Swinley Forest Strategic Water Main Installation

3.7km pipeline to increase South East Water's water storage and transfer capacity and be prepared for development and population growth in the region

by James Brockwell

The £6.5m Swinley Forest Strategic Water Mains project involves constructing 3.7km of potable water pipelines within Swinley Forest, Bracknell, Hampshire. A total of 11 connections are required to connect the new water pipelines into the existing potable water infrastructure. The works are being undertaken in an area that is environmentally sensitive and is extensively used for recreation. The routes of the pipelines are within private land designated as Special Protection Area (SPA) and Site of Special Scientific Interest (SSSI). The majority of the pipeline routes are located within commercial coniferous plantation. Construction began in October 2014 and is due to be completed in November 2015.

The two excavators and drag box installing the 1,000mm nominal bore pipeline - Courtesy of South East Water

Objectives

There are three main objectives for the project; the first is to increase the storage and water transfer capacity within South East Water's western supply region to ensure security of supply, the second is to provide adequate water supply for projected future development and population growth in the region. An existing 16-inch uPVC water main that is prone to bursting is also being replaced and abandoned as part of the project.

Undertakings

The project comprises of the design, supply, installation, testing, sterilisation and commissioning of:

- 75m of 450mm nominal bore.
- 1,028m of 700mm nominal bore.
- 1,936m of 1,000mm nominal bore.
- 725m of 1,200mm nominal bore potable water pipelines.

The scheme focuses around two large service reservoirs known as Surrey Hills and Crowthorne which supply properties in Farnborough, Camberley, Frimley, Bracknell and Wokingham.

Once constructed, the pipelines will allow greater transfer capacity between these two reservoirs, meaning that water can easily be routed around the network as required due to demand or operational issues. The increased transfer capacity between Bray Keleher WTW and Crowthorne Reservoir will also allow for an increased output at Bray Keleher WTW to be utilised.

The 16-inch uPVC pipeline that is prone to bursting will be replaced with an upsized 700mm nominal bore pipeline which will supply future demand in Camberley and Frimley.

Farrans Construction and Civil Engineering Limited successfully tendered for the contract and appointed Mouchel as its designer.

Construction method

Farrans is installing the pipelines using open cut construction techniques utilising a seven metre long drag box and two 20 tonne 360º excavators. This simple method of installation has allowed an impressive lay rate of up to 220m per day. It also meant that open excavations were kept to a minimum in an area extensively used for recreation.

The Aquadam in use - Courtesy of South East Water

A section of the 700mm nominal bore pipeline has been installed beneath a watercourse known as Wish Stream; the crossing has been achieved using a method known as fluming, using the Aquadam system. The Aquadam consists of four watertight bags and a length of pipe. The bags are used to create two dams and the length of pipe is used to flume the water between them.

The upstream dam is deployed first by laying two of the bags, one on top of the other, in the bed of the stream with the flume pipe sandwiched between them. Water from the watercourse is then pumped into the two bags. When filled with water the flexible bags sink into the stream bed creating a watertight seal. The watercourse is now flumed through the pipe maintaining a flow in the stream and can be crossed by open cut excavation. The water used to fill the Aquadams can simply be returned to the watercourse when the dams are no longer required.

Negotiating pipelines

As demand on Crowthorne Reservoir has increased over the years new pipelines have been installed to maintain customers' supplies. This has resulted in an abundance of pipelines close to the reservoir which have to be negotiated when installing the 1,200mm pipeline. This involves deep excavations to cross beneath the existing pipelines. It also required an increased number of air valves due to the change in pipe elevation when negotiating these pipelines.

Unexploded ordinance

A proportion of the land is owned by the Ministry Of Defence and is regularly used for military training. A pre-construction Unexploded Ordnance (UXO) survey identified a medium risk of uncovering ordnance in this area. Prior to excavation, explosive ordnance safety and awareness briefings were given to all construction personnel conducting intrusive works. Instructions were also provided containing information detailing actions to be taken in the event that UXO is uncovered.

Cutting head post drilling with coupon still inside
Courtesy of South East Water

A non-intrusive magnetometer survey and target investigation was carried ahead of any intrusive works. This involves identifying the location of metallic objects below the ground along the route of the pipeline. Once identified, these objects are then excavated and investigated. In the areas where the survey was not conclusive, due to the magnetometer picking up background 'noise', an explosive ordnance disposal engineer was present whilst excavation was undertaken.

Archaeological issues

There are a number of known archaeological features nearby the working area including World War Two era tank traps and a number of redoubts from the era of the Napoleonic Wars. As such, archaeological supervision was required when topsoil stripping the works easement and excavating the pipeline trench in the vicinity of these features.

Split tee and branch valve secured to main
Courtesy of South East Water

An unknown structure was uncovered along the proposed alignment whilst topsoil stripping. The area was immediately fenced off whilst archaeological investigation was carried out. In order not to delay to the construction programme the pipework was re-aligned to avoid the structure and allow for a buffer zone. To change the alignment, the specified length for a flowmeter bypass had to be reduced. Archaeologists have not reached a conclusion on the purpose of the structure uncovered, but believe it to be a foundation for a search light or similar and documented its location.

Under pressure connections

Two of the 11 connections carried a significant customer impact. Shutting the water mains down in order to undertake these connections would interrupt a large number of customers' supplies for a long period of time. To minimise the impact, two under pressure connections were installed; a 300 equal tee and a 1,200 x 700 off tee.

Installation involved clamping a split tee with the desired size branch onto the live water main and then bolting the correct sized gate valve onto the branch. Inside the tee a rubber o-ring forms a seal between the tee and the pipe. Once the arrangement was secured to the main it is pressure tested to ensure the integrity of the fitting and to ensure the arrangement is free from leaks. This was an important step as the main would have to be shut down to rectify any leaks discovered around the fittings once drilling commenced.

Once pressure testing was competed a drill was bolted onto the gate valve. The valve was opened and the drill is then driven towards the live main and a hole cut a similar size to the branch. Once the hole was cut the drill was retracted and the gate valve closed. The drill was then unbolted from the gate valve and removed. A blank plate was then installed.

Although minimal, there are risks associated with this type of connection. If too higher pressure is applied during the pressure test there is a risk that a main could fail under loading. There is also a risk that the cutting head of the drill could become stuck when drilling into the main. To mitigate these risks, contingency fittings were on site the day before the tee was to be installed. The cutting head was also inspected prior to the drilling.

Environmental issues

The works are located entirely within the Thames Basin Heaths Special Protection Area (SPA) and the Broadmoor to Bagshot Woods and Heaths Site of Special Scientific Interest (SSSI).

These sites are designated primarily for their rare breeding bird status and special heath and woodland habitats. An Environmental Impact Assessment and Habitat Regulations Assessment were completed prior to the project commencement. Assent from Natural England was also obtained for the enabling works.

It was important that works did not have an impact on the SPA birds – Dartford Warbler, Nightjar and Woodlark – which return to the area for breeding at the start of summer. During the breeding season bird monitoring was undertaken to ensure the day-to-day activity of any rare birds was not being interrupted.

Populations of Great Crested Newts were discovered in two ponds close to Crowthorne Reservoir. Reptiles are also prevalent along much of the pipeline. Exclusion fencing was installed around areas of significant populations, traps installed and a programme of trapping and relocation undertaken to safely remove any newts or reptiles to specialist reception areas before construction took place.

Progress

At the time of writing (July 2015) with four months of the project left to finish, 75m of 450mm, 1,936m of 1,000mm and 725m of 1,200mm pipework has been installed along with 1,028m of 700mm pipework installed and commissioned.

South East Water' Engineering, Operations, Asset Management and Communications teams are successfully working alongside Farrans to deliver the project. The successful collaboration is reflected by a good on-site relationship between client and contractor.

Clear signage with information about the works has been deployed on site and regular meetings are held between South East Water, Farrans and the land owner, the forest user group is also presented to on a quarterly basis. This regular interaction has maintained a good relationship between all parties involved, as well as forest users and members of the general public, while this project has progressed.

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Drill bolted to valve prior to drilling - Courtesy of South East Water