried prepared two reports on:

- Review of the 1984 Detail Design of Kremenata Dam, and
- Environmental and Social Impact Assessment (ESIA) of the Kremenata Dam and its auxiliary facilities

The ESIA recommended considering also the Desivojce site, mainly for two reasons:

i. The catchment area of Desivojce is greater than the one of Kremenate, suggesting larger water flows, and
ii. The feasibility study of 1985 needs to be significantly updated to reflect actual society demands, environmental aspects, and dam engineering developments.

As a result, Kremenate and Desivojce sites are being regarded as the two alternatives for the realization of the water reservoir. Hogosht could be considered at a later stage of development

For planning strategy and financial reasons, the preparatory studies for the realization of the multipurpose reservoir will be done in two phases:

- Phase 1: covering site investigations at both Kremenate and Desivojce sites, and preparation of a Basic Design of the preferred alternative.
- Phase 2: additional site investigations at the preferred site, final design, preparation of tender documents for the construction contract, construction supervision.

The present document contains the terms of reference (ToR) of Phase 1.

SCOPE OF WORK / DESCRIPTION OF TASKS

Scope of work of Phase 1 includes the following tasks:

- Task 1 - Basic studies to levels adequate to inform a basic design:
  i. Topography,
  ii. Hydrology,
  iii. Geology and seismicity,
  iv. Environmental and Social.
- Task 2 - Site investigations at Kremenate and Desivojce sites.
- Task 3 - Basic design of the selected dam alternative (Kremenate or Desivojce).

- **Task 1 - Basic studies**
  i. *Topography*

Survey works should cover the dam site and appurtenant works over an area of about:
53 Ha, for Kremenate site, and 77 Ha, for Desivojce site. Surveying the reservoir area up to the proposed dam crest elevation. Field survey works shall be carried out including and specifying locations and dimensions of all public or private installations, facilities, or properties within the storage reservoir using modern field survey instrument such as Total Station. The level of the topographic survey details should be sufficient to prepare the basic design of the dam works, as well as drawing the stage-storage capacity curves of the reservoir at each (1) m interval of height. Contour mapping of the proposed dam reservoir at (1:2500) scale. Drawing cross-sections of the dam axis up to the level of the crest elevation at scale (1:500). The topographic survey completed data and the terrain shape data model shall be used to prepare the storage capacity and the corresponding surface area curves of the dam reservoir at different water heights (at 1 m intervals). At least (4) Benchmarks (reference points) shall be established at site: (1) point each on left & right abutments and (2) points on the dam axis. Geographical coordination and elevations of the benchmarks shall be identified & recorded. These points would be used in any future surveying works. Field surveying should be carried out using advanced surveying devices such as the Total Station and the Global Positioning System (GPS). Accuracy should be achieved with error rate not exceeding 0.1%, according to the global projection system (UTM) and Geographical (WGS1984). The data of each surveyed point should be recorded and presented in the form of a spreadsheet table (Excel) such as the point, its coordinates, the elevation of its location (Elevation) measured above sea level, and the date of the survey. An advanced engineering software program such as AutoCAD or Surfer program should be used to draw the resulting spatial grid, as well as a contoured map that shows the change in the terrain of riverbed with flow direction on the map. Cross-Sections of the river shall be drawn with a scale (1: 100) vertical and (1: 500) horizontal, over a distance of 2 km downstream of the dam site, to clarify the details of the changes in the topographical form of the water course. Topographic maps of the dam site should be presented in the final report.

ii. *Hydrology*

The following documents contain a review of the available hydrological data:

a. Review of the 1984 Detail Design of Kremenata Dam, and
b. Environmental and Social Impact Assessment (ESIA) of the Kremenata Dam and its auxiliary facilities

The Consultant should update and integrate such data, as appropriate to inform the selection of the preferred dam site, and to prepare the basic design of the preferred alternative.
The hydrological study shall include the following tasks.

i. General hydrological characteristics of the river basin (see references a) and b) above).
ii. Climatic characteristics, precipitation analysis.

iii. River flow analysis using statistical rainfall data, calibrated with flow gauging station data. to define the rainfall event characteristics. Outputs shall be average daily inflows, averages monthly inflows, and averages of annual inflows to the dam sites.
iv. Flood analysis for dimensioning the discharge works. Outputs shall be peak river flows (with probability P = 0.01%, P = 0.1% P = 1% and P = 5%), and corresponding volumes of the flood wave
v. Probable Maximum Flood assessment.
vi. Sediment yield assessment, from the catchment area to the reservoir.

The basic information for the sedimentation study will be derived from measured accumulation of sediments in other reservoirs. Should such information be inadequate, the consultant shall carry out bathymetric surveys at selected reservoirs which are deemed representative of the Kremenate and Desivojce river basins. Representativeness will be based on land use mapping (e.g., using Google maps or similar). Sedimentation assessment should inform the decision to include, in the basic design, control devices for managing the sedimentation process in the reservoir and downstream the dam.

iii. *Geology and seismicity*

Geology

The 2019 Review of the 1984 Detail Design contains geological information on the Kremenata alternative.

Annex A, herein, outlines geological features of the Desivojce alternative.

The Consultant shall review such information and validate it with desk reviews and filed surveys, as necessary to frame the site investigations and inform the comparison of the two alternatives.

The geological study, supplemented by the results of site investigations, shall aim at:

- Identifying geological hazards i.e., geological features that may negatively affect successful construction and operation of the dam; the table provides examples of geological hazards.

Potential Geological Hazards	
Open rock mass joints	Active faults
Highly weathered rock	Liquefiable soils
Shear zones from ancient landslides or faults	Artesian pressure
Fissured clays	Highly compressible or dispersive soils
Tension cracks	

- Providing the geological framework for the characterization of the geotechnical properties of the dam site to inform the basic design of the dam.
- Identification of the potential sources of material for dam's construction (clay, gravel, sand and rock).
- Assessing stability of the reservoir rim's slope stability and reservoir water tightness.

Based on geological studies, the Consultant should also assess the implications of the mineralogical composition of the terrain on water quality for drinking water supply.

Seismicity

In Phase 1, seismicity assessment of the two dam sites shall be based on:

- regional geology,
- seismic history,
- local geology.

The Consultant shall carry out a preliminary seismic hazard assessment to recommend seismic design parameters for dam design:

- OBE, Operating Basis Earthquake: level at which little or no damage is expected, and,
- SEE, Safety Evaluation Earthquake: earthquake that produces the maximum level of ground motion to which the dam must be designed to resist. Under such loading, the dam must not suffer catastrophic failure or uncontrolled release of its reservoir that presents a life safety risk downstream; significant damage to the dam or economic loss may be tolerated.

The Consultant shall also advise on active faults crossing the dam site and/or the reservoir area.

iv. Environmental and Social

In the year 2019, a MESP's Consultant carried prepared an Environmental and Social Impact Assessment (ESIA) of the Kremenata Dam and its auxiliary facilities.

In Phase 1, a preliminary ESIA should be prepared also for the Desivojce alternative, the extent of which should be adequate to compare the two alternatives also on environmental and social grounds. To that aim, the "Site Sensitivity" criterion shall be used as defined in the following table.

	Site Sensitivity Level		
Topic	Low	Moderate	High
Natural habitats			
Forestry			
Land use and involuntary resettlement			
Physical cultural property			
Vulnerability to natural habitats			
Community health and safety risks			

The 2019 ESIA for Kremenata Dam provides elements for assessing the site sensitivity level. In the case of Desivojce, the elements illustrated in the following table shall be assessed to provide a comparative basis with Kremenata, in terms of site sensitivity level.

Project location	**Sensitivity of issues**	**Nature of potential impacts**	**Magnitude of impacts**
In or near sensitive and valuable ecosystems	Forest modification	Irreversible destruction or degradation of natural habitats and loss of biodiversity or environmental services of ecosystems	Absolute quantity of resource or ecosystem affected
In or near such as archeological or historic sites	Wetland conservation	Health risks	Amount affected in relation to existing reserves
Densely populated areas: resettlement, pollution impacts	Affecting protected sites or areas	Lack of effective mitigation measures	Intensity, frequency, and duration
Areas with conflicts over rights to natural resources	Appropriation of land		Probability of occurrence

Hydrologically important areas, replenishment of aquifers, watersheds of dams.	Impacts on international waterways		Cumulative impacts
Lands or waters with valuable resources (fishery, minerals, high agricultural value)	Transboundary issues		

- **Task 2 - Site investigations at Kremenate and Desivojce sites**

The Consultant is expected to nominate a qualified sub-contractor for the execution of the site investigations.

The following elements should be considered:

- Kremenate site was already investigated in 1984, and results are presented in the 2019 Review, hence it is expected that only incremental investigation will be carried out at Kremenate.
- Desivojce site has never been investigated, hence the extent of the investigations is expected to be larger than at Kremenate.
- The investigation level should be adequate to compare the two alternatives, and to provide sufficient information for the basic design of the selected alternative.
- In Phase 2, an additional site investigation campaign will be carried out, at the selected dam site, for detailed design purposes.

The investigations should characterize the following elements for basic design purposes:

- Dam foundations, including depth to rock, degree of weathering, rock mass joint pattern, groundwater levels, rock mass permeability, slope stability.
- Availability of construction materials, location of potential quarries for impervious soils, aggregates, sand, rock; based on mineralogic criteria, assess risk of alkali-aggregates reaction phenomena.
- Route of access to dam sites, with particular reference to slope stability.
- Reservoir slope stability and water tightness, mainly based on geological surveys.

The site investigation and laboratory tests, necessary for achieving the above-described objectives shall be carried out in two phases:

- Phase 1: Basic Design, object of the present ToR, and
- Phase 2: Tender-Base Design of the selected dam alternative.

The following table illustrates a minimum scope of work for Phase 1, to be adapted to each dam site.

Scope of Work	**Unit**	**Quantity**
Clear vegetation on dam footprint to expose ground surface for geological mapping.	ha	5
Geological mapping of dam footprint, showing soil/ rock types, degree of weathering, rock discontinuities (stereo nets, opening and infilling of prevalent discontinuities).	Sum (Euro)	50,000
Geophysical surveys campaign on the dam site. Seven seismic refraction profiles.	m	2,000
Excavate two trial trenches (one in each abutment)	m3	1,000
Laboratory tests on soil/ weathered rock: 5 grading curves, and Atterberg tests on fines.	Sum (Euro)	50,000
Rock joint survey and structural mapping, classification of degree of weathering in trial trench exposures.	sum	100,000
Two boreholes, with core recovery and water pressure tests, each site, from crest elevation, depth 60m. Core logging.	m	120

Laboratory tests on core samples: 10 unit weight; 30 Point Load; 10 UCS; 10 Los Angeles abrasion.	Sum (Euro)	20,000
Field reconnaissance of potential quarries for construction materials	sum (Euro)	10,000

Bidders shall price the minimum program and, separately, those additional tasks they deem essential to inform the Feasibility Report.
Bid evaluation will be based on the price of the minimum program. The additional tasks, if any, will be considered by the Employer who may decide to revise the program, as deemed appropriate, at the beginning of the consulting services.

- **Task 3 - Basic design of the selected dam alternative (Kremenate or Desivojce)**

Decision workshop: dam site

The Consultant will present the results of the basic studies and of the site investigations in a decision workshop on the preferred dam site option: Desivojce or Kremenate.
The presentation will rationalize the dam types recommended at each site and outline comparative analysis (E&S sensitivity, Technical, Financial criteria) to inform the decision. The presence of the Panel of Experts is highly desirable in the workshop.
The Consultant will then proceed with the Basic Design of the selected dam site.

Draft Basic Design

The Basic Design shall contain the elements necessary to understand the technical solution, including basic studies and design calculations, and to produce a preliminary cost estimate of the capital investment.
As a minimum, the basic design should contain the following elements:

- Report on studies and investigations,
- Preliminary Design drawings,
- Design report,
- Preliminary bill of quantities and cost estimate,
- Current cost uncertainty and contingency allocation.
- Terms of reference for Phase 2 investigations.

Decision workshop: contractual system

The above elements will be presented, in draft, to a second decision workshop in which the preferred contractual implementation system will be deliberated:

- Either “Employer’s Design”, or
- “Design & Build”.

The chosen system will determine the level of detail of the tender-base Design. The presence of the Panel of Experts to this second decision meeting is highly recommended.

Final Basic Design

The final task of Phase 1 Consultant will be the preparation of the Final Basic Design of the selected dam alternative. The above listed elements will be updated as necessary and the ToR for the preparation of the Tender-base Design added. The level of detail of the Tender-base Design will consider the chosen contractual system for project implementation.

- **REPORTING REQUIREMENTS AND TIME SCHEDULE FOR DELIVERABLES**

Based on the present ToR, the Consultant shall prepare a method statement for project implementation and submit it with its response to the bid. Methodology will be assessed for:

- Responsiveness to ToR,
- Scheduling and sequencing of tasks,
- Resource allocation,
- Site investigations program, and nominated subcontractor for its execution.

In the course of the assignment, the Consultant is expected to submit the following reports.

Draft Basic Design and First Decision workshop	**Second Decision Workshop and Basic Design**	**Timing**
Report on studies and investigations	Design report (studies, investigations, description of the proposed solution, geotechnical, hydraulic, and structural calculations)	End of Month 6
Comparative analysis (E&S, Technical, Financial criteria) of the two alternatives	Design drawings (to a level adequate to derive meaningful quantities of the works)	End of Month 6
Current cost uncertainty and contingency allocation	Bill of quantities and cost estimate (including recommendations on contingency allocation)	End of month 7
Draft scope of work for Phase 2 investigations	ToR for the preparation of the Tender-base Design (based on the chosen contractual system)	End of month 7

- **QUALIFICATION REQUIREMENTS FOR EVALUATION**

The Consultant is expected to fulfill the following minimum requirements:

- At least 10 years of operations proven by evidence/registration from business registry. This is applicable for each member in case of a consortium.
- The Consultant and/or any of the consortium members must have at least 10 years of experience working in dam planning, design and dam construction supervision.
- At least one assignment executed successfully in the last ten (10) years and related to one of the activities: feasibility study, preliminary design, detail design and tender dossier preparation, supervision of site investigations and dam construction works, dam safety management, instrumentation and monitoring for dams and underground works at comparable scale of the requested assignment.

The shortlisting evaluation criteria are:

Criteria	**Weight**
Consultant profile and background	30%
List of assignments executed in the last ten (10) years and related to one or more of the activities: feasibility study, preliminary design, detail design and tender dossier preparation, supervision of site investigations and dam construction works, dam safety management, instrumentation and monitoring for dams and underground works. (Dam height approx. 40 meters)*	70%

*Previous experience equivalent to 70%-80% of the size of the requested assignment.

Successful Consultant must register in Kosovo as a condition for contract signature according to the legislation, or in case of a consortium, at least one of the members of the consortium must be registered in Kosovo.
The Consultants' Staff CV are NOT subject to evaluation at the shortlisting stage

Consultant will be selected in accordance with the procedures set out in the World Bank's Guidelines: Procurement Regulations for Investment Project Financing (IPF) Borrowers, July 2016, revised Nov 2017, according to selection based on Quality and Cost Base Selection (QCBS) method.

TEAM COMPOSITION

The firm shall assemble a multi-disciplinary team of professionals. Staff for all positions should be fluent in both spoken and written English and have basic computer and common software usage skills.
The key positions are shown in the following table, along with the minimum years of relevant experience.
As a minimum, the Project Manager and the Dam Specialist should be permanent staff of the consultant.
The following table describes the minimum qualifications and skills of the Consultant's Team. For each expert listed in the table, the firm will provide qualification and curriculum vitae.

Expert	Qualifications	Skills
Key expert 1 - Team Leader	Master's degree in Civil Engineering	The Expert shall have expertise in carrying out feasibility, preliminary design, and detailed design studies for dam projects, with demonstrated project management skills, with at least **15** years of experience in the mentioned areas. Experience as Team Leader in assignments of similar scope related to the feasibility study, design and tender dossier preparation or works supervision of the dam construction, implemented according to recognized contractual procedures (e.g., EU-PRAG, FIDIC, World Bank), in at least three projects each with the minimum budget of EUR 1 million (the value of each consultancy contract) where the expert provided substantial long-term and continuous inputs during project's implementation. Proven experience of management multinational teams. Ability to operate within multi-sectoral, multi-cultural, multi-skilled teams and demonstrate flexibility in working style. Excellent communication and transfer of knowledge skills (for capacity building activities). Must be able to write clear, concise technical reports in English. Shall be permanent employee of the Consultant or have a previous extended working relationship with the Consultant.
Key expert 2 - Dam Specialist	Master's degree in Civil Engineering	The Expert shall have expertise in carrying out feasibility, preliminary design or detailed design studies for dam projects, with at least **15** years of experience in the mentioned areas. Experience in at least two projects for study, design or works supervision of the dam construction, implemented according to recognized contractual procedures (e.g., EU-PRAG, FIDIC, World Bank). Must be able to write clear, concise technical reports in English. Shall be permanent employee of the Consultant or have a previous

		extended working relationship with the Consultant.
Key expert 3 - Engineering Geologist	Master's degree in Engineering Geology or Geotechnical Engineering	The Expert shall have expertise in carrying out feasibility, preliminary design or detailed design studies for dam projects, with at least **12** years of experience in the mentioned areas. Experience in at least two projects for study, design or works supervision of the dam construction, implemented according to recognized contractual procedures (e.g., EU-PRAG, FIDIC, World Bank). Must possess excellent communication and transfer of knowledge skills (for capacity building activities). Must be able to write clear, concise technical reports in English.
Key expert 4 - Hydrologist/ Water Resources Engineer	Master's degree in Hydrology or Civil Engineering	The Expert shall have expertise in carrying out feasibility, preliminary design or detailed design studies for dam projects, with at least **12** years of experience in the mentioned areas. Experience in at least two projects for study, design or works supervision of the dam construction, implemented according to recognized contractual procedures (e.g., EU-PRAG, FIDIC, World Bank). Must possess excellent communication and transfer of knowledge skills (for capacity building activities). Must be able to write clear, concise technical reports in English.
Key expert 5 - Economist/ Financial Specialist	Master's degree in Economy or Finance	The Expert shall have expertise in carrying out feasibility, preliminary design or detailed design studies for water resources projects, with at least **12** years of experience in the mentioned areas. Experience in at least two projects for study, design or works supervision of the dam construction, implemented according to recognized contractual procedures (e.g., EU-PRAG, FIDIC, World Bank). Must possess excellent communication and transfer of knowledge skills (for capacity building activities). Must be able to write clear, concise technical reports in English.
Key expert 6 - Environmental Engineer	Master's degree in Environmental Engineering	The Expert shall have expertise in preparing environmental and social management plans for the infrastructure projects, with at least **10** years of experience in the mentioned areas. Must possess excellent communication and transfer of knowledge skills (for capacity building activities). Must be able to write clear, concise technical reports in English.
Key expert – 7 Surveyor	Master's degree in Geodesy/ Land Surveying or related fields	The Expert shall have expertise in feasibility, preliminary design or detailed design studies for the water resources projects, with at least **8** years of experience in the mentioned areas. Must possess excellent communication and transfer of knowledge skills (for capacity building activities). Must be able to write clear, concise technical reports in English.

- **DURATION**

The duration of the assignment is seven (7) months from the contract signing date? The Consultant shall perform the services from November 2022 until May 2023.

ANNEX A: Geological features of the Desivojce River Basin

Geological characteristics of the area

This terrain is characterized by the Dardana Massif, an integral part of the large Rhodope massif, which also represents its western continuation in the territory of the Republic of Kosovo.
In terms of geology, the region of the Desivojce River accumulation catchment area and the planned location for construction of Desivojce Dam, the following rock types are found: Granites, Gneisses, Mica-schists, Quartzites, Amphibolite, Migmatite.
Geological construction in the location planned to construct the hydro-technical work consists of metamorphic rocks: gneisses, mica-schists, quartzites, migmatites, and amphibolite as well as granitoid magmatic stones suitable for the construction of the "Desivojce" dam
Quaternary deposits consisting of sand and gravel have been deposited along the Desivojc River, streams and rivers.

Litostratigraphy

Granites meet due to large masses in the form of silos which are embedded in the side schist. The thickness of the silos varies from a few meters to 10-100 meters.
The intrusion of granites into the lateral rocks is concordant and has contributed significantly to the pegmatoid phase's penetration into the formations around the area. This allowed the formation of the spatial front of granitization in numerous pegmatite veins in the granite and the surrounding schist.
The mineralogical composition of granites includes quartz, orthoclase, plagioclase biotite, muscovite. Pegmatites include quartz, orthoclase, microclimate and rarely plagioclase, muscovite, in small quantities of biotite, garnets, tourmaline, and very rarely beryllium.
Regarding pegmatites, the formations of quartzite veins, which are also carriers of Sb mineralization in the territory of the catchment area of the Desivojce River, are partially connected.

Gneisses, mica-schists, quartz- gneisses makeup over 95% of the terrain surface and are concentrated outside the granitoid mass and include all other representatives of the parasite: mic a-schists, quartz, amphibolite schist, amphibolite, granite. According to the composition, this series is quite heterogeneous. As the most common member is biotitic gneiss which in some places passes into muscovite-biotitic gneiss or schist derived from gneisses.
Mica-schists and quartzite meet only sporadically in the para series. Due to the large terrain cover, the quantitative ratio between schists and granite is reflected only as approximate. The rocks of this group consist of quartz, orthoclase, plagioclase, as salic minerals. From mafic minerals are distinguished: biotite (with the highest participation), muscovite, amphibole
Granular gneisses in some parts of the terrain turn into granular gneisses but without significant mineralogical composition changes. Their structure observed during the terrain violation is mainly granoblastic to lepidoblastic.

Photo. 1 Gneisses

Photo 2. Site planned for the construction of the Hydro-technical work of the "Desivojce" dam

Amphibolite have limited prevalence compared to gneisses. They are found within the series of gneisses with a clear boundary with the surrounding rocks as well as in some places with gradual transitions to gneiss. The geological map of the Desivojce river basin is shown in Figure 4.

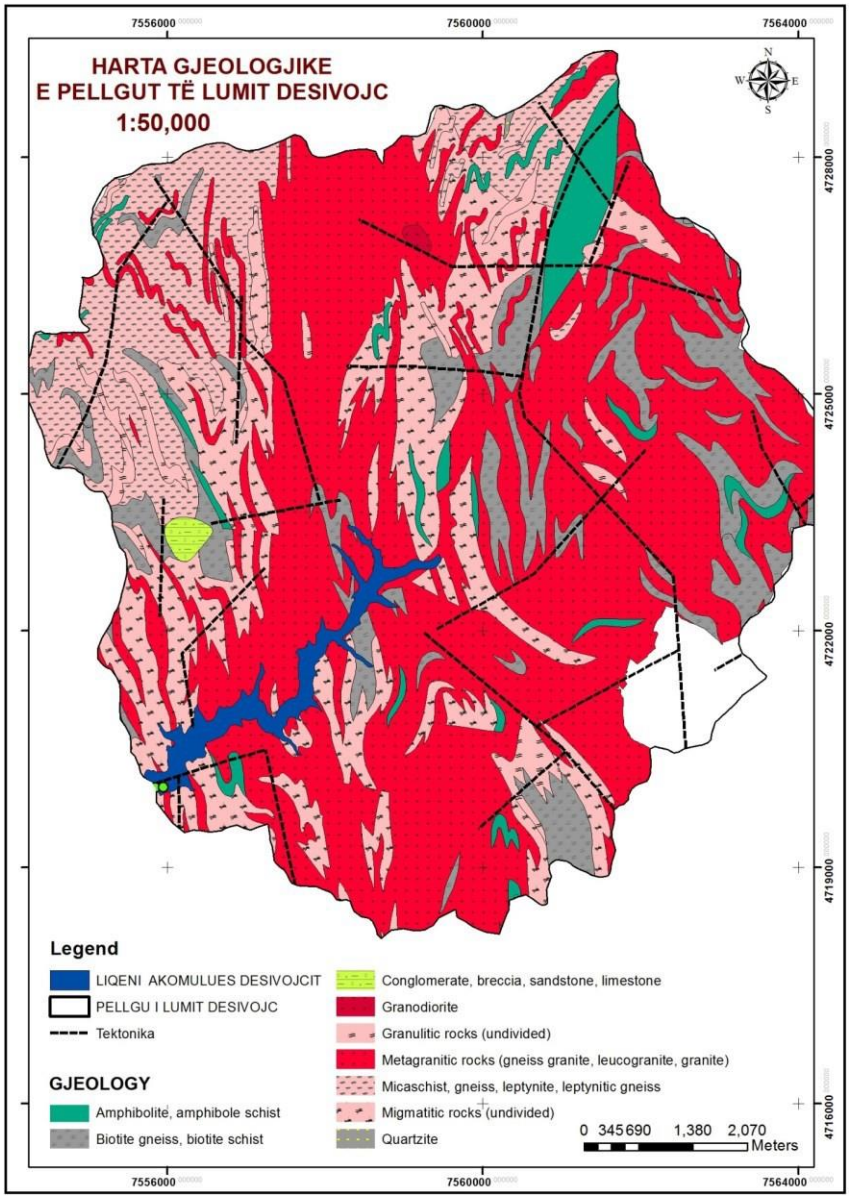

Figure. 4. Geological map of the Desivojce river basin

Hydrogeology

All water in the explored region through streams and canals discharges into the Dosivojce River and then into the Krivareka River

There are some natural springs in the suburbs and in the broader area of the site, which usually contacts springs and fountain springs for which we do not have information about the flow capacity. There is no detailed data regarding groundwater treatment in this research phase, which must be verified but during the detailed research phase through research drilling and injection for groundwater level.

Mineral resources

Antimony ore

On the edge of the part of the granitoid massif of Bujanovac that belongs to the part of the catchment area of the river Desivojce, the occurrence of antimony veins in the site of Kranidell Rogocica, Zhuja, Policka, and Lisocka has been confirmed.

These sites have been explored in the past with a small volume of geological research. It should be noted that the economic evaluation of these antimony manifestations has remained open for these sources. Earlier site research, in addition to geological surveys, mineral exploration works have also been carried out.

Surveys have been carried out in detail on the vast surroundings of Kranidelli and the Great Prron Valley between the settlements of Rogoçica and Kranidelli.

Iron ore

The iron deposits found in this territory are of particular importance in the Çarri-Sedlarë-Kamenica Municipality.

The geologically researched area comprises crystallized schists found in the Rhodope tectonic unit of the Bujanovac granitoid massif. The main carriers of mineralization of this spring are amphibolite formations. This spring's mineralization area is presented in the form of magnetite lenses with a length of 700 m and different thicknesses from 0.5 to 9 m that are inserted in the nest of schists.

The mineralogical composition of this ore is composed of magnetite accompanied by hepatitis, pyrotine, pyrite and chalcopyrite.

In this region, iron ore has been known since ancient times, but systematic research revealed iron deposits of categories A and B.

Representative ore samples taken for semi-industrial experimental studies have resulted in this content.

Photo 3. The village of Sedlarë, the place called 'Çarr'

Fe	SiO_2	Al_2O_3	CaO	MnO	Mn	S
48,02 %	7,74 %	9,08 %	3,75 %	0,06 %	0,34 %	2,40 %

Other mineral resources

To the north of the village of Hogosht in the municipality of Kamenica lies the source of garnets. The garnets are attached to the mega-schists as they belong to the type of Almaden mineral. The garnets of this site represent the most characteristic composition of rocks with precious minerals. The garnet crystals have irregular rhombohedral shapes.

The Hogosht garnets source during the exploration phase has been followed by research in earlier periods with a length of about 20 m and a width of 3-5 m. The source of garnets opened in this part holds an estimated 1800 t.

Considerable reserves of construction materials and decorative stones, such as gneisses, granites that have appeared in the vast part of the area which meets the condition of use as a building material in the construction of hydro-technical works are considered in the catchment area of the Desivojce River. Figure 5. Map of useful minerals in the Desivojce river basin.

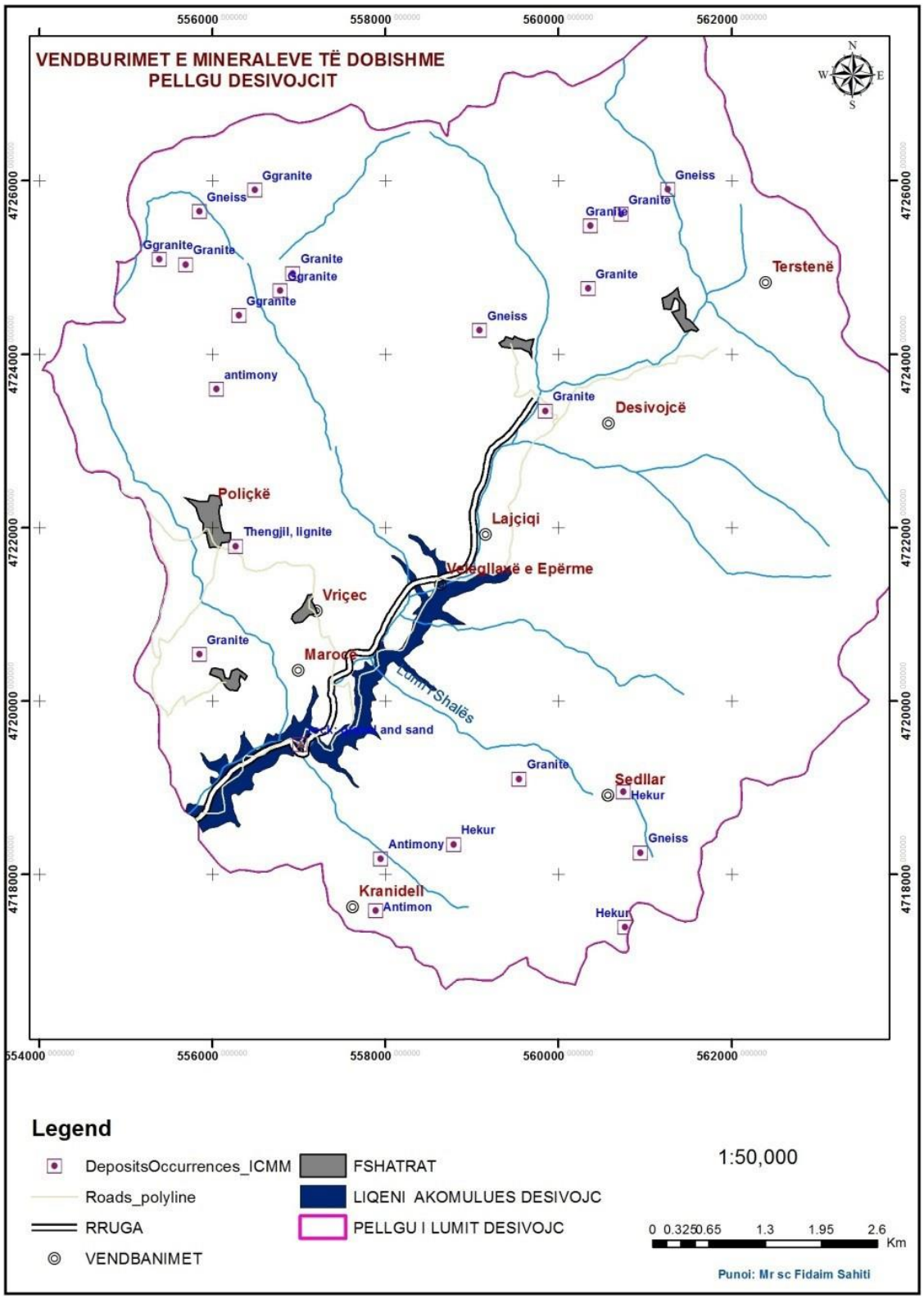

Figure 5. Map of useful minerals in the Desivojce river basin