

Runcorn WwTW - Phase II

£6.4m AMP5 refurbishment of a 1960s WwTW in Cheshire

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Runcorn WwTW is one of United Utilities' major WwTW and was first constructed in the 1960s. It serves a Population Equivalent (PE) of 96,800 with a Flow to Full Treatment (FTFT) of 54ML/d and a discharge consent of 30mg/l BOD, 45mg/l SS. Runcorn WwTW was identified for a full refurbishment in AMP5 for delivery in two phases. Phase I, (approximately £3m), to improve the serviceability of the sludge treatment assets was completed in 2011. Phase II (£6.4m), the subject of this paper, started on completion of Phase I. The project will improve the serviceability of the treatment stream to ensure the works can be safely operated and maintained while complying with the limits of its Environmental Permit for the foreseeable future.



ASP1 (refurbished) – Digesters 1 & 2 at the back - Courtesy of United Utilities Water Plc

Exiting works

The original works built in the 1960s and 1970s comprised:

- 2 (No.) 6mm inlet escalator screens.
- 2 (No.) detritors with reciprocating rake grit removal.
- Flow split into process streams 1 & 2.
- Stream 1 comprising:
 - ▲ 2 (No.) circular primary settlement tanks (PSTs).
 - ▲ 2 x 8 (No.) aeration pockets (Activated Sludge Plant 1).
 - ▲ 4 (No.) circular final settlement tanks (FSTs).
- Stream 2 comprising:
 - ▲ 1 (No.) rectangular PSTs.
 - ▲ 10 (No.) aeration pockets (Activated Sludge Plant 2).
 - ▲ 4 (No.) circular FSTs.
- Combined outfall discharging to the Manchester Ship Canal.
- Storm water overflows to 2 (No.) rectangular storm tanks (3,432m² total) served by a common scraper bridge.

Further improvements in the 1980s and 1990s included:

- Sludge digestion.
- Combine heat power (CHP) generation added in 1989.
- Sludge thickening via gravity belt thickeners (GBTs) added in 1992.

Digested thickened sludge from Runcorn is tankered away to Warrington North WwTW. In AMP4, the CHP system gas holding tank, digesters, boilers and the GBTs were fully refurbished as part of an initial refurbishment project (Phase 1 project) for a total budget of approximately £2.5m.

Project need

The project need at Runcorn was two-fold:

(A) Maintenance Needs: Trend analysis carried out in AMP4 at Runcorn WwTW had highlighted a deterioration of the Works'

performances both in terms of consent compliance and in terms of operational running costs due to the poor serviceability of most the works assets (mechanical, electrical and civil assets). This was particularly true for both ASP 1 and 2 which were built in the 1970s.

(B) Environmental Permitting Need: Runcorn WwTW operates under an Environmental Permit (EP) and must comply with all environmental regulations within the sludge treatment area of the site. To achieve compliance with the 'BAT' (Best Available Technologies) principles which underpin these regulations, it had been identified that the entire drainage system of the sludge treatment area needed to be upgraded (double containment, return to the head of the works etc).

The existing flare stack was also identified as non compliant with the same environmental regulations and needed to be upgraded.

Project scope of work

The approved scope of work was as follows:

Activated Sludge Plant

- *Replace all M&E assets on ASP1:* Replacement of aerators, valves and penstocks, new dissolved oxygen instrumentation, new MCC, new kiosk, concrete repairs.
- *Replace all M&E assets on ASP2:* Replacement of aerators, valves and penstocks, new DO instrumentation, new MCC, new kiosk also housing storm MCC, concrete repairs.
- New 1,000kVA transformer and associated cabling.

Storm Tanks

- New storm water return PS including new rising main returning flows up stream of storm overflow, new storm tanks cleaning system, storm tanks refurbishment, new MCC housed in ASP2 kiosk.
- Replace storm tanks associated isolation penstocks, bell mouth valves and ancillary pipeworks.

Primary Settlement Tank 1

- New weir plate, replacement of auto de-sludging pumps.

Sludge process stream

- New filtrate balancing tank 300m³ including mixing and new filtrate return pumps and associated pipework.
- New main sludge PS MCC housed in a new kiosk.
- Replacement of existing heat exchangers by 2 (No.) new 500kW units and ancillary pipework.
- Provision of a new sludge recirculation pumping station.
- Replacement of existing hot water pipework.
- New Heater House MCC housed in a new kiosk.
- Replace all returned activated sludge (RAS) bellmouth valves.
- Emptying, cleaning and minor refurbishment of the existing sludge digesters internal structure, internal pipeworks and valves.

Final Settlement Tanks

- Replace all FSTs actuated inlet valves.

Site Communications and Control

- Full Upgrade of the existing outdated SCADA System.
- Upgrade of existing telemetry and IPM systems.

Environmental Permit Compliance.

Upgrade of the existing site drainage system to comply with all environmental regulations (double containment, return to the head of the works etc).

Digester/CHP system flare stack

Upgrade of the monitoring and control system of the existing flare stack to comply with current environmental regulations.



Storm Return Pumping station wet well
Courtesy of United Utilities Water Plc



Storm Return Pumping Station
Courtesy of United Utilities Water Plc



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One cell of ASP1 (refurbished)
Courtesy of United Utilities Water Plc



Biogas storage bag (implemented as part of Phase I project) and CHP gas flare stack - Courtesy of United Utilities Water Plc



FSTs and ASP2 (behind green kiosk)
Courtesy of United Utilities Water Plc



New liquor balancing tank (in green) and Digester 2
Courtesy of United Utilities Water Plc

The challenges

Complying with the Environmental Permit: Maintaining compliance with the site Environmental Permit (discharge consent) during the site activities was a primary requirement from the project sponsor and client. This was a major constraint when ASP1 and ASP2 had to be taken off line to be refurbished. Extensive planning activities took place prior taking the ASPs off line (one at a time) to ensure that compliance could be maintained on one ASP alone.

A risk based approach was adopted based on close and intensive monitoring of the process performances with contingency plans ready to be implemented if deterioration occurred such as over-pumping, chemical dosing (ferric sulphate) to remove more effluent load in the PSTs. The shutdown periods were also reduced to the minimum through precise scheduling and extended working hours during the activity.

Interfaces with existing assets: As for all projects of this nature, managing the interfaces between new assets and assets being refurbished/replaced with the remaining assets being retained has been a difficult task especially when the site is very old and asset records (manuals, drawings etc) may not necessarily be accurate or even available.

Despite extensive asset surveys carried out during the planning phase of the project, surprises have occurred during the construction phase (such as asset specifications, locations or conditions found not to be as expected), which required design changes that adversely impacted on the project schedule and budget. A robust change control process has been implemented allowing these changes to be managed in the most efficient way from a technical point of view, from a schedule point of view and from a cost point of view.

Secondary Digesters: During the early stage of the construction/implementation phase of the project, an opportunity to save on digested sludge tankering by actuating and automating all disused secondary digesters decanting valves was identified and additional "spend to save" funding was secured on the basis of a 4 years pay back period.

Pre-thickening sludge holding tank: During the early stage of the construction/implementation phase of the project, the air mixing system of the pre-thickening sludge holding tank (which ensures uniformity and consistency of the raw sludge being presented to the gravity belt thickeners for thickening) failed and additional funding was subsequently secured to replace the failed system as part of the project.

Progress

The scope of work was competitively tendered in spring 2012 and subsequently awarded to Imtech Process Limited. After a 5 months detail design period, activities started on site in September 2012. At the time of writing (August 2013), construction is 80% complete with ASP1 successfully refurbished and back online while ASP2 is off line and being refurbished.

Completion of all site activities is planned for November 2013. The various scope changes post contract award agreed by all parties have added a further 3 months period onto the initial contract duration of 16 months. The project is currently forecasting to outturn on the initial approved budget of £6.4m.

The project forms part of United Utilities' £3.6 billion investment programme between 2010 and 2015, which will improve water quality and the environment across north west England.

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