Kirklevington Sewage Treatment Works

two RBCs replace 1960s plant to meet new consent

by

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Kirklevington Sewage Treatment Works (STW) is situated south of Yarm and serves an estimated population of 1100. The works provides primary settlement, biological filtration and humus tank with sludge storage facility. The original works was constructed in the 1960s. Some electrical and mechanical refurbishment has been carried out since then, however, the STW required to be updated to meet new consents set by government.

Kirklevington STW upgrade to meet consent courtesy: Northumbrian Water

The STW appeared on the National Environment Programme and was to be subject to a new consent of 60SS; 40BOD; 15NH3 as from 31 March 2004. The works was struggling to meet the new consent standards, while meeting the old dual consent of 90SS; 80BOD for flows below 9 l/s and of 100SS; 100 BOD for flows above 9 l/s.

Feasibility study

Several options had been identified to achieve the new consent standards at Kirklevington STW..

* **the first obvious option** was to refurbish the existing process line by upgrading the filters media, adding an extra humus tank, add storm water retention facility, replacing re-circulation pumps, replacing and upgrading sludge handling facilities, adding flow measurement to the process line and upgrading the general health and safety performance of the site.

This option was disregarded due to its high net present value (NPV) cost (high maintenance level still required) and the little available space on site to build a new humus tank and storm tanks.

* **another option** was to stop using the Kirklevington consent by entirely abandoning the STW and transferring all flows to the Yarm sewerage system via a transfer pumping station and a three mile transfer pipe. After extensive analysis of the Yarm sewerage system, it appeared that part of it could not cope with the extra flows coming from Kirklevington.

The cost of upgrading the Yarm network was prohibitive and this option was subsequently disregarded.

The last and recommended option was to:

* decommission the current treatment stream;
* replace the current process stream by a package plant consisting of two Rotating Biological Contactor (RCB) units to treat a flow equivalent to three times dry weather flow (DWF);
* convert current primary settlement tanks into storm tanks;
* re-design the STW inlet to suit the storm tank facility.

This solution had the advantage of giving the STW a twenty-year lifetime and the site would need little manual intervention to function. The NPV cost of this option was by far the lowest one compared to the other two options.

Rotating Biological Contactor (RBC)
A Rotating Biological Contactor is an all in one STW including primary settlement stage, a biological filtration stage and a final settlement stage.

Tuke & Bell supplied two 550 population equivalent RBCs. The 550 population equivalent unit is the biggest unit of the manufacturer's RBC product range.

Technical data (per unit):

maximum treatment capacity	4.1 l/sec
approx dry weight	18 tons
approx Operational weight:	200 tons.
approx dimensions	13.5m x 5m x 6m
power consumed Input to Motor:	91kWh/day.

Construction & commissioning
Delivery to site of the RBC units was identified during the detail design stage as a major issue, as the units would be delivered fully assembled. Access road to the site goes through a very busy residential area and was too narrow and winding for the special 12 axles heavy load lorries. After investigating a costly helicopter assisted delivery, it was decided to transport the units through damp and muddy agricultural fields on a special trailer and tracked tractor. The operation took a half day per unit to cover 600 yards!

The inlet of the works was rebuilt to allow flow measurement, flow control, flow splitting and storm water separation.

Some temporary flow diversion and re-circulation arrangements were made to allow the seeding/commissioning of the RBC units while still maintaining the compliance of the STW using the old process line.

After six weeks of seeding period (biological agent growth inside the RBS to reach a proper level of bio-filtration) flow through the old process line was turned off and the RBCs were put fully on line.

Conversion of the old primary settlement tanks into storm tanks could then start at the same time as demolition of the old works structures. No demolition material or excavated soil left site as they were all used to backfill the old humus tanks and bio-filters and to cover the rest of old works structures.

Operation & site maintenance
The site now only needs to be visited by Northumbrian Water Limited's (NWL) operation team once a week instead of four times and de-sludging of the RBC units takes place once a month instead of up to four times. Sludge is tankered off site to NWL Regional Sludge Treatment Centre at Brand Sand.The site is virtually odour free as the entire process is contained inside the GRP structure of the RBC units.

Process performances
The RBC process line is currently achieving 95% BOD removal, 90% SS removal and 75% ammonia removal and the works comfortably meets the new revised consent standards.

Procurement & programme
The feasibility study, conceptual design and detail design were carried out by *MWH UK* and the construction main contract was awarded to *Byzack Constructors Ltd.,* NWL's framework contractor on separate open book ECC option C contract with target cost. The RBC units were supplied and commissioned by *Tuke & Bell Ltd.*

Conceptual design started in June 2003 and the construction phase in November 2003. The RBC process line was operational by March 2004 in time to meet the revised consent standards applied to the STW on March 31st 2004. The project was completed (demolition phase and final re-instatement) in June 2004 as per initial construction programme and was comfortably within the budget of £1m. ■

Note:*The author of this article, Geraud Ramond, is Project Manager, Northumbrian Water Ltd*

Kirklevington: RBC units fully assembled were towed across fields to site courtesy: Northumbrian Water