



Council for Development and Reconstruction (CDR)
Ministry of Energy and Water (MoEW)
Water Establishment Beirut and Mount Lebanon (WEBML)

Federal Institute for Geosciences
and Natural Resources (BGR),
Hannover, Germany

German-Lebanese Technical Cooperation Project

Protection of Jeita Spring

**Project Presentation at ESCWA
World Water Day
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Outline

- Background of Technical Cooperation & Project
- Importance of Water Resources Protection in Lebanon
- Project Area and Specific Problems
- Project Components – Planned Activities



Technical Cooperation with Lebanon

- BGR conducts Technical Cooperation projects on behalf of the German Ministry of Economic Cooperation and Development since 1958
- BGR is currently working in 40 countries (59 projects)
- Focal point: water (25 projects)
- Focal area: Middle East (14 projects; Jordan, Syria, Yemen, Lebanon)
- Germany decided to allocate funds for reconstruction after the war in July 2006
Keserwan area was selected for KfW wastewater project
KfW asked for assistance of BGR

Two German projects in the same area for the same purpose (reduce the pollution risk for the drinking water resources):

KfW: construction of wastewater facilities

BGR: establish groundwater protection zones and assist KfW/CDR and other donors by integrating geoscientific aspects into the planning process for wastewater facilities



Importance of Water Resources Protection

Though water resources in Lebanon are abundant, they are increasingly at risk. **The rapid and uncontrolled urban expansion** has caused a **severe deterioration of water quality** over the past decades.

The groundwater resources of Lebanon are mostly stored in limestone aquifers which are highly karstic. In many areas the karst is exposed at the surface (**open karst**) and rainfall infiltrates easily.

Groundwater flow velocities in the karst system are **extremely high** (up to 2,000 m/h). This is the reason why any contamination will reach the drinking water sources very fast and without any major attenuation. The **main contamination risk** results from **wastewater** that is infiltrating the karst aquifers unhindered from cess pits, sinkholes or even wells. Contamination is extremely high at the **beginning of the rainy season**.

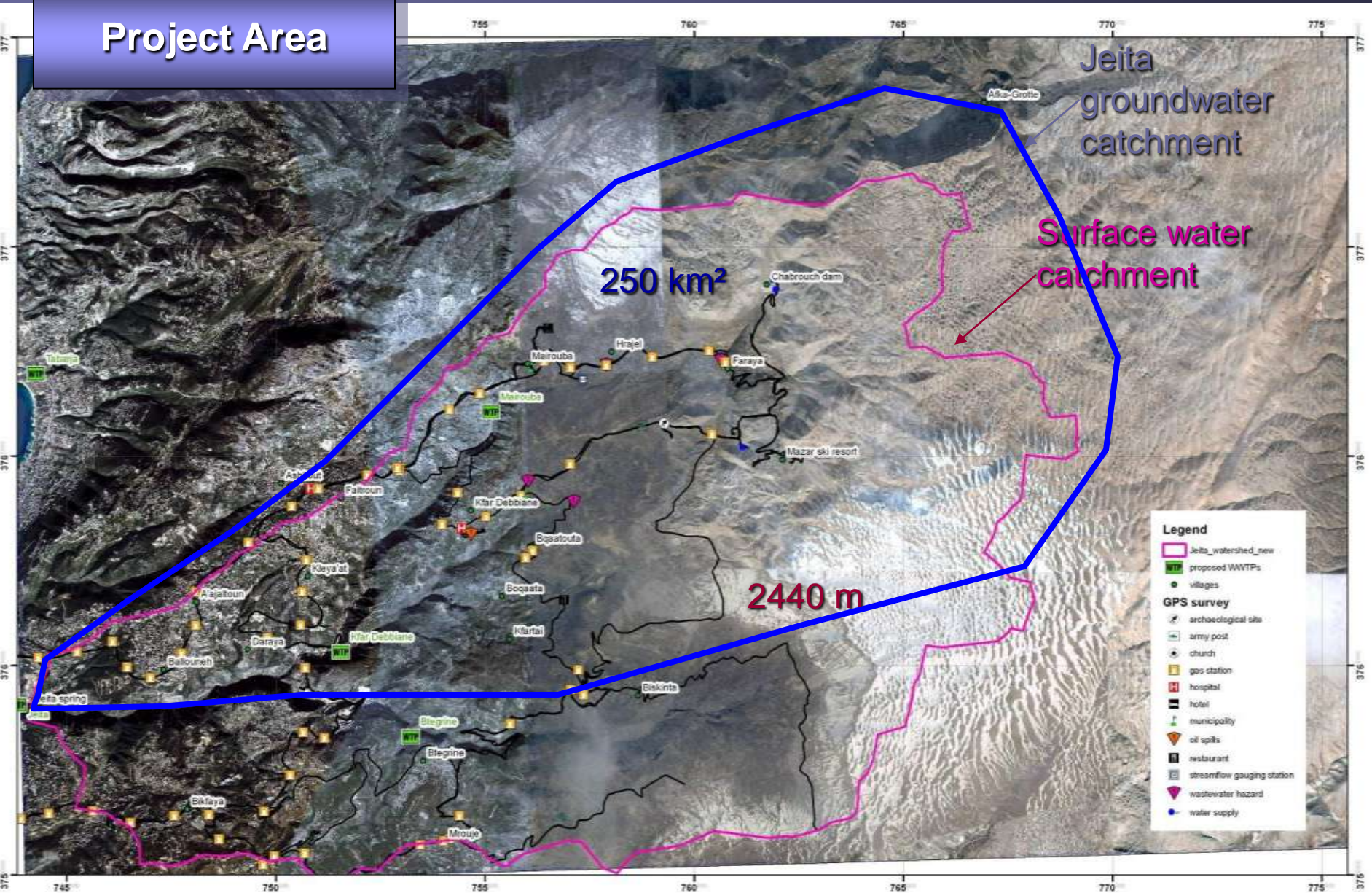
Due to the nature of the karst, the groundwater system dewateres quickly so that at the **end of the dry season water shortages** frequently occur.



overflowing wastewater
collector in Hrajel



Project Area



Protection of Jeita Spring



Specific Problems

Jeita Catchment

- High rainfall (on average 1450 mm/a)
- high level of karstification
 - ▶ high infiltration / low retention capacity
 - ▶ high spring discharge peaks during January to April (up to 30 m³/s), low flow during dry season (min. 1 m³/s)
- recent strong increase in scattered residential areas
 - ▶ high risk of contamination (approx. 200.000 inhabitants)

Main pollution sources:

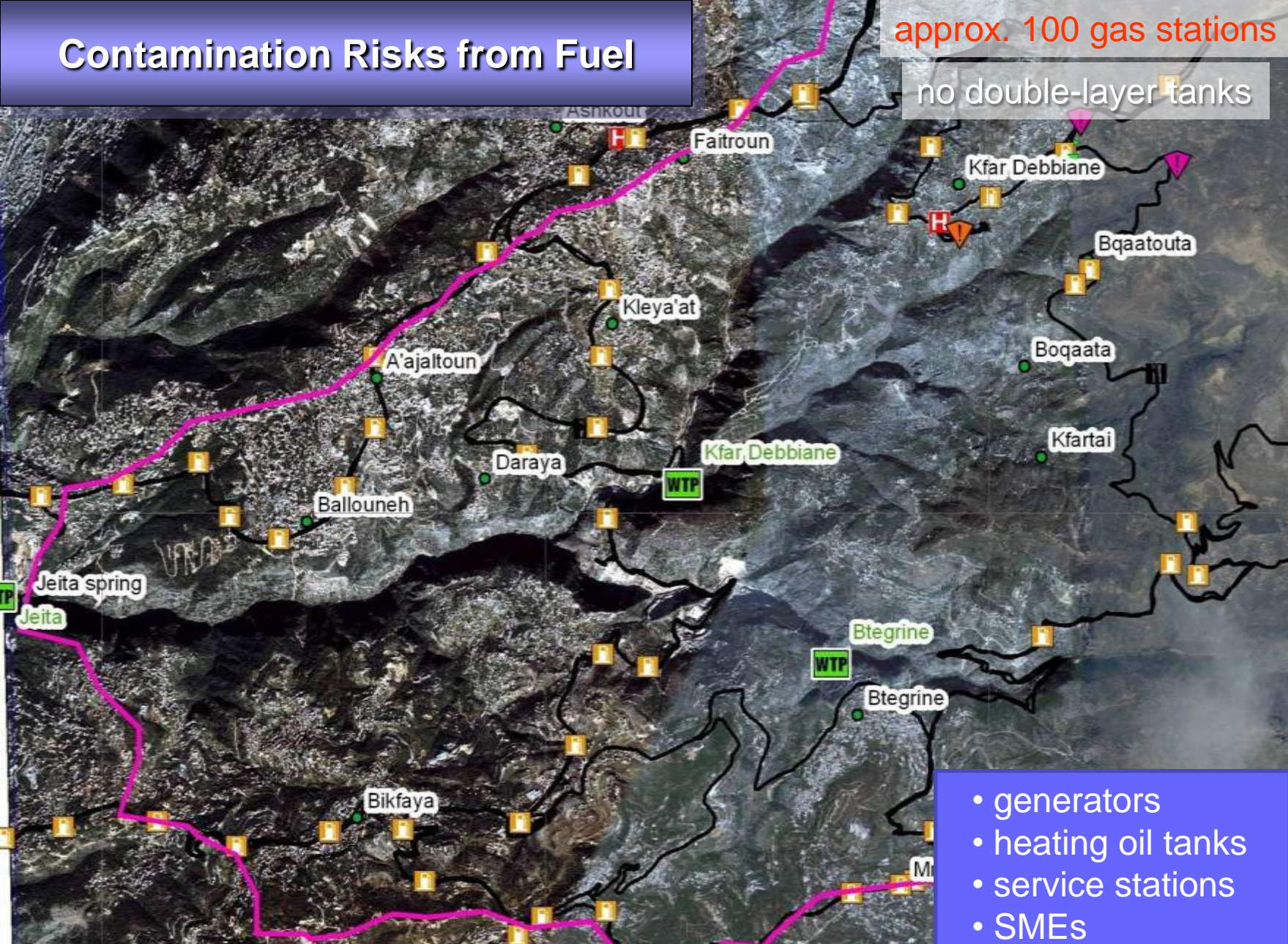
- wastewater (no WWTPs yet)
- waste (often illegal disposal)
- gas stations (approx. 100)
- quarries (cement, decoration stone)
- Jeita – Dbaye water conveyor (1940s)



Contamination Risks from Fuel

approx. 100 gas stations

no double-layer tanks



- generators
- heating oil tanks
- service stations
- SMEs



Protection of Jeita Spring

Planned Project Activities

1. Integration of water resources protection aspects into the investment planning and implementation process in the wastewater sector

- Support of CDR and other institutions concerning the prioritization of wastewater projects as well as the design and **site selection for WWTPs, collector lines and effluent discharge locations**;
- Support of CDR concerning the preparation of **EIAs for wastewater projects**, with regards to their impact on the water resources;
- Preparation of **best practice guidelines for the implementation of wastewater projects** with special consideration of the aspect of ground and surface water protection.

Integration of geoscientific aspects is important for a better planning of wastewater facilities:

► areas of rapid infiltration (groundwater vulnerability), rapid groundwater flow paths (dissolution channels), land/rock slides, fault zones, earthquakes, soil stability, risk of flooding



Planned Project Activities

2. Integration of water resources protection aspects into landuse planning

- Delineation of **groundwater protection zones** for the Jeita Spring and, if possible, other springs and wells used for drinking water supply in the Jeita groundwater catchment basin;
- Determination of the **vulnerability** of the groundwater system, preparation of an inventory of **hazards to groundwater**, and determination of the **risk of groundwater pollution**;
- Support of the relevant governmental institutions in **implementing the proposed protection zones** and urgent protection measures;
- Providing advice to MoEW concerning the establishment of a **legal basis** for the implementation of protection zones for ground and surface water resources.



Planned Project Activities

3. Collection and use of monitoring data concerning quality and quantity of water resources

- Establishment of a monitoring network (groundwater, surface water, meteorological data);
- Giving advice to WE-BML concerning the use of monitoring data, e.g. concerning the **control of the efficiency of the established wastewater treatment facilities** or to adjust the **operation of the water supply system** during times of high contaminant loads.



Project Implementation

Duration

Phase I: Delineation of GW Protection Zones

July 2010 – May 2012

Phase II: Implementation of GW Protection Zones (proposed)

June 2012 – May 2014

Partners

- Council for Development and Reconstruction (CDR)
- Water Establishment Beirut Mount Lebanon
- Ministry of Energy and Water
- Municipalities
- Ministry of Public Works (Landuse Planning)

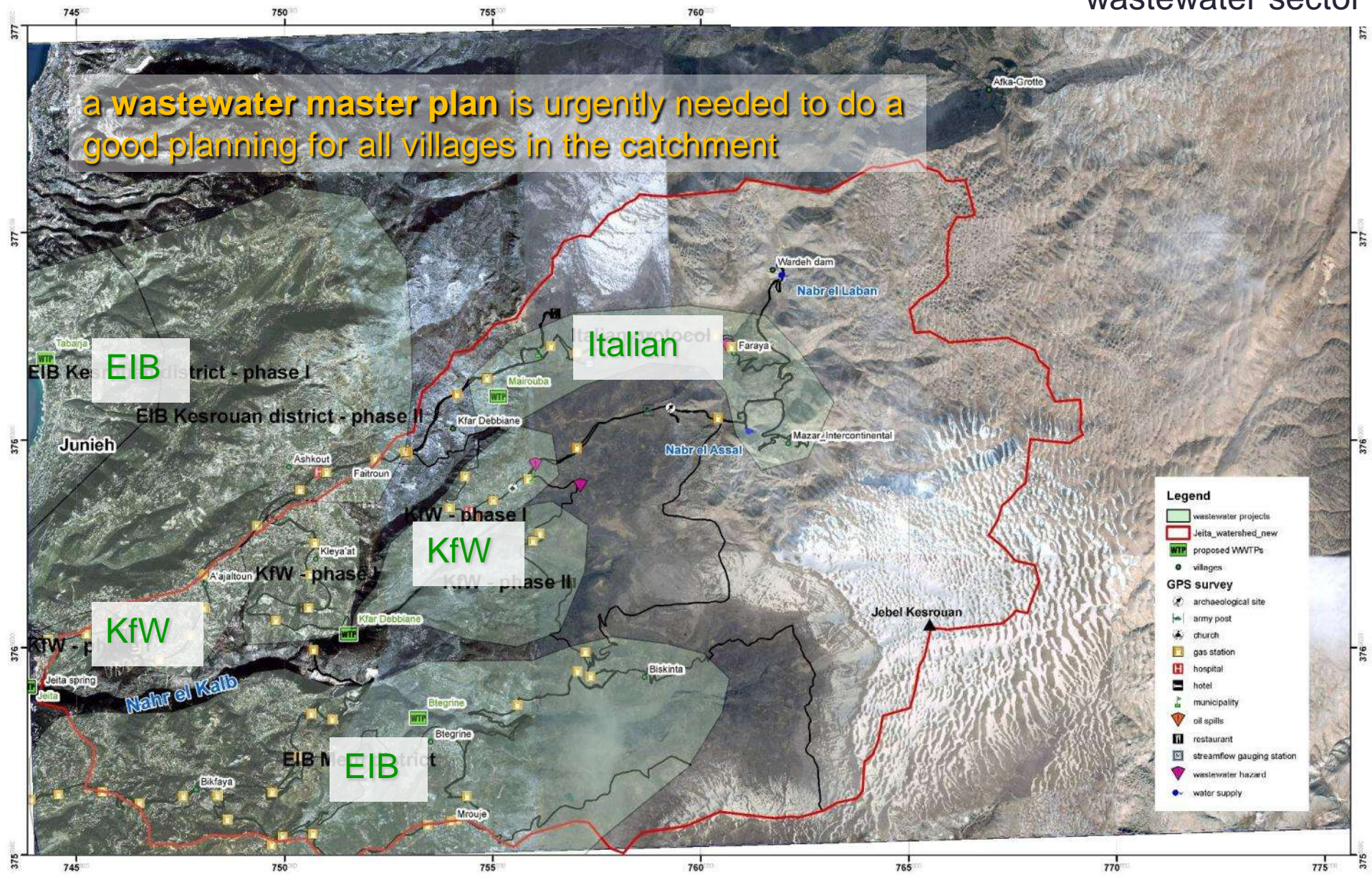
Scientific Partners: University of Göttingen/Germany, div. Lebanese Universities



Project Implementation: Component 1

Integration of water resources protection aspects into the investment planning and implementation process in the wastewater sector

a wastewater master plan is urgently needed to do a good planning for all villages in the catchment

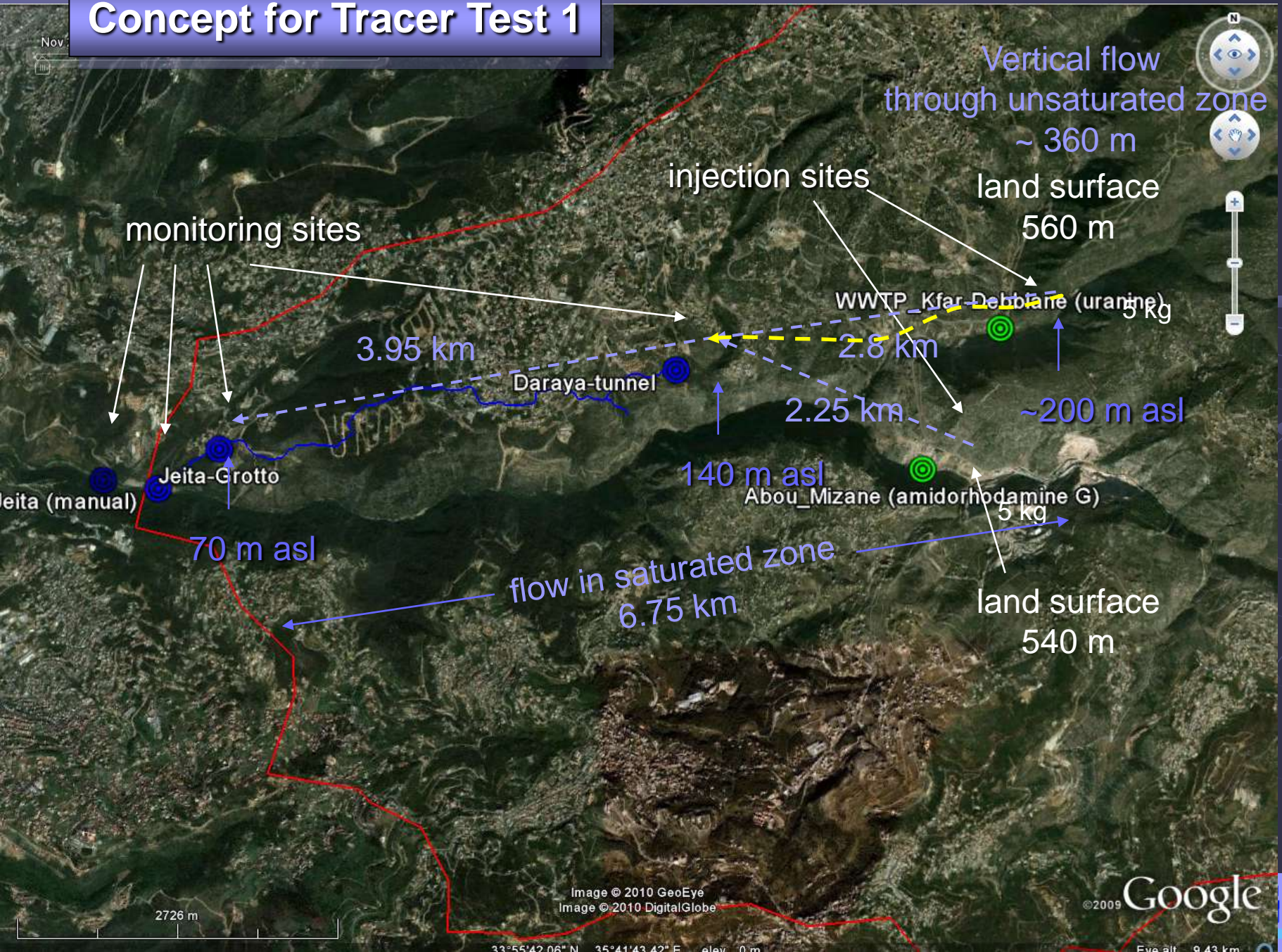


Specific Problems concerning Wastewater Treatment

- Topography (water must be pumped up at several locations; extremely high gradients)
 - Electricity not available 24/7 (max 50%)
 - Large spacing between residential areas
 - Households cannot be forced to connect to collector lines
 - Municipalities have begun to construct collector lines based on their own concept (material / diameters / gradient ?)
 - Does their concept, material, etc. fit with KfW's/EIBs concept, material, ... ?
 - Geology: karst, tectonics, landslides, rock slides, earthquakes
- Important to integrate geoscientific aspects into wastewater projects

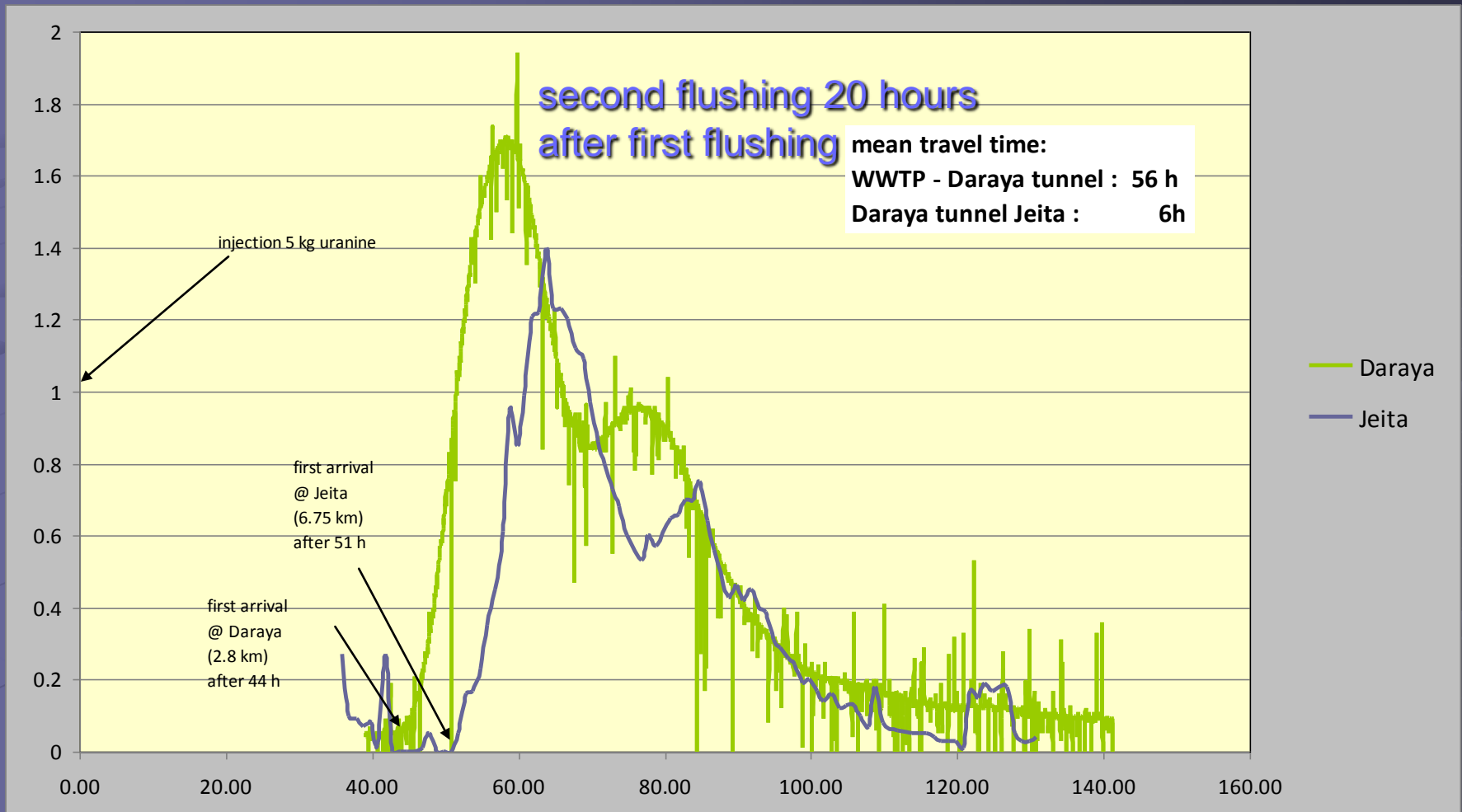


Concept for Tracer Test 1



Results of Test 1

Test 1A - Tracer uranine



Consequences

The zone over Jeita cave (Ballouneh, Daraya) is considered to be most vulnerable to pollution

- a **wastewater master plan** for the Nahr el Kalb catchment is urgently needed in order to define priority intervention areas
- landuse planning in those villages should **ban the installation of open cess pits** and modify their plans for extension of residential areas
- **no industrial sites** should be allowed in the entire groundwater catchment



Consequences

Priority should be given to wastewater facilities in high-risk zones



Project Implementation: Component 2

Integration of water resources protection aspects into landuse planning

Groundwater Protection Zones: using Groundwater vulnerability concept

- ▶ landuse restrictions

Risk Assessment (emanating from various groundwater hazards)

- ▶ control, monitoring, withdraw license, cleanup

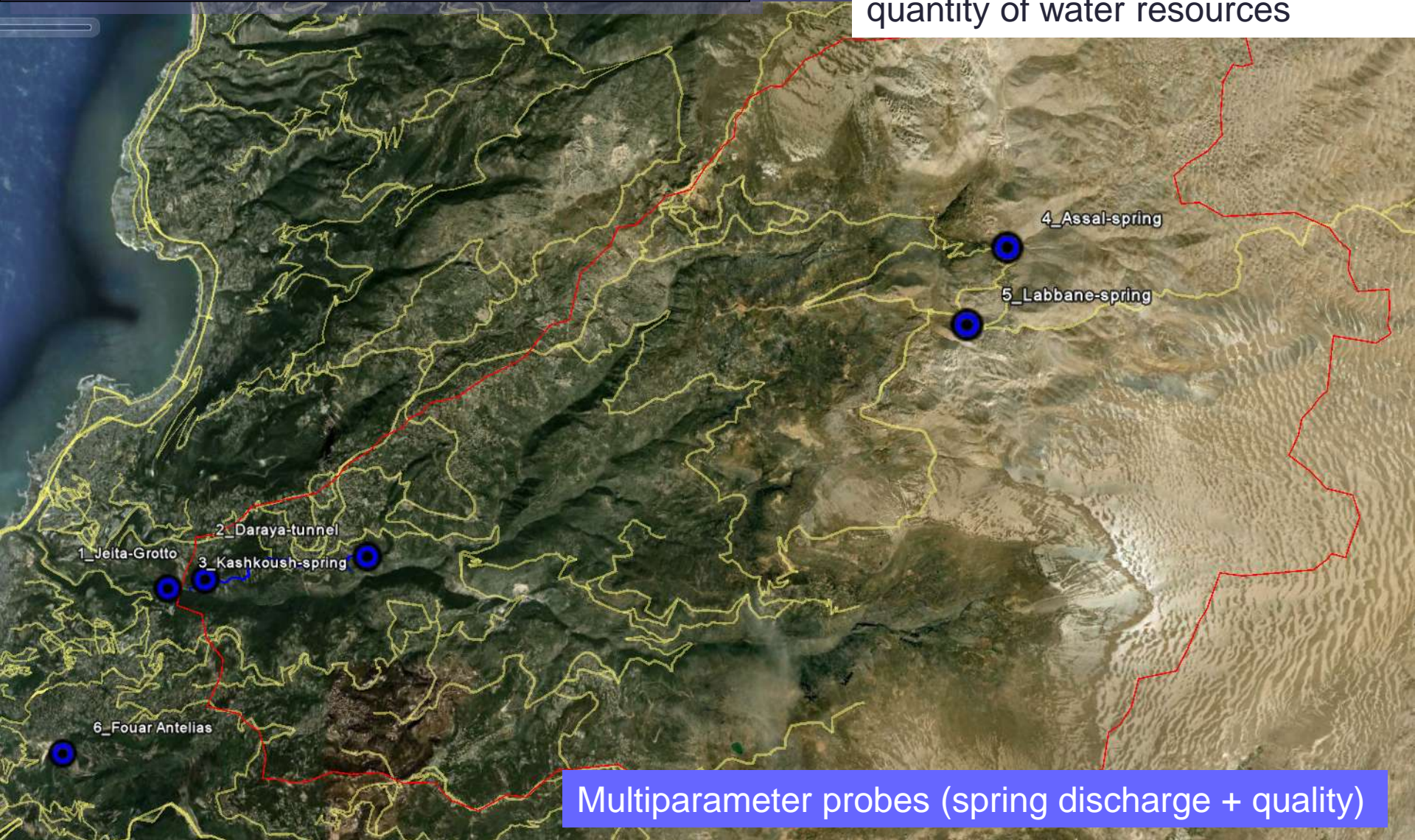
Groundwater Balance

- ▶ improved water resources management
- climatology > 6 new weather stations
- surface water runoff > 4 new runoff stations
- groundwater recharge > SWE (laser scans ? point measurements for density)
- groundwater discharge: spring discharge monitoring



Project Implementation: Component 3

Collection and use of monitoring data concerning quality and quantity of water resources



Protection of Jeita Spring



Spring Monitoring

- multiparameter probes
- gauging stations
- direct discharge measurement



Labbane spring



Jeita spring



Daraya tunnel

Multiparameter probes
parameters:
Water level
Temperature
EC
pH
ORP
DO
(ammonium)
(ISE)

Telemetric data transfer



Kashkoush spring



Assal spring

Thank you for your kind attention

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