

Airdrie Environmental Project

one of Scottish Water's flagship environmental projects for the 2010-2015 investment period is completed on time and under budget

by William Ancell BA (Hons)

One of Scottish Water's largest environmental undertakings in the 2010-2015 investment period was the Airdrie Environmental Project – a challenging scheme that required a large amount of planning and stakeholder engagement as well as complex engineering work. A wider project – the Metropolitan Glasgow Strategic Drainage Partnership (MGSDP) – is underway to tackle drainage and sewerage issues in the metropolitan Glasgow area. The Airdrie work is one part of the overall strategy of cleaning up Scotland's equivalent to the River Thames.



'Molly the Mole' tunnelling machine breaking through the exit shaft at Airdrie Railway Station - Courtesy of Scottish Water

Project need

The Scottish Environment Protection Agency (SEPA) determined that the water quality in the South Burn in Airdrie was suffering from storm water discharges from combined storm overflow (CSO) units at various locations in the town. Subsequently Scottish Water designed and costed a project to remove these discharges into the South Burn, which eventually contributes to the River Clyde, and redirect them to a new storm transfer sewer.

There was also a requirement to remove flooding risk from eight properties in the town.

Finally the project aimed to alleviate the likelihood of flooding at the Cairnhill Road railway bridge. An issue since the 1960s, it is one of the lowest points in the town centre and is surrounded on all sides by shallow vertical slopes and a lack of permeable land that can soak up surface water.

Project overview

The project consists of several interconnected pieces of infrastructure. The CSOs are tied into the existing and some new sewer tunnels that then feed into a large diameter storm transfer sewer that runs 1.2km in length to a storm tank. Thereafter storm flows discharge to the North Calder water. Attenuated flows from the storm tanks are returned to the existing sewer network as the flows subside.

Having settled on the budget and the design for the project Scottish Water approached several potential delivery partners and invited them to tender. Ultimately Byzak Ltd were the successful bidders having a proven history of delivering similar schemes such as the River Exe Tunnel for the National Grid.

Tunnel route selection

On their appointment Byzak proposed radical changes to the tunnel

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Geoff Aitkenhead, Asset Management Director, and Richard Ackroyd, Chief Executive of Scottish Water, with local school children as 'Molly the Mole' gets ready to start her journey - Courtesy of Scottish Water

route in the design. The original proposal involved tunnelling in difficult ground conditions beneath the busy A89 road between Coatbridge and Airdrie, which would have necessitated extensive site compounds at street junctions. It was also viewed that the original proposal had implications for properties and would cause severe disruption for residents and commerce. Byzak's alternative route was much less disruptive and would maximise the benefits from using the company's specialist tunnelling plant.

Scottish Water challenged Byzak to prove their alternate route was viable by performing extensive below ground survey work to ascertain the rock conditions for the tunnelling machine, and having successfully done so, Byzak appointed Grontmij as their consultants for the detailed design.

As well as being less disruptive the alternative solution resulted in savings to the client of around £2m. There has also been a major reduction in service diversion saving approximately £1m.

Tunnelling operation

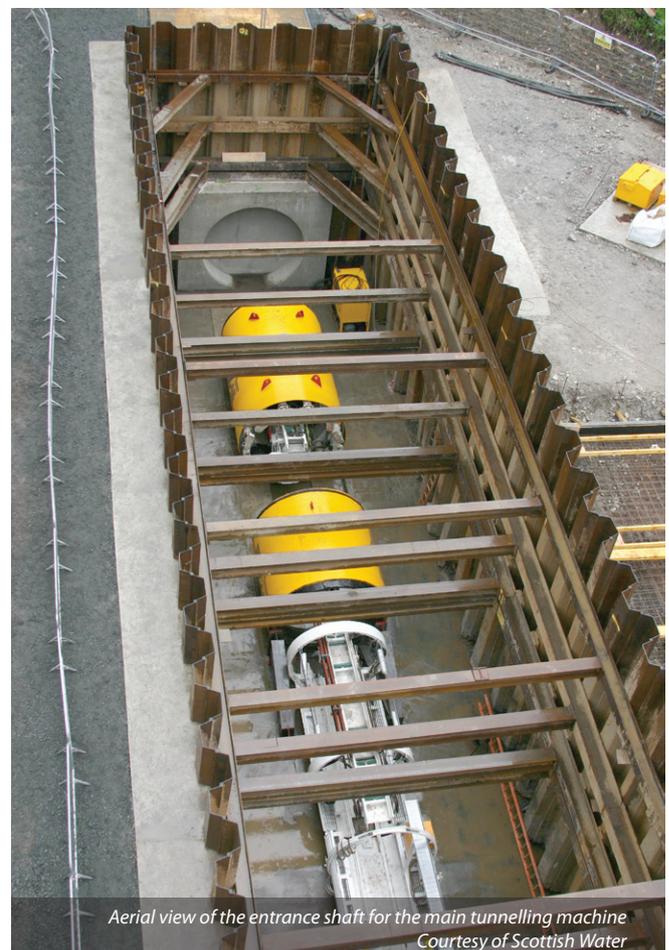
Work started by excavating a shaft at a brownfield site near the Go! Outdoors store at Locks Street. As an entrance shaft location this was ideal, with enough space to establish site offices as well as ample storage for building materials. It was also secluded and screened from nearby residential properties and was just a short distance from the storm tank location at the former Airdrie WwTW.

The tunnel was constructed using a Herrenknecht EPB tunnel boring machine (TBM) named 'Molly the Mole' by Aimee Stewart, a local pupil at Alexandra Primary School. Byzak had previously used this machine for similar projects in the UK and it was a proven technology.

Launched from a 38m x 8m x 9m deep sheet piled pit, the TBM was driven at an upgrade of 1 in 37 towards a reception shaft in a car park near Airdrie railway station. The ground conditions were mainly mudstones, shales and sandstones of the Coal Measures Series,



The entrance shaft for the tunnelling machine
Courtesy of Scottish Water



Aerial view of the entrance shaft for the main tunnelling machine
Courtesy of Scottish Water



The storm tank at the site of the former Airdrie WwTW
Courtesy of Scottish Water



Aerial view of the entrance shaft for the tunnelling machine
Courtesy of Scottish Water

but also included areas of made ground (demolition materials, abandoned coal workings, industrial waste). At full production 'Molly the Mole' was covering 60-70m per week.

Intermediate shafts for the tunnel were unnecessary and because of the remote location of the main working compound, double shifting on the main tunnel drive became acceptable and site deliveries and spoil transportation had only a limited impact on the local community.

The tunnel runs upwards to Airdrie Railway Station car park. It is a 1,202m long, 2.44m diameter, segmental tunnel constructed as single span, with a horizontal and a vertical curve, at depths up to 40m beneath a residential secondary road.

The storm water storage tunnel is connected to the existing sewerage network by 2 (No.) pipe jack tunnels - one being 206m long and 1,500mm diameter, the other is 316m long and 1,600mm

diameter. The 1,600mm diameter pipe jacks comprise 3 (No.) lengths radiating from a common 9m deep 7m diameter segmental drive shaft located close to Airdrie town centre. The 1,500mm diameter pipe jack extends the main storage tunnel to a new 25m diameter storm tank.

The pipe jacks were constructed using a backactor pipe jack shield and were completed using 'Wullie Worm', a Herrenknecht AVN 1600D remote controlled full face slurry machine. A major under track crossing of Airdrie Train Station was completed at end of January 2012.

Despite the tight programme, with hard work and good planning Byzak ensured that the tunnelling work was completed on-spec, safely and within the given timescales; an exceptional achievement on such a complex project and ensured that the project team fulfilled the promises given to various stakeholders regarding the timing of the work.



The view inside the storm transfer tunnel
Courtesy of Scottish Water



'Molly the Mole' tunnelling machine coming out of the tunnel at Airdrie Railway Station - Courtesy of Scottish Water

Combined storm overflows

Two lengths of auger boring (70m and 65m) will be constructed in Airdrie town centre area to allow one of the CSOs to be removed from the existing network.

Constructed within an open excavation, the new 11m deep storm tank downstream of the tunnel comprises 25m diameter smooth face precast concrete segments, factory made and founded on in-situ reinforced concrete bases.

The tank incorporates an innovative CSO chamber and flow switching chamber. Precast hollow core roof slabs complete the construction. Controls for the storm screens and the 4 (No.) transfer pumps will be housed in the brick MCC building constructed at ground level.

At Milton Street, the 3.9m long x 2.7m wide CSO chamber comprised 3 (No.) main components – the main chamber, the roof slab and the weir wall – which were craned into position and assembled on site. After making connections to the newly constructed pipe sewers the 6mm static peak screen from Hydrok UK Ltd was installed. Traditional formwork was no longer needed and, as a result, excavation and backfill quantities were significantly reduced, and construction periods significantly shortened.

Other works

To the south of the town, as part of the Cairnhill Road Flood Alleviation Scheme section of the works, the existing sewerage network has been upgraded. A total of 900m of new sewer in sizes 300mm diameter to 1,050mm diameter have been laid in open cut in Cairnhill Road and adjoining streets at depths up to 5m.

Public awareness

Scottish water have communicated regularly with the local community to ensure the work has as little impact as possible.

The team has also volunteered for a community event cleaning up Centenary Park in Airdrie by weeding plants, painting and cleaning up play equipment.

Local businesses and residents were kept aware of the latest news on the project through letter drops, posters, press releases, school bag drops, face to face meetings and through our online channels.

Scottish Water also made use of social media to keep the public informed through their own website (www.scottishwater.co.uk/airdrie), on Facebook (www.facebook.com/cleanairdrie) and with Twitter (@cleanairdrie).

Conclusion

Upgrades to the existing sewer network in Cairnhill Road and Broomknoll Street will reduce the risk of flooding which has blighted the area for several years. The project also picked up a small sewer upgrade near Airdrie Business centre which will reduce flooding in this area.

The railway bridge flooding should no longer occur as the new transfer sewer created has plenty of headroom to deal with severe rainfall.

Not only is the Airdrie Environmental Project one of Scottish Water's flagship environmental projects, but it is also one of the largest that the company will be undertaking in Scotland during the 2010-2015 investment period. By autumn 2012 the work will be finished on time and under budget, and will significantly improve the water quality in watercourses across Airdrie and in the wider River Clyde catchment.

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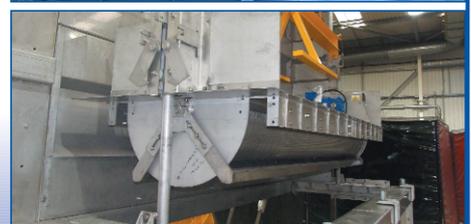
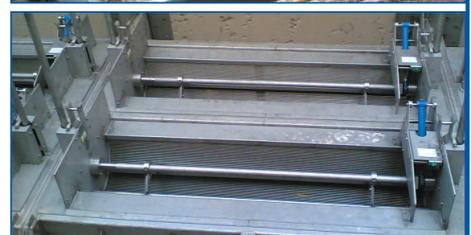
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