



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

Proposal for an Improved Capture and Conveyance of Jeita Spring (project component 4)

Final Project Workshop
11 July 2014

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Current Status

Around 6 km

Dbayeh WEBML drinking water treatment plant

Kashkoush Spring
Jeita spring



Data SIO, NOAA, U.S. Navy, NGA, GEBCO

Image © 2014 DigitalGlobe

Google earth

lat 33.926934° lon 35.617914° elev 287 m eye alt 21.86 km



Protection of Jeita Spring



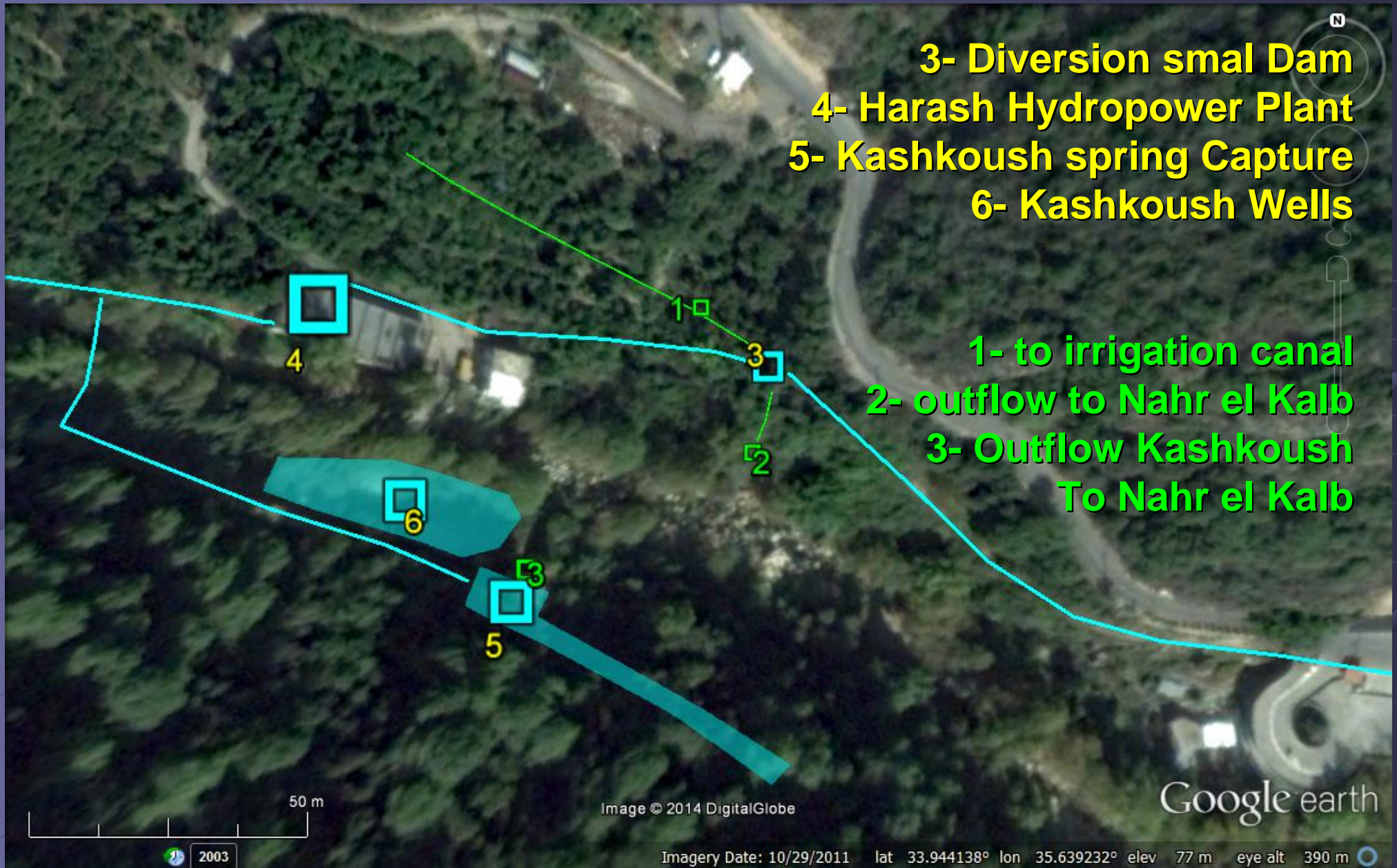
Current Status

- 1- Capture dam inside Jeita grotto
- 2- Diversion Dam at natural exit of Jeita spring

0- Outflow to Nahr el Kalb



Current Status



Current Status

4- Outflow to Nahr el Kalb at Mar Abda Bridge



Current Status



Current Status



Current Status

- **Maximum capacity for Transmission Mains = 3.1 m³/s**
- **Capacity limited due to:**
 - the Tunnel
 - overflow settings
 - leakage
- **To irrigation 0.7 m³/s (between June and September) Existing water rights**
- **What about leakage?**



**A Tracing dilution test was conducted on
26-01-2012**

- Jeita Spring discharge = 10 m³/s**
- Harash hydropower flow rate = 4.3 m³/s**
- Dbaye treatment plant intake = 3.1 m³/s**

Max capacity

- Leakage and overflow = 1.2 m³/s**



|| Water Safety





Water Safety

The overflow at Mar abda Bridge during high flow in the river



Protection of Jeita Spring

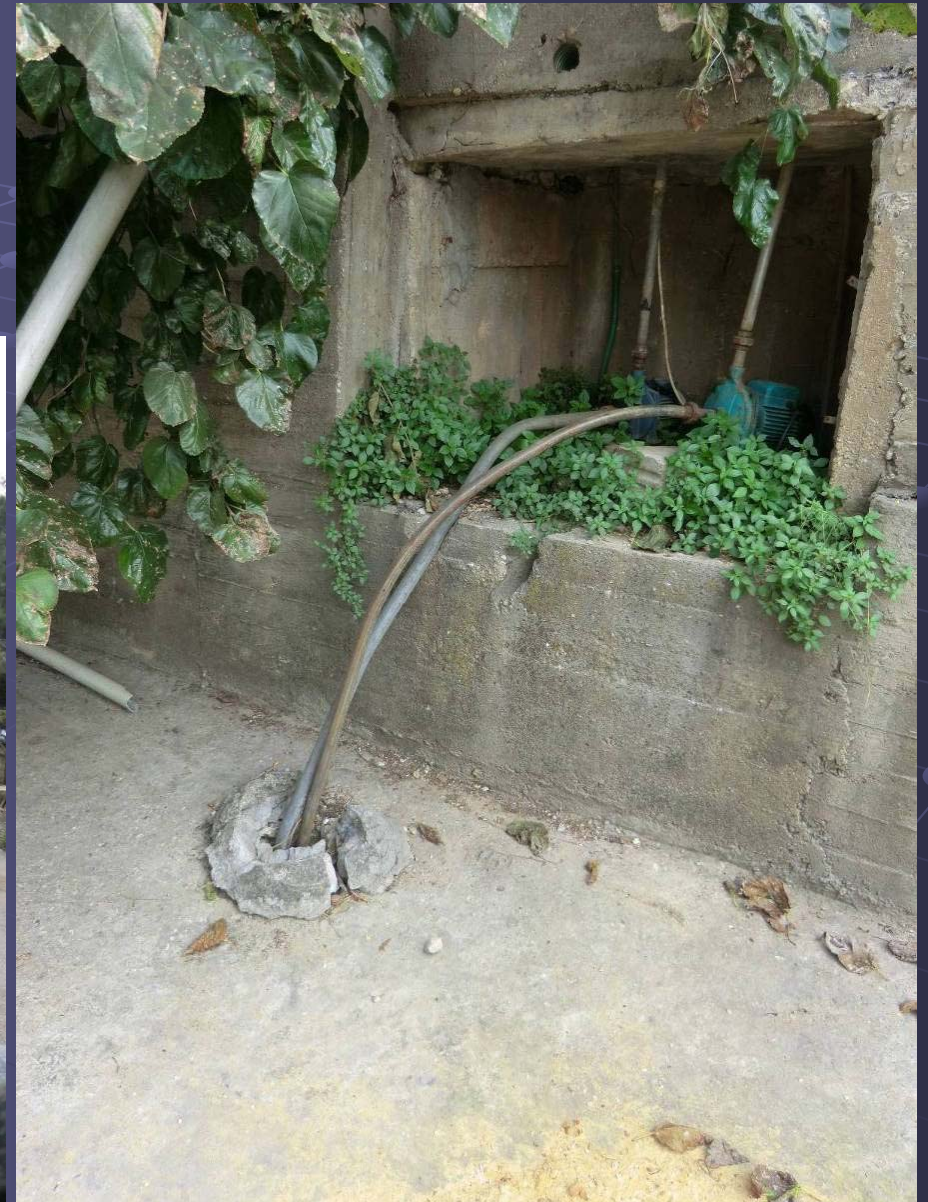






Water Safety

In Mokhada village, pumping water out of the canal and having workshops right over it.





III Georisks



Apart from all above mentioned risks:

- **Earthquakes**
- **Tectonic movements**
- **Landslides**
- **Rock falls**

It's an active tectonic zone

Geological dip is almost vertical

- **And Nahr el Kalb flooding**



IV

Capture Improvement



Capture improvement

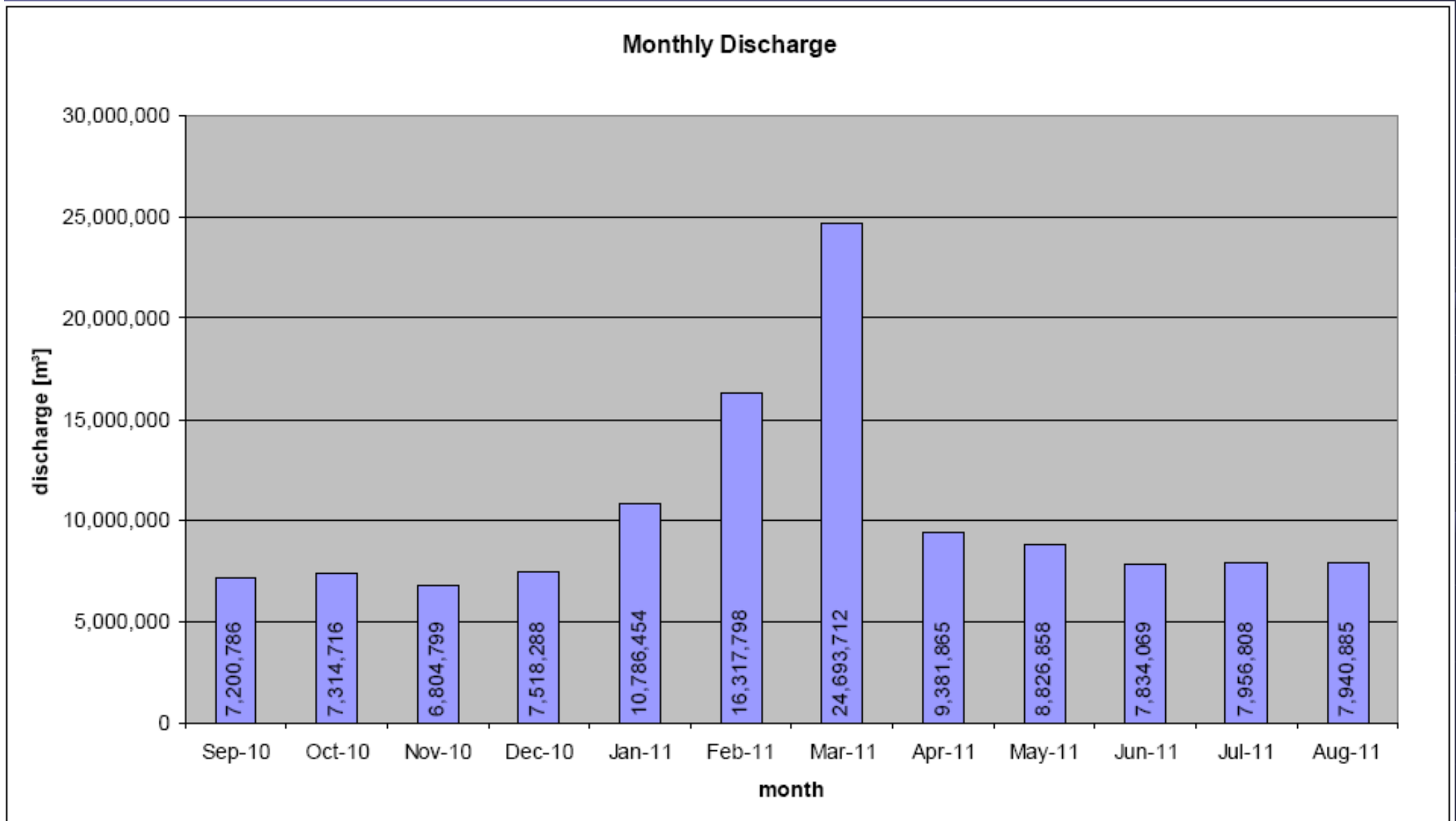
- Under current conditions the upper part of the canal can convey only a maximum of 4.3 m³/s
- Jeita Spring discharge not measured correctly
- A monitoring system by BGR (at 500 m upstream of boat moorings) ADCP and Multiparameter probe.

To establish a **Water Balance** based on real data for Jeita Groundwater catchment



Capture improvement

Jeita Spring Discharge during water year 2010/11
122.6 MCM with a flow velocity between 2 and 65 cm/s



The intention of this work is to give advice which conditions must be met by the new design:

- **Withdraw up to 6m³/s (520,000 m³/d)**
- **Allow measuring Spring discharge between 0.5 up to 50 m³/s**
- **Protection of water quality**
- **Filtering of solid parts before entering**
- **Closed pipeline, no withdrawals allowed (more water transferred and hydropower used)**



Capture improvement

- **Keep the access for tourists in the lower part of the grotto**
- **Automatically water level regulation at the boat mooring**
- **Keep the narrow passage near boat mooring reducing the pressure on the future intake**

To avoid illegal connections, the best solution would be to build a Tunnel from Kashkoush spring or from Mokhada to the treatment plant in Dbayeh



Capture improvement

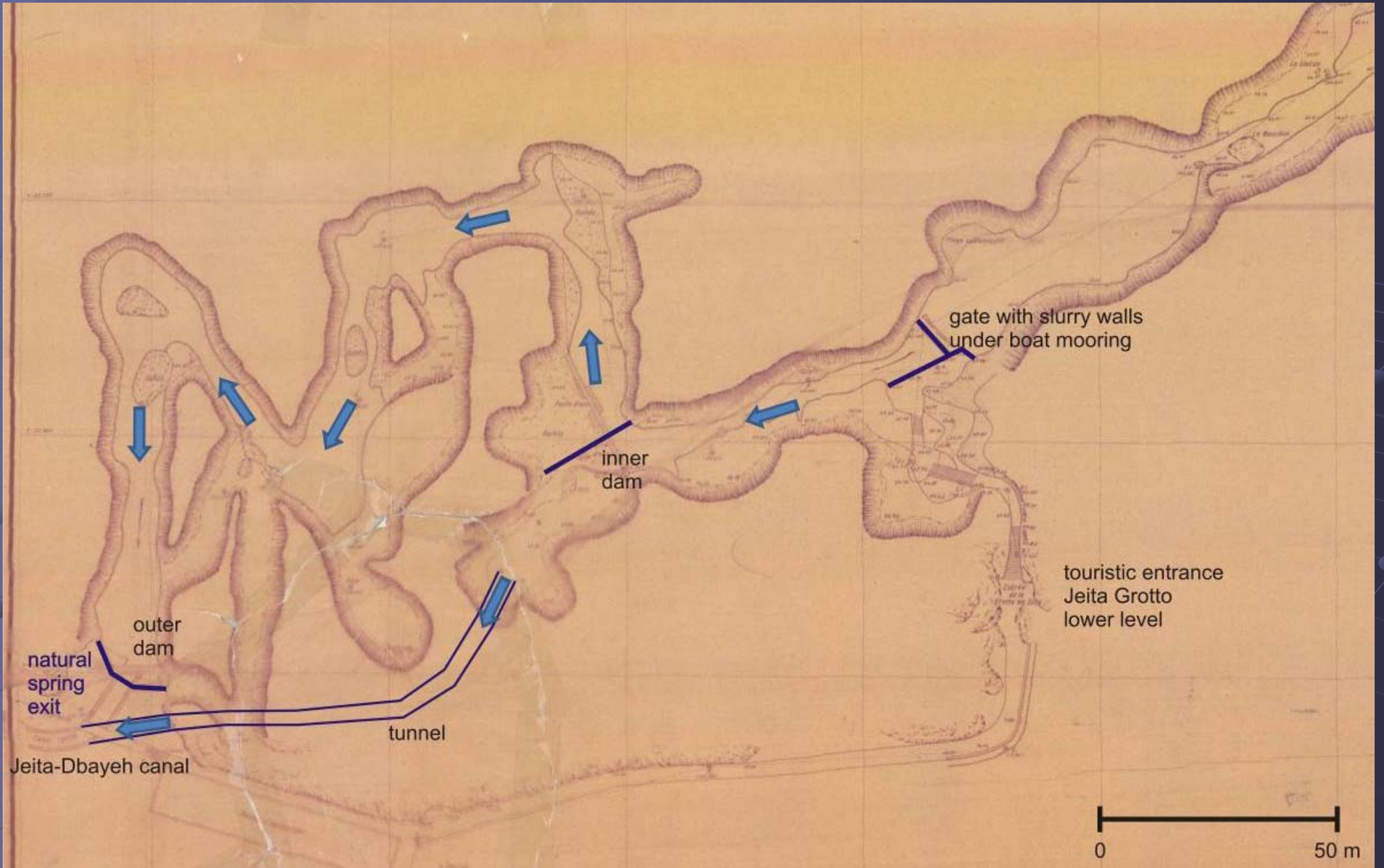


- The system must be a double pipe at the places where there are high risks of landslides and rock fall



Capture improvement

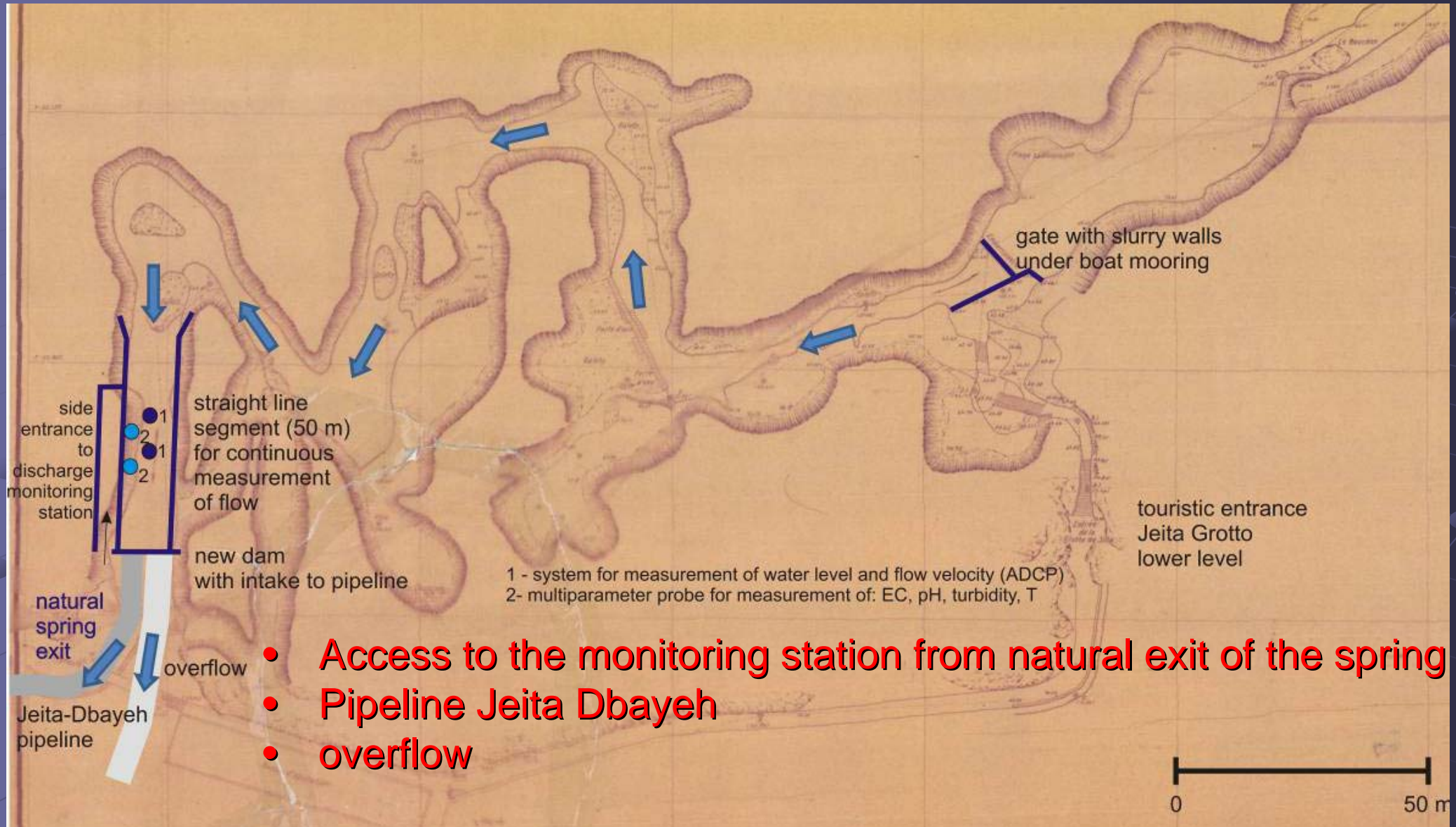
Jeita Spring current capture system



Capture improvement

Jeita Spring suggested capture system

- Straight segment 50 m length 6-8 m width and 4 m height



- Access to the monitoring station from natural exit of the spring
- Pipeline Jeita Dbayeh
- overflow



For construction the following aspects have to be considered:

- **Construction during low flow period (below 2 m³/s)**
- **A dry year**
- **Works between beginning of August until end of October**
- **Remove existing system after the end of constructing the new system**

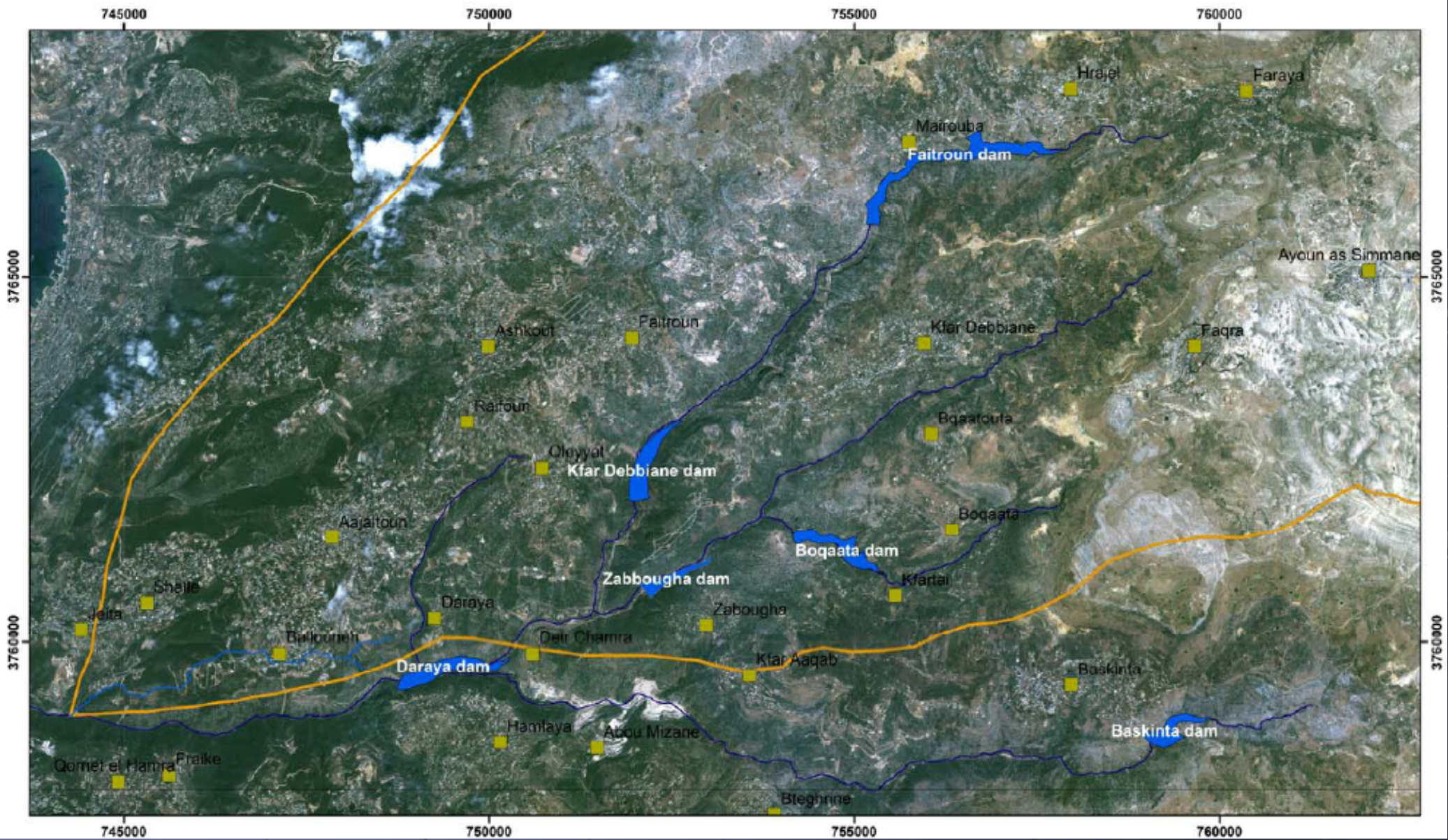


V Storage Options



Storage Options

Managed Aquifer Recharge Dams In Nahr el Kalb Catchment



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Storage Options

Managed Aquifer Recharge Dams In Nahr el Kalb Catchment

Proposed Dam	Storage [m ³] met by runoff	Function	Infiltration capacity
Kfar Debbiane	7.3	MAR > Jeita spring	High
Faitroun	6.6	MAR > Jeita spring	Very high
Zabbougha	3.0	MAR > Jeita spring	High
Daraya	9.0	storage	Low
Baskinta	6.0	MAR > Faouar Antelias spring	Very high

Based on the water balance, the tracing tests and updated geological map, the key assumptions are:

- groundwater recharge in the Upper Cretaceous Aquifer (C4) reaches 80 %
- groundwater recharge in the Jurassic is on average around 50 %
- groundwater Flow is governed by the complicate geological and tectonic structure.



*Thank you for your
kind attention*

www.bgr.bund.de/jeita

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