

# Meadowhead, Stevenston & Inverclyde Scheme

## three sewage treatment plants come on line in one single project

**I**n the first stage of a 30 year design-build-finance-operate contract, three new sewage treatment plants are coming on line at Inverclyde, Stevenston and Meadowhead on the Ayrshire coast of Scotland. This coastal area south of Glasgow is popular with tourists and holidaymakers, with the resorts of Largs, Wemyss Bay and Ayr itself attracting considerable numbers. Until recently much of the sewage was discharged through sea outfalls and treatment provided little more than screening and de-gritting plus disinfection at Ayr. This project is designed to meet EU standards regulated by the Scottish Environmental Protection Agency (SEPA) standards for effluent discharge.



STW under construction (courtesy ONDEO Degremont)

West of Scotland Water (now integrated into Scottish Water) awarded the contract to *Ayr Environmental Services*, a joint venture group combining *Ondeo Degremont*, *AMEC Project Investments Ltd* and *Ondeo Services UK plc*. Having been awarded the initial contract, Ayr Environmental Services (AES) subsequently placed two contracts, one for the design and construction of the new works, the other for their continuing operation. As lead contractor on the first contract, AMEC Construction has overall responsibility and undertook all the civil works, with Ondeo Degremont being responsible for the process design., M & E installation and commissioning of the treatment facilities.

To meet EU and SEPA standards has required a substantial upgrading of the existing facilities, and in the case of **Inverclyde**, near Inverkip, the most northerly of the new sites, a completely new works. This is designed to serve a population of 81,000 in Greenock, Gourock and surrounding areas, generating a flow to treatment of 85 MI/day and dry weather flow of 41 MI/day. The flow is almost entirely domestic.

**Stevenston**, further down the coast, serves Gourock Valley, Ardrossan and coastal communities totalling 90,000. Flow is 96MI/day, with a dry weather flow similar to Inverclyde, but unlike

Inverclyde, there is a 15% industrial component, including effluent from a major pharmaceutical manufacturer.

Largest of the new works is at **Meadowhead**, serving a population of 313,000 in Ayr, Kilmarnock and the towns of the Irvine Valley. Flow to treatment is 185MI/day and dry weather flow 83ML/d. Some 70% of the flow is domestic, with the remaining industrial component including effluent from a large paper mill.

### Problems

All three locations presented considerable problems, both in the nature of the sites and nature of the effluent. In order to meet the tightening discharge standards, reduction in BOD and COD to 25 and 125mg/l (the equivalent of 70% and 75% respectively) were required, plus reductions in suspended solids, ammonia, and 'red list' substances such as a heavy metal, pesticides and solvents.

### Advantages

While treating all three as parts of a single project had many advantages, it also meant that close cooperation was needed, not just between AMEC and Ondeo Degremont but also with the other parties involved, including Ayr Environmental Services, Ondeo Services and, of course, the ultimate client, Scottish Water. Input from all the team was a vital contribution in dealing with health and safety matters, smoothing out bottlenecks in the programme, finding acceptable solutions to problems and ensuring that the final works would operate according to specification. Scottish Water's involvement was particularly valuable in that existing operations at Meadowhead and Stevenston had to continue while the new works were under construction.

### Works in a quarry

The site at Inverclyde was particularly unusual, in that the new works have been placed in an old disused quarry. Although excellent from the environmental viewpoint, since the works are completely hidden, the location presented considerable problems for the contractors. The base of the quarry was filled with water, which had to be pumped out before construction could start and other areas had to be blasted away to provide the necessary space for new plant. Even so, fitting all the necessary facilities into the area was a challenge.

Environmental restrictions on noise and odour were also severe. To keep these to a minimum the inlet and primary works have been completely covered. At 30m diameter, the rotating GRP covers for the primary tanks were the largest in the UK at the time..

Sewage for treatment is pumped in from two former outfalls at Gourock and Ardgowan. The flow from **Ardgowan** is screened and grit is removed at the existing pumping station whilst the flow from **Gourock** is pretreated at the new treatment facility. After primary

settlement, flow passes into a fine bubble activated sludge system, treated effluent is discharged via an outfall through the quarry wall. Sludge is combined and thickened using an *Ondeo Degremont* gravity screen and is then tankered to **Meadowhead** for further treatment.

The new works at Stevenston has been constructed at the site of the existing outfall headworks, right on the coast overlooking the Isle of Arran. The existing screening and grit removal facilities have been incorporated, but a new pumping station has been built to take the flow to primary and secondary treatment. An activated sludge process has been installed. Here, the problem has been the composition of the flow. The ratio of COD to BOD is unusually high, and the effluent contains residual organic matter that is expected to be difficult to degrade biologically. The sludge is thickened on site and then transported by tanker to Meadowhead.

At **Meadowhead** the industrial component in the flow including that from a paper mill, is expected to present treatability problems. The Scottish Water inlet works, include screening and grit removal but to meet the new standards has required substantial additional treatment. Due to the nature of the wastewater and site constraints, direct secondary treatment by a high rate activated sludge process, without primary treatment was selected. This is followed by a *Biofor*® biological aerated filter (BAF) for final polishing.

The *Biofor*® units represent *Ondeo Degremont's* development of the BAF system. These upflow reactors utilise a special filter medium, *Biolite*, which can be tailored to the nature of the wastewater and treatment objectives such as COD and BOD removal, nitrification of ammonia and nitrate removal. The units are specifically designed to treat very high hydraulic loadings. The process air is introduced into the lower part of the reactor to flow co-currently with the wastewater, producing even distribution of biomass through the media bed. The units lend themselves to automation and because they are modular, the number of units 'on line' can be adjusted to the desired treatment levels. All these additional works plus the necessary pipework and pumping systems had to be constructed in a limited space alongside the existing preliminary works. The compact nature of the *Biofor*® units was a big advantage.

### 100t dryer

**Meadowhead** also incorporates the final treatment facility for sludge from all three sites. Thickened sludge tankered in from Inverclyde and Stevenston is combined with Meadowhead sludge, is dewatered in a centrifuge, then passed to one of *Ondeo Degremont's* *Naratherm* sludge dryer, which is a key component in the Ayrshire project. The dryer, weighing in at 100t, is capable of handling 1,400kg of dewatered sludge per hour at 22% dry solids, the equivalent of over 10,000t of sludge a year. It uses wedge shaped paddles to give exceptional plug-flow, mixing and heat transfer, effectively providing stable, pathogen free dried product

with a dry solids content of up to 95%. Following drying the sludge, much reduced in volume, can be disposed of to landfill, but the biosolids may also be formed into pellets. Various other options, such as conversion to a synthetic fuel product, agricultural use and off-site power generation, are available.

Work on the two year contract began in April 2000 and the treatment works are currently being commissioned. The project has presented a number of challenges, particularly from the design point of view. Restricted construction sites, environmental constraints and the problem of finding the most appropriate treatment methods for difficult wastewaters have been among them.

There have been, however, considerable advantages brought about by the integration of the three works into a single project, rather than treating each as a one off. The workforce has been used more efficiently and equipment manufacture and delivery could be programmed and coordinated.

### Cost benefits

There are also significant cost benefits in integrating the final sludge disposal systems from all three works into Meadowhead. The heating phase of the large dryer is the most expensive part of the operation, but once up to temperature, it can be operated economically for long periods. Tankering in sludge from Inverclyde and Stevenston provides a more continuous and consistent supply and is a more economic solution to the disposal of sludge from the smaller works.

While **Ondeo Degremont** has supplied and installed all the plant, the company will continue to be involved in the future running of the works through its Services Division as part of *Ayr Environmental Services Operations* (AESOps), the joint venture with *Ondeo Services UK plc* which will be responsible for operation and maintenance of the works for the next thirty years. *Ondeo Degremont's* familiarity with the installed systems will ensure that routine planned maintenance and repairs can be carried out swiftly. Adjustments or additions to the treatment plant needed to deal with changes in the nature of the influent, or to meet higher standards of effluent discharge, can also be made with the confidence that these will be compatible with the existing plant.

Construction of the plant and initial commissioning was completed towards the end of last year and process commissioning is now nearing completion. Throughout the contract, close cooperation between the various parties has been a significant factor in its successful completion. ■

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