

Cranleigh, Woking, Farnham & Earlswood STWs

Thames Water AMP5 framework- year one GBMJV
South London wastewater schemes

by Andy Citawarman MICE

GBM is one of a number of Delivery Partners who will be carrying out Thames Water's AMP5 base load process programme for water and sewage treatment, and major pumping station works improvements for North and South London between 2010 to 2015. This article will focus on the wastewater sludge dewatering and odour improvement schemes on four Sewage Treatment Works around the South London Area at Cranleigh, Woking, Farnham and Earlswood.



Woking STW - Sludge Buffer Tank

Courtesy of GBM JV

Regulatory Drivers

A number of project deliverables are subject to, and targeted around, regulatory requirements. The two main regulatory drivers on these four schemes are:

- **Driver 1: Odour Reduction:** To reduce the odour generated on the site. This will be achieved by reducing the odour escaping into the atmosphere from the sludge holding tanks.
- **Driver 2: Sludge Quality - Nitrogen Vulnerable Zone (NVZ) Regulations:** NVZ Regulations need to be fully implemented by January '12. These regulations restrict the period under which liquid sludge may be added to land.

Contract arrangements

GBM is a Joint Venture between Galliford Try, MWH Treatment (formerly Biwater Treatment) and Mott MacDonald. The contract arrangements are on a modified I Chem E Burgundy book Target Cost (TC) basis. It is a two part contract focusing upon both Project

and Programme level arrangements, with a Total of Target Cost, Guaranteed Maximum Price (GMP) at Programme level. There are gain-share opportunities, which are evaluated by the application of various key performance indicators.

CRANLEIGH & WOKING STWs – SLUDGE DEWATERING & ODOUR

Cranleigh Sewage Treatment Works (STW) is situated in the Guildford Asset Management Area, and is located approximately 12km south of Guildford. The STW serves a population of approximately 14,200 located in the town of Cranleigh and the villages of Hascombe, Dunsfold, Rowly, Ewhurst and Ewhurst Green.

Raw sludge from primary and secondary treatment co-settles in the Primary Settlement Tanks (PSTs) and is pumped to three existing Sludge holding Tanks. In the past, the co-settled sludge was thickened in the sludge holding tanks to achieve 3-4% DS before being tankered away off site, and the liquors were returned back to the inlet works.



Refurbishment works

The main scope of works completed for Cranleigh STW are summarised as follows:

- *Belt dewatering press:* a 1m wide Ashbrook Simon-Hartley (AS-H) Klampress was installed, producing 27-28% Dry Solid sludge cake. This has been regarded as a big success for the scheme.
- *Poly-dosing plant:* a BASF liquid polymer dosing plant was installed (part of AS-H sub-contract package).
- *Fixed Screw Conveyor:* a CTM Systems fixed screw conveyor was installed with three points discharging sludge cake into a sludge skip. The conveyor was also connected to the new odour control unit (AS-H sub-contract).
- *MCC:* TAP completed the electrical installation of the dewatering plant and MCC inside a new GRP kiosk. CEMA completed the cabling works.
- *Glass Fused to Steel Tanks:* Kirk Environmental supplied and installed two Permastore GFTS tanks. A 49m³ tank, complete with sludge mixing pump and odour control was installed for sludge buffering purposes. A 219m³ tank was installed as a liquor balancing facility receiving flows from the new liquor transfer pump station.
- *Civil Works:* TC Jones was the civil sub-contractor responsible for completion of the underground pipework installation, construction of concrete slabs, manholes, underground pump stations and valve chamber installations.
- *New washwater and potable water pump stations:* DSI Group completed the installation of a new washwater pump station consisting of a new 6m³ above ground washwater holding tank, new washwater booster pumps (duty/assist/assist) and MCC, where the pumps and panel are located inside a new GRP kiosk.
- *Odour Control Unit (OCU):* OSIL Ltd supplied and installed the new 5m tall biotrickling tower to treat odour emissions from the three existing sludge holding tanks, new sludge



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CTM are proud to have designed, manufactured and installed the fixed and radial screw conveyors at the Cranleigh & Woking STWs, recently commissioned for Thames Water.



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- Continuous mixers



Woking STW - Washwater Holding Tank and Booster Pump Package Pump Station - Courtesy of GBM JV



Woking STW - Slewing screw conveyor - Courtesy of GBM JV

buffer tank, new belt press unit and one parked sludge skip. The biotrickling tower is then followed by a carbon polishing unit and odour extraction fans which extracts the treated odour and discharges them to the atmosphere through a 6m stack. The OCU was designed with a capacity to produce a maximum odour emission rate of 225 ouE/s.

Woking STW – Sludge dewatering

Woking is a medium sized double filtration STW located 1km East of Woking with a current PE of 72,000 (2006). As with Cranleigh STW, a sludge dewatering solution was required for Woking STW, however the main differences between Cranleigh and Woking are summarised as follows:

- In terms of scale, the works at Woking STW are generally twice as big as Cranleigh STW. For example a 2m wide Klampress outdoor unit, 240m³ sludge buffer tank and

- 440m³ liquor balancing tank have been installed at Woking.
- Odour was not the primary driver for the scheme, therefore an odour extraction unit was provided for the belt press and conveyor only.
- Prior to addition of the dewatering plant, co-settled sludge from the PSTs was pumped to a single buffer tank where the sludge was then pumped to feed an existing drum thickener, and the thickened sludge pumped to a redundant digester tank for storage, prior to tankering away off site.
- A slewing screw conveyor was installed, instead of a fixed screw conveyor, where the conveyor discharges the sludge cake into three different sludge skips.

Cranleigh & Woking challenges and innovative solutions

There was a “regulatory date” that was imposed on both Cranleigh (sludge solution only) and Woking, which was 31 March 2011 due to the NVZ regulations mentioned on the drivers above. Therefore, the main challenge for this scheme was a town planning issue.

Due to a very tight programme, the original idea to contain the belt press inside a building was disbanded. GBM and Thames Water Town Planning Teams worked together with Ashbrook Simon-Hartley to provide a steel cladding system which is easy for operation/maintenance and suitable for outdoor usage. Cranleigh STW is the first Thames Water site to use this arrangement and has set a precedent for many similar projects in the AMP5 Programme. Originally the Cranleigh project brief stated that the odour scheme did not have to be completed until 2012, but during preliminary design, GBM decided to complete both odour and sludge schemes at the same time since the sludge scheme depended on the odour scheme: if the sludge scheme was completed first then a temporary odour solution would have to be provided as odour was a major issue for Cranleigh.

At Cranleigh and Woking the issue of the originally open sludge holding tanks had caused some disturbances to nearby residents in the past. As odour reduction is a primary driver, GBM provided a completely new odour control system for the site to treat odour from existing and new sludge holding tanks, and a GRP cover system was provided to enclose the originally open sludge holding tanks.

During detailed design, Surrey City Council classified MCC Kiosks and Poly-dosing Containers as “work places”. Previous “permitted development” status was revised, and planning applications were required.

The Cranleigh Project Brief specifies that GBM provide sludge skips/ bins with odour extraction capabilities. GBM worked together with Thames Water Bio-recycling Team, Viridor and Firber to provide a solution which is easy to maintain and operate. These skips were the first of their kind within Thames Water Operational Sites. Overall



Farnham STW - New Ammonia Scrubber - Courtesy of GBM JV



Farnham STW New Air Mixing System to Existing Sludge Import / Buffer Tank - Courtesy of GBM JV



Farnham Existing OCU Upgrade (New fans, carbon polisher and stack) Courtesy of GBM JV

five new modified skips have been provided for Cranleigh and Woking STWs.

FARNHAM & EARLSWOOD STW –ODOUR IMPROVEMENT

The STW is located north of Farnham, with a domestic population of 37,000. It is situated in the Farnham Asset Management Area, and serves parts of Guildford, Waverley, Wrecclesham, Rowledge and Spreakley. Farnham STW primarily treats sewage of a domestic origin, although some industrial releases are also received. The regulatory/primary driver for Farnham STW was to reduce odour emissions from lime cake silo/conveyor and sludge buffer tank, where the specified guaranteed performance is to produce a maximum stack discharge odour emission rate of:

- 555 ouE/s from sludge silo/conveyor
- 209 ouE/s from sludge buffer/import tank

The site receives both imported raw sludge and SAS. Both raw and SAS from the sludge holding tanks is screened independently. The raw and SAS are then blended in 2 (No.) sludge blending tanks, which in turn feed 2 (No.) enclosed centrifuges. The dewatered sludge is limed and conveyed to a storage silo. The discharge rate of the conveyor is 15m³/hr. The silo is a panel-sectioned, bolted structure, with a GRP roof and concrete base. The storage capacity of the silo is 850m³.

Refurbishment works

The main scope of works completed for the project are summarised as follows:

- **New ammonia scrubber unit:** OSIL Ltd supplied and installed a new ammonia scrubber package plant to reduce the ammonia produced by the limed sludge cake. The packaged plant includes a venturi scrubber unit, a 3m³ double skinned nitric acid (5% concentration) storage tank, chemical dosing plant, recirculation pump system and a safety shower unit complete with eye wash station. OSIL also completed the installation of new above ground odour ducts and connection to an existing biofilter unit.
- **Upgrade of existing OCU:** OSIL upgraded the existing biofilter unit by provision of new carbon polishing unit, provision of additional Lava Rok media, and replacement of existing extraction fans to cater for additional flows from the ammonia scrubber and sludge import/buffer tank.
- **Air mixing unit:** S.A.M.S. Ltd (Slurry Aeration Management Systems) supplied and installed a new air mixing system on the existing sludge import / buffer tank which prevents consolidation of sludge within the tank.
- **New bunded concrete access road and raised 0.5m³ brick chamber:** To allow for nitric acid delivery spillages, which is being delivered in 1m³ IBCs / pressure tanks.

Earlswood STW

Earlswood STW has a population equivalent of approximately 53,000, and similar to Farnham STW, an ammonia scrubber unit was required. The main difference between Farnham and Earlswood were that odour control and air mixing were not required for any existing sludge import/buffer tanks, and no upgrades were required for the existing Biofilter Odour Control Unit.

Challenges and innovative solutions

Odour reduction was the main driver for both Farnham and Earlswood STWs, where Thames Water's previous odour study in 2008 indicated that the existing limed cake silo and conveyor was responsible for approximately 20% of the odour generated from the sites, and residents had begun submitting complaints regarding odour.

Lime stabilisation is one method of treating sludge which produces

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Belt Conveyor Enclosure with easy-to-maintain "Rubber Clip On" solution for Farnham and Earlswood - Courtesy of GBM JV



Cranleigh Sludge Cake (27-28% DS) Courtesy of GBM JV

alkali suitable as a fertiliser for agriculture. This method has only been adopted for the last 10 years or so, but when lime dust is mixed with the acidic sludge it generates an exothermic reaction which heats up the sludge destroying any unwanted bacteria. This heating up of the sludge produces high levels of ammonia, and a cocktail of odorous sulphurous compounds, which are required to be treated. Provision of ammonia scrubbers to cater for this issue is still relatively new for Thames Water, and monitoring the performance of the OCUs is considered to be very important.

Traditionally chemical scrubbers require a strong acidic solution to "scrub" the odour away, with typical usage of >80% sulphuric acid for most suppliers. But the odour subcontractor, Odour Services International Ltd (OSIL), have provided their venturi (ammonia) scrubbers with 5% nitric acid which, further diluted with potable water, will not be as hazardous as the typical sulphuric acid solution.

The project brief initially specified for a new Odour Control Unit to be provided for the sludge buffer/import tank, but since OSIL are the current odour maintenance contractor for Thames Water with special knowledge of the site, the solution provided was more economical, and this was achieved by upgrading the existing Biotrickling tower and adding a carbon polishing unit prior to discharge to atmosphere.

The project briefs for both Farnham and Earlswood STWs stated that any open areas on the sludge-lined cake feed conveyor be enclosed. Theoretically, this seemed easy but proved to be difficult in practice because for belt conveyors spillages are unavoidable and the typical method of enclosing conveyors by steel cladding system was not operable/maintainable. Therefore GBM provided a "rubber clip-on" solution which is easy to maintain, and also satisfied the requirements of the project brief to enclose the conveyor. A new access platform was also provided for the high level access points. This part of the works was completed by Kemical Dosing Ltd.

Summary

All of these projects provided significant challenges. At the time of writing, the current status of each of the schemes is:

Cranleigh	The commissioning of the sludge dewatering scheme has been completed and the construction of the odour control plant is underway. The regulatory date for the sludge scheme (31.03.11) was achieved and the new sludge dewatering plant was duly put into service. Final completion of the scheme was May 2011.
Woking	The commissioning of the sludge scheme and the handover process are underway. The regulatory date (31.03.11) was again achieved, with the new sludge dewatering plant in service.
Farnham	The project were completed on time, and handovers was achieved in December 2010, as originally planned
Earlswood	The project were completed on time, and handovers was achieved in December 2010, as originally planned

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