Thornbury/Aust Pipeline & Outfall

£3.5m treated sewage outfall into Severn Estuary

by
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The catchments of Thornbury and Aust are served by respective sewage treatment works discharging secondary effluent to the Severn Estuary. Although the level of treatment is sufficient, the outfall pipelines have remained unchanged since the plants were first constructed, terminating above low water mark and providing inadequate dilution to meet current UK and European standards. The points of discharge into the estuary were deemed to be unsatisfatory with respect to the aesthetic impact of the discharge. EA Guidelines for such tidal waters require the outfalls to be fully submerged at all times and sited to achieve a minimum initial dilution ratio of 1:10 and a 95%ile of 1:50. A further issue related to the storm retention lagoons at Thornbury STW. These lagoons provide adequate capacity, but the overflow weir into local drainage was determined to be an Unsatisfactory Intermittent Discharge, needing the installation of a bi-directional 6mm screen on the outlet. Improvement works were an agreed AMP3 quality output with compliance to be achieved by 31st March 2005.

Thornbury/Aust Pipeline: Outfall into Severn Estuary alongside First Severn Bridge *courtesy: Severn Trent Water*

Scope of works

The site of the Thornbury discharge was such that the outfall would have needed to be extended by some 3km across the river to provide the required dilution - hardly a practical solution. Alternative options included extending the outfall just sufficiently to be permanently submerged and constructing storage tanks at the STW to control discharges according to the tidal cycle (costly) or providing UV disinfection.

Aust STW, however, is located nearby to a deep water channel by the first Severn Crossing, giving plenty of potential for achieving the necessary dilution. The final proposal, therefore, entailed laying a new pipeline cross country to pump the treated sewage from Thornbury STW to Aust STW, where the two flows could be combined to discharge through a new outfall at Aust Rock. This was considered to offer the most robust solution with the lowest NPV cost.

The new works re-utilise 2.5km of the existing ductile iron outfall pipeline from Thornbury STW to Oldbury-on-Severn, from where a new 400mm diameter rising main transfers the flow 4.5km to a high point at Aust. The flow from Aust STW is also pumped to this point and the pipeline continues as a nominal 500mm diameter gravity out fall, extending some 700m along the foreshore and thence 500m across Aust Rock. The final discharge point terminates in an open port at an underwater cliff face 3-4m above the river bed and some 12m below mean tide level.

New final effluent pumps have been installed at Thornbury STW to cope with the increased head, comprising duty/standby units with variable speed drives each nominally rated at 113 l /s, and a new submersible lift pumping station of 23 l/s capacity is provided at Aust STW.

Planning & environmental issues

The Severn Estuary is an internationally recognised site for wildlife interest, particularly birds and wetland species, so demands a high level of protection. The adjacent Severn Levels, where the cross country pipeline is routed are known to be of regional archaeological interest.

Construction of Aust outfall. Trencher in background working on salt marshes *courtesy: Severn Trent Water*

The cheme was determined by the Local Planning Authority (South Gloucestershire Council) to require an Environmental Impact Assessment due to perceived impacts on the estuary and the archaeological potential of the Levels. A planning application was made in February 2004, supported by an Environmental Statement which detailed ecological and archaeological surveys undertaken during 2003 and presented proposed mitigation measures. The Statement also addressed the water quality and land drainage aspects of the scheme. A total of nine consents were required to obtain planning permission,

The planning conditions imposed time limited consents.No work could be undertaken within the Severn Estuary between October and June to avoid disturbance to over-wintering bird populations and fish migrations. The outfall works were further constrained by the need to minimise damage to the protected saltmarsh along the foreshore, resulting in a method statement for the work being included as part of the planning condition.

The route of the transfer main from Oldbury to Aust is through agricultural land, crossing several watercourses, hedgerows and public rights of way, and is generally of limited environmental impact. However, surveys identified two localised habitats of Great Crested Newts along the pipeline. Work within 250m radius of these areas could only be commenced once the newts had been excluded from the site by licensed ecologists, requiring a DEFRA exclusion licence (but only once planning permission had been granted).

Archaeology along the pipeline route was another main planning consideration and mitigation involved extensive geophysical survey techniques, excavations, and aerial mapping. Substantial quantities of Roman-British pottery and a Roman road were uncovered.

Implementation

The project was tendered as a design-and-construct contract under EEC Option C. The contract was awarded in February 2004 to *TJ Brent* (now part of *May Gurney*) who appointed *Pell Frischmann* as their designers and subcontracted the outfall work to *Stockton Drilling.*

The tender programme assumed installation of the cross-country pipeline in a 'rolling' operation commencing at Oldbury and finishing at Aust. This was facilitated by the use of polyethylene (HPPE) pipe throughout, allowing prior welding of pipe strings ready for installation as the excavation progressed. In the event, the contractor's method and sequence of working was dictated by access restrictions due to archaeological mitigation and the time spent waiting for the newt exclusion. Every effort was made by *Brent* to minimise the effects of the disruption, but construction inevitably became fragmented leading to a reduced rate of progress. The pipeline included a 200m section crossing under Oldbury Pill (a local watercourse) which was successfully installed by directional drilling to avoid breaching flood defences.

Greater Challenge

Construction of the outfall proved an even greater challenge. The access and working restrictions along the foreshore were overcome by using a trencher, allowing some 500m of pipeline to be installed in two days and successfully limiting disturbance of the saltmarsh. The rock was too hard to enable a trencher to cut through, so hydraulic breakers were needed for the 440m of open cut across the rock, working in 6 hour tidal windows.

The final 60m of outfall reduces to 350mm diameter and was required to be installed through the rock at a 1 in 5 slope exiting at a near-vertical cliff face under water. This was carried out by specialists *Stockton* using directional drilling. The drill rig and equipment were set on to a barge on 'spud' legs anchored in station, maximising the period that work could be carried out during each tidal window. The drilling rate during the pilot bore was much slower than anticipated and after successive enlarging by back reaming, the final bore proved unstable due to the fragmented nature of the rock. Jetting and pigging only served to consolidate the rock debris into an immovable plug.

A pneumatic pipe-ram was used to hammer a welded steel outer sleeve through the debris, but attempts to clear this out also failed. Eventually, further steel pipe was welded on and the blocked section of sleeve pipe, complete with debris was pushed out into the river to be cut off by local divers working during the one hour of slack water at low tide. It then took only a matter of hours to slide in the HPPE outfall pipe, insert the prefabricated make-up piece to connect to the rest of the outfall pipeline and concrete the assembly securely in place.

Pumps

New pumps at the respective treatment works were installed during November and flows diverted down the new outfall just before Christmas 2004. Although this project was technically straight forward, its execution was particularly challenging due to the sensitive nature of the site, and successful conclusion was very much due to the extensive efforts and co-operation from all parties involved: the project team, local council, consultees and contractors alike. ■

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