Chingford South WTW

first new surface water treatment works in London for 13 years

by
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This project, the first new surface water treatment works in London for 13 tears, formed part of the strategy to resolve the deficit in water treatment capacity and increase supply resilience to London by providing a new £42m WTW for North London sited at Chingford South, where Thames water supply previously only had an existing raw water pumping station for the adjacent William Girling reservoir.

Chingford South WTW

The scheme provides the following benefits:

* an additional 40 Ml/d all year round treatment capability;
* the facility to quickly augment the output to 58.3 Ml/d. (future 61.8 Ml/d) with borehole water as needed;
* the treatment process and hydraulic design will make greater use of water from King George V Reservoir;
* reduces the pressure on Coppermills WTW and raw water aqueducts supplying that works, particularly during periods of algal blooms, when Coppermills' treatment capacity is reduced;
* provides greater security of supply by reducing reliance on the aged 42" supply main from Coppermills to Chingford.

Treatment process

The raw water feed to Chingford South WTW is surface water derived and as such suffers from algal blooms, turbidity and pesticides, and is also at risk from Cryptosporidium. A robust form of treatment was, therefore, required that could remove all of the above.

The most appropriate treatment stream for this water was identified as pre-ozonation, pH correction, coagulation, flocculation, dissolved air flotation (DAF), dual media rapid gravity filtration (RGF), granular activated carbon (GAC), pH re-adjustment, orthophosphoric acid dosing and super - and de chlorination. Chloramination was also required as the treated water will combine with other chloraminated water in the distribution system.

The main treatment processes selected are DAF, RGF, GAC and disinfection. The operating performance of this combination is enhanced with the addition of pre-ozonation upstream of the DAF's. The ozone is dosed to reduce pesticides and aid colour removal and reduces the coagulant demand, particularly in summer when the ozone equates to a reduction of approximately 50% in coagulant dose.

Raw water sources

The primary raw water source is the King George V (KGV) Reservoir. The Sir William Girling (SWG) Reservoir will be the secondary source. Water from KGV Reservoir is drawn off via the existing drawoff outlets in the drawoff tower, and connected to the WTW through approximately 500m of existing and new pipework. Water from SWG Reservoir is drawn off through a completely new drawoff arrangement comprising siphons over the embankment crest, and approximately 100m of new pipework.

During the winter peak, spring algal bloom, peak summer demand and autumn algal bloom periods, local borehole water will be used to increase the works output, as it only requires disinfection.

These boreholes are part of the North London Artificial Recharge Scheme (NLARS) and currently deliver into the reservoirs and are expected to be used for about 6 months a year.

Pre-Ozonation

A single Pre-Ozone Contactor will be provided with a total process flow requirement of 42.5 Ml/d. The contactor will have a minimum design contact time of 5.6 minutes under maximum flow conditions with all streams running, and will have plug flow characteristics. Pressure over and under pressure relief valves and all other features required by TWUL's SPD will be provided.

DAF Clarifiers

Four DAF lanes will be provided, each comprising separate flocculation and flotation tanks of steel construction mounted on concrete plinths. The DAF units will have an average loading rate of 13.7m/h out of the process including re-cycle increasing to 14.6 m/h under design maximum flow and water quality conditions..

These units are hydraulically de-sludged. It had been found elsewhere in Thames Water that efficient desludging could be achieved by carefully controlling the DAF de-sludge to 6 litres per metre of desludge weir for sufficient time to remove the majority of the sludge blanket.

Rapid Gravity Filters

There are six rapid gravity filters of steel construction supported on concrete plinths to treat the clarified flow. The RGFs were designed for a maximum process flow of 42.1 Ml/d

The filter area is $35m^2$ with a total area of $210m^2$. Leopold floors are incorporated into the RGF design. The filters contain media to a depth of 1200mm, which will consist of 600mm of No.2 anthracite, on 600mm of 14/25 grade sand (0.6-1.18mm).

Filter backwash is initiated on time, head loss, filtrate turbidity or operator instruction. Backwashing is provided with a combined air and water (CAW) system, so as to provide collapsed-pulse (CP) washing with 100% standby capacity available. Backwash water for both the RGFs and the GACs is stored in a common Clean Washwater Tank adjacent to the Relift Pump sump below the floor slab on the Main Process Building. The tank is sized for the backwash of two RGF units, which have a greater washwater requirement than the GACs. Launder levels in the RGFs have been designed to ensure no media is lost during the wash cycle and that any air is driven out of the system before water is passed over the outlet weirs.

Pressurised Granular Activated Carbon (GAC) Filters

Eight pressurised GAC units were required to treat the full works flow containing Chemviron Filtrasorb F400 grade GAC. The minimum Empty Bed Contact Time (EBCT) is 10 minutes at maximum flow with one unit off line and the maximum filtration rate is 18 m/h. The nominal vessel diameter is 4.2m with a bed depth of 3.03m (excluding media below the underdrain in the dished ends). The volume of carbon per vessel is approximately $46.7m^3$. The vessels are to the current Chemviron design, widely used by Thames Water and are known as PTU 45s.

Disinfection

Disinfection is provided by super-and de-chlorination using 10% Sodium hypochlorite and 20% sodium bisulphite. The hypochlorite is added upstream of the Contact Tank in front of a static mixer such that a coefficient of variation (CoV) of 0.05 is achieved within one pipe diameter of the mixer exit.

A single reinforced concrete chlorine Contact Tank with a working capacity of 1920 m^3 has been constructed. There was no redundancy built-in as the plant will be shutdown during any tank inspection requirement. The volume and configuration of the Contact Tank has been confirmed by CFD Modelling to provide a t_5 of 31 minutes and a t_{mean} of 43 minutes at the maximum design flow of 63.5 Ml/d.

De-chlorination is provided by 20% sodium bisulphite at the outlet of the Contact Tank and is also dosed upstream of a static mixer shared with the ammoniation dosing point. Ammoniation was required for compatibility with water in the distribution system. Ammoniation is achieved by ammonium sulphate dosing, which is dosed downstream of the sodium bisulphite through the same static mixer.

Project team

Thames Water brought together, for the first time on a single project, the expertise of three of its AMP3 Capital Programme Alliance Contractors: **Trident West Alliance** (Thames Water Engineering (TWE), MJ Gleeson, MWH); **Network South Alliance** (TWE, Morrison Construction, WS Atkins); and **Network North Alliance** (TWE, Barhale, Faber Maunsell).

Supply chain manufacturers for the main process treatment (Purac), ozonation (Ozonia), and systems integrator (Aston Dane) were fully integrated within the project team by a project Extranet.

Progress

Construction work started in April 2004. First water was put into supply in April 2005, a month ahead of schedule. The plant was fully handed over to Thames Water Operations in November 2005.■

Note: *The author of this article, Duncan Stewart, is Senior Project Manager, Thames Water Utilities Ltd..*

**** Elsewhere in this edition of UK Water Projects we have printed an article, by the same author ,detailing the construction work on this important project for London, The speed with which this £45m works was constructed and put into service has given us the opportunity to meet the deadline for this 2006 edition in time to produce here full operational details of the water treatment works. Editor***