

Uttlesford Bridge WTW

UV and borehole pump replacement

by Matthew Sutton Msc PMPDP

Originally built in 1965, Uttlesford Bridge Pumping Station near Saffron Walden consisted of two boreholes, a contact tank, booster pump suction tank and treatment by marginal chlorination. The licence at Uttlesford Bridge is a combined group licence with Springwell Farm of 13.64MLD. There are times during peak demand that up to 5MLD compensation flow is requested by the Environment Agency (EA) from Uttlesford Bridge to support the River Cam. The site output is crucial to balancing the needs of customers and with sustainability reductions taking place at other nearby sites, the Eastern area sources will become increasingly critical with any outages likely to directly impact the import of water from Anglian Water at a cost. The difficulty in arranging the outage for the borehole verticality tests proves how integral Uttlesford Bridge is to Affinity Water in the Eastern area.



Inside the main treatment room - Courtesy of Nomenca Ltd

Project background

There were four booster pumps, three of which were operable, and a surge vessel. The treated water from Uttlesford Bridge is pumped to Sibleys Reservoir or to the Wenden zone in an emergency. In 1998, due to the construction of the Northern Link Main, a third variable speed booster pump and associated control functions were installed to allow for the additional head loss in the delivery main to Sibleys Reservoir.

There were a number of challenges with the previous configuration of Uttlesford Bridge. The design of the high lift pump house needed to be improved and the force pumps could not be economically refurbished or adequately maintained in situ. Replacing them required extensive work in potentially removing the roof structure, which was not appropriate for Uttlesford Bridge as it was imperative that it remained in service.

Scope of works

Nomenca carried out an initial outline design, reviewing the existing scope carried out by another contractor. Nomenca

proposed a different design and verified the previous outlined design. Through discussions with Affinity Water, Nomenca gained a good understanding of the requirements and a solution was agreed in collaboration which encompassed both outline designs. The proposed solution also incorporated a large section of works as an offsite built package. This package consisted of: the main MCC, a UV disinfection system, a hypochlorite dosing system and the hypochlorite storage tanks and offloading system. The offsite build provided benefits in reducing health and safety risks, reduced disruption to the local residents due to the reduced works on site and a reduction in overall programme of works.

Nomenca completed the detail design, procurement, delivery, installation, commissioning and project managed the construction of the works to the outline design and to Affinity Water standards and specifications. The works included:

- All civil and building works including erection/installations, site construction, pipework (buried and above ground) and connections to existing mains.



Water quality analysers - Courtesy of Nomenca Ltd



Main MCC - Courtesy of Nomenca Ltd



Chemical fill point - Courtesy of Nomenca Ltd

- All mechanical, electrical, instrumentation, controls and automation (MEICA) works including all process and integration works.
- Testing and commissioning of all works including factory and site testing.
- Decommissioning, removal and disposal of redundant plant.
- Demolition and making good where appropriate to facilitate the works.
- Programme and management of the works including planning permits, outages and site delivery management.
- Management and organisation of other authorities as necessary for the safe transportation, delivery and off-loading of plant.
- Training Affinity Water staff, provision of drawings, O&M manuals and health & safety file and updating of Affinity Water asset management system and tagging of all site assets.

In addition, Nomenca needed to ensure the continued operation of the existing plant during construction and commissioning of the new works. The existing plant could then be phased out and removed. There were some minor shut downs required to bring the new works online; however, these were limited to just 3 (No.) in total lasting no longer than 6 hours.

Project objectives

The project objective was to resolve the above-mentioned issues by installing new larger borehole pumps capable of pumping to the network pressure without the need for the force pumps, with a new UV treatment system which is compliant with Affinity Water disinfection policy and meet parameters set by the Drinking Water Inspectorate. Both the pumping, MCC, and disinfection facilities have been installed in steel kiosks designed to meet the enhanced security standards. A standby power generator facility along new fuel delivery area and access arrangements was also installed, which will protect the site from power failure and thus protect the water output to the region.

Ancillary works also included re-routing the existing water mains from under any new kiosk. The existing site security perimeter fence had to be extended to accommodate the works. Once the new UV and marginal chlorination treatment process had been commissioned, a 14-day performance test was completed, all which allowed the existing plant and equipment to be decommissioned and removed from the existing pump house. The existing contact tank, suction tank and pump house was decommissioned in a manner required by Affinity Water that does not incur any future asset maintenance requirements.

A new human machine interface (HMI) within the new UV and marginal chlorination MCC at the site was configured to display all mimics, set points, alarm conditions and historical trending facilities associated with the replacement duty/standby borehole pumps, the new UV and marginal chlorination treatment process, the new sodium hypochlorite storage and dosing equipment, the new booster pump and the new final water quality analysers and customer protection panel.

Finally, flood protection was designed into the new systems including:

- Protection from surface water ingress in to the boreholes.
- Protection from flood water ingress in to the disinfection kiosk and MCCs.

Project achievements

Nomenca utilised its innovative Skilled Assembly in a Factory Environment (SAFE) off site build approach to construction, which meant that the design and development of a 20m x 4.5m treatment

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Table of designers, contractors and suppliers

Client	Affinity Water
Principal contractor	Nomenca
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Civil sub-contractor	Groupbridge
Mechanical sub-contractor	Edwards Elite Engineering
Electrical sub-contractor	Main Electrical
MCC supplier	Max Wright
UV supplier	ATG
Borehole pump supplier	KSB Pumps

plant could be fully built and tested in our construction facility prior to being transported to site. The treatment plant consisted of fill points and panels, storage tanks, dosing rigs, sample boards, UV reactors, pipework, structural steelwork and a main site MCC. It is the biggest of its kind in the country.

This innovative approach to off-site construction provides benefits such as, reducing health and safety risks, efficiency in construction time at site which provided financial benefits and reduced shut downs. Reduction in wastage of raw materials, reduced carbon footprint and a reduction in environmental impacts with less disruption to local residents and businesses due to reduced site traffic and also reduced programme of works.

Initially Nomenca undertook a 3D laser scan of the site to capture all of the assets using a FARO focus scanner. In addition, a full utility survey of the underground services was produced using a ground penetrating radar (GPR). Consequently, Nomenca was able to provide the client with a virtual reality view of the site following the extensive site survey.

The 3D model was imported into Nomenca's virtual reality software, and showcased to the client at final review meetings, to the construction teams for constructability reviews and even to the local residents and council for planning application meetings. Once the AutoCAD model of the proposed improvements was complete it was superimposed over the model of the existing works to ensure that the equipment being built off site would be a perfect fit once transported. There were some slight modifications that this highlighted that if dealt with whilst on site would have caused a delay to the programme of works and an increase in costs.

A basic concrete ring beam to support the rig was cast on site, minimising on site construction works and enabling safe off-loading when the new treatment plant was delivered to site.

Longer term benefits are realised by Affinity Water as they no longer have the maintenance challenges on site. The benefits to the local community include maintaining high quality drinking water and less down time as the plant is now more reliable. The use of UV treatment has also meant the quantity of sodium hypochlorite used in the process has been greatly reduced. A greatly improved interlocked delivery system was also installed along with a chemical interceptor tank meaning a much-reduced risk to the environment and contamination of any spillages of sodium hypochlorite during delivery.

Conclusion

The main works was completed in 2017, with the full project now in beneficial use. The construction methods have proved beneficial for various reasons:

- Reduction in health and safety risks.
- Programme reduction.
- A reduced carbon footprint.
- Reduced disruption to local residents.

From the outset, Affinity Water and Nomenca have worked collaboratively on the project from outline design to completion and aim to carry forward the innovations used on more sites within Affinity Water.

Nomenca is also encouraging other clients of the added benefits in the 3D scan and modelling and off-site building of package plants where it is feasible and appropriate. Both Affinity Water and Nomenca look forward to finding new innovative solutions to provide benefits to future projects.

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Outlet pipework - Courtesy of Nomenca Ltd



Pressure transducer - Courtesy of Nomenca Ltd