

Newtownbreda WwTW

£5m upgrade to an outdated WwTW in southern Belfast to serve an increasing population and meet nitrogen and phosphorus consent conditions

by Derek Crabbe BSc (Hons)

Newtownbreda Wastewater Treatment Works (WwTW) is located at Galwally, on the bank of the River Lagan, 4km south of Belfast city centre. Northern Ireland Water's current £5 million upgrade, is designed to increase the capacity of the treatment plant for a population equivalent (PE) of over 44,000 in the South Belfast catchment. Construction work commenced at the site early summer 2010, and it is anticipated that the project will be completed in March 2012.



New glass lined steel sludge storage tanks (approx 500m³ each)
Courtesy of Northern Ireland Water



New Final Settlement Tanks
Courtesy of Northern Ireland Water

Background

The original Newtownbreda Wastewater Treatment Works was constructed in 1963. The works was initially designed to treat the growing suburban area of South Belfast, which had a PE of 20,000. The area has since successfully expanded, and in doing so has attracted significant commercial premises and businesses, including a large shopping centre at Forestside.

With several large parks and the extensive River Lagan, the area is well renowned for its recreational pursuits. The river and neighbouring areas also attract many visitors all year round. With Council investment to improve the pathways, and with the re-using of traditional tow paths, greenways for traffic-free bike routes and recreation have been developed.

In 1985 the works was upgraded to add modern inlet screening and secondary treatment, and then a few years later, tertiary filtration.



Newtownbreda WwTW – Old works prior to the current upgrade
Courtesy of Northern Ireland Water

Sludge processing was carried out, and a bio-digester plant was utilised to improve the treatment process. This was successfully operated for many years, but in 1998 the plant was decommissioned and sludge was then transported to a new incineration plant at Duncrue WwTW.

Objectives/need

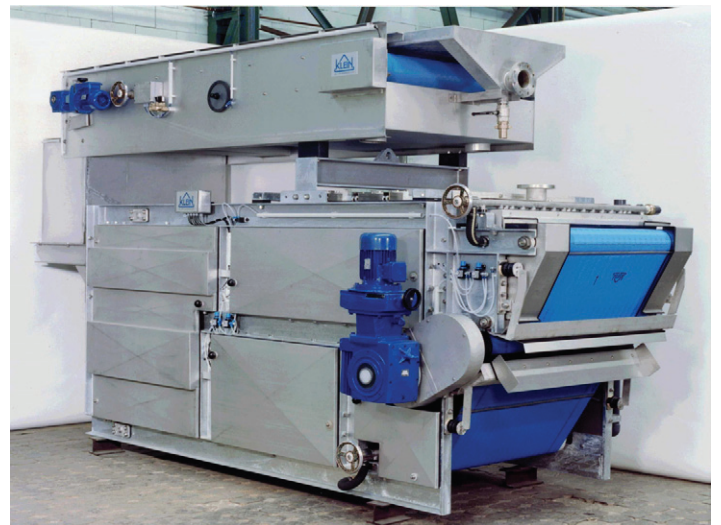
The old treatment works was in need of modernisation. Nearly all elements of the works operation were manual, and the existing plant required one full time operator, with support from M&E and additional reclamation staff.

De-sludging, storm and general operations were manually carried out, which resulted in significant overtime on weekends and very careful sludge management to deal with the lack of capacity. Frequently, the sludge export had to be carried out after hours in order to provide sufficient space for holiday periods and plant maintenance.

This upgrade has been identified to meet the new total nitrogen and total phosphorous consent conditions. The upgrade will also ensure the works can meet its future full flow to treatment capacity, and allow further development in the catchments.

The works required modernisation to automate the treatment process. It required modern control functionality, such as historical data recording to ensure it was compliant with the permits and licensing agreements. The new control plant shall utilise SCADA Wiscon, and operator controls shall be via one of two touchscreen HMIs on the site. This software will also allow the site manager to have remote contact with the site, and provide them with full control of any plant connected to the PLC network. This provides invaluable information for the operators (especially if things stop working out of hours)!

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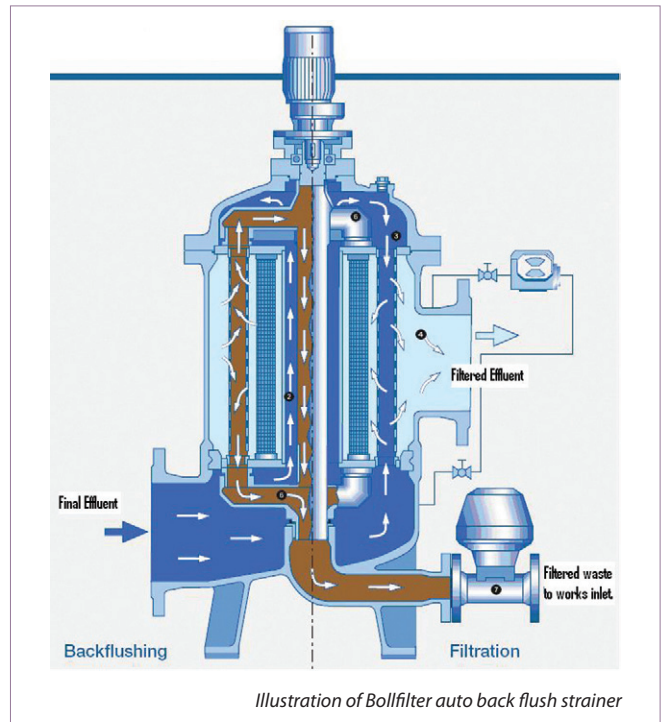
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NI Water Operations required a plant that would deliver robust treatment, low operating costs, and consistent performance. The plant is based around an activated sludge process, a traditional sewage treatment technology, which represents the lowest running cost for the land space available. It will be capable of meeting the consent standard, along with an onerous total N standard.

Consent standards

The aim of the works upgrade is to provide a treatment facility that complies with European Union legalisation, and it is designed to meet these needs for South Belfast catchments up to the year 2030. In line with the projected combined population growth the works design is over 44,000 PE.

Future Consent Standards to be achieved at Newtownbreda WwTW		
Parameter	95 Percentile	Upper Tier Limit
Biochemical Oxygen Demand	15mg/l	50mg/l
Suspended Solids	30mg/l	75mg/l
Ammonia	5 mg/l	20mg/l
Total Phosphorous as P	2 Annual Average	n/a
Total Nitrogen as N	15 Annual Average	n/a



In addition to the wastewater treatment upgrade, the NI Water Sludge Disposal Strategy had plans for the Newtownbreda site too. Following the bio-digester decommissioning in 1998, sludge from the existing treatment works was tankered off-site for dewatering and incineration. To thicken the sludge, traditional picket fence thickeners were utilised, but since these are well past their service life, Operations sought an improved method of thickening.

The proposal selected, was to replace the picket fence thickeners with modern plant, which includes new storage and buffer tanks to increase the number of days capacity available on-site. 2 (No.) new Huber Drum Thickeners were selected for the sludge thickening.

Solution

The existing site was the obvious location to construct the upgrade as the site benefited from having available space. The site had been used for a number of purposes since its initial construction in 1963, including being used as a divisional operation base, M&E operation base, M&E store and more recently, a strategic generator site. These operational roles have now been moved elsewhere and the existing structures presented opportunities to re-use.

The new process will consist of improved preliminary treatment, flow control, screening improvements, grit removal, primary treatment, and an increased activated sludge aeration system.

To optimise the efficiency of the new aeration plant, a fine bubble aeration system was selected. This system is well established in the wastewater treatment processing industry, and achieves superior performance compared to surface aeration or course bubble aeration. The optimal structure is to achieve lengthy air to water contact,

and thus a deep tank provides this contact time. The aeration tank structures are approx 6.5m deep, each with a capacity of 1,000m³.

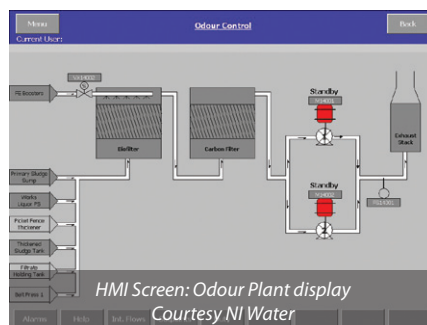
Other plant additions include increased secondary final settlement tank capacity, with the construction of two new above ground final tanks with rotating bridge scrapers, which will provide scum and sludge removal.

Final effluent recycling system

Final effluent shall be re-used on the site in a bid to reduce the potable water consumption. Within the design, the contractor has included a separate final effluent feed to the two areas that utilise backwashing, namely the inlet screenings and sludge plant. The washing of the automatic screens is probably the greatest use of potable water on most WwTWs, and at Newtownbreda, as per many of the NI Water sites, a new final effluent re-circulation pumping station will be installed. This will boost a sufficient volume of the final effluent to a pressure of approx 6 Bar, which will backwash the inlet screens and sludge screens as required.

Because the final effluent can contain small solids or fibres carried over from the treatment process, automatic strainers are used to ensure the water is suitable for the spray bars used on the mechanical plant. This filters the effluent to 50 Microns, and to ensure a reliable source, automatic back-flushing units have been utilised. The illustration above shows the selected Bollfilter unit.

The proposed treatment process should negate the immediate need for the existing tertiary micro-filtration plant on the site. However, as the works inlet flows and biological loads increase, it is expected the tertiary plant will be returned to operation.





New Final Settlement Tanks under construction
Courtesy of Northern Ireland Water

River protection and improvements

Northern Ireland Water, in partnership with the Graham MWH JV, has developed robust Environmental Management Plans to meet NI Environmental Agency requirements. Deep excavations within this proximity of a main river can always incur obstacles, but with assistance and agreement with NIEA, abstracting the water locally and discharging within their guidelines allowed the work to be progressed without construction delays. The deepest structure on site was a new 12m diameter shaft. The structure was a new anoxic tank for the process, and was constructed within very limited space using pre-cast segment shaft construction method. It measured 11m deep and was approx 6m into the natural water table.

To control water ingress, 4 (No.) bore wells were provided around the outside of the shaft. Pumping here was constant over the full construction (approx 6 months), and had to be carefully monitored and tested due to its discharge in the vicinity of the River Lagan. The structure also required anchoring given its depth and local ground conditions, this required 16 (No.) ground anchors, and each drilled over 10m into the rock beneath.

Conclusion

The Newtownbreda WwTW upgrade is being undertaken by NI Water working in partnership with Jacobs Consultant Services, and the joint venture contractors Graham Construction/MWH Treatment. This design and build project is just one example of



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the scale of investment required to provide cleaner rivers, meet European standards and deliver a modern water and wastewater infrastructure. The investment is also essential to protect public health and provide Northern Ireland with a modern service comparable with that of water companies in the UK.

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