

Broughton WwTW, Kettering, Northants

Anglian Water install Bio Bubble SBR plant

By Phillip Cullum

Situated approximately four miles west of Kettering off the A43 trunk road to Northampton, Broughton WwTW requires extensive improvements to meet the demands of projected local infrastructure growth from the villages of Broughton and nearby Cransley, with new flows to be received from Mawsley. In addition, the works are to meet revised consent limits to final effluent quality, complying with River Needs Consent (RNC) requirements and storm overflow discharges to Asset Management Plan (AMP).



Reaction Phase (courtesy Bio Bubble Ltd)

Basis of design

Population	4280	PE
DWF	963	m ³ /d
Formula A flow	6760	m ³ /d
Flows to full treatment (FFT)	78.6	l/s
SS	15	mg/l
BOD	10	mg/l
Amm.N	2	mg/l
Consent compliance	95	%ile

Full secondary treatment for flows to Formula A.

Project Value £1.4M.

Value management considerations

A number of options were considered including upgrading and

extending the existing works, replacing the existing works with a new activated sludge system and sludge holding facilities, or installation of the *Bio Bubble SBR process*.

Besides having to meet the revised River Needs Consent (RNC) limits and storm overflow AMP3 obligation, further key requirements were to review operational considerations and, in particular, the projected increase to sludge production. Being surrounded by agricultural land, access to the site for maintenance and sludge tanker movements necessitated particular attention.

The final recommendations held preference for the *Bio Bubble SBR*, which was considered to be the best possible option capable of meeting specific site requirements and, of surpassing the revised RNC consent of BOD 11 mg/l; SS 22 mg/l and NH₃-N5 mg/l with compliance percentile of 95%. The *Bio Bubble* process afforded the most competitive system; not only by means of lower



Decanting Phase (courtesy Bio Bubble Ltd)

capital installation costs, but also towards operational costs and other practical requirements. These include:

- * a new treatment works with small footprint allowing installation to take place whilst the existing plant remains in full service throughout the entire contractual installation phase;
- * high quality performance producing a final effluent well within the RNC consent limits meeting a basis of design of BOD 10mg/l; SS 15 mg/l and NH₃-N₂ mg/l with compliance percentile of 95%;
- * plant designed to receive formula A flows to full treatment negating the requirement for construction of storm tanks in addition to benefiting from a higher quality effluent discharge throughout storm periods;
- * low and stabilised sludge production to 95%ile reduction (≤ 0.05 kg/kg BOD removed)
- * sludge concentrations of 3% DS achievable direct from the secondary treatment reactors that will contribute significantly to reduced tanker movements;
- * low manpower operational requirements when compared with other processes with simple, low frequency attendance for maintenance routines, mainly requiring a single operator to attend without the requirement for highly skilled staff.

In addition to the above, confidence of the *Bio Bubble SBR* process already exists within the Anglian Water region where several plants had previously been installed. It had been particularly noted that during bad storm periods, Bio Bubble plants remained within consent and required no site attendance. Furthermore, annual sludge production from existing Bio Bubble installations was noted as being significantly low.

Process

The new works receives raw sewage flows by gravity from the Broughton outfall sewer and pumped flows from Cransley and Mawsley.

All flows enter the inlet channel; where preliminary screening is undertaken by a rotary drum 6mm aperture fine screen. Screenings are washed and compacted then discharged into a collection container ready for disposal. Faeces and other reduced organic matter returns to the screened sewage flow and convey onward to full secondary biological treatment.

A Storm Overflow allows storm flows greater than Formula A to

over-weir. Flows equal to or less than Formula A will flow to full secondary treatment. Measurement of flows to full treatment is monitored and controlled by a partial depth measurement flow meter actuating a variable position penstock.

Screened sewage enters the Bio Bubble Sequencing Batch Reactor (SBR) balance tank where air mixing of the screened sewage is promoted to alleviate odours and variations in the incoming influent strength. Two Reactors provide full secondary treatment receiving screened sewage direct from the Balance Tank via one of the two screw-centrifugal transfer pumps.

The *Bio Bubble SBR* incorporates an internationally patented intelligent Reaction system. which has an infinite range of operating parameters to control all flows up to Formula A. The process will automatically change to suit incoming flow conditions and, where a full load is not available, the Reactors will not discharge, but will select a minimum aeration cycle reducing energy utilisation by 75%. *Bio Bubble's* patented variable buoyancy decanter is pneumatically controlled and will simply raise and lower so that only the required volume of final effluent will be discharged. Full protection is provided to instantly disengage decanting sequences either automatically or by manual selection. The decanters are manufactured from stainless steel and are practically maintenance free with service life of plus 20 years. The Bio Bubble SBR process pursues the natural qualities of an over-extended sludge age and proliferation of higher life organisms. This approach contributes to significant improvements in sludge stability that is highly mineralised, nutrient rich with extremely low pathogen counts and, concentrated to a 3% DS waste sludge discharge direct from the Reactors. Results are, therefore, reflected by a high quality final effluent but with very low sludge production; typically, 0.05 kg/kg BOD that falls well below other treatment processes where annual surpluses are normally greater than 0.2 kg/kg BOD/d. Anticipated sludge production is 0.46m³/d at 3% DS.

The final effluent discharges to a tributary of the River Nene, where the consent limitations were met from the first batch release. Moreover, regular sampling confirms that the final effluent remains continually within the basis of design limitations.■

Note: The author of this article Philip Cullum is Treatment Manager, Anglian Water Services .