

# Maltsters Rising Main

replacing 500m of rising main by directionally drilling overcoming tides, difficult ground conditions, sensitive customers and significant EA constraints

by Matt Steer & Gil Clelland

As part of the South West Water Delivery Alliance H50's capital improvements programme, the Maltsters Sewage Pumping Station (SPS) Rising Main was identified for improvement after seven historic bursts within the last two years. This rising main is situated near the picturesque village of Tuckenhay, Devon, on the Harbourn River which converges with the River Dart. These bursts had all been on a 50m section outside an idyllic rental property (Hill Quay Cottage), which was affecting both their business and that of the renowned Maltsters Public House at the opposite side of the estuary. The primary cause for the bursts was the ductile iron material of the pipe reacting to limestone in the surrounding area.



Successfully crossing the estuary with the directional drill rods - Courtesy of South West Water Delivery Alliance H50



Directional drilling rig - Courtesy of South West Water Delivery Alliance H50



No disruption to the business during the drilling work - Courtesy of South West Water Delivery Alliance H50

## Project background

The rising main, which serves circa 430 people, flows north-west from the SPS where it crosses the Harbourn River and along a private garden and a public track, finishing at Ashprington STW - a distance of approximately 500m. The driver for the project was to rehabilitate Maltsters Rising Main to restore serviceability, reduce burst risk and provide 50-year asset life.

## Project scope

- Full replacement of existing rising main:
  - ✦ Install approximately 130m of 125mm OD PE100 (SDR 11) pipe across a tidal river.
  - ✦ Install approximately 377m of 125mm OD PE100 (SDR 11) pipe with minimum 150mm granular bed and surround across a track, gardens, a field and a STW.
- Provision for new flow meter chamber, air valve and washout.
- Grout existing 480m of 100mm internal diameter DI main.

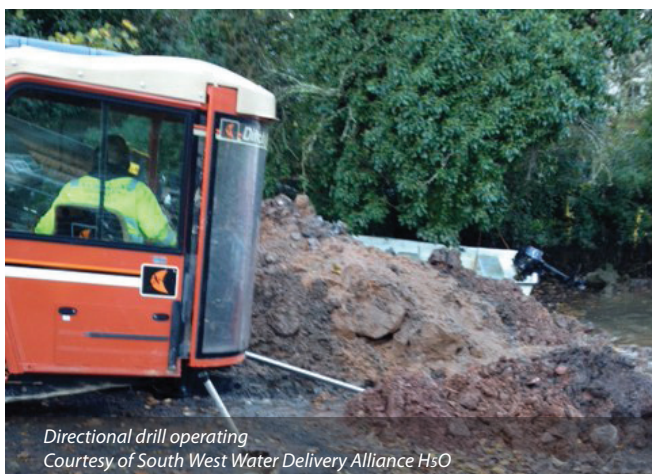
## Design challenges

The preferred option considered was to slip-line the existing rising main across the River Harbourn, then to replace the remaining sections to reduce burst risks to an acceptable level. However, a CCTV survey showed that lining the main would not be possible due to deformations within the existing pipeline; therefore, it was necessary to install a new pipeline to prevent further leakage.

The team installed a recoil check valve on the downstream riverbank which will reduce burst and pollution risks under the river and at the SPS by dissipating surge pressures.

The team deviated from the original plan which was to divert the natural course of the estuary at low tide across the tidal mudflats before open cutting part way across, installing a sleeve then diverting the water course back through the deep channel. This was because the environmental impact to fish, migrating sea birds and marine life within the mud structure would have been significant.





The main would need to be installed by directional drilling beneath the estuary, requiring a method to overcome tidal constraints, challenging ground conditions and minimise environmental impact.

The risks associated with using excavators trafficking over bog mats on the mudflats and the constrained tidal working window was substantial. Had a mechanical breakdown occurred the emergency rescue plan which the team considered would have been extremely challenging. The directional drilling was not without programme and budgetary risks given that the prevailing ground conditions in the area were limestone and rock - failure would have meant incurring directional drill mobilisation costs and programme delays.

### Innovation

The proposal was to directional drill below the estuary, pull in a 180mm sleeve and insert a 125mm pipe. This was deemed to be risky due to the volume of lime stone, and the cost of setting up a lagoon for the slurry with limited working space. However there would be significant benefits in terms of programme and cost if successful.

The team mobilised the directional drillers to site, opened up the launch and reception pits and during the following low tide begun to drill. Before they reached the low water channel they hit an outcrop of limestone and had to withdraw. The angle of the drill was moved and several different positions and angles were tried, to find a route past the rock shelf.

One of the challenges was to make regular checks as the drill progressed to ensure the Sonde was on course, which was made difficult by the consistency of the mud. A small boat was utilised to carry out the checks, and on the mud flats boards were used for the engineer to access the Sonde position and were removed as work progressed.

The team were finally able to get the rods through; however, the drill was reamed back before the tide came in, so the tidal water collapsed the void. Works started again but this time the team worked at night, taking rods off and travelling across the river to join them back on to ensure they maintained the void when the tide came in. This unusual methodology proved successful and allowed the reaming to be completed and to pull the 180mm sleeve in successfully.

### Project management

A combined effort was required from the beginning by H50 Managers and SWW Estates team. They met on site with the Stakeholders to advise them of the programme, the quantum of the disruption and reassure them that the work would be completed quickly with the minimum of disruption. The team put a plan in place to bypass the section at the most risk and managed to procure sufficient pipe to mobilise to site before the design and methodology was fully developed. The flexibility and quick decision making demonstrated by all involved was very impressive; from SWW Operations identifying there was a significant problem in terms of environmental and stakeholder risks to mobilising on site in only two weeks.

As the team worked on the pipeline there were regular discussions with the designers on the requirements. Although changes to the design were required, the team were flexible and agreed changes based on common sense and the changing site conditions. Close liaison between the designers and the construction team meant that the scheme was engineered to be constructed in two stages without increasing the burst risk. Once on site the team experienced unusual bed-rock which required amendments to the proposed alignment and air valve/washout locations, but through liaison between the Alliance a solution was agreed without delaying the scheme.



### Safety and sustainability

During the wet well and valve manholes works the team noted that an existing gasket was close to failure (this had recently been repaired by SWW Operations following a spill event in the Maltsters car park).

They were concerned that it would fail and flood the Maltsters car park and then spill into the estuary, and were pointed in the direction of colleagues in the RIO and Reactive team who mobilised another contractor at short notice to effect a repair around the planned pump outage and tanker mobilisation which was planned for the commissioning of the pipeline.

The change from the designed method of open cut to directional drilling across the estuary removed most of the environmental and health & safety risks associated with open cutting in a tidal environment. The construction programme was able to be significantly improved on which in turn reduced the overall out turn costs.

The open cut team were then able to operate concurrently on the mains laying from the estuary to the existing sewage treatment works which contributed to the reduction of the overall programme. By deploying the resources in this way the team were able to shorten the duration that the existing main was in service, therefore reducing the risk of a further mains burst, contamination of the watercourse and the possibility of prosecution by the Environmental Agency.

### Customer relations

This scheme had a high public profile due to frequent bursting and the design/construction programme was very tight to avoid any negative public relations due to overpumping at the Maltsters Arms. The majority of the existing rising main route was in private land with sections through a privately owned garden, and extensive negotiations were held with landowners.

Expectations from stakeholders were managed before works commenced, and as the team progressed the works they kept the Hill Quay Cottage residents informed and sent regular updates and photographs to the Cottage owner who resides in London.

Regular liaison with the Maltsters Arms owner on progress/programme and methodology gave them reassurance that H5O was committed to replacing the pipeline while observing the requirements of their business and the busy holiday period. On completion of the works an accolade was received from the Maltsters Arms: *'I am delighted with the work. It is of exceptional quality.'*

Re-landscaping was also carried out on the garden at Hill Quay Cottage, and the customer was delighted with the finished

product. An accolade was received from a holiday maker at the cottage: *'They were all very polite, professional and seemingly efficient at what they were doing. They took the time to warn us if they needed to move equipment and make particularly loud noise with machinery. Although no-one wants to have building works going on whilst on a holiday, we couldn't have asked for a nicer team of gentlemen.'*

### Results

The rising main has now been refurbished and offers reliability and environmental protection for another generation. This also protects the businesses of those affected by the bursts, whose customers were being disturbed when pumps and tankers were required during the night to control the risk of overflow from attenuation tank.

The measurement of success in making the change is verified by the following; commercially by the cost savings to the project, reduction in programme duration by more than 3 weeks which meant less disruption to the affected businesses and ecologically the prevailing ecosystem was unaffected such as the marine life in the estuary and the passage upstream of migrating water birds.

From a sustainability perspective the team installed a pipe sleeve which serves to protect the pipe from damage and facilitates replacement should it ever be required; the shorter duration also saved establishment and transportation costs. From a customer viewpoint, satisfaction that they were well informed and their individual needs considered throughout the project.

### Summary

Works began in July 2015 and with breaks in the works to comply with stakeholder and tidal constraints were completed in March 2016 with a budget of £342k.

This high profile environmentally sensitive scheme had significant working constraints, dealing with sensitive customers, tides and EA challenges. A series of options were considered to overcome these various challenges before deciding on the successful directional drill technique beneath the river; this together with regular and sensitive customer engagement enabled the project to be delivered to the satisfaction of both the client and local stakeholders.

The innovative trenchless technique and unusual methodology could be utilised by future projects working in a similar environment, to minimise the environmental impact.

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