Hassop Sewerage Scheme

first time sewerage within the Derbyshire village including gravity sewers and a new rotating biological contactor (RBC) treatment plant

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Under Severn Trent Water's AMP5 Section 101a (first time sewerage) Regulatory Obligation the company will provide a connection to a public sewer to 546 properties. The project in village of Hassop, located in rural Derbyshire within the Peak District National Park, provided a public sewerage system to 19 properties including a public house and a country club complex. The new wastewater treatment works was required to treat flow from a population equivalent of 210, and the consent to discharge for the site required 40mg/l BOD, 30mg/l suspended solids and 20mg/l ammonia.

Hassop WwTW rotating biological contactor (RBC) - Courtesy of KEE Process Ltd

Background

The Hassop properties subject to the Section 101a of the Water Industry Act 1991 application were served by a private village drain. Flows taken from high level septic tank overflows were discharged to a local watercourse. This outfall is upstream of the River Derwent that flows past Chatsworth House.

There were known environmental and amenity problems caused by 12 properties in the village which the Environment Agency had investigated. The low permeability of the ground made the use of soakaways unsuitable hence rendering the septic tank's discharge system ineffective. This resulted in the overloading of the tanks and foul flooding to the surrounding area.

In 2007 the Hassop Estate applied for the village to be provided with a public sewerage system and in 2010 STW accepted liability to provide a new public sewer for the village.

The lowest whole life cost solution proposed was to construct a new package rotating biological contactor (RBC) treatment works, handling flows from 1,390m of newly constructed 150mm/300mm diameter gravity sewers built in public highway and within private pasture lands. These flows discharged to a new pumping station which lifted flows to be treated by the RBC before gravitating to a new outfall.

Innovation

By adopting (rehabilitating up to acceptable standards) sections of the existing private village drain, the amount of new sewer construction in the carriageway was reduced. This realised many advantages including:

- Reduced scope of works in hard dig/shallow rock.
- Reduced risk of damage to underground services.
- Reduced programme during winter months.
- Reduced noise and dust from construction activities.
- Reduced traffic disruption.
- Minimised road closure duration benefitting the customers and local businesses.
- Increased site safety and productivity.
- Improved delivery assurance.

Due to a minimal flow volume (<50m³/d) discharging from the new works outlet, the flow meter in the outfall chamber did not need

Modular pumping station
Courtesy of NMCNomenca and Severn Trent Water

RBC delivery
Courtesy of NMCNomenca and Severn Trent Water

to be MCert accredited. However a bespoke design was needed to adapt the template 'H-Flume' to ensure site specific compatibility.

The ultrasonic head was installed above the flow channel, calibrated and commissioned along with the associated flow meter. This allows measured flows to be read on-site or remotely via a telemetry signal. The open chamber nature of this design incorporated access points within the mesh gridding which had to be suitable for both Environment Agency sampling and STW Operational maintenance needs. The ultrasonic head was fitted on a hinged access cover, integrated into the gridding. This enabled the head to be cleaned and replaced without the need to enter a confined space containing live sewerage flows.

A modular plastic pump station, with integrated wet well, valve and discharge chambers, lifted the in-coming gravity flows up to the RBC inlet. These flows were then allowed to gravitate, which dissipated turbulence and ensured flows were presented to the RBC at the required laminar flow rate. Not only did this utilise the advantages of off-site construction, but also reduced the need for an additional length of rising main with separate discharge chamber hence enabling a reduced site footprint.

Early local authority liaison helped appreciate strict local authority planning restrictions. This ensured the application would be sympathetic with the local surrounds and would be successful upon first submission without major conditions. The RBC site layout, including reinforced grasscrete tanker turning head, had to be orientated to minimise its visual impact without effecting upon future development plans of the adjacent landowner.

Sustainability

Treating the sewage locally i.e. constructing a new independent RBC was better than pumping the 1.6km, against a 56m head difference, to the nearest existing catchment (another RBC). Also pumping such small catchment flows against this difficult pumping specification to this neighbouring works would have required expensive dosing to prevent septicity and would have a detrimental impact upon its current discharge consent.

As dug material was extracted during the construction activities and was used as selected backfill for the new sewer and assisted in the works ground profiling. Work in this fashion meant only a limited amount of excavated material was sent off site to landfill. This achieved a 77% site waste plan efficiency from materials reused/recycled versus material imported to site.

Every effort was made to prioritise the separation of surface water from property sewage flow. One particular property was found to contribute significant surface water flows, frequently days after rain fall. Site investigation identified attenuation tanks in the rear garden which intercepted and stored land drainage flows from further up the catchment before returning these throttled back flows.

A degree of surface water, especially in low flow rural catchments, can often provide self-cleaning advantages. However in excess these will have a negative impact upon the downstream RBC whereby rinsing the discs of essential built up media.

Separation of this particular property was achieved by allowing the existing surface water to continue to flow to the village drain, but with a new sewer length picking up the foul flows.

Project management & procurement

As no existing village drain service plans were available, and it was unfeasible to completely expose during pre-start site investigation, clashing with the new sewer was a constant risk throughout this job. This conduit, which was encountered at various depths and in differing states of repair and material, needed to remain a live asset hence, could not be abandoned.

The delivery of the 12 tonne fibreglass RBC to site pre-fabricated required a complex lifting plan (involving a 90 tonne crane) and was installed within a single day. The modular concept enabled:

- Construction in a safe and controlled environment.
- Reduced the number of contractors required on site.
- Avoided potential delays due to rain, snow and low temperatures.
- Reduced the duration of construction on site.
- Improved health and safety with the reduced period of deep excavation being open.

As part of the STW policy of *'delivering customer and community excellence'* the team attended local parish council meetings before and during the construction stage which helped understand the needs of this close knit community. This face to face consultation also helped explain to the public the engineering difficulties the project faced and facilitated mitigation measures to minimise disruption. This customer engagement helped the project team understand the impact the road closure would have upon the rural community and how best to plan for the construction phase.

Provisions were made to ensure school transport could continue. It also diverted and provided an alternative public bus service and liaised with local businesses such as Bakewell Agricultural Centre (busy cattle market) and Lafarge quarry/cement works, so they could plan accordingly. To acknowledge the help and support received from the parish council's contribution during the project, a donation was made to help support a local community project.

Application of engineering principles and judgement

A new environmental discharge permit was requested from the Environment Agency which resulted in needing to achieve an effluent quality of 40mg/l BOD, suspended solids of 30mg/l and 20mg/l ammonia.

Had this project not been located in the sensitive Peak District National Park, a descriptive consent would have been appropriate for a catchment of this scale. For small works to meet a numeric consent with a nitrifying capability, confounded by low anticipated incoming flows represented a real treatment challenge. Even though a population equivalent of 210 was calculated, the majority of this, 157, related to two commercial properties – a public house and country club complex.

Therefore the treatment works had to cope with a wide range of flows without producing nuisance odours or starving the matured discs. This large variation in design flows presented a challenge to keep the plant within consent especially during changeable weather conditions.

Through collaborative working and early supply chain involvement designers from KEE Process were involved from the outset. Their existing product range consisted of small modular packaged units for these flows but struggled with Hassop's ammonia implications. KEE Process developed a new, much larger single-piece factory-built plant to ensure that consent could be achieved. This plant was delivered to site ready and placed on a pre-prepared concrete slab and backfilled.

Summary

This was a challenging scheme, but by adopting a 'can do' attitude and ensuring that the key stakeholders and supply chain partners were involved from the outset, the team was able to develop a solution that achieved consent and was sympathetic to the local environment.

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Installing the RBC - Courtesy of NMCNomenca and Severn Trent Water