Acomb Landing WTW

new 35Ml/d DAF plant for the City of York

by Mark Hewison and Fred Mukonoweshuro BSc, MSc, CEng, MICE

Yorkshire Water's Acomb Landing WTW is located approximately 1 mile to the west of York city centre on the west bank of the River Ouse. Development of the site dates back to 1846, with numerous phases resulting in the current layout, which comprises four separate process streams. The works dating from the initial development are registered by the Institution of Civil Engineers Panel for Historic Engineering Works (Ref: HEW 0216), but the index entry notes that *'progressive developments have led to the demolition of the early works'.* The entry also notes that Acomb Landing was the site of the first use of rapid gravity filters in Britain. The current project replaces the existing works with a new 35Ml/d DAF Plant.

Acomb Landing WTW *Courtesy of Peter Smith Photography*

Existing works

Yorkshire Water Services Ltd (YWS) purchased the Acomb Landing WTW from York Waterworks plc in early 1999, and have since undertaken work to increase the pesticides removal capability by the introduction of the Granular Activated Carbon (GAC) sandwich process in the existing slow sand filters. Further work to improve the automation of the process streams and upgrading of the sludge handling facilities has also been undertaken.

Currently only two streams are operational, one being the number 3 plant at the north end of the site, and the other a hybrid of the number 1 and 4 plants in the southern part of site. The site currently provides a reasonably constant base flow of 21Ml/d to serve the city of York. The existing WTW has been downrated to 21Ml/d, while the regional water resource plan calls for an output of 35Ml/d. The 14Ml/d deficit is made up from Elvington WTW, which is located to the south east of York and this reduces the outage allowance in the Water Resource Plan.

Pre-feasibility work and feasibility study

The pre-feasibility work, undertaken by Arup in the early part of the Yorkshire Water Services AMP4 programme, concluded that the Acomb Landing site would be best served by the construction of a new 35Ml/d water treatment plant. This would address the operational problems associated with the existing plant; maintain the Acomb Landing abstraction licence for Water Resource requirements, offer potential for future expansion, and potentially support YWS rationalisation enabling the future closures of more expensive smaller works.

Following the pre-feasibility work, a detailed feasibility study carried out by Arup, provided a number of options which vary from building a completely new works, to refurbishing and incorporating existing assets into a single process stream. Although the reuse and refurbishment of existing assets offered the best commercial advantage over a new build, YWS decided that a new build was the best use of investments with significant benefits, as well as being in line with the business strategic aspirations, which include rationalisation of the vast Acomb Landing site land. After the detailed feasibility, which was completed in 2007, YWS approved the construction of a new build plant but delayed the scheme until AMP5.

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Piling for the new building in progress *Courtesy of Arup*

Construction in progress *Courtesy of Arup*

Procurement process

At the end of 2009, Acomb Landing was used as part of the procurement process for YW's AMP5 Large Schemes Framework. The six joint ventures that had reached the final selection phase carried out joint investigations into areas such as asset condition, flows and loads, environmental surveys and geotechnical investigation. Each then carried out their own optioneering and development of their preferred option. Following review with YWS these were developed into full design and build tender submissions. The tenders were then assessed for two purposes: (i) as part of the selection of four partners to the Large Scheme Framework, and (ii), for the award of the Acomb Landing scheme.

The Acomb Landing scheme was awarded to Earth Tech Morrison (ETM) in August 2010 for £12.8m with a completion date of September 2012. The wining tender was based on a new build 35ML/d plant.

Solution

The following solution content was identified (see process schematic) below:

- Construction of a new intake with a new passive intake fish screen and a raw water pumping station
- Provision of raw water pre-settlement by utilising the existing subsiding reservoir No. 1 (see figure 2)
- Provision of a new building structure to house the new plant
- New Dissolved Air Flotation (DAF) clarification stage
- New Rapid Gravity Filtration (RGF) stage
- New ozonation plant for pesticides removal
- New Granular Activated Carbon (GAC) adsorbers
- Re-use of existing contact tank
- New chlorination plant
- Retain treated water storage and high lift pumping station (new pumps and motors)
- Retain existing wash water handling facilities
- Provision of two new centrifuges for sludge dewatering

Further significant capital efficiencies have been derived from the utilisation of a plasma ozone generating system from Primozone, a Swedish based company. This system has a number of benefits both in terms of lower CAPEX and OPEX compared to the conventional ozone generating systems. Another notable benefit of this ozone generation system is its reduced footprint, which resembles an office filing cabinet unit.

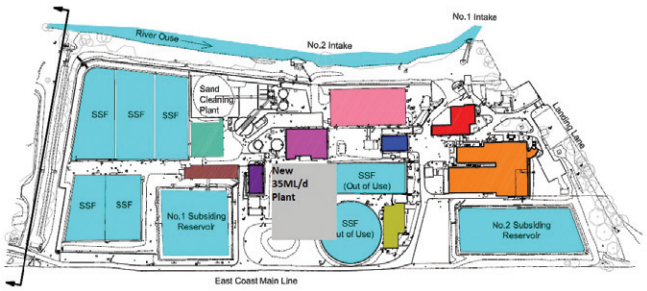

Figure 2: Acomb Landing site location including footprint of the new plant

The Design Development process prospered from a committed team comprising ETM, Arup, and YWS with the active participation of key YWS stakeholders. The well attended design development sessions indicated keen Client interest in finding sound engineering solutions with capital efficiency benefits.

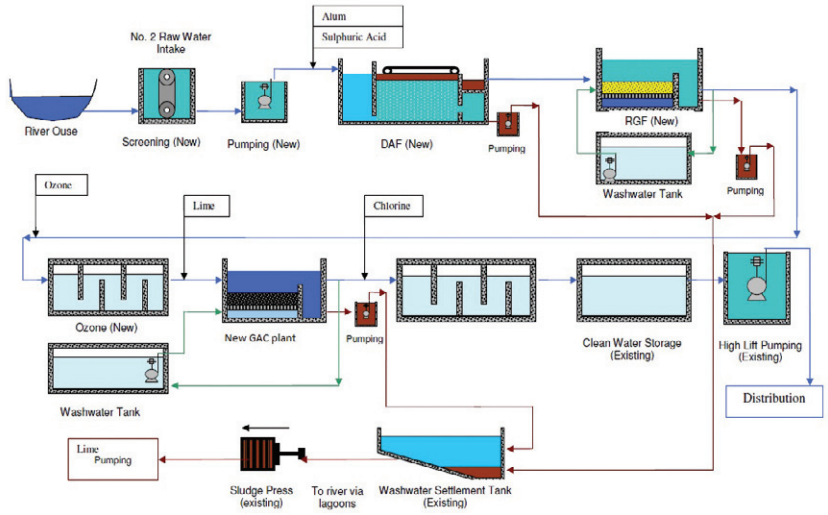

Figure 1: Acomb Landing process schematic

Influences to the approach to delivery

Apart from focus on the key drivers of the project, consideration has been required to a number of inherent factors that influence the approach to be taken in tackling the delivery of the scheme. These comprise:

- Planning for the new building structure which was obtained with little objections from the local council.
- The ground conditions around the site are very poor resulting in the need for piling.
- The proximity of the new building structure to the adjacent East Coast Railway line meant strict adherence to Network Rail construction restrictions.
- Ongoing negotiations with the EA regarding the construction of the new intake screen within the River Ouse. No major objections are expected.

Acomb Landing WTW under flood *Courtesy of Peter Smith Photography*

Another pertinent issue is that of flood resilience of the site. The flooding of Severn Trent Water's Mythe WTW in 2007, which cut off water supply to over 350,000 people for up to 17 days, highlighted the critical importance of water treatment works. The Pitt review recommends that the operator build resilience to flooding in their critical infrastructure.

For Acomb Landing, the entire site, with the exception of a small area, is shown on the EA flood risk mapping as being liable to inundation in a 1 in 100 year flood event, ignoring the existing flood defences. The modelled flood levels along the River Ouse including climate change allowance are as follows:

- 1 in 100 year: 11.30m AOD
- 1 in 200 year: 11.90m AOD
- 1 in 1000 year: 13.29m AOD

However, the part of the site containing new plant (see figure 2) is protected with a flood defence, crest level of approximately 11.94m AOD. This level of defence is just under an annual probability of 1 in 200. This existing level of defence is currently being discussed with the EA.

Construction began in January 2011 with no major issues to date. The majority of the civil works is expected to be completed by the end of this year. The project enjoys the benefit of offline construction with minimum impact to the existing works and therefore no major issues are expected when it comes to commissioning.

The close relationship forged between YWS-Arup-ETM throughout the value added ideas, reviews and the design development stage is paying dividends now the scheme is in the construction phase.

Key project participants

- Client: Yorkshire Water Services Ltd
- Principle Contractor/Designers: Earth Tech Morrison (ETM)
- Technical Consultant: Arup
- Commercial Consultant: Turner & Townsend

The Editor and Publishers thank Mark Hewison, Yorkshire Water Project Manager, and Frederick Mukonoweshuro, Senior Engineer with Arup, for preparing this article for publication. Both are members of Yorkshire Water's Asset Delivery Unit.

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