Gobowen Sewage Pumping Station & Rising Main

new pumping station and rising main increases capacity and reliability, while reducing operation and maintenance Health & Safety risks

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Fernhill Lane Sewage Pumping Station is located in the small town of Gobowen to the north of Oswestry in north-west Shropshire. The pumping station receives flows from a population of approximately 2,500 people. The sewerage system is primarily combined, and therefore the pumping station receives storm flows in wet weather. The pumping station has Environment Agency consent for discharge of flows above 50l/s to the adjacent watercourse in wet weather. This report describes the process followed by the Integrated Team from identification of the problem and creation of the Capital Works Project in 2006, through all the feasibility, design and construction stages, to delivery of the solution for a sewage pumping station in Gobowen, North Shropshire in 2010.

Construction of new wet well *Courtesy of Severn Trent Water*

Background

Sewage was pumped through a 1.4km long, 8" uPVC rising main, as far as the next catchment, and subsequently on to Drenewydd Sewage Treatment Works in Oswestry for treatment. The rising main had a history of a significant number of bursts (average 3 per year) which were anecdotally believed to result from solar damage to the uPVC material prior to the pipe being installed in the ground. There were also various problems with the operation of the Sewage Pumping Station including lack of storage volume and restricted access to the mechanical & electrical equipment, which was unreliable and reaching the end of its useful life. There were also Health & Safety risks with operation and maintenance of the Sewage Pumping Station, relating to lifting of heavy covers and the proximity of overhead power lines.

The integrated team

An Integrated Team had been established for the delivery of a number of Sewage Pumping Station projects for Severn Trent Water throughout the five year AMP4 period (2005 to 2010). Severn Trent Water Asset Creation staff carried out the project management and initial mechanical & electrical design.

Consultants Grontmij carried out the civil engineering design, and managed associated issues including hydraulic calculations, geotechnical investigations, ecological surveys and planning permission. The construction element was managed by McPhillips (Wellington) Limited who carried out the civil engineering works. The main mechanical & electrical construction element of each project was subcontracted to May Gurney of Cheadle. Severn Trent

Water Framework Agreements were in place for supply of key items of equipment such as pumps from ITT Flygt, and control panels from the Boulting Group.

Rising main

The rising main bursts had all occurred on the first 800m section nearest to the pumping station which was subjected to the highest operating pressure. After completion of the investigations, the decision was made to replace the full length of rising main, and to upsize by approximately 10% to 280mm OD MDPE. The chosen new route involved two additional river crossings, which were carried out by directional drilling. Surge analysis of the rising main identified the need to install softdrive units at the pumping station, and air valves in the rising main, to reduce the risk of water hammer.

The pumping station

The first option considered by the team when addressing Sewage Pumping Station Projects was to retain as much of the existing asset as was feasible, and minimise the amount, and therefore the cost, of new construction work. On many sites, the scope of the project was limited to replacement of unreliable mechanical and electrical equipment, together with minor civil engineering & building works necessary to make this happen, or to resolve Health & Safety problems.

However, investigation of the problems at the Fernhill site, identified a number of factors that could, at best, realistically be solved by reconstructing the pumping station. These included:

- Inadequate storage volume.
- Wet well covers that were unsafe to lift.
- Pump removal that was difficult to achieve safely.

There was also a problem with the transformer supplying power to the site, which was pole-mounted, immediately adjacent to the wet well. This meant that normal cleaning operations could not be carried out.

Having decided on construction of a new station to increase the storage volume from 20m^3 to 90m^3, a borehole was drilled to confirm the strata at the site. This identified artesian conditions from the alluvial nature of the ground conditions, where gravel beds were overlaid by a 2m firm clay strata at a depth of 10 metres. The artesian pressure rose about 1m above ground level, an approximate equivalent uplift of 105kPa.

Many options were considered in outline design for the new shaft, with particular focus on flotation, and dealing with the water inflow during construction. The standard design for a shaft of this size, would have been 7m deep with a plug extending a further 4m into the clay and gravel strata. The design team, working with the construction team, identified the opportunity to vary the profile of the wet well to eliminate the need to construct within, or close to the artesian layer. A sheet-piled cofferdam was proposed to allow the shaft to be constructed bottom-up. The intervening space between the cofferdam and the shaft was calculated, such that the weight of concrete infill would be sufficient to provide the necessary factor of safety against flotation of the structure in artesian conditions. The whole arrangement was made into a single structure with the use of shearstuds welded to the sheetpile cofferdam.

There was still an issue with groundwater to be managed during construction, which was achieved by sinking 4 (No.) boreholes around the perimeter of the sheet piles. Dewatering pumps were installed in these boreholes to drawdown the artesian pressures in the local vicinity of the excavation.

Summary

The project was costed at £1.1m, and having received all the required approvals, construction commenced on site in October 2009, with completion and commissioning achieved in October 2010.

The project was delivered on time and under budget, a tribute to all members of the Project Team whose contributions and commitment created an exceptional working relationship to deliver a first class installation.

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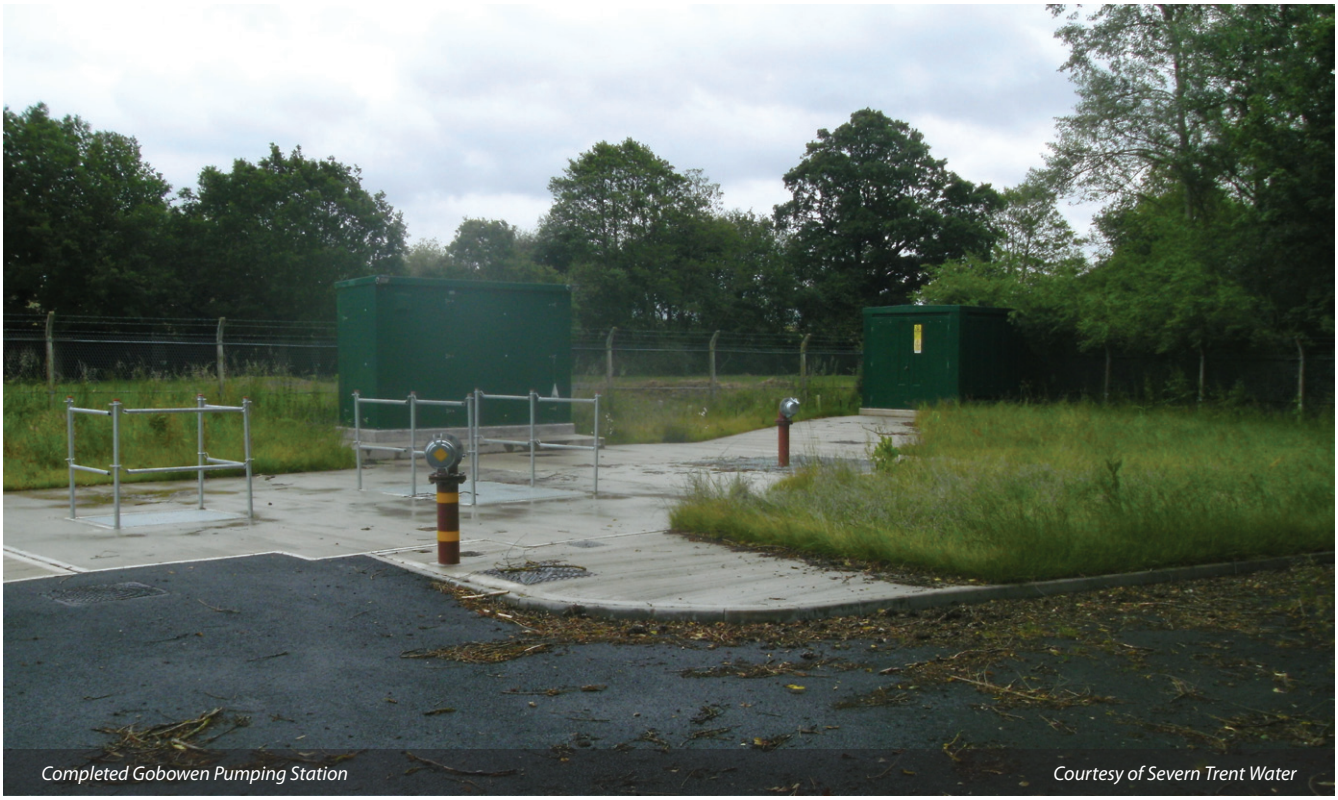

Completed Gobowen Pumping Station *Courtesy of Severn Trent Water*

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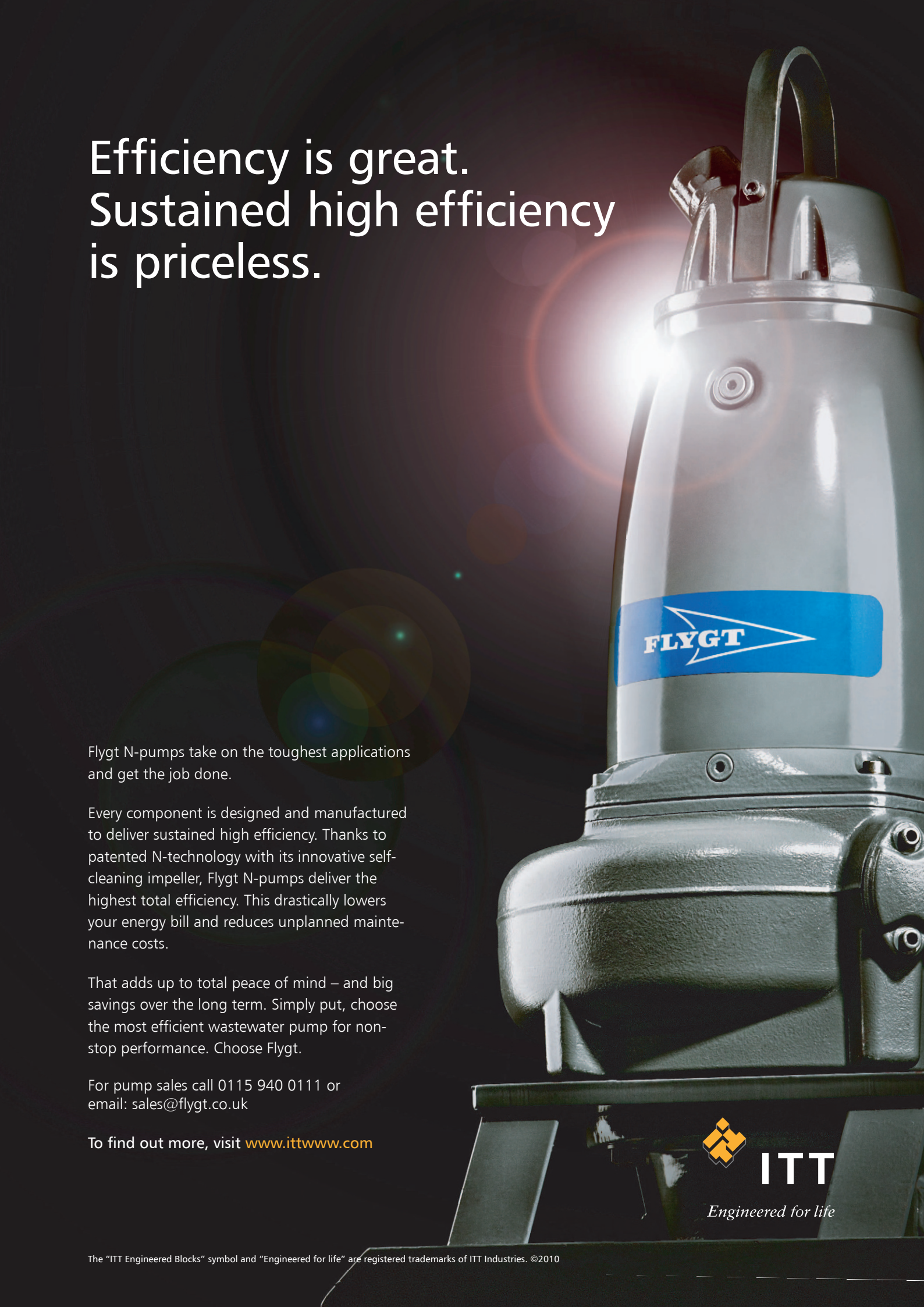

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