

# Barrow Hill Shaft 3D BIM Survey Case Study

**Client:** Thames Water

**Location:** North London

**Value:** £1.8m

**Duration:** 12 Months

## In Brief...

The Thames Water Ring Main (TWRM) in London is an 80km long, 2.5m diameter tunnel built between 1988 and 1994 to take water from five treatment works and transfer flows via pumping stations housed in shafts along the route. It is a major part of London's water supply infrastructure and carries an average daily flow of 0.3 x109 gigitalitres – a little under one-sixth of the capital's daily demand.

Barhale was appointed by Thames Water to carry out refurbishment works at Barrow Hill Shaft, one of a total of 22 on the ring main. Located at St. Edmunds Terrace on the edge of Primrose Hill in North London, Barrow Hill is the deepest of the shafts at 80m deep and also the biggest with a four way tunnel connection at its base.



Flange - before



Flange - after

## Background...

This was the 15th shaft Barhale refurbished for Thames Water under the current refurbishment programme. Work included upgrading the shaft drainage, access, flooring, electrics and pipework. This work ran from December 2018 to December 2019 and was valued at £1.8million.

Drawing on the experience gained at other TWRM shaft refurbishments, Barhale decided to take the opportunity to create a trial 3D digital model of the lower section of the shaft. At its most basic level, this model enabled Barhale to replace paper-based safety and quality records with digital versions.

Looking ahead, the model will also bring significant benefits to Thames Water and anyone working in the shaft in the future. For example, the model will have details of the shaft components so will remove the need to carry out a pre-survey and eliminates the associated risk of confined space entry prior to the commencement of any future works.

Before any scanning and modelling work could be undertaken, the Barhale team faced a big challenge. There was significant water ingress to the shaft. Anyone familiar with the Barrow Hill location will be aware that there are a number of potential contributing factors including high levels of ground water as rainfall averages have increased and the presence of the Barrow Hill reservoir. At best, the shaft was damp while at other times significant volumes of water would pour in, making it a difficult working environment. So before work to address any damaged assets such as leaking flanges or burst pipes was possible, it was essential that the shaft was made water tight.

Working with Tempo PCE, Barhale developed an innovative solution. A series of holes were drilled through the shafts concrete rings making it possible to insert a lance. Normet TamPur 125, a hydrophobic polyurethane was then injected. The chemical reacts when it comes into contact with water to produce a rigid polyurethane foam, sealing and waterproofing the shaft. Effectively, an additional resinous waterproof barrier was created over the outside of the shaft. Using this approach Barhale was able to deal with more than 300 leaks.

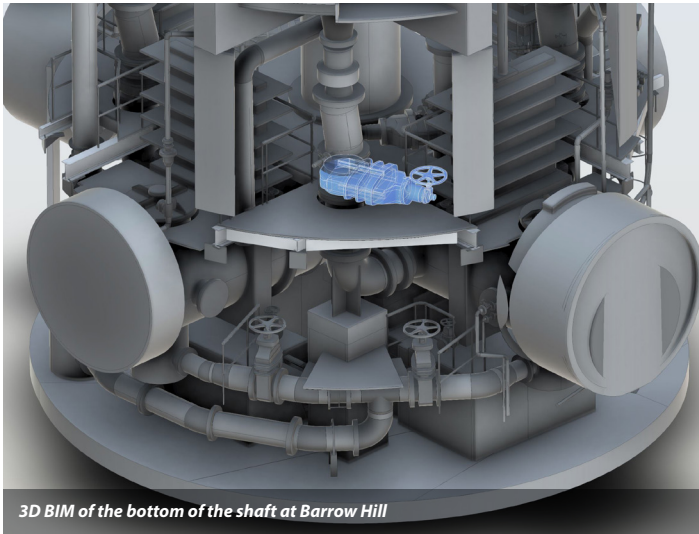
Once the shaft was dry, the Barhale team was able to progress the maintenance and refurbishment work.

## Technical Features...

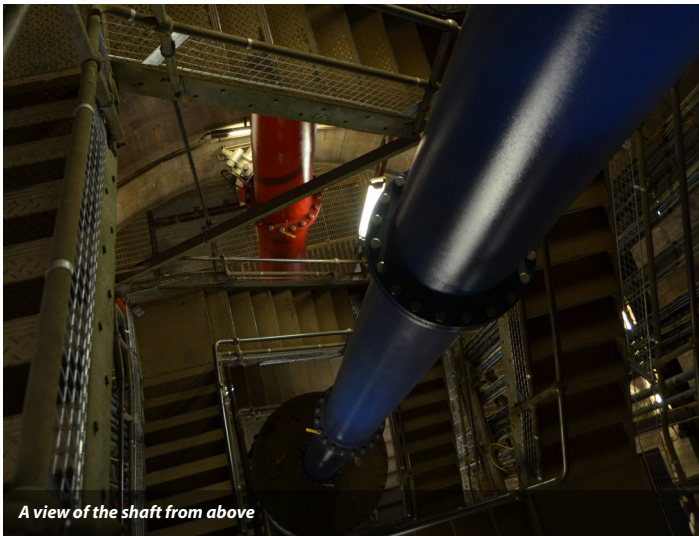
The works presented a fantastic opportunity to adopt a forward-thinking strategy, simplifying potential future works at the shaft through digital modelling the shaft.

Barhale engaged land and engineering surveying specialist Murphy Surveys to carry out a 3D laser scan survey of the lowest three levels of the shaft. Murphy Surveys then built a digital model using Autodesk's BIM 360 Field software. All the existing components within the shaft were picked up in the survey. As Barhale replaced that component with something new, data relating to every new part was attached to the model.

For example, if bolts were replaced on a pipe flange, a Barhale engineer took a tablet device down into the shaft once the job was finished, carried out all the safety and quality checks, such as the torque on the bolts and recorded them electronically.



3D BIM of the bottom of the shaft at Barrow Hill



A view of the shaft from above

### Technical Features Cont...

This information, together with the engineer's signature and any photos taken of the work, were automatically attached to that component and then synchronised to the master model online so anyone with access can log in and look at it.

Barhale and Murphy Surveys' scope of work included:

- Murphy Surveys completing a 3D survey using a Leica 3D laser scanner and a NCTech iStar 360 camera; creating the model using BIM 360 Field software; hosting the model data; and provisioning of Apple tablets for the team to complete the post work survey
- Barhale providing site access and confined space rescue and supervision; making available inspection test plan check sheets to upload to the model; completing post work surveys utilising the Apple tablets; and uploading survey information to the model. Barhale team members are able to view the survey information but not the model using Autodesk BIM 360 Field web browser which requires a license fee. 3D Autocad software is required to view the model.

### Customer Benefits/Feedback...

The main benefits to Thames Water of having the 3D BIM model come from not having to go into the shaft to survey or check information before work commences. The model will be kept live and can be viewed and updated when required through maintenance periods. There is the opportunity to use the model for design, scaffolding, temporary works design and planning isolations. On this contract, a model was only built for the bottom of the shaft. For future contracts, Barhale plan to complete a model from the start for all the shaft works.