Counters Creek Flood Alleviation Scheme

protecting busy residential areas of West London from flood risk with a minimum of disruption to the local population

The Counters Creek Flood Alleviation Scheme was developed by Thames Water in response to the widespread basement flooding caused by intense rainfall in the Royal Borough of Kensington and Chelsea and the London Borough of Hammersmith and Fulham. The scheme aims to reduce flood risk for relevant basement properties through a series of interventions that include: local foul water and storm water sewer upgrades to increase capacity in areas particularly prone to flooding; the installation of pumping devices called Flooding Local Improvement Project (FLIP) units to protect individual basements; and the installation of sustainable urban drainage schemes.

Purser's Cross Road shaft - Courtesy of Barhale

Undertakings

Barhale Ltd, alongside its specialist design partner, Pick Everard, designed and built seven local schemes as part of the broader Counters Creek scheme. These local schemes typically involved increasing the sewer capacity in the respective area by installing a new sewer alongside the existing sewer. Two of the schemes also included the construction of new pumping stations and sewer networks.

Construction was carried out in two phases which started in February 2019. Phase One consisted of three schemes (Tabor Road, Perrymead Street and Castletown Road) and Phase Two consisted of four schemes (Bowerdean Street, Bradbourne Street, Queensdale Place and Purser's Cross Road).

Supply chain: Key participants

- ***Client***: Thames Water
- ***Principal contractor***: Barhale
- ***Designers***: Pick Everard
- ***MEICA***: JRP
- ***Precast concrete***: FP McCann
- ***Pumps***: Xylem Water Solutions

Phase 1

- Tabor Road (to protect 9 properties)
- Perrymead Street (to protect 7 properties)
- Castletown Road (to protect 3 properties)

In all three cases, the flooding was caused by a surcharge of the downstream sewer. The solution was developed following site investigation works and verification through additional hydraulic modelling. It consisted of installing attenuation rider sewers with a flap that shuts when the existing sewer surcharges. The rider sewer and manhole chambers have sufficient storm storage to protect the connected properties while the flap valve is closed.

Tabor Road: Barhale laid a 4m deep 1050mm diameter concrete rider sewer with a dry weather flow channel to improve performance in low flow conditions. The connection to the existing sewer was made at a new, 1.35m diameter manhole with a 300mm diameter flap valve constructed downstream of an existing manhole. Two new 1.8m diameter manholes were installed on the rider sewer.

Perrymead Street: Barhale laid 22m of new rider sewer at a depth of 4.5m, comprising 600mm x 900mm ovoid concrete pipes, to

Tabor Road rider sewer manhole - Courtesy of Barhale

Laying the 900mm rider sewer in Bradbourne Street - Courtesy of Barhale

improve the sedimentation performance during dry weather flows. Barhale also constructed one connection manhole of 1.8m diameter and two 1.5m diameter manholes on the rider sewer. To avoid a congested area of services, which included a high-pressure gas main, the connection manhole was located approximately 10m away from the end of the rider sewer.

The pipework was installed with timber heading for the portion beneath the high-pressure gas main. Barhale also found a void under the high-pressure gas main and had to remove the existing protection slab, fill in the void, and replace with a new concrete slab on top of the gas main. The remainder of the pipework was installed through open-cut.

Castletown Road: Barhale laid 37.5m of the new rider sewer at 5.5m depth, comprising 600mm x 900mm ovoid concrete pipes. Barhale constructed a 1.8m diameter connection manhole located approximately 7m away from the end of the rider sewer again to avoid a congested area of services including a low-pressure gas main. Two additional 1.5m diameter manholes were installed on the rider sewer.

Enabling works consisted of several utilities and mains diversions, including one 125 PE water main close to the line of the proposed rider sewer at Tabor Road, and two further water mains, one of 125mm diameter and one of 200mm diameter, at Perrymead Street.

With the exception of the short section at Perrymead Street, the rider sewers were installed primarily through open cut methods, and were laid in sections. The works were carried out under road closure. All spoil was removed from site and the backfill imported. The manholes were constructed as excavations supported by sheeted piles and frames.

Phase Two

- Bowerdean Street (to protect 15 properties)
- Bradbourne Street (to protect 6 properties)
- Queensdale Place (to protect 3 properties)
- Purser's Cross Road (to protect 16 properties)

As with the Phase One schemes, at Bowerdean Street and Bradbourne Street the flooding mechanism was a surcharge of the downstream sewer. Similarly, the solution consisted of the installation of attenuation rider sewers with a flap that shuts when the existing sewer exceeds its capacity.

Bowerdean Street: Barhale faced constraints in the shape of a 4" cast iron water main through the proposed site and laterals from two properties which would clash with the line of the proposed rider sewer. Barhale's approach was to divert and remove the original sewer and then to install a replacement section which did not interfere with either the water main or the laterals. The 64m length of diverted 300mm vitrified clay (VC) pipe main sewer was installed through open cut in 7.5m sections alongside the new 900mm, concrete pipe rider sewer (50m in length).

Both sewers were laid in the same trench, approx. 3.7m wide. Barhale also installed 5m of 300mm diameter VC pipe connection sewer. Three 1.8m diameter and one 1.2m diameter manholes were constructed on the rider sewer and three 1.2m diameter manholes were built on the diverted sewer.

Bradbourne Street: Barhale installed 41m of the new concrete rider sewer through open cut in sections of 7.5m. The existing sewer was kept intact, and the connection to the existing sewer was made at a new 1.5m diameter manhole constructed close to the lateral connection from a property. The 300mm connection sewer was VC pipe, 3m in length. As before, a 300mm diameter flap valve was installed to prevent surcharge from the existing sewer backing into

the rider. Two additional 1.5m diameter manholes were constructed on the rider sewer.

Queensdale Road: Barhale constructed a 6m deep, 3m diameter pumping well that continuously draws down the water level in the sewer upstream of the installation through two submersible pumps operating on a rotating duty/standby regime. The well was built through excavation up to the formation level with the support of sheeted piles and frames.

A concrete base was poured. The shaft was then built on top with caisson rings and protected with a concrete surround. The pumping arrangement enables all the flow upstream of the installation to be diverted to the pump well.

By not discharging from an overflow during storm conditions, the risk of residual sewage in the well becoming septic at the end of pumping is avoided. It also ensures that the pumps operate sufficiently during long periods of dry weather, thus improving reliability.

A 4m deep diversion chamber was also constructed on the existing sewer to divert the flow to the pumping station. The chamber has a 400mm diameter diversion pipe to the pump well with two penstocks to isolate the well. A 4m deep, 2.4m diameter precast concrete valve chamber was constructed to accommodate the non-return valves and gate valves.

Barhale also constructed a 1.8m diameter flow meter chamber located downstream of the valve chamber to accommodate an electromagnetic flow meter and a Bauer connection next to the flow meter chamber. A 1.8m diameter, 4m deep return chamber was constructed to accommodate the main discharging back into the trunk sewer, which was protected with a stainless steel baffle plate at the point of the discharge from the pumping station. The interjoining pipework between chambers was limited to 3m to keep all works in close proximity to the new pumping well location.

Barhale also constructed a control kiosk and ventilation stack.

Purser's Cross Road: Barhale constructed a shaft tank pump well and two inlet chambers (IC1 and IC2) in Purser's Cross Road, and a diversion chamber on the existing trunk sewer in Parson's Green Lane, with an attenuation sewer (consisting of different size manholes and different size pipes) to direct flow to the shaft tank pump well.

Barhale's solution was preferred to that of a previous proposal to install a row of box culverts at Purser's Cross Road which would have proved difficult because of the high groundwater level.

Instead, Barhale lessened the excavation required for the actual storage by creating a larger diameter, deeper shaft and by reducing the size of the drainage required to carry the flows into the shaft. The lead-in drainage was also reduced in depth. By greatly reducing the need for dewatering, the new solution also addressed the risk of settlement and impact on nearby properties as the local geology is predominantly gravels.

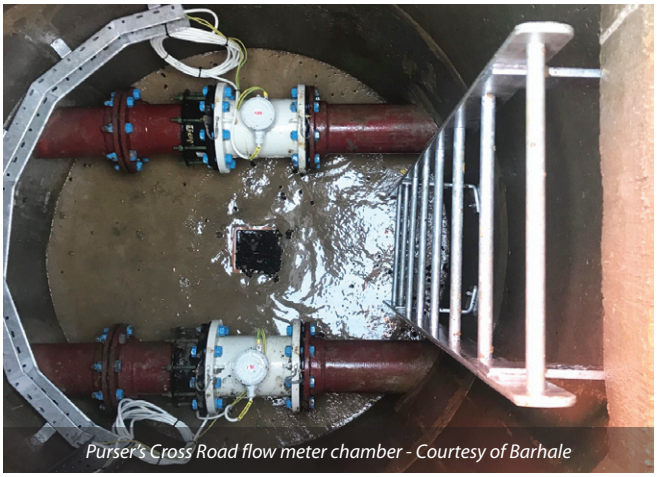
The shaft is 5m internal diameter and 14.8m internal depth. Although deeper, the shaft made use of a wet caisson method, to prevent any groundwater from being pumped away from the works. The only water in the shaft was carried through the water table (5-6m). Once a seal was achieved, and as the team pushed through the clays present at approximately 11m depth, they could then remove the groundwater from the shaft footprint. A 4m deep concrete plug was also installed to prevent shaft flotation.

The pumps and shaft tank act to draw down the water level in the upstream sewer to prevent flooding of the upstream basements.

Purser's Cross wet well access ladder - Courtesy of Barhale

Purser's Cross wet well pumping station - Courtesy of Barhale


Purser's Cross Road pump well shaft - Courtesy of Barhale


Purser's Cross Road flow meter chamber - Courtesy of Barhale


Purser's Cross Road shaft sinking - Courtesy of Barhale


Purser's Cross Road wet well shaft - Courtesy of Barhale

The attenuation is sufficient to prevent flooding when the surcharge level in the downstream sewer is too high to continue accepting the discharge from the shaft tank and also when the pump rate is beaten by the sewer inflow.

Two submersible pumps were installed to operate on a rotating duty/standby regime. The models have been chosen not only to manage the considerable variation in static head that occurs but also to operate close to the best efficiency point during normal dry weather conditions.

Enabling works for the shaft tank pump well included the diversion of a 600mm existing sewer from the footprint of the shaft tank and the diversion of a 100mm cast iron water main (replaced with approximately 38m of 125PE 100 SDR 17 pipe).

IC1 on Purser's Cross Road is 3m diameter; IC2 is 2.1m diameter; both chambers are 4.5m depth and they were built as wet caissons due to limitations of space.

At Parson's Green Lane, Barhale first diverted the flow of a nearby industrial estate away from the pumping station to an existing sewer downstream via two new manholes of 1.2m diameter. The diversion was 225mm clay pipe. The diversion chamber in Parson's Green Lane was constructed on the existing brick sewer and is 1.8m diameter and 4.5m deep.

The diversion chamber has two penstocks to isolate the well. From the diversion chamber, Barhale installed 15m of 450mm diameter concrete pipe with timber heading under high voltage cables and connected it to the IC2. From IC2 to IC1, a 900mm diameter, 8.75m long sewer with dry weather flow channel was installed through open cut. From IC1 to the main shaft, 5m of 450mm diameter ductile iron pipe was installed through open cut.

A flow meter chamber of 1.5m diameter was constructed for a single, dedicated pumping main to monitor the point of discharge for each pump. Barhale installed two flow meters in the chamber. Barhale also installed 12m of twin 300mm diameter ductile iron pipes from the flow meter chamber to a 1.8m diameter reception chamber with a penstock valve and baffle plate to protect the penstock valve from the wet well discharge directly on the penstock, and 5m of 300mm pipe from the reception chamber to a 1.5m diameter outfall manhole with a flap valve at the end. A baffle plate protects the penstock valve from any direct discharge from the wet well. All the chambers were built as excavations with sheeted piles and frames.

Barhale then installed 52m of 600mm diameter sewer through micro-tunnelling, to direct flows from properties on Swan Mews (the street perpendicular to Purser's Cross Road) to IC1 (IC1 acted as the launch pit for the micro-tunnelling tunnel boring machine). Barhale also constructed three manholes in Swan Mews: 1 (No.) 1.5m diameter reception manhole for the tunnelling, and 2 (No.) 1.2m manholes to bring the flows into the reception chamber.

Conclusion

The local flood alleviation schemes that Barhale constructed together with the additional measures that Thames Water has implemented as part of the broader Counters Creek Scheme will minimise flood risk for Thames Water customers that have suffered basement flooding in the past. The approach also provides a resilient and flexible solution to addressing longer-term challenges such as climate change and population growth.

Finally, the approach minimised disruption in a densely populated area of London to the satisfaction of local customers.

The editor and publishers would like to thank Barhale for providing the above article for publication.