



Andrade Gutierrez Engenharia, S.A.
Lebanon Office: Beirut Symposium
9th Floor, Office B
Sin El Fil, Beirut - Lebanon

Beirut, December 6, 2021

Statement for exclusive purposes of submission in Call for Tender¹

Subject: Jannah Dam and Lake Works Phase II (Lebanon) - Bulkhead construction executed by BAUER Lebanon

Dear Sir/ Madam,

As per BAUER's request, I hereby state the following:

BAUER Lebanon, a subsidiary of BAUER Spezialtiefbau GmbH, has been engaged by Andrade Gutierrez Engenharia, S.A. for the construction of *Jannah Dam and Lake – Phase II* project, a Dam located on the river of Nahr Ibrahim in the district of Byblos, Mount Lebanon Governorate, with a capacity of 38 million cubic meter, which feeds the area of Beirut, Byblos and its suburbs, including a hydroelectric power of 40MW.

BAUER's scope of work included the Construction of the Upstream and Downstream Diaphragm walls, the Bulkhead's construction, and the Grouting Works.

One of the remarkable challenges on this project was the execution of the planned Bulkhead, allowing the excavation down to the foundation depth of the dam main body in the non-rocky soil. The relatively limited dimensions of the stretch available for the construction and the related hydraulic conditions prohibited an open excavation.

Technical Description of the Executed Bulkhead

The deep excavation to the foundation level of the dam is ensured by an arch-shaped bulkhead. The executed barrettes-based concept originates from Bauer (and replaced the concept of a cut-off wall made of jet-grouting elements). The diaphragm walls, up to 38 m deep and with a total volume of approximately 11,200 m³, were constructed using a BAUER BC 40 cutter in alluvial deposits, mostly in zones of noticeable permeability, which exacerbated the challenges imposed by the locally encountered artesian conditions. The diaphragm walls on the upstream and downstream sides were executed first. Then the diaphragm wall in the

¹ This statement is intended to be presented by BAUER in call for tender and may not be used for any other purpose without Andrade Gutierrez Engenharia, S.A.'s prior written consent.

middle. When excavating the diaphragm wall in the middle, the BAUER BC 40 cutter continuously overcut the previously excavated diaphragm walls on the upstream and downstream side. The three parallel, overcut diaphragm walls, each with a wall thickness of 120 cm, are connected by a capping beam. The result is a homogeneous, force-locked block.

Details of the Contract

Execution period: October 2018 to February 2019

Location: The Jannah Dam located on the Nahr Ibrahim River, about 30 km northeast of Beirut in Lebanon

Quantities:

- Three parallel, overlapped diaphragm walls
- Max. depth 38 m
- Nominal width of each row: 120 cm
- Total bulkhead volume of approx. 11,200 m³

Geological Condition:

From top down to the depth of about 15-20m the alluvium consists mainly of gravel, highly rounded pebbles and occasional boulders of basalt and limestone in a sand matrix. Underlying these coarse soils there are silty and coarse sands with a maximum thickness of about 20m in the current river channel. Clays, silty-clays and/or sandy clays were frequently encountered at the bottom of the alluvium. The bedrock is mainly dolostone with several fault zones, and with sizeable pockets filled with decomposed basalt.

The professional way in which the BAUER team prepared and executed the works was very well received. Trial mixes and general quality management and control along the detailed method statement secured the highest standards of quality for the product. The bulkhead was fully exposed in the course of excavation down to dam foundations, showing absolutely flawless, perfectly interlocked, uniform block.

The work carried out in constructing the Diaphragm Walls in the Republic of Lebanon was very professional.

BAUER was proactively seeking solutions, addressing issues, and were answering questions related to any subjects of the works.

BAUER's professional approach towards Health Safety Environment (HSE) was excellent.



Yours faithfully,

By and behalf of the Contractor

A handwritten signature in blue ink, appearing to read 'Oscar dos Santos Marques', written over a horizontal line.

Óscar dos Santos Marques

Contractor's Representative



CONTRACTOR'S REPRESENTATIVE