Hemingbrough WwTW

urban waste water treatment directive scheme

by
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The Wastewater Treatment Works scheme at Hemingbrough, a small village in North Yorkshire, was implemented under the asset management programme (AMP4) agreement with Yorkshire Water Services Ltd, which is structured to deliver innovative design and construction to tight timescales. Hemingbrough WwTW was required to achieve the existing consent as well as the new consent that came into effect in 2010. The existing consent restricted the discharge to 150mg/l SS, while the new consent kept this restricted SS discharge consent at 150mg/l but plus 25mg/l BOD and 125mg/l COD.

Hemingbrough WwTW *Courtesy of CostainMouchel*

Prior to the completion of this scheme, the flow was pumped from the nearby village of Hemingbrough by two pumping stations to the works - which comprised a single primary settlement tank (PST) - and then to the existing outfall. The PST was desludged by diaphragm pump with discharge to a sludge storage tank on the site.

Proposed Works

Yorkshire Water Services Ltd (YWS) tasked CostainMouchel to design and construct the new £2.4m wastewater treatment works at Hemingbrough. The new scheme was constructed on a greenfield site, adjacent to the existing works but on the opposite side of the access track. The land for the new site was procured as part of the scheme.

A requirement to keep the site footprint to an absolute minimum led to several discussions with the Environment Agency. It was agreed that the works would treat flows up to 3DWF only - and pass flows in excess of 3DWF to storm tanks - instead of treating all flows.

The outline design of the scheme was:

- New inlet works with fine screening to 6mm in 2D, flow balancing and storm overflow;
- Two new glass reinforced plastic (GRP) primary settlement tanks;
- Two plastic media percolating filters;
- An interstage pumping station;
- Two GRP humus settlement tanks;
- Modification of the existing PST for use as a storm tank, with storm return pumping.

Inlet Works
The most notable innovation at the inlet works was the decision to construct the structure from galvanised steel rather than concrete. The screen locating tank and the inlet reception/flow balancing tank were also constructed from mild steel, with suitable coatings to give appropriate design life. This approach produced significant cost and construction time savings compared to a similar concrete structure.

Investigations into the performance of the two existing feed pumps found that they would be able to deliver to the new raised inlet works without losing any flow performance, which removed the need for new pumps. A significant amount of the existing rising main system associated with the two pumping stations was also used, again, saving significant costs and construction time.

Flows of up to 3DWF now pass to two new conical glass reinforced plastic (GRP) PSTs, each of 5.5m diameter, which are situated above ground. Flows above this limit overflow from the inlet reception tank to the existing PST, now converted into a storm settlement tank.

The GRP tanks were located so that the vast majority of the settlement volume is above ground, which is a cost effective method of constructing primary settlement tanks without the need to install concrete tanks and a sludge scraping bridge.

Storm Flows
The existing PST was modified to allow it to be used as the storm settlement tank. It contains the first flush of storm water and, when full, overflows to the existing outfall. During low flow to the works, its contents are returned to the inlet reception tank by a new submersible pump in the storm tank.

Biological Treatment
The two plastic media percolating filters are 10m diameter units with a media depth of 2.4m. In order to maximise filter performance, the filter distributors are provided with electric drives.

Glass reinforced plastic humus tanks in the background, with plastic media-percolating filter in the foreground *Courtesy of CostainMouchel*

The filter bed retaining walls were constructed from precast concrete panels, which is a design approach used previously by CostainMouchel. This approach provides lower design costs along with lower purchase price and installation costs.

Flows from the filters combine and discharge to the interstage and recirculation pumping station.

Interstage and Recirculation Pumping Station
The submersible pumping station delivers flows to secondary settlement humus tanks, and also provides recirculation to the plastic media percolating filters during low flow to the works. The recirculation system utilised a significant portion of the humus tank feed pipework. It is brought on line by automatic operation of an electric actuator.

Duty/standby variable speed drive (VSD)-driven submersible-type pumps were provided so that the pass forward flow is proportional to the incoming flow. This ensures smooth passage of flows to the humus tanks, in order to guarantee maximum settlement efficiency.

Secondary Settlement
Flows from the interstage pumping station pass to a steel distribution chamber located within another high-level structure located between the GRP humus settlement tanks. Flows from the new humus tanks combine and discharge to the existing outfall on the existing site.

The top water level (TWL) of the effluent in the humus settlement tanks was determined to be approximately 6m above ground level. This allows the discharge of the final effluent to the River Ouse by gravity during high tides to meet the Urban Waste Water Treatment Directive standard.

Works Liquor Pumping Station
The existing pumping station was retained. Its only modification was the replacement of the submersible pump with a unit able to pump to the new raised inlet works.

Scheme Challenges
This successful scheme has been lauded as an example of efficient working. The scheme was not only completed in the allocated time, but was also producing final effluent of the specified quality prior to the required date.

However, the construction was carried out during one of the worst winters for 30 years. The weather was a particular challenge because all the structures on the site needed to be constructed on significant concrete piles, in order to overcome the poor ground conditions caused by the site's position immediately next to the River Ouse.

Access to the site for construction traffic was influenced by the local planning authority and, consequently, an alloy access road was installed across the field adjacent to the site.

The local planning authority was also interested in the appearance of the works from the local access track and properties, so CostainMouchel developed 3D CAD drawings for the scheme. These were used to create a walkthrough presentation that highlighted the location and height of the inlet works, PSTs, HSTs and also the bund and planting details. This was presented to the planning team and the local residents at a scheme liaison meeting, and was well received.

Conclusion
The final scheme was delivered in the prescribed timeframe and produced the required effluent quality prior to the revised consent date. The scheme was deemed to be a success, despite the considerable challenges faced during the design and construction period.

The Team
The project was delivered for YWS by the AMP4 Waste Water (East) Joint Delivery Team, which comprises YWS, Mouchel and Costain. All staff involved - working together as CostainMouchel - are co–located in Castleford, West Yorkshire.

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