



Dams and reservoirs

- Seepage control and cutoff
- Seismic remediation and mitigation
- Sinkhole stabilisation
- Foundation improvement
- Overturning and sliding

Keller Group plc - Who we are

Every day, people around the world live, work and play on ground prepared by Keller, the number one geotechnical specialist contractor worldwide.



North America

- North-East
- South-East
- Florida
- Mid-West
- Central
- West
- Canada
- Specialty Services
- Moretrench Industrial
- RECON
- Suncoast

Europe

- Central Europe
- North-East Europe
- South-East Europe and Nordics
- South-West Europe
- UK

AMEA

(Asia-Pacific, Middle East and Africa)

- ASEAN
- Austral
- India
- Keller Australia
- Middle East and Africa

Solutions specialist

Used alone or in combination, our techniques solve a wide range of geotechnical challenges across the entire construction sector – from industrial, commercial and housing projects to infrastructure construction for dams, tunnels, transportation and water treatment, as well as projects to address environmental challenges.

Global strength and local focus

We are unique in that we combine global strength and knowledge with our local presence and focus. Our knowledge of local markets and ground conditions means we're ideally placed to understand and respond to a particular local

engineering challenge. Our global knowledge base then allows us to tap into a wealth of experience, and the brightest minds in the industry, to find the optimum solution. With 9,000 employees and operations across five continents, we have the people, expertise, experience and financial stability to respond quickly, get the job done and see it through safely.

By connecting global resources and local knowledge, we can tackle some of the largest and most demanding projects around the world but the everyday work we do is just as important and, in total, we handle an unrivalled 6,000 projects every year.



Keller at a glance

 Established in 1860	 6k contracts executed a year
 40 countries	 9,000 employees

Building the foundations for a sustainable future

-  Ground improvement
-  Grouting
-  Heavy foundations
-  Earth retention
-  Instrumentation and monitoring





Challenges we can solve

Our extensive geotechnical expertise accumulated over many years enables us to provide cost-efficient solutions and respond flexibly to a variety of challenging situations and conditions.

Our ground preparation techniques allow you to construct your project as designed when it must be built over less-than-ideal soils. We perform our work safely around structural buildings. Our quality control capabilities help to ensure what we construct in the ground is to specification.

We take special care to keep disruption to a minimum, selecting technology and equipment to ensure operations can continue during the work.

Health and safety

We believe no one should be harmed as a result of any work we do and our ultimate goal is zero incidents.

Health and safety is a priority for Keller and we have a proven track record of one of the lowest accident frequency rates in our industry. The commitment of leaders and employees to our Think Safe programme has earned us awards and recognition from industry bodies as well as our clients.

Dams and reservoirs

Keller understands issues faced by owners and operators as they maintain the safety of dams and the communities they serve. From grouting for seepage control to ground improvement for the seismic remediation of dam sites to the installation of cutoff walls and more, Keller provides the complete range of geotechnical solutions for planned and existing dams.

Quality control has always been a key aspect of our work and we implement the most advanced quality control methods. We use state-of-the-art data acquisition equipment for precise verification.

Whether your situation is typical or unique, Keller has the experience and innovation to assist engineers, contractors, and owners with identifying and implementing the best solution.

Our commitment to sustainability

At Keller, we are committed to better understand our contribution to sustainable development and work collaboratively with our customers and stakeholders to reduce potential impacts.

We offer:

- Soil remediation and prevention of contamination: cost-effective and environmentally-beneficial soil remediation solutions to reduce contaminants to levels which are suitable for use without environmental risks or danger to health.
- New materials and design solutions to reduce carbon: lower carbon products to help clients reduce the carbon footprint of their projects, as well as carbon measurement and offsetting.
- Equipment to reduce spoil and materials: innovative solutions to help clients reduce and/or reuse spoil generated from some ground improvement techniques, like piling and grouting, saving the cost of removal from site and disposal.

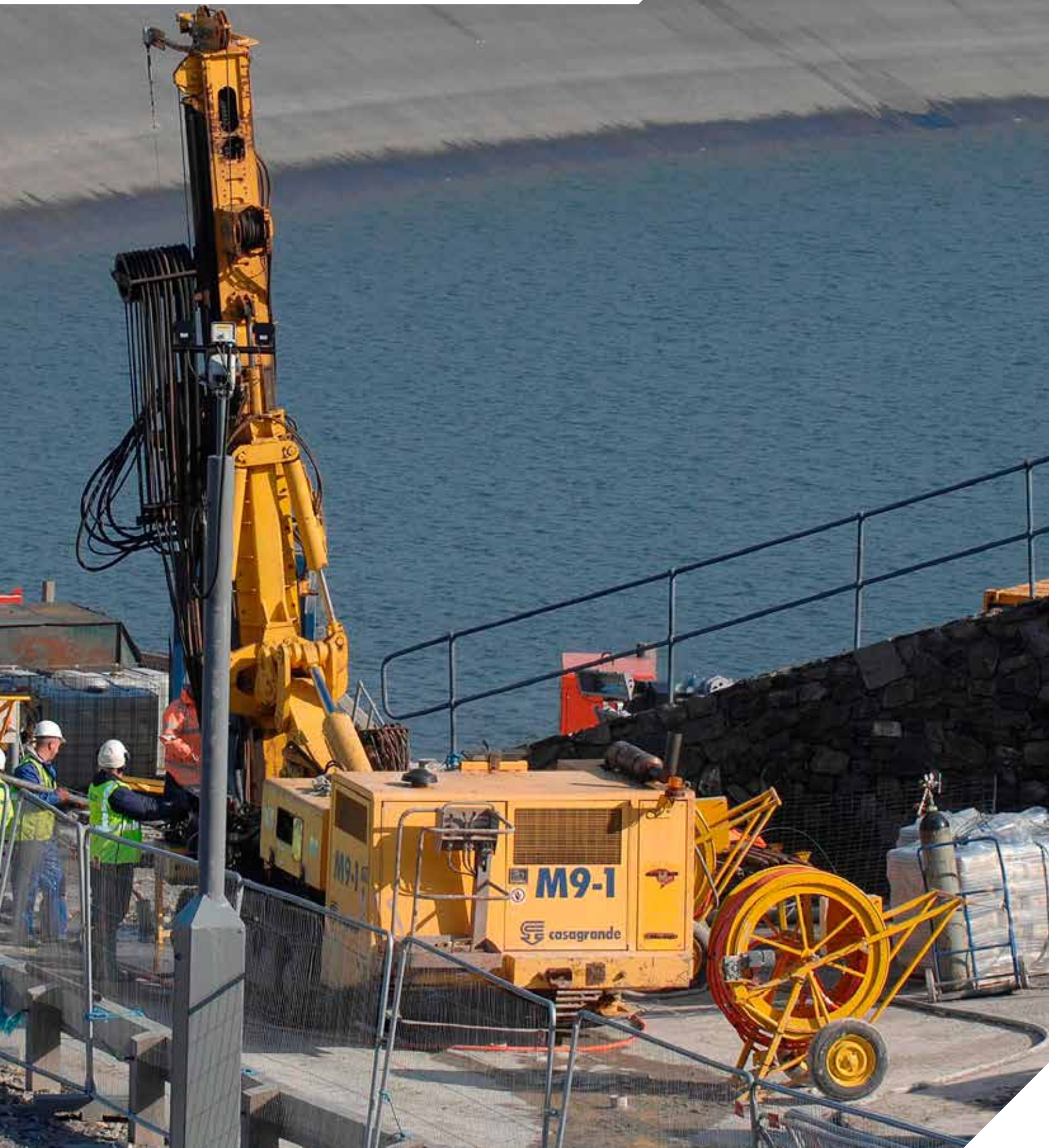
Grouting

Dinorwig Power Station, North Wales

Built in the 1970s, Marchlyn Dam acts as a pumped storage reservoir for Dinorwig Power Station, in North Wales. To meet increased electricity demand, a decision was taken to increase the height of the dam, and as part of the upgrade, also to seal leaks that had developed on both abutments. This required the installation of a grout curtain to 110m depth to both abutments of the existing rockfill dam, using an Ascending Stage technique. The slate was highly fractured, so grout holes had to be carefully drilled to reduce problems of borehole collapse and achieve required positional tolerance. Grout design had to consider the hydraulic effects of fluctuating ground water levels from the pumped storage scheme. Water levels within the reservoir fluctuated by up to 30m over a 24-hour cycle during drawdown stage and refilling for electricity production. Grout design also had to consider the wash-out effects on pollution of downstream watercourses, and avoid damage to dam wells and monitoring. Consequently, Microfine grout was used above 40m depth, and Mayco Silica below 40m. Critical grouting operations were phased to tie-in with reduced periods of electricity demand. The operations were conducted in an environmentally sensitive area where protection of watercourses and reservoir were paramount. Site wide environmental controls were developed by Keller and the project was completed without incident.



Project examples



Grouting

Polavaram Dam

Andhra Pradesh, India

Keller is proud to be associated with an ambitious multi-purpose mega national project with specialized technique of Jet Grout cut off below u/s & d/s cofferdam. Through this project we have been instrumental in introducing Jet Grouting, a relatively new and superior technology. The project necessitates working on a perennial river having a 2 km wide bank. Moreover, we are required to work on stringent deadlines because the onset of monsoon poses added operational challenges, or worse, even nullify all previous efforts. There are several dynamics for the accomplishment of certain geo-technical tasks. That's when Keller India leverages its "Global Strength Local Focus" advantage over its competitors. Transfer of technology entails the deployment of the best people and machines from across the globe. The specialty pumps from US, the specialized drill rigs from Germany and technical expertise from across globe exemplify the sheer strength of our resources in executing such a project. Project has bagged Vishwakarma award by Construction Industry Development Council for Safety Excellence.



Project examples

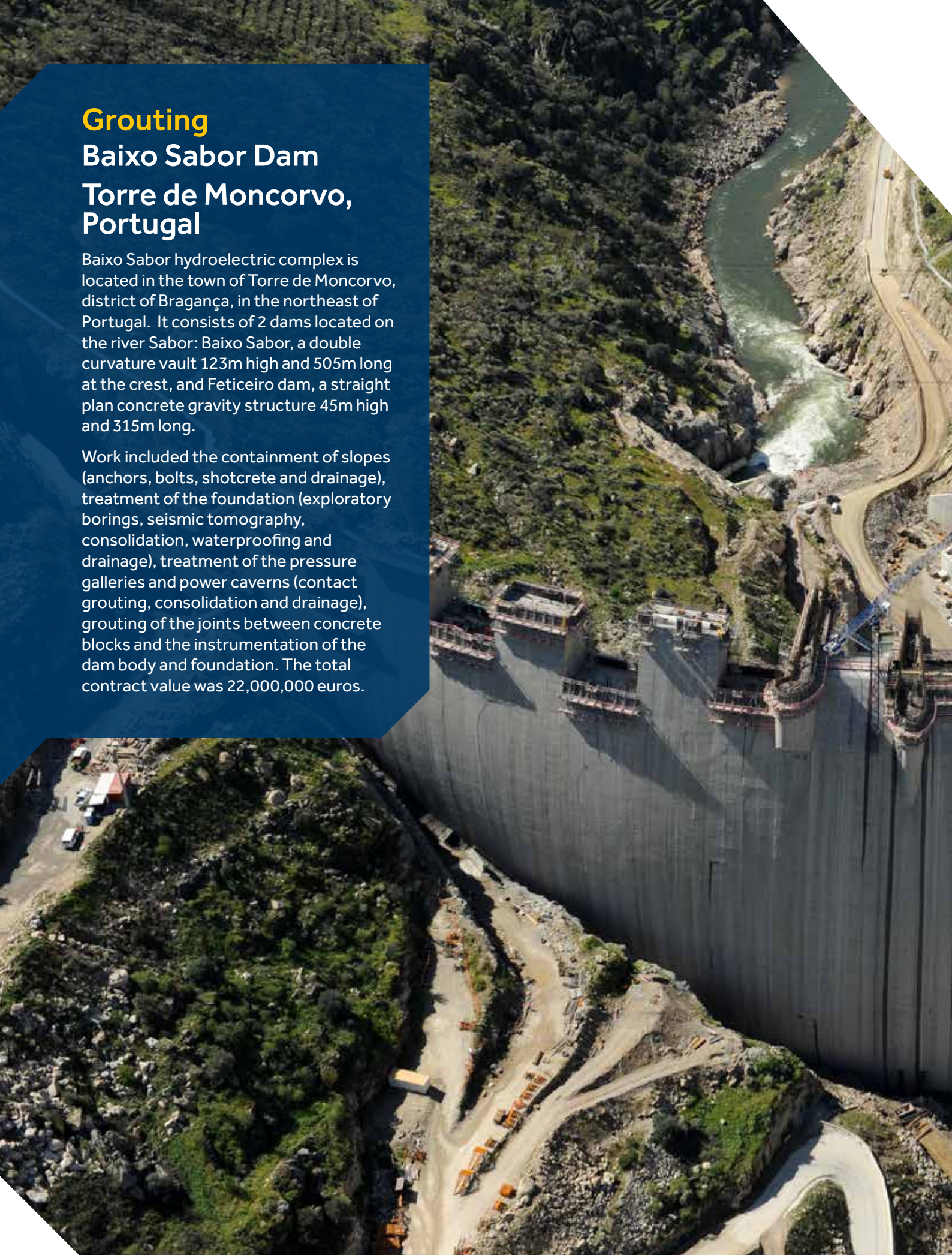


Grouting

Baixo Sabor Dam Torre de Moncorvo, Portugal

Baixo Sabor hydroelectric complex is located in the town of Torre de Moncorvo, district of Bragança, in the northeast of Portugal. It consists of 2 dams located on the river Sabor: Baixo Sabor, a double curvature vault 123m high and 505m long at the crest, and Feticheiro dam, a straight plan concrete gravity structure 45m high and 315m long.

Work included the containment of slopes (anchors, bolts, shotcrete and drainage), treatment of the foundation (exploratory borings, seismic tomography, consolidation, waterproofing and drainage), treatment of the pressure galleries and power caverns (contact grouting, consolidation and drainage), grouting of the joints between concrete blocks and the instrumentation of the dam body and foundation. The total contract value was 22,000,000 euros.



Project examples



Grouting Restoration for Dischingen embankment Dischingen, Germany

Direct water leakage from the dam structure was detected at several points during excavation for renewal of the air-side leachate drainage system. This increased permeability placed the entire structural stability of the embankment at risk. Following thorough investigations of the embankment body, Keller Grundbau constructed a 3,590 m² Soilcrete® lamella sealant barrier.



Project examples

Slurry cut-off wall

Abberton Reservoir, Essex, United Kingdom

Abberton Reservoir, near Colchester, was undergoing major earthworks to increase its capacity by 60%. As part of this a low permeability cement bentonite (CB) cut-off wall was required along the existing reservoir causeway, taking into account an existing culvert. The reservoir is a Site of Special Scientific Interest.

A cement-bentonite slurry wall was installed along the 630m causeway with jet grout columns providing continuity and sealing around an existing culvert. The design CB mix would act as the trench stabilizing liquid during excavation and when hardened would form the final cut-off wall. Daily trench and slurry samples were tested for

permeability and strength. To seal the culvert, 14 jet grout columns were installed through the pre cut roof and completed with high pressure grout injection to enlarge the columns' diameter. Drill casings were inserted to allow spoil removal to the surface requiring very little spoil removal from the culvert floor.



Grouting

Lake Manatee Dam Manatee County, USA

Lake Manatee Dam is a 4,700-foot-long, 27-foot-high zoned earth embankment with a pervious outer shell and a central clayey core. Significant internal erosion and piping threatened uncontrolled release of the reservoir if left untreated. A 95- to 105-foot-deep cutoff wall was required through the spillway and 3,000 feet of adjacent embankment.

With the dam in a fragile condition, the construction process had to have minimal impact on the dam and the most critical sections needed to be completed before the impending hurricane season. Construction of the wall beneath the spillway without damage to the concrete structure was also challenging.

From barges placed in the stilling basin, Keller cored small diameter holes through the spillway and constructed the underlying cutoff wall with overlapping 4-foot-diameter jet grout columns. A soil mix wall was efficiently constructed with the TRD method. The TRD process minimized risk to the dam since the thick, constructed in place, soil mix material would fill or choke off any erosion channels encountered.



Project examples





Ground improvement Kununurra Dam Kununurra, Australia

Situated in remote Western Australia, the Kununurra diversion dam supplies water to the irrigation system that supports the region's agriculture. As part of the dam owner's maintenance program concerns were raised that the east abutment of the dam could suffer serious damage in the event of an earthquake with a magnitude of more than 7.2. Following initial advice provided by Keller to the designer, sand filter piles were chosen by the client to allow the water to flow without washing away any materials with vibro stone columns installed to improve the stability. The works were undertaken on a difficult sloping site with poor sub-grade material, which required our plant to be re-configured to reduce the platform requirements and consequently reduce the thickness of the platform.

Project examples

Deep foundations Loriguilla Dam Chulilla, Spain

A waterproofing curtain was made to improve the conditions of the rock mass for a later execution of a drainage gallery that would release the existing pore pressure. The diversion tunnel was also waterproofed the same way. The challenge consisted in drilling up to a depth of 70 m with a deviation of less than 2%. The works were performed with a Comacchio 800 drill rig, equipped with a down the hole water hammer which significantly reduced the drilling deviation. Deviation was controlled with a gyroscope and resulted in less 1,5% for the deepest holes.

Waterproofing grouting was carried out through the "ascending system" combined with the "descending system" to fit the fracturing of the rock mass. A Vopi type field computer was used to control and record the grouting parameters.

Ground improvement River Rhône Switzerland

In the third phase of the Rhône correction, a 16,000 m² wall between the towns of Riddes and Aproz was constructed. This aimed to improve the existing dam in Aproz to a length of more than 1,600 m and to protect the town from flooding.

To meet the requirements for the designed wall with a thickness of 35 cm, the DSM method was chosen. With the triple paddles, the execution of 50 cm thick walls is easily possible. A new mixing tool was developed, which worked well on this ground conditions. They were very inhomogeneous and varied in terms of compactness and could be classified as abrasive.



Project examples





Grouting/Slurry Wall Chapel House Reservoir, Cumbria, United Kingdom

Built over 100 years ago, the client United Utilities, required improvements to Chapel House Reservoir to comply with a dam safety assessment. Water supply from the reservoir had to be maintained throughout the works and fish migration through the waterway undisturbed. Following detailed stability assessment of the dam, Keller constructed a low permeability cut-off wall through the middle of the dam, with a grout curtain which extended below this into rock. Improvements to the spillway, and construction of a new wave wall and access road, followed the geotechnical works.

Project examples



Earth retention Polder Wörth- Jockgrim Germany

Measures to improve the safety of the nearby Jägerhöfe farms were necessary for the construction of the Wörth-Jockgrim flood retention system. The aim was to prevent any flow through the dike structure in the area of a watercourse junction. Using the DSM method with triple paddles, Keller Grundbau constructed around 60 m of sealant barrier to the west of the Neupotzer Altrhein and another approx. 600 m to the east.

Earth retention

Clearwater Lake Dam Piedmont, USA

Clearwater Lake earth embankment dam was founded on karstic limestone rock that had developed significant groundwater seepage due to the rock's soluble chemical nature. A deep cutoff wall was necessary to provide a permanent solution to the seepage.

Keller used four of its latest state-of-the-art hydromills to install the cutoff wall. Three hydromills worked full-time and the fourth was ready as a backup when one was down for servicing. The cutoff wall is 4,080 linear feet long and approximately 200 feet deep. Keller modified its fleet of hydromills to effectively penetrate a large amount of rock, enabling it to complete the cutoff wall ahead of schedule and on budget.



Project examples



Groundwater control

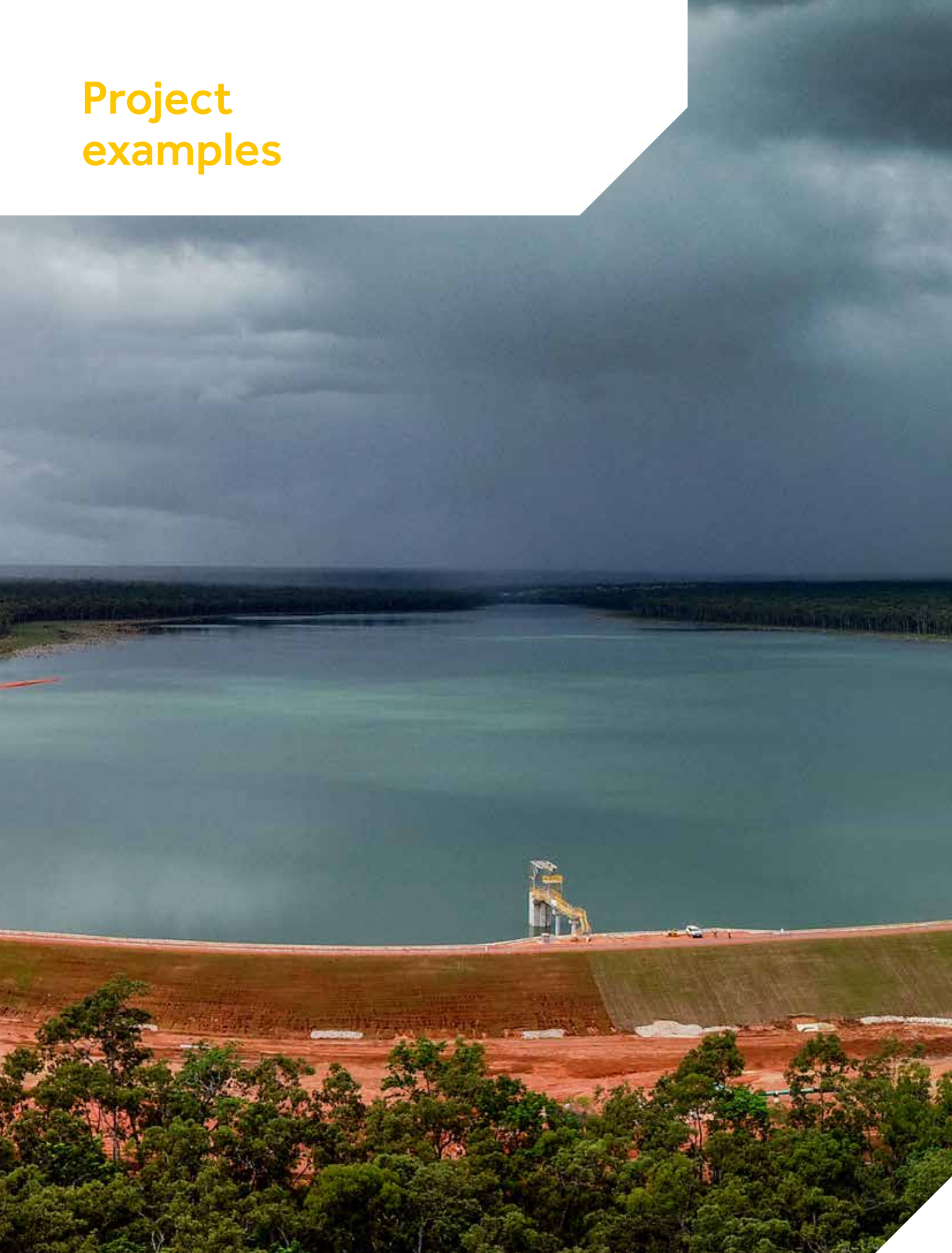
Amrun Dam

Weipa, Australia

The Amrun project was developed by Rio Tinto to expand their bauxite mining operation on Cape York. The site is located in far north Queensland, Australia and is characterised by monsoonal seasons. A cut-off wall underlying the dam was required to prevent water seepage. The project involved constructing a 22,000m² cement-bentonite slurry wall, 2.3km long, 800mm wide and to depths of 7-13m. "Keller's determination to complete a task, to the design and quality required, regardless of issues placed in front of them, is exemplary. Keller seem to have an ability to specifically place the correct and very professional management individuals, including experienced core team members, on specific projects, which provides for a competent outcome that achieves all expectations." Bechtel



Project examples





Earth retention

Flood protection

Urslau

Saalfelden, Austria

Due to the flood of the century in 2002, the town of Saalfelden was badly affected by the "Urslau" river, which is why the torrent and avalanche control designed the project to upgrade and widen the channel cross-section. In order to be able to create the planned deepening of the river bed - which averages around 3m - the Urslau was temporarily separated in its river axis with a sheet pile wall and the existing bank walls were underpinned using Soilcrete®.

The challenge with this project was the limited space between the sheet pile wall and the existing bank walls and the length of the construction site of more than 350m between the site construction area and the production area.

Project examples





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