INTERNATIONAL MOLYBDENUM ASSOCIATION
THE VOICE OF THE MOLYBDENUM INDUSTRY

SUPPLYING WATER IN THE DESERT

Qatar, which the World Resource Institute lists as the world's most water-stressed country, is currently building a number of mega reservoirs to ensure a safe water supply for its growing population. Molybdenum-containing stainless steel dowel bars are helping to tackle this incredible challenge.

Maintaining a supply of clean drinking water in the desert is no easy feat. Increasing that supply for a growing population is even more challenging. Qatar is expected to see its population rise by nearly 20 percent over the next ten years. To keep pace with this growth, the country is building the world's largest reinforced concrete reservoirs.

A growing thirst

Orchestrated by Qatar General Electricity and Water Corporation (KAHRAMAA), the ambitious "mega reservoir" project aims to address a huge increase in the demand for potable water. Qatar's population is expected to increase from approximately 2.7 million to 3.3 million by 2030. The Qatari government is working diligently to build the infrastructure needed to accommodate this forthcoming population growth. To that end, the Qatar National Vision 2030 (QNV2030) development plan was launched in October 2008. Its stated objective is to "transform Qatar into an advanced society capable of achieving sustainable development" by 2030. The new series of mega reservoirs marks perhaps one of the most important facets of this development: securing a reliable water supply for the growing number of families, businesses, and tourists. Indeed, there will be a surge of visitors in 2022 when Qatar hosts the football World Cup in Doha.

Compounding the growing pains is the fact that Qatar lacks natural fresh water sources from lakes and rivers, and limited groundwater supplies are reserved for agricultural use. Therefore, Qatar's potable water comes from two huge desalination plants. They convert saltwater from the ocean into high quality, potable water. The plants will be connected to five reservoir sites via a 600-kilometer network of pipes with a diameter of up to 1.6 meters. The newly constructed reservoirs will ensure enough water is stored near population centers, where it is used, rather than where it is generated, thereby reducing overall pumping and energy required.

Constructing mega reservoirs

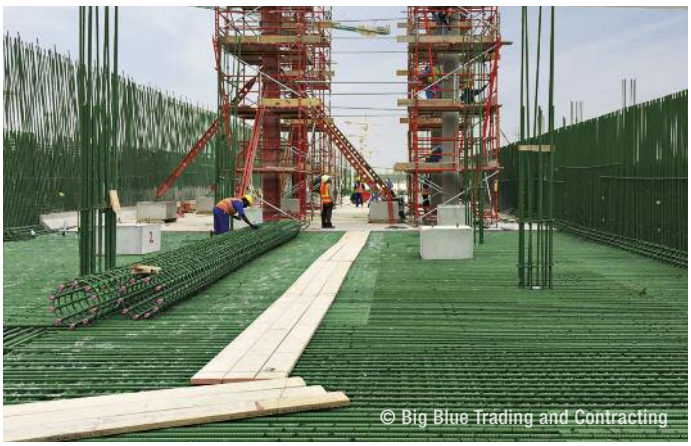
The reservoir initiative is designed to extend potable water reserves in Qatar from two days to seven days. The project will roll out in two phases. The first phase aims to meet projected demands for water by 2026. This requires a storage capacity of about 8.7 million cubic meters, to be kept in the world's 24 largest reservoirs at five different locations along the Qatar National Utility Corridor. The second phase of the project will provide seven days of water storage to meet expected demand in 2036. During phase two, 16 additional reservoirs will be added to the five reservoir sites. Ultimately, each of the five reservoir sites will include up to nine of the giant reservoirs.

The reservoirs will be interconnected, allowing water to flow from north to south and vice versa, so it can be delivered to the population centers in Eastern Qatar. Each of the 24 reservoirs in this first phase of the project covers an area of 300 meters by 150 meters, equivalent to nine football pitches, with towering walls reaching a height of 12 meters. It would take the water from more than 5,000 Olympic swimming pools to fill the reservoirs constructed in the first phase. Once the second phase of the project is completed, it will deliver a total storage capacity of approximately 14.4 million cubic meters.

The role of a dowel bar

A dowel bar is a smooth round bar that transfers load uniformly across joints in concrete construction, while still allowing the adjacent concrete slabs to expand and contract independently of one another.

Half of the dowel bar is firmly embedded into one concrete slab, while the other half is in a specially designed plastic sleeve in the adjoining concrete slab. Known as debonding, this allows the dowel bar to move freely in the sleeve with the expansion and contraction of the slabs. The sleeves consist of uPVC pipes that contain half the dowel bar, compressible filler, and an end cap. Once the finished dowel bars are in place, corrosion resistance is crucial as access for maintenance would be complex and costly.



The interior of one of the reservoirs under construction. A green Fusion Bonded Epoxy (FPE) coating protects the steel reinforcing bar against corrosion.

An oasis with stainless steel

Molybdenum is a key contributor to the success of the reservoir project. Molybdenum-containing stainless steel dowel bars are used in the expansion joints of the walls and floors of the mega reservoirs. They allow the massive concrete slabs to expand and contract in a controlled fashion with changes in temperature and movements of lateral load, managing stress within the joints. The reservoirs are designed to operate for at least a century, so durability of all components is extremely important.

One of the mega reservoirs at a distance. They will be filled with drinking water beginning in 2020.

A few words from the project team

Dr. Steve Jones, commercial manager at Outokumpu, outlined some of the challenges faced when asked to supply the dowel bars for one of the reservoir sites. “We were approached with a demanding set of performance requirements. The dowel bars are exposed to a range of temperatures and corrosive environments. Molybdenum-containing stainless steel is a must for this type of application”. The 2% molybdenum content in Type 316L stainless steel ensures good resistance to corrosion and a very long service life.

Waseem Ameen, Managing Director at Big Blue, the engineering company in charge, describes why Type 316L dowel bars were used. “We needed to be confident that we were using the appropriate grade of stainless steel that would give optimum performance and withstand the rigorous conditions within the challenging environment. The dowel bars will be required to perform without maintenance for many years to come, ensuring the mega reservoirs will supply water reliably to Qatar for the next century and beyond”.

These massive mega reservoirs will support water security in the most water-stressed country in the world. Their construction is an engineering triumph, unparalleled anywhere. Molybdenum plays a crucial role in ensuring the longevity of the giant concrete tanks, which will supply Qatar with potable water for many decades to come. (Michael Bold)