CONCRETE DAM REPLACEMENT AT LAKE GRIMSEL

Kraftwerke Oberhasli AG (KWO), headquartered in Innertkirchen in the canton of Bern, operates a total of ten power plants in the Grimsel and Susten areas, which are supplied with hydropower from eight reservoirs.

With a volume of 94 million cubic meters, Lake Grimsel is the largest water reservoir in Switzerland. Lake Grimsel was created by the Seeuferegg (gravity dam, 42 meters high) and Spitallamm (arch dam, 114 meters high) concrete dams completed in 1932. It has been known for some time that the Spitallam concrete dam has needed reconstruction. This is due to the steadily increasing separation of the structures between the downstream (air side) mass of concrete and the upstream (water side) face concrete, which is leading to an increasing deterioration of the structure’s condition.

The department of Construction and Environment of KWO, which is led by Andres Fankhauser, was entrusted with developing a reconstruction project that would receive approval to proceed. Matthias Stähli is also working in this team as a technical officer for construction. He has been working for KWO for 15 years and has been using Allplan for his various work projects for nearly 28 years. These activities include project planning, small design projects, and construction management. In May 2017, KWO submitted the building application for the construction of the new concrete dam Spitallamm on Lake Grimsel. Matthias Stähli was significantly involved in this with the support of the software from Allplan. “I use Allplan Architecture as well as Allplan Engineering and am impressed by the user friendliness and the various possibilities of these programs.”
A NEW CONCRETE DAM IN A CHALLENGING TOPOGRAPHY

After an extensive review, the construction of a new water barrier proved to be a safer and more cost-effective solution compared to the reconstruction of the existing concrete dam. Due to the construction of a new wall, Lake Grimsel can continue to be operated during the entire construction period, virtually without restriction. The project managers hope to start the construction of the estimated 120 million CHF structure in 2019. Construction will last six years. During the summer periods, work is expected to run 24/7. The new, double-curved arch dam is located on the downstream side in front of the existing wall and has approximately the same crown height. Its crown length measures 195 meters and the maximum height is 113 meters. This results in a concrete volume of 206,000 cubic meters. In the past, a total of 1,235,450 cubic meters of concrete was required to build the eight dams that are in operation. How do you plan a new concrete dam in a topographically challenging terrain with a variety of existing inlet and outlet tunnels?

“Thanks to the meticulously precise reworking of all existing plans in 3D and their combination with the digital terrain model, we were able to create the ideal conditions for adding the geometrically demanding new building objects in the 3D basic plan in the form of a double-curved wall with a parabolic arc,” explains Matthias Stähli. What he explains in a few words is extremely complex to design and implement. The existing tunnel system, for example, could be precisely checked for all points of conflict between the new and existing tunnels thanks to its spatial representation in 3D.
“WITHOUT MODELING IN 3D, THE COSTS WOULD HAVE EXPLODED”

“Thanks to modeling the project in 3D with Allplan Engineering software, I was able to work out the design basics for submitting the building application virtually on my own,” reports Matthias Stähli. He is convinced that much of this design work could not be planned in 2D, and the time and effort required would have been excessive without modeling in 3D: “In 2D, at least two more people would have been involved in this project.” The technical officer is impressed by how easy it is to generate profiles and sections, for example, from the 3D model and to be able to do this at any position. He had different experiences regarding the data exchange with other engineering firms involved in the project. “Whether the data exchange works is primarily dependent on the recipient’s software.”

According to Matthias Stähli, they also had to use a GIS system due to the large amount of data in the terrain model. In summary, he describes the software from ALLPLAN as a superior, user-friendly, and logically structured design tool.

FACTS ABOUT THE CONSTRUCTION

- Client: Kraftwerke Oberhasli AG (KWO), Innertkirchen
- Development of the building application: Kraftwerke Oberhasli AG (KWO), Innertkirchen

CORE DATA OF THE NEW CONCRETE DAM

- Crown length: 195 m
- Crown width: 8 m
- Maximum width of the foundation base: 20 m
- Maximum height: 113 m
- Concrete volume: approximately 206,000 m³
- Expected construction time: 2019 – 2025
- Costs: 120 million CHF
THE CUSTOMER

KWO’s history goes back to 1908. At that time, pioneering engineers came to the Grimsel area and recognized the great hydropower potential. In 1925, they began to build the first concrete dam here – the highest in the world at the time. Today, KWO is one of the leading hydropower companies in Switzerland. Around 195 million cubic meters of water are stored in the eight reservoirs, which corresponds to the amount that four million Swiss residents consume per year. This energy store feeds the ten power plants with its 29 turbines, which has a total output of 1317 megawatts. This corresponds to the power of 3000 megawatts. KWO produces 2400 gigawatt hours of electricity every year, which corresponds to the power consumption of 1.2 million Swiss residents in one year. Since its founding in 1925, more than 1.5 billion CHF has been invested in the power plants. KWO has been owned by Berner Kraftwerke (BKW) since 1938 with a share of 50 percent, and the cities of Basel, Bern and Zurich own 16 and two-thirds percent each. Currently, the company employs around 500 people (300 full-time employees) who primarily live in Oberhasli.

ABOUT THE COMPANY

ALLPLAN is a global developer of open solutions for Building Information Modeling (BIM). For more than 50 years ALLPLAN has pioneered the digitalization of the construction industry. Always focused on our clients we provide innovative tools to design, construct and manage projects – inspiring users to realise their visions.

ALLPLAN solutions are being used by over 240,000 Architects, Engineers, Contractors and Facilities Managers in 20 languages. Headquartered in Munich, Germany, ALLPLAN is part of the Nemetschek Group. Around the world over 400 dedicated employees continue to write the ALLPLAN success story.

ALLPLAN UK Ltd
5 Charter Point Way
Ashby Park
Ashby de la Zouch
LE651NF
Tel: +44 01530 560126
sales.uk@allplan.com
allplan.com

“Thanks to modeling the project in 3D with Allplan Engineering software, I was able to work out the design basics for submitting the building application virtually on my own.”

Matthias Stähli, specialist for maintenance projects (KWO, Innertkirchen)