

Yorkshire Water's Large FFD Scheme Programme

YW's £300m fresh water fish directive programme

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Yorkshire Water (YW) has invested over £300 million in waste water treatment works as part of their commitment to the Fresh Water Fish Directive (FFD) in the AMP4 period. This article provides a final update on progress with these schemes since the introduction in UK Water Projects 2007. Also covered in more detail are the large schemes at Spen Valley WwTW and Huddersfield WwTW.



Esholt WwTW: Activated sludge plant to left (part of Phase 2) and primary settlement tanks to right (part of Phase 1)

Courtesy of Peter Smith Photography

The five year AMP period has been challenging, however Yorkshire Water and their Contract Partners have delivered the capital programme on time and on budget. Yorkshire Water is in the enviable position of achieving the goals and visions set out at the outset, whilst maintaining good working relationships.

Programme Update

For Yorkshire Water the FFD programme involved unprecedented upgrades to many of its largest treatment works. In response to this challenge YW created a strategic FFD Vision that was carried through the FFD Programme. The initial work on the AMP4 programme involved undertaking a Strategic Study to develop a Management and Design Guide to give direction to bring the Vision to reality.

Having completed the study YW and [Arup](#), as Framework Technical Consultants, quickly progressed feasibility and tendering to the extent that by early 2008, all Contracts had been awarded for major FFD

schemes. As a consequence of this YW were in a good position to complete all their schemes well within the regulatory timescale.

Esholt WwTW Phase 1 & Phase 2

Esholt WwTW was the first scheme to commence and was completed during April 2007. Commissioning of the primary settlement tanks and hydroturbine was undertaken in conjunction with commissioning of Esholt WwTW Phase 2. The Contractor was [Mott MacDonald Bentley](#).

Esholt WwTW Phase 2 was completed during December 2009. Phase 2 focused on the biological treatment with the construction of a new activated sludge plant. Energy is being generated from waste in a new digestion plant and surplus secondary sludge is being used to generate power from biogas in a combined heat and power plant. The Contractor was Morgan Est with designer [Grontmij](#). The combined contract value was £75m.

Halifax WwTW

This scheme was completed during August 2009. The scheme consisted of upgrades at three sites (Salterhebble, Copley and North Dean). The works were constructed in a very congested area with many interfaces with existing assets. The sludge treatment facility was the first of its type to be built in the UK in compliance with IPPC regulations. The Contractor was [North Midland Black & Veatch](#). The contract value was £20m.



Halifax WwTW

Courtesy of Peter Smith Photography

Neiley WwTW

This scheme was completed during April 2008. A major constraint on the scheme was the space available to locate new process plant. The existing humus tanks were converted to final tanks and a new final tank was constructed with an optimised volume following CFD modelling. The Contractor was Morgan Est with designer [Grontmij](#). The contract value was £8.5m.



Neiley WwTW

Courtesy of Peter Smith Photography

Knostrop WwTW and Odour Schemes

Knostrop FFD scheme required a major upgrade to the treatment facilities on the site, largely comprising the replacement of the existing filter beds with an activated sludge plant. The odour scheme addressed challenges with sludge management. The odour scheme was completed during October 2009. The Contractor was [Black & Veatch](#). The WwTW scheme was completed during April 2010. The Contractor was Laing O'Rourke with designer [Halcrow](#). The combined contract value was £55m.



Knostrop WwTW

Courtesy of Peter Smith Photography

Spenn Valley Strategy

Phase 1 of the Spenn Valley strategy involved construction of a new Activated Sludge Plant at Mitchell Laithes WwTW, Dewsbury. The Contractor was [Earth Tech Morrison](#) and was completed during July 2009. Archaeological excavations on part of the site revealed evidence of late Neolithic, Iron Age and Romano British settlements. Phase 2 of the strategy is due for completion in November 2010 and is described in more detail later in this article. The combined contract value is £55m.



Mitchell Laithes WwTW

Courtesy of Arup

Naburn WwTW

The scheme was completed during October 2008. The scope comprised the conversion of sequence batch reactor to an extended aeration activated sludge plant. New FST's with extensive piled foundations were constructed adjacent to the River Ouse. The Contractor was [Black and Veatch](#). The contract value was £15.5m.



Naburn WwTW

Courtesy of Peter Smith Photography



Lundwood WwTW

Courtesy of Peter Smith Photography



Harrogate South WwTW

Courtesy of Peter Smith Photography

Lundwood WwTW

The scheme was completed during August 2008. Innovation comprising the incorporation of retrofitted PST's and conversion of existing humus tanks to FST's led to an efficient scheme. The Contractor was [Earth Tech Morrison](#). The contract value was £8.5m.

Harrogate South WwTW

The scheme was completed in January 2010. Challenges were experienced in accommodating significantly increased flows over the Great Yorkshire Show three day period in July and introducing a new high voltage power supply to the site. The Contractor was Laing O'Rourke with designer [Halcrow](#). The contract value was £10m.

Spen Valley Phase 2

The Spen Valley Phase 1 project, which was described in UK Water Project 2009, involved construction of a new activated sludge wastewater treatment works at the existing Mitchell Laithes Treatment Works in Dewsbury. Phase 2 included a new inlet works at Mitchell Laithes WwTW however the main element is a pipeline to transfer crude sewage flows from the existing works at North Bierley and Spenborough to Mitchell Laithes for treatment. The Principal Contractor for Phase 2 was [Mott McDonald Bentley](#) whilst [Arup](#) were Yorkshire Waters framework consultant for the strategy and contractual project manager.



Mitchell Laithes WwTW Inlet Works

Courtesy of Arup



Spen Valley Greenway signage

Courtesy of Arup



Moorend Pumping Station site

Courtesy of Arup

The pipeline involved laying an 8 mile long main along the corridor of Sustrans award-winning Spen Valley Greenway, which is a key recreational facility and commuter route, used by over 250,000 people per annum. The potential disruption to users of the Greenway was addressed by a major collaborative initiative undertaken by Yorkshire Water, Arup and MMB focusing on minimising all customer impacts through:

1. Ensuring that Greenway users were aware of the works being carried out;
2. Providing easy to follow, safe and suitable diversionary routes;
3. Providing long term and lasting improvements to disturbed areas;
4. Addressing issues, concerns and complaints immediately when they occur.

Construction along the Greenway was divided into two sections and diversionary routes were established around each. For the Southern section, a new route through the Lower Spen Country Park was constructed, providing a new 2km commuter and recreational facility. Construction on the northern section followed the works in the south and involved three diversion routes being set up. The main diversion route, along the Spen Valley Ringway, led to new sections of tarmac track being laid, linking the previously fragmented commuter route into one continuous 4km stretch.

The most significant element of the diversionary route was the section through Heckmondwike Cutting. The cutting is an engineering masterpiece, formerly part of the Leeds New Line linking Leeds and Huddersfield. The route had been abandoned for 23 years before the construction commenced and had become

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Heckmondwike Cutting

Courtesy of Arup



Dewsbury Cut Pipebridge

Courtesy of Arup

extremely overgrown and prone to fly tipping. In fact 330 tonnes of rubbish had to be removed before tarmac could be laid!

These routes not only served as temporary diversions of the highest quality during the construction works, but remain as permanent extensions to the local cycling network that will deliver sustained long-term benefits, leaving a positive legacy for the community.

In order to address any issues which occurred during construction a dedicated, site based, Community Relations Officer, was appointed. He was able to communicate with the public and other third parties along the route. Signage of the temporary diversions was a major exercise involving installation of hundreds of temporary signs plus maps and explanation on the works being undertaken.

The design of the pipeline route along the Greenway also provided

challenges particularly where obstructions were encountered, such as underbridges. In several locations the pipeline had to come above existing ground level to avoid these obstructions. A variety of measures to minimise the impact were designed in these situations ranging from burring with earth to disguising under a seating area. Great care was also taken with the reinstatement of the land following construction. A restoration plan was developed which enhanced the biodiversity of the corridor and allowed re-colonisation of appropriate flora and fauna.

Other elements of the project included construction of a storm pumping station at Moorend and provision of storm storage at Spenborough. In addition to the Greenway the pipeline crossed major roads, the River Calder and a canal. It also crosses and runs alongside a live railway line. Each section providing its own design and construction opportunities.

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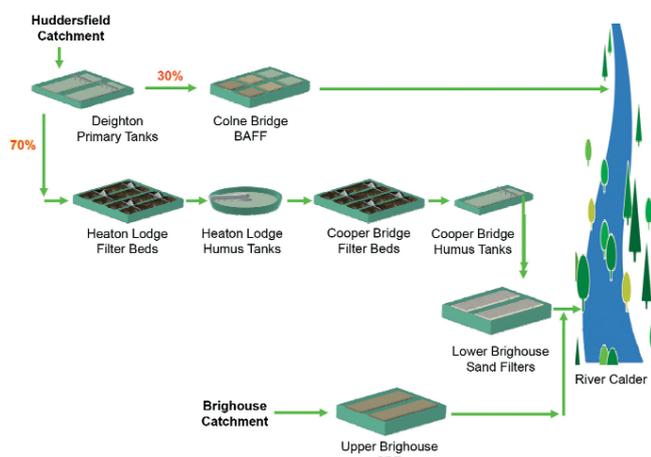


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Huddersfield WwTW

The Huddersfield FFD scheme was designed to provide compliance with the revised consent for this large municipal catchment. There are seven treatment sites in the area which contribute to the treatment of the waste water. The scheme restructures the way in which these operate by redistributing flows, optimising the performance of some of the existing assets and replacing some life expired assets with a new treatment system. The new consent of 5mg/l for ammonia applies to the outfall serving the combined sub-catchments of Brighouse and Huddersfield.

The Original Huddersfield Treatment Process



Huddersfield Original Configuration

The original configuration for the Huddersfield catchment is summarised in Figure 1. The municipal effluent received preliminary and primary treatment before being split between the Colne Bridge BAFF plant and the Heaton Lodge trickling filters. The Heaton Lodge filters provided carbonaceous treatment before transferring the effluent to the nitrifying Cooper Bridge filter works prior to being blended with the Brighouse flows for discharge to the River Calder.

The effluent from a local chemical producer receives pre-treatment prior to being blended with the flow being transferred to the Heaton Lodge filter works.

Arup were appointed to undertake the feasibility study to identify the most appropriate solution for the catchment. The appointment was under the terms of the YW Framework Agreement for Technical Consultant. Numerous options were identified and considered in detail. The scheme had to satisfy the requirements of the YWS Fresh Water Fish Directive Design Strategy. As such the new secondary treatment process would be based around the use of a fine bubble activated sludge plant.

The Revised Huddersfield Treatment Process

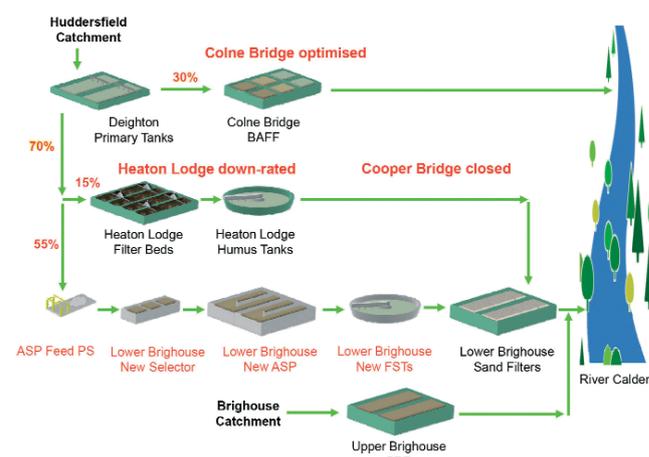
The FFD scheme was split into two contract packages. The initial contract was placed with [Earth Tech Morrison \(ETM\)](#) to construct a whole new inlet works. This included coarse screens, grit removal using detritors and fine screens. A new inter-stage pumping station was required to elevate the flow back into the primary tanks. The new inlet works was provided within a restricted site while having to ensure that the performance of the existing plant wasn't compromised.

The second and largest contract package was awarded to Morgan Est on a design and construct basis with [Grontmij](#) undertaking the detailed design. The 118 week contract was awarded with a target cost of approximately £19.5M

The scope of the Morgan Est works is shown in Figure 2 and included

the following;

- Recondition the primary settlement tanks and the sludge removal system;
- Reduce the FFT to the Colne Bridge BAFF plant;
- Reduce the FFT to Heaton Lodge filter beds so that they become nitrifying;
- Construct a new ASP transfer pumping station;
- 4 lane ASP;
- 4 No. 40m Dia. Final Settlement Tanks;
- Sludge Thickening facilities including SAS storage tanks and 2 No. centrifuges;
- Installation of a new control system to allow the various sites to be operated as one virtual site.



Huddersfield New Configuration

Construction of the new Lower Brighouse ASP

The down-rated Heaton Lodge plant has a treatment capacity of 29,500 m³/day and the new Lower Brighouse ASP can treat a maximum of 118,600 m³/day.

Each ASP lane has operational dimensions of 72m x 31.5m x 6m. All four lanes were built as a single structure with an integrated selector tank. The structure was founded on driven piles with the formation level being at approximately existing ground level. This allowed the structure to be built without disturbing contaminated land which had been identified on the site.

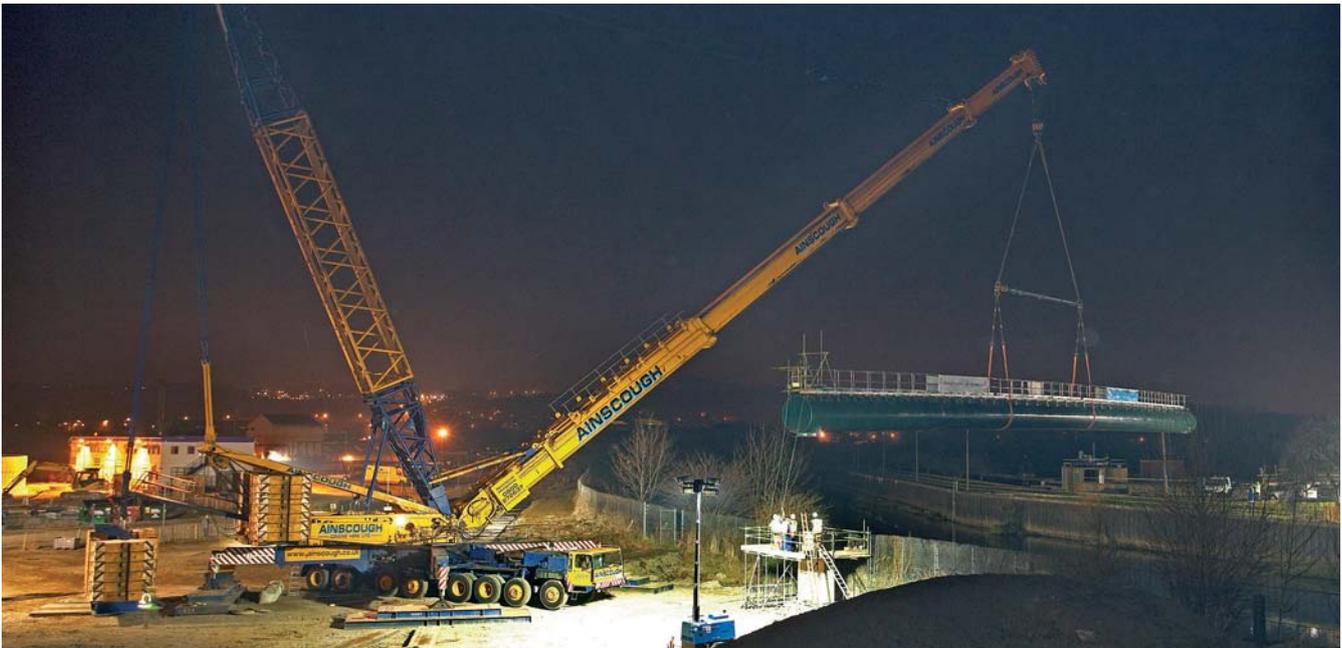
The configuration for the site included space for the construction of an additional ASP lane and final settlement tank to allow for future growth in the catchment and the closure of the Heaton Lodge plant.

Flows have to be pumped to the new ASP. This is done by a new pumping station incorporating submersible pumps. The flow crosses the river via a 55m long pipe bridge. The pumping main is contained within a structural host pipe which crosses the river in a single span.



Final Settlement Tanks Construction

Courtesy of Arup



Lifting the pipebridge into position

Courtesy of Peter Smith Photography

A key feature of the scheme was the implications of working across so many operational sites.

The various sites which form part of the Huddersfield complex were the responsibility of various operational teams. As such when considering an intervention to the process it wasn't possible to just liaise with one particular site or operator. Full catchment liaison was necessary because it was necessary to maintain compliance at all times.

The complexity of the scheme introduced challenges for implementing the CDM Regulations. Designated construction sites were identified at the individual treatment sites. These were controlled and managed by the most appropriate contractor. It was determined that the most effective way to deliver the schemes was for ETM and Morgan Est to be responsible for their own packages of work.

As well as the construction contracts being undertaken by ETM and Morgan Est there were several significant maintenance schemes being undertaken directly by YWS. Coordination between all parties was essential. Monthly meetings were held which involved all of the relevant parties to ensure full awareness, cooperation and communication between them. Weekly meetings were then undertaken on a localised basis to discuss specific issues.

The Arup site supervisor was heavily involved with the liaison meetings. It became apparent during the construction programme that a significant amount of time would be consumed coordinating and managing the meetings. It was considered that the effort invested in these processes provided significant value because the works were constructed and commissioned with minimal critical path disruption due to the actions of third parties.

AMP4 - Lessons learned

From the outset Yorkshire Waters' Shining Star vision was to ensure "Guaranteed Compliance" & "Maximum Efficiency". The sites are the best that have ever been built and new standards have been set for operating them.

There have been lessons learned and they would fall into the following areas:

- Optimisation of resources, co-located with Contractor and Client;
- Need for clarity on roles and responsibilities and sharing of information;

- Technical improvements;
- Need for effective communication with Framework Suppliers;
- Document control and checking;
- Manage late changes and initiatives.

Note: The Editor and Publishers thank Noel Feather, Philip Press and Peter Caldwell, Associates with Arup, for producing the above article for publication. ■



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