Wick Wastewater Treatment Plant

first time WwTW on exposed headland for Highland town

by

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Scottish Water's Wick Wastewater Treatment Plant (WwTP) Project has provided first time wastewater treatment for residents and businesses in the Highland town of Wick, Caithness. The project, part of Scottish Water's "Small Town and Rural" (STAR) programme of wastewater schemes, commenced construction in June 2002 and was successfully commissioned after take-over tests in December 2003.

Wick, Caithness, Scotland WwTW under construction

Photo: *Courtesy Scottish Water*

Wick is the county town of Caithness, with a resident population of some 8,000. In addition there are a number of trade discharges, including the local distillery and the airport.

A large majority of the sewage emanating from Wick is pumped to the coastal headland on the north shore of Wick Bay. A small proportion gravitates from properties recently constructed on this headland and a small village to the north of Wick. Prior to the construction of this new WwTP the only treatment that sewage received, prior to its discharge to the North Sea, was from 6mm screening.

In 2000, the *North of Scotland Water Authority* appointed four teams to assist with the design and construction of various waste water treatment projects throughout the Highlands, Islands and north-east of Scotland. The (STAR programme). One of the teams appointed, *Delta Scotland,* a joint venture between *AWG Construction Services Ltd* and *Earth Tech Engineering Limited,* was given a number of schemes in the Highlands and Grampian, one of which was the provision of a first time wastewater treatment plant at Wick, to comply with the UWWTD legislative requirements.

One of the key elements of this project was its prominent and exposed location on Wick's North Head. This is a popular walking area for locals and safety during construction, in addition to the plants' final appearance, were extremely important factors in the design and construction phase of the project. Vital to the progress and development of the project was the relationship (promoted by *Delta Scotland and NSWA)* built up between project team members from both organisations.

Delta Scotland, working as a fully integrated JV and in close partnership with Scottish Water personnel were responsible for the design, construction and commissioning of the WwTP. Prior to the award of the contract, *Delta Scotland* also worked closely with Scottish Water's project manager in order to secure the land purchase and detailed planning permission for the WwTP.

Design parameters

The new plant has a design capacity of 13,500 p.e, with a maximum flow to full treatment (FFT) of 6 x Dry Weather Flow, i.e., 171 litres per second. Treated final effluent must meet UWWTD standards for coastal discharges of 25mg/lBOD: 125mg/l COD and storm discharges must be screened to 6mm in both directions. Site produced sludge must be dewatered to a minimum of 22% dry solids content.

Plant layout

A new sewer interception chamber, constructed on the existing

Erection of the *Kitpac* sectional building courtesy Scottish Water

sewer upstream of the Headworks building, conveys the sewage to a new storm separation chamber. Flows greater than FFT are screened prior to discharge to the existing sea outfall. FFT is controlled by an electromagnetic flowmeter and an eccentric plug valve on the outlet of the storm separation chamber, which limits FFT to 6xDWF.

The inlet works consists of a *Jones & Attwood* 'band' type 6mm fine mesh screen (duty only) with screenings flushed to a washing/compaction unit, where they are discharged into a skip. In the event of a screen failure, flows automatically pass forward for treatment via a bypass channel, incorporating a manually raked, 12mm bar screen. A grit separator is provided for removal of grit from the flow for treatment.

The screened and de-gritted flow enters the Primary tank Feed Pumping Station, containing variable speed, submersible pumps, operating on a duty/(assist)/standby basis. Operation of the primary tank feed pumps is varied by the control system to maintain the water level in the wet well within a pre-set band, thereby ensuring that the pass forward flow to the primary tank is approximately equal to the influent flow to the wet well.

Rather than provide conventional primary settlement of the sewage, the primary settlement tank is designed, primarily, to generate primary sludge to blend with the surplus activated sludge (SAS) in order to increase the dry solids content within the de-watered sludge cake.

Biological treatment is provided by the Cyclic Activated Sludge System (CASS™) process. Unlike conventional continuous flow activated sludge processes the CASS™ compartmental variable volume reactor is an intermittent process working on the 'fill and draw" principle, whereby the sewage is treated within a unit during a cycle of filling, aeration, settling and partial emptying. Typically, there are six four hour or eight three hour cycles during a day. The process combines the basic functions of aeration and settlement in one unit and hence there are no final settling tanks or high capacity return activated sludge pumps.

Secondary treatment

The Wick WwTP secondary treatment requirements are met by installing two CASS™ basins. Each basin is equipped with an electrically actuated skimmer to decant clarified, treated effluent at the end of the settle phase of the CASS™ process cycle. Two submersible pumps are provided in each basin, one to remove SAS from the process and the second to return mixed liquor from the main compartment to a selector zone at the inlet to the basin, during fill and settle cycles, in order to ensure the correct floc loading rate on the activated sludge biomass, to optimise sludge settleability. There are fixed aeration grids within each basin and process air is supplied to the basins by variable speed, duty blowers. The air flow rate is controlled via the CASS™ PLC, based on monitoring from a dissolved oxygen probe in the CASS™ basin. Automatic control of the oxygen supply minimises power consumption.

Two sludge storage tanks provide a combined storage capacity equivalent to 5 days. The tanks receive a combination of primary sludge, surplus activated sludge and scum. The sludge is mixed in the tanks prior to transfer to the sludge dewatering equipment. A Solids Technology sludge belt press dewaters the mixed sludge to provide a cake with a minimum of 22% dry solids content.

A *Kitpac* sectional building was constructed to house the plant control centre, welfare facilities, sludge dewatering unit and the sludge cake skip. The dewatering room, skip room, sludge tanks and scum pumping station are all connected to the plant odour control unit, a MONASHELL™ biofilter.

Special site considerations

The site for the Wick WwTP is in an extremely exposed location. This presented a number of issues which had to be addressed during the design and construction period. The exposed site presented a greater risk of site delays due to high winds. In order to minimise this risk *Delta Scotland* made use of construction methods to combat this i.e. use of *Kitpac* sectional building, which meant that the building superstructure was completed rapidly without the need for lengthy periods of scaffolding. In a similar vein, the *Galglass* proprietary system was selected for use during construction of the concrete CASS™ basins and primary.

The site location also presented problems with regard to public access. Wick's North head is a very popular walking area for the community. In such an exposed location trees are not a common

Wick WwTW facing South over CASS courtesy Scottish Water

feature, therefore, careful consideration was given, during the design phase, to the use of landscape bunding as a screen. The additional benefit of this was that excavated material could be used to form the bunding, which minimised traffic along the single track public access to the site. Planting of natural plant species along this bunding has also been undertaken.

Finally, an alternative temporary walkway was constructed around the site to "guide" members of the public away from the main body of the site to minimise the risk to the public from construction activities. Representatives of *Delta Scotland* and *Scottish Water* also provided presentations to the local primary school (both at the school and on site) and the local community, in order that curiosities would be satisfied and the public kept informed with regard to progress of the project.

The relationship built up by the combined team delivering this project (both *Delta Scotland*, design and construction personnel and the Scottish Water engineering team) provided the drive and teamwork ethic required in order to successfully deliver a first-time sewage treatment provision for the town of Wick. ■

Note: *The author of this article, Stewart Samson, is Design Manager for Delta Scotland, a joint venture between AWG Construction Services Limited and Earth Tech Engineering, Limited*