The Hoddesdon Transfer

increasing water resources in the Lee Valley

by

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This challenging £29m Thames Water Project has the objective of achieving a 25Ml/d increase in water resources by facilitating inter-sewerage catchment transfers from Enfield in north London to Rye Meads wastewater treatment works in Hertfordshire. The subsequent increase in water volumes in the River Lee will then allow increased raw water abstraction during low flow periods.

Pipeline construction in southbound carriageway of A10 - June/03 courtesy: Thames Water

The project outputs form part of Thames Water's overall Resource Development Programme agreed with Ofwat in January 2001, which aims to increase and secure deployable water resources to protect customer supplies in the event of low flow events. Key elements of the project are:

* interception of a 1.3m diameter trunk sewer in Enfield;
* construction of a non-terminal pumping station including a dosing plant to prevent sewage septicity;
* construction of 18.9km of 600mm diameter rising main mainly in ductile iron;
* 12 micro tunnels under railway lines, rivers, canals and roads;
* one crossing under the M25 motorway using an existing culvert.

The project programme has been particularly challenging, with detailed design by *WS Atkins* commencing in May 2002, construction commencing in March 2003 and the agreed Ofwat completion date of March 2004.

The contractors employed are part of Thames Water's Alliance Partnership. *Murphy Pipelines* are constructing the pipeline north of the M25; *Barhale Construction* are constructing all micro tunnels and the M25 crossing itself, and *Enterprise Management Services* are constructing all pumping station works and the pipeline south of the M25.

Key aspect of the project design was the establishment of a pipeline route. A value management workshop was held in May 2002 to analyse available route options. Project team members, experts and advisors from outside of the immediate team attended so that environmental, property, traffic management, customer, planning and geotechnical issues were all included in the discussion.

The workshop discussed five main routes; Each route was scored relative to key performance and risk criteria, resulting in a hybrid route being selected for detailed design. This final route, is a mixture of highways and field areas, mostly involving land owned by the Lee Valley Regional Park Authority. Every effort was made to avoid sensitive environmental areas and major residential roads.

Environmental impact assessment

Information was submitted to all four local authorities affected by the project and all concurred that the works were permitted development apart from one local authority which determined that an environmental impact assessment was required. As substantial measures had been taken to reduce the impact of the pipeline on the environment during design, it was Thames Water's opinion that an impact assessment was not required. If an assessment had been carried out it would have made completion of the project by the agreed date impossible and possibly pushed the end date back by 12 months.

An appeal was made and in December 2002 the Government Office for the Eastern Region, representing the Secretary of State, gave formal approval for the project to proceed as permitted development.

This validated key decisions made by the project team when selecting the route during the value management process.

Challenging hydraulic requirements

From a design perspective the design has had to resolve the hydraulic challenges of a 600mm diameter 18.9km pipeline through the relatively flat ground profile of the Lee Valley

Two additional problems also had to be resolved; a suitable location for a pumping station with associated storage tank and a design that allowed only a proportion of the flow in the existing sewer to be intercepted. The flow profile in the sewer is diurnal and does not allow continuous pumping at a set rate.

These problems were resolved by designing a deep wet well with a weir that allowed the trunk sewer to be backed up sufficiently to provide the required 1000m^3 storage. A computational fluid dynamics model of the wet well ensured that flows to the submersible pumps were uniform without vortices and that deposition of solids were minimised.

Another computer model assessed the hydraulic performance of the pipeline and determined the pumping requirements. It was this analysis which identified a requirement for 1000m^3 of storage.

This model also addressed the key issue of surge protection as a failure of the pumps could result in a surge wave along the pipeline leading to negative/vacuum pressures that could damage the integrity of the pipe. A variety of options were considered but after robust analysis an air valve only option was selected.

Land & highways challenge

With a pipeline 18.9 kms long a large number of landowners and consultantees were affected by the scheme. Third party consultations and approvals were part of the project's critical path and their management was key to its success.

Those most affected were:

* London Borough of Enfield, Broxbourne, Epping Forest and East Herts;
* Enfield Highways, Hertfordshire Highways, The Highways Agency, Hertfordshire Traffic Police;
* English Nature, English Heritage, The RSPB, Lee Valley Regional Park Authority, Herts & Middlesex Wildlife Trust, Essex Wildlife Trust.
* Private landowners, 44 plots and 117 owners/leaseholders.

In addition, Network Rail, Environment Agency, Transco, British Waterways, and British Petroleum Agency approvals were required before works could begin in certain areas.

Land for the new pumping station was acquired off three different parties, and has been a mixture of leasehold and freehold purchase. Unfortunately, delays of around three months were experienced in this area, most notably because one of the interested parties proved very difficult to deal with.

Tunnelling activities

Micro tunnels (11 of 675mm diameter and 1 of 1200mm diameter) were used for constructing major crossings beneath railway lines (four), roads (two) and rivers/canals (six). The depth of tunnels beneath railway lines was primarily governed by Network Rail requirements for no more than 3mm settlement and whenever boring machines were operating within the zone of influence either side of the tracks, construction teams monitored the tracks continuously for any settlement.

Conclusions

This project has been a real challenge to the project team and not without its difficulties, especially around pumping station land acquisition, environmental impact issues and most recently groundwater issues at the pumping station site. Despite all this, the project is on track to be substantially complete by the end of March as intended. ■

Note on the authors: *Chris Davies is a project manager and Matt Coombs, a lead design engineer with Thames Water Utilities*