

Drum Vacuum Sewerage Scheme

first time scheme for rural community

Located in the Perth & Kinross area of northeast Scotland, the town of Drum, with a population equivalent of 250, was not serviced by the sewerage network. Original investigations considered a conventional gravity sewerage. However, the need for 5 to 6 pumping stations and deep excavations in an area of high ground water led the designers to consider vacuum sewerage. *Flowvac Environmental Ltd*, specialists in vacuum sewerage technology developed a scheme comprising of a single vacuum pumping station, linked to 6,169 metres of 125mm diameter MDPE vacuum sewers, all laid in shallow trenches, typically between 1.100 metres and 1.250 metres deep. An added bonus was the ability to locate the Vacuum pumping station within the sewerage treatment works site, thus reducing the time, finance and complications of additional land purchase.



Drum: Vacuum sewerage installation

courtesy Scottish Water Solutions

Only two properties were unable to be connected directly to the vacuum system, a problem that was overcome by discharging through a vacuum interface valve chamber.

Vacuum Sewerage utilises air pressure to operate the valve opening and closing, and as a force that accelerates the sewage towards the vacuum pumping station at velocities between 5 and 8 metre per second.

Vacuum sewerage systems have three key elements.

- * **the interface valves;**
- * **the collection sewers;**
- * **the vacuum sewers.**

Interface Valve Chamber

The interface valve chamber is where the gravity house connections meet the vacuum sewer. As liquid accumulates within a sump in the base of a precast concrete chamber, it pressurises a diaphragm within the valve controller that allows vacuum from the main to

open the valve. The liquid is forced into the vacuum main by atmospheric pressure within 3 seconds, the valve then remains open for a further 3 seconds to take in air.

Vacuum sewers

The vacuum sewers vary in size consistent to the flows present. The sewers are laid at a gradient of 1:500 from the head of the sewer towards the vacuum station. As the depth increases, due to gradient or rising land, lifts are inserted comprising two 45 deg bends that adjust the invert level up by 300mm, thus maintaining the shallow excavation depth. This process is continued to the vacuum station. On downhill slopes the gradient of the pipe follows the terrain. In simple terms, the vacuum sewer has the appearance of a water main in plan and gravity sewer in section, with a saw toothed profile.

Vacuum station

- * the vacuum vessel;
- * duty & standby sewerage pumps;
- * duty & assist vacuum pumps;
- * motor control panel.

The vacuum vessel retains the recovered sewerage. The typical operating vacuum maintained within the system is between 16 inches Hg and 20 inches Hg, although on occasions this can be slightly increased if the losses within the system dictate. The sewerage storage utilises the lower third of the vessel whilst the remainder of the vessel is available for vacuum storage.

The sewerage depth within the vessel is controlled by sewerage discharge pumps. The sewerage is discharged under vacuum conditions to enable the system to continue recovering sewerage at all times.

Vacuum levels are maintained by two vacuum pumps, each pump is sized to operate the system on its own. A typical daily run time for the vacuum pump is 4 hours.

Motor control panels vary in complexity, depending upon the client's requirements. Most water authorities have their own specification, whilst privately owned systems often require a more moderate control system. Essentially, they all perform the same task in that they control and protect the motors operating the various pieces of equipment. The control panel also contains the automatic restart function described above.

Design

The vacuum sewers and vacuum station are designed in house to comply with the hydraulic requirements of 'Sewers for Adoption' published by the WRC - typically 4000 litres per dwelling per day.

Interface valve chambers are sized for 4 hours storage per property at dry weather flow, below the lowest incoming sewer. This allowance, normally will mean that the system need not be attended should a fault occur overnight, until the following morning.

'First time' project

Drum is a 'first time sewerage provision' project. Prior to the project, each household in the community was responsible for the treatment of their own wastewater - mostly through private septic tanks. The effluent from these, discharges into small local watercourses, but eventually flows into the phosphorous sensitive Loch Leven (one of SEPA's drivers behind the project).

The new sewerage network conveys wastewater to the newly constructed WWTP, which is located South West of the community. The treated effluent is then pumped 1.5km to discharge into the River Devon. The River Devon forms part of the River Forth catchment, and environmentally, this discharge has less impact than an equivalent into Loch Leven.

All elements of this project take the form of a new construction - from the installation of private drainage in gardens, through the new vacuum system to the WwTP, and final discharge of treated effluent back into the environment.

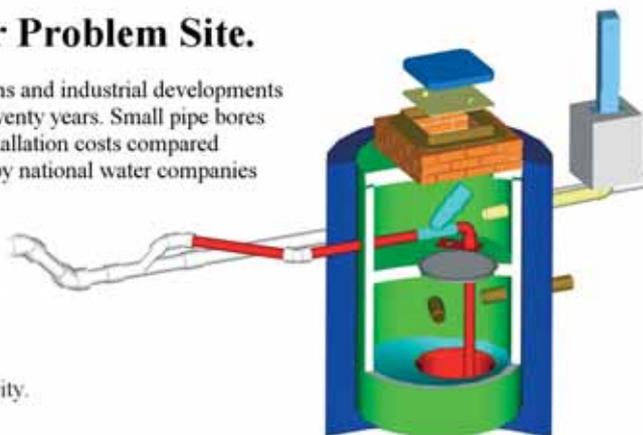
One of the main challenges for the delivery team, has been installing a new public drainage system within a settled community.■

Flowvac Environmental Ltd

Vacuum Sewerage Will Drain Your Problem Site.

Flowvac Sewerage Systems successfully drain entire villages, towns and industrial developments throughout the UK with thousands of installations over the past twenty years. Small pipe bores and shallow excavation depths result in dramatic reductions in installation costs compared to conventional gravity drainage. The system has been embraced by national water companies and private clients alike giving significant advantages where:

- Site ground levels give little opportunity for natural drainage.
- Ground conditions make excavation costly.
- High ground water levels make excavation costly.
- There is a need to transport the effluent upwards against gravity.



Flowvac Environmental Ltd, 25a Charles Industrial Estate, Stowmarket, Suffolk, IP14 5AH
 Tel: 01449 770933 Fax: 01449 770599 Website: www.flowvac.co.uk Email: sales@flowvac.co.uk