

Queen Elizabeth II Reservoir

Tunnel Relining

Client: Thames Water

Location: South West London

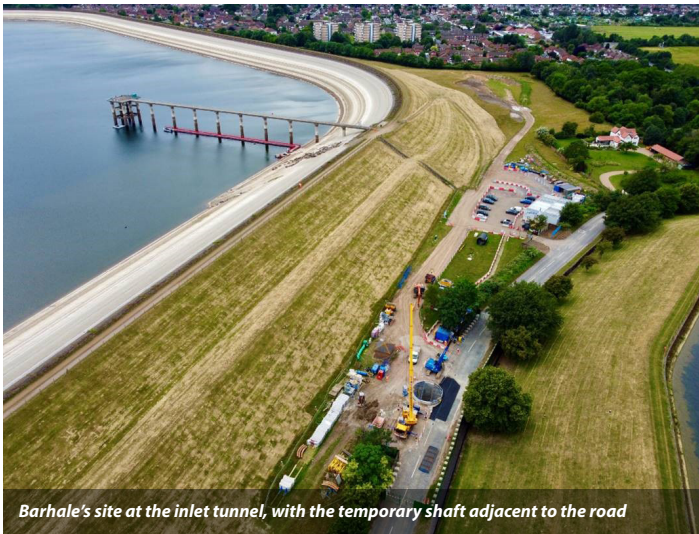
Value: £11m

Duration: 12 Months

In Brief...

The Queen Elizabeth II (QEII) Reservoir is a raw water reservoir in South West London that is owned and operated by Thames Water. The reservoir holds over 19 million litres of water, equating to 10% of the raw water storage for London. Once treated, this provides clean drinking water for millions of people across Surrey and London.

Barhale were engaged by Thames Water to complete this £11m tunnel relining project to guarantee the integrity of the aged inlet and outlet tunnels. The goal of the project was to strengthen the tunnels and prevent any leakage at this crucial clean water asset.



Barhale's site at the inlet tunnel, with the temporary shaft adjacent to the road



The outlet tunnel temporary access shaft site

Technical Features...

The project involved relining two no 2.5m diameter tunnels. Before works could begin, the reservoir needed to be drained to a significantly reduced level, and the tunnels fully isolated for safety.

The level of the reservoir was reduced to about 6m, maintaining enough water to sustain the wildlife in and around the water.

The first tunnel to be relined was the inlet tunnel, which runs from Walton Treatment Works into the QEII. The second tunnel was the outlet, which takes water from the QEII to Hampton Treatment Works.

The inlet tunnel is 1,060m in length and outlet tunnel is 826m in length, both 2.5m diameter wedge-block construction (600mm long blocks).

To access and reline the tunnels, both the inlet and outlet required two access points.

For the inlet tunnel, this was at Walton Treatment Works, where a surge tower pipe was removed for access and refurbishment. Additional works here included adding a 600mm butterfly valve to futureproof the surge tower pipe. The secondary access point for the inlet tunnel was a temporary 6m diameter access shaft constructed at the North West boundary of the reservoir.

The access points for the outlet tunnel were at an existing, permanent shaft at Boormans Field (in a nearby residential area) and a new 6m diameter temporary access shaft within the boundaries of the reservoir at the North Easterly entrance.

The temporary access shafts were jacked circa 18m depth and then underpinned down to the top level of the tunnels, totalling 44m deep. Reinforcing ribs were installed inside the tunnels to strengthen them and the tunnels were then broken into from the shaft.

Inlet Tunnel...

The temporary shaft required for the inlet tunnel was located at the base of the QEII. This access shaft was between the reservoir embankment and Walton Road, which runs parallel to the reservoir and is a well-used route between residential areas. To gain access safely and in the correct location over the tunnel, the shaft encroached into the road. This meant that traffic management was required for the duration of the inlet tunnel works to minimise the disruption to the travelling public as much as possible.

After isolating and draining down, this tunnel was found to be free clear of debris, so required minimal cleaning to prepare for relining works.

Outlet Tunnel...

Works commenced at the inlet tunnel, with teams then moving onto the outlet tunnel.

Once shaft construction at the inlet tunnel was complete, the team moved straight onto the outlet tunnel temporary shaft which was within the grounds of the reservoir. At the location of the outlet shaft, to enable works to progress, demolition of an existing sampling building was required.

Whilst relining works were ongoing at the inlet tunnel, the outlet tunnel was being cleaned to enable the relining.

Concrete Relining...

The tunnels were both relined with poured concrete, with steel fixing done ahead of the concrete work. Shutters were installed in situ by the team, with concrete poured and cast in place.

Isolation Procedure...

To protect our workforce relining the tunnels, Barhale worked collaboratively with Thames Water to complete and implement a robust and thorough isolation procedure. This included making sure that every valve and outfall into the tunnels was double isolated – with primary and secondary physical and electronic isolations.

This procedure is drawn up by both parties and signed off and witnessed by representatives from Barhale as well as Thames Water's Abstraction and Operations Teams.

In total there were over 30 isolation points, with the primary physical isolation being at the location of the valve or outfall, and the secondary electronic isolation occurring at the remote control room. Additionally, there were a number of large valves within the reservoir that needed to be isolated. Specialist divers worked with our team to install blanking plates. These plates were 3.5m diameter and 2.3 tonnes each, so required careful installation to guarantee full isolation.

Tunnel Cleaning...

To allow the lining to be done, both tunnels had to be cleared of any debris having been isolated and drained down.

The inlet tunnel was largely free from debris so didn't require much clearing. Along the outlet tunnel however, zebra mussels had settled along the walls and invert so needed to be removed. This was done manually using scrapers and trollies which were then emptied in the tunnel using a vacuum system.

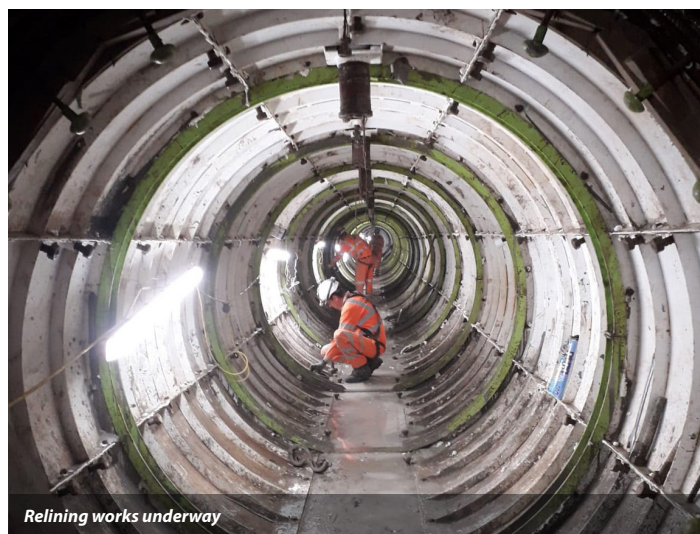
Innovation...

Communication in tunnels often presents a challenge as it requires maintaining contact over long distances where there is likely to be minimal signal. Barhale's team decided on the use of traditional baby monitors as they are simple, cost effective devices. This was a resounding success, with functionality that enabled clear communication over distances of 500m within the tunnels.

Thames Water Recognition...

This project was awarded Thames Water's Project Pride Award, a high accolade that recognises and rewards projects working as part of the Capital Delivery AMP7 Framework that achieve Health and Safety Excellence.

These awards are issued to projects of all sizes and at all stages of the construction lifecycle that have consistently achieved standards befitting 'Excellence'. They cover a range of criteria such as leadership, competence, health and wellbeing, safe workplace and more. Barhale's team at the QEII reservoir were recognised for their competence; developing skills to work in a safe and healthy way.



Relining works underway



Tunnel after relining

Customer Engagement...

The team put in every effort to beat the outline programme, and will finish ahead of schedule by about four months. This is a significant efficiency saving for the client, meaning Thames Water were able to get the reservoir back online sooner than planned, reducing the logistical challenge of sourcing water from elsewhere.

The original programme was for relining to take 4 months, completing in February 2022. The team will finish relining by the end of 2021, with Thames Water able to refill the reservoir in January 2022.

This project involved a significant amount of customer engagement and management. The permanent shaft and valve house at Boormans Field are located within a residential area, surrounded by homes. It was therefore crucial that the team took every effort to mitigate disruption – installing sound barriers, planning works carefully to not take place too early or late in the day, and keeping lights to a minimum.