

Dartmouth STW

first time sewage treatment for estuary towns

by Peter Brooks CEng, FICE, MCIWEM

The beautiful towns of Dartmouth and Kingswear, nestling in the South Hams countryside near the mouth of the River Dart in south Devon are much favoured by tourists with a strong focus on water sports. They are also an important port of call for many cruise ships. Now, for the first time, the towns are connected to a sewage treatment works handling flow from the 11,000 population. These works have been built on the site of an abandoned water treatment works already owned by South West Water.



Dartmouth STW showing narrow access road with hairpin bends (Copyright: Still Imaging, Chudleigh, Devon; courtesy SW Water).

Location

Whenever a brand new sewage treatment works is proposed, there is always considerable opposition and apprehension from the local population. Although sewage from the towns' sewers discharge directly into the area's greatest asset, the beautiful River Dart, trying to identify a suitable site for the first ever sewage treatment facility proved difficult.

Both Dartmouth and Kingswear are built on the banks of the Dart Estuary, naturally the lowest point. To attempt to site the sewage treatment works within the estuary frontage of this Area of Outstanding Natural Beauty with its many listed buildings, Sensitive Marine designation and fishing interests proved extremely

difficult. However, South West Water still owned a long abandoned water treatment works just north of Dartmouth, at the head of Old Mill Creek. The site had long returned to nature and a number of wild species had moved in.

Environmental challenge

Access to the old water treatment works site was via a narrow lane, with several hair pin bends on its descent to river level from the higher ground of the general catchment. Planning constraints prescribed that a new access road had to be cut down to the site and that the only practicable route was through a conservation area of ancient woodland, full of wildlife and environmentally sensitive species.

An ecological study was undertaken which identified the largest badger sett in Devon, requiring restricted working areas, to reduce disturbance, and gates to ensure the badgers were not trapped inside. The old treatment works building had become a home for both the lesser and greater horseshoe bat and the rare British long eared bat. They were to remain in the roof of the building which was transformed, literally beneath them, to become the new control building for the plant.

Engineering challenges

The engineering challenges were equal to the ecological difficulties. Site for the sewage treatment works lay in a narrow valley completely surrounded by mature trees, a narrow lane and a public footpath and bridle way. The design team were challenged with not only designing a sewage treatment works which could operate effectively in such a small footprint, but also one that could be built having construction access at only one point.

Inclined Bubble Aeration

This activated sludge process was adopted as being particularly suited to coastal applications where there is a possibility of saline ingress.

Because of planning constraints, access to the site had to be built before any site works could commence and an early sub project was set in July 2001 to build the 1000m long access road which falls some 100m over its length. Construction of the road was undertaken 'top down' so as to create access for the road building plant required. The 4m wide access has been sited so as to minimise both excavation and embankments and to minimise overall gradient. Nevertheless, there are still lengths where the road has a gradient of 20% and so a 'wearing' course offering high skid resistance has been utilised.

Pipeline

The 300mm dia inlet pipeline which feeds the sewage treatment works and the 350mm dia final effluent line were constructed in twin trench from the main pumping station sited in a public park on the banks of the river. The PS had been built some six years earlier to screen raw sewage from Dartmouth and pump to a new outfall directly into the river.

The final effluent pipeline made use of this outfall along with the short length of rising main which formed part of the 2200m long rising main to the sewage treatment works. The rising main passes through the Dartmouth Naval College ground and open farmland before joining with a major sub-catchment, and gravitating to the STW over its final leg.

North Sea Oil Technology

North Sea oil technology was used to convey the sewage from Kingswear, on the east bank of the River Dart to Dartmouth on the west. A 160 tonne directional drilling rig was sited in a Marina on Kingswear waterfront, once all the yachts had been launched and the normally crowded area had become temporarily free. A 150mm diameter pilot hole was drilled some 22 metres beneath the bed of the 20m deep estuary. To ensure that the drill head emerged at the correct position in Dartmouth, *Allen Watson Ltd* installed a wireline guidance system which was laid across the bed of the estuary to give a directional signal that was received by a receptor within the drill head. The drill head emerged within half a metre of its target in the Mayors Avenue car park, adjacent to the main pumping station.

A larger 300mm diameter hole was then reamed back towards Kingswear, allowing a steel sleeve casing to be installed through the bore. All of the excavated material was removed at the drilling rig at Kingswear by flushing with a special "mud" which was then cleaned and re-used, whilst discarding the excavated material.

Final phase of the operation was to thread the 125mm dia. MDPE pumping pipeline 740m from Kingswear to Dartmouth inside the steel sleeve. The whole drilling operation went extremely well meeting the very tight programme that had been set for this vital element of work. The pipeline was commissioned to coincide with completion of the pumping station in Dartmouth.

Ancillary works

In order to resolve as many of the key deliverables in Dartmouth under one project, the scheme also included resolution of deficient sewer overflows, and as an essential adjunct the reduction of saline ingress into the existing sewer system. The latter was achieved very successfully utilising ICS - an infiltration control system, whereby the saline ingress is balanced by a penstock controlling sewage retention within the main sewer at times of high tides.

A significant area of Dartmouth lies at the top of the catchment and the design team decided to divert this flow directly to the sewage treatment works in order to reduce pumping and associated costs.

Teamwork

The entire project has been managed utilising the successfully proven SWW model of a process contractor - *Purac Ltd*, handling process design and construction; *Pell Frischmann Ltd* providing hydraulic and civil design, and *Alfred McAlpine* undertaking civil construction. ■

Note: The author of this article, Peter Brookes is Programme Leader, South West Water.

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