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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Protection of Jeita Spring

Current Status

Around 6 km

Dbayeh WEBML drinking water treatment plant

Kashkosh Spring

Jeita spring

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Current Status

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

0. Outflow to Nahr el Kalb
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Current Status

1- to irrigation canal
2- outflow to Nahr el Kalb
3- Outflow Kashkoush To Nahr el Kalb
4- Harash Hydropower Plant
5- Kashkoush spring Capture
6- Kashkoush Wells

Diversion small Dam
Protection of Jeita Spring

Current Status

4- Outflow to Nahr el-Kalb at Mar Abda Bridge
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Current Status

7 - Diversion Mokhada
7a - Mokhada Dam
8 - Mokhada canal Bridge
5 - to irrigation Wata canal
Current Status

- Tunnel inlet (9)
- Tunnel outlet (10)
- Dbayeh intake (11)
- Dbayeh drinking water treatment plant (WEBML) (12)
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
II

Water Safety
Protection of Jeita Spring

Water Safety

Overflow at Mar Abda bridge

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

Mokhada Dam and Mokhada diversion

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Water Safety

Mokhada canal inside the village (leaking)
Water Safety

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

The Tunnel to Dbayeh (once a year maintenance)
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

Monthly Discharge

<table>
<thead>
<tr>
<th>Month</th>
<th>Discharge [m³]</th>
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<tbody>
<tr>
<td>Sep-10</td>
<td>7,200,786</td>
</tr>
<tr>
<td>Oct-10</td>
<td>7,314,716</td>
</tr>
<tr>
<td>Nov-10</td>
<td>6,804,799</td>
</tr>
<tr>
<td>Dec-10</td>
<td>7,518,288</td>
</tr>
<tr>
<td>Jan-11</td>
<td>10,786,454</td>
</tr>
<tr>
<td>Feb-11</td>
<td>16,317,798</td>
</tr>
<tr>
<td>Mar-11</td>
<td>24,693,712</td>
</tr>
<tr>
<td>Apr-11</td>
<td>9,381,865</td>
</tr>
<tr>
<td>May-11</td>
<td>8,826,858</td>
</tr>
<tr>
<td>Jun-11</td>
<td>7,834,069</td>
</tr>
<tr>
<td>Jul-11</td>
<td>7,956,808</td>
</tr>
<tr>
<td>Aug-11</td>
<td>7,940,885</td>
</tr>
</tbody>
</table>
The intention of this work is to give advice which conditions must be met by the new design:

- Withdraw up to 6 m$^3$/s (520,000 m$^3$/d)
- Allow measuring Spring discharge between 0.5 up to 50 m$^3$/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.
• The system must be a double pipe at the places where there are high risks of landslides and rock fall.
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
Capture improvement

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
Managed Aquifer Recharge Dams
In Nahr el Kalb Catchment
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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