I. Introduction
- Due to rapid urban development and reconstruction, demand for construction materials has increased over the past 20 years.
- Eight quarries located in the groundwater (GW) catchment (+two close by, outside).
- Four major categories of extraction:
  - Dimension stones;
  - Decoration rocks;
  - Aggregates (gravel);
  - Sand.
- Three major categories of materials:
  - Limestone;
  - Sand;
  - Gravel.
- Coverage of demand within the absence of governmental control.
- Improper management causes environmental and safety problems.
- Negligence of water resources protection.

II. Problem Statement
- Eight quarries within the GW catchment work on an unclear renewal of old operation permits. They are operated without legal permits. They pose a high contamination risk to Jeita spring.
- Storage and handling of fuels and lubricants for operation of machines are likely to contaminate GW.
- An extraction efficiency of usable material of 75% causes high rates of tailings, and requires a relevant land surface for storage, circulation and set back.
- Generated waste (gravel, sand, dust) is illegally dumped in the environment.
- Tailings and sludge, reaching surface waters, increase their turbidity.
- Turbid surface water (SW) infiltrates into GW. Turbid GW is difficult to treat (chlorination becomes ineffective).
- Non-compliance with law to rehabilitate quarries after extraction. Abandoned quarries often used as landfills.
- GW pumping (conducted to cover water requirements or to allow quarrying operations) is a potential qualitative (intrusion of hazards) and quantitative (over-abstraction, lowering of GW table) threat to GW.
- Change of GW and SW flows.
- Blasting operations increase cracks and fissures in the karst network.
- Potential of collapse of karst caves and dolinas.
- High erosion potential causes mobilization of fine material and washout towards streams.
- Lack of hydrogeological information and knowledge prevents environmental sound management of quarries.
- Governmental negligence of municipalities' and public society’s complaints about extraction practices.
III. Legal Framework & Stakeholders

- Quarry sector first institutionalized by decree 8803/2002 (amended by decree 16456/2006 and 1735:
  - Definition of permitting requirements (EIA, blasting activities, storage and transport of rocks and wastes, reporting by responsible staff).
  - Sector controlled by the National Council of Quarries.

National Council of Quarries:
- Consists of general directors of 9 ministries.
- Provides strategic planning, incl. definition of quarry areas.
- Granting permissions, together with related municipalities.
- Permit is allocated by the governor following the decision of the Council and municipalities.
- Multiplicity of actors/ responsibilities hinders efficient policy making.
- Non-transparent decision making: Even though any quarry activity within the Jeita GW catchment is prohibited, currently eight are operated.

IV. Recommendation

- Introduction of compelling management and operation policies that consider:
  - GW vulnerability: No permits above sensitive aquifers that are abstracted/ tapped for domestic supply.
  - Urbanization: No quarrying close to urban areas (buffer 500 m).
  - Environmental sound engineering practices.
  - Modern technology and hydrogeological science need to be integrated into strategic governmental quarry planning (definition of quarry areas).
  - Hydrogeology needs to be considered in management practices due to potential GW pollution during operation.
  - Create an easy accessible hydrogeological database to allow conduction of required EIAs (Environmental Impact Assessment).
  - Introduction of sustainable waste management for by-products: reuse, recycling or proper dumping of taintings.
  - Quantity of on-site GW water abstraction must be limited to a sustainable rate that considers GW recharge rate and other users of the aquifer.
  - GW abstraction (method and quantity) must be controlled by the government.

- Control rehabilitation of quarries after closure.
- Enforce ban on waste dumping in abandoned quarries and on operating quarries that dump into the environment.
- Public and governmental awareness on potential hazards of rock extraction to GW must be raised.
- Improvement of law enforcement: need for significant penalties for any non-compliance with guidelines.
- Need for an environmental police for law enforcement.

- Dumped material, used for landfills must comply with a standard, not to pollute GW.

Ministries that are represented in the National Council of Quarries (through the general director):