

# Minworth Sewage Treatment Works

## £100m upgrading scheme for Severn Trent's largest STW

**M**inworth Sewage Treatment Works, Severn Trent's largest STW treats sewage arising from a population equivalent of 1.75 million from Birmingham and the Black Country. The works also treats sludge arising from a population equivalent 2.5 million which is made up of the works indigenous sludge transferred by pipeline from the nearby Coleshill STW and sludges imported from smaller treatment works in south Staffordshire and north Warwickshire. The works will be extended and improved during the AMP4 period by two major schemes. The *first phase* will address a UWWTD UID requirement and will provide additional storm water storage capacity. The *second phase* will address a requirement under the Fisheries Directive, to meet the stricter discharge ammonia consent by the provision of additional activated sludge plant capacity and existing aeration plant upgrade. In addition to the two main phases, AMP4 includes a number of other schemes across the whole site including an extensive programme of replacement, refurbishment and improvements to existing assets identified by operational maintenance risk assessments, and three schemes to enhance the output of the existing site power station.



Minworth STW: Work ongoing for £100m upgrading scheme

courtesy Biwater Ltd

### Phase 1 - Storm Water Capacity Improvements

The existing preliminary and primary sewage treatment process at Minworth consists of a preliminary treatment stage with bar screens and aerated grit channels followed by 20 rectangular primary settlement tanks and 6 rectangular storm tanks. The existing civil structures are in very good condition but the M & E assets present some operational difficulties which lead to process performance difficulties.

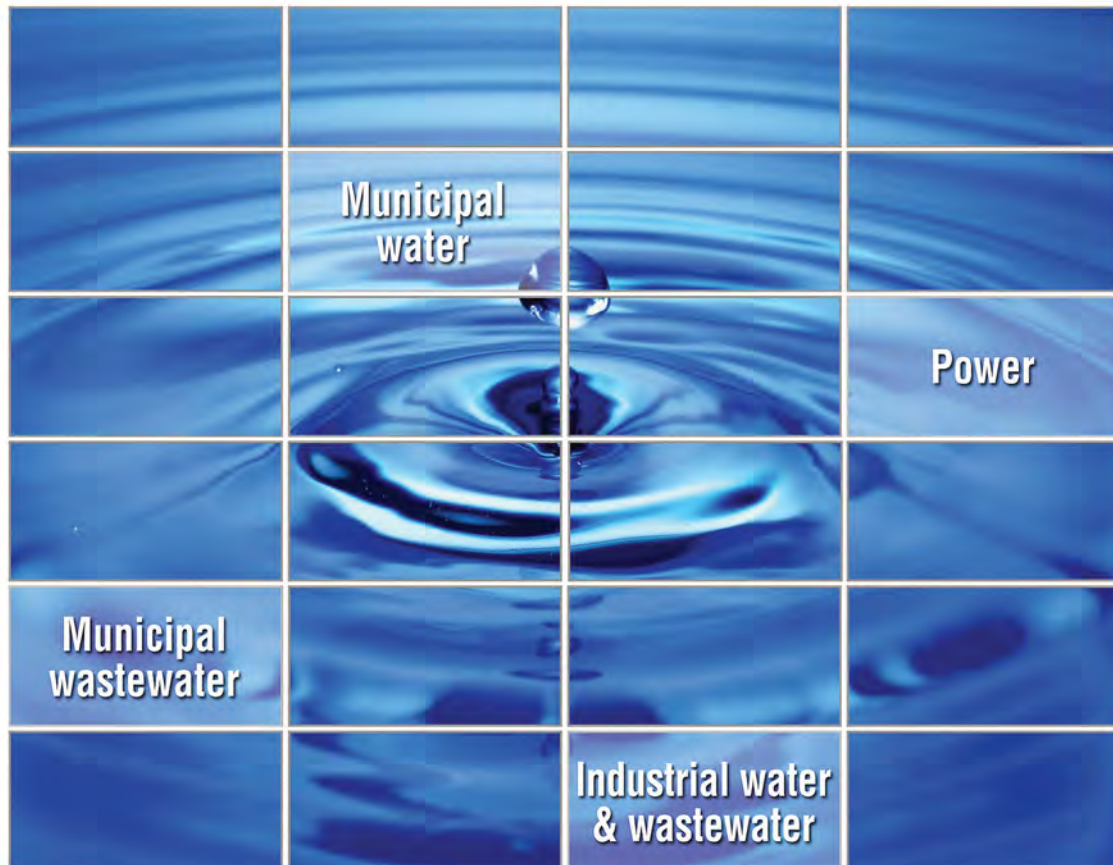
The existing storm tanks have insufficient capacity and need to be increased by 61,000m<sup>3</sup> to meet UWWTD requirements and address the periodic unsatisfactory intermittent discharge of storm water. The best option identified was to **provide a completely new primary treatment stage** and retain the existing primary settlement tanks to operate as storm tanks and supplement the capacity provided by the existing storm tanks

Work under the AMP4 scheme is to provide 22 new circular radial flow primary settlement tanks, each 30m in diameter 3.5m sidewall depth to treat a total flow to full treatment of 12.4 m<sup>3</sup>/s. The flow will be delivered to the new primary tanks via a new 360m long, 5m wide,

3m deep carrier channel connecting to the existing works inlet forebay. This channel will incorporate a radial flow control gate to limit the passing flow to the design value and to direct the balance of the flow up to 6DWF over a side overspill weir and through the existing inlet screens which will be retained, with refurbishment, as a storm water screening facility.

A new inlet works will also be provided with a 6mm screening facility consisting of eight 2.2m wide perforated plate screens, each designed to handle a flow of 2,000 l/s and a grit removal stage consisting of four 13m dia conventional cross flow detritors. The screened and dewatered flow will pass through six 1.8m dia pipes to six separate flow distribution chambers for distribution to the primary tanks. The settled sewage from the primary tanks will be collected in a culvert system with flows from the individual tanks being collected in a central collector culvert and directed to a new settled sewage pumping station. This pumping station will consist of 6 axial flow pumps, each designed to lift 2,500 l/s through a static delivery head of 3.5m selected due to their high efficiency. The settled sewage will be lifted to such a level that it can then flow under gravity, via a culvert situated directly underneath the primary tank collector culvert

# Delivering **solutions** today... for tomorrow's water



**Eimco Water Technologies** provides some of the best solutions in municipal, power and industrial water and wastewater treatment. With over 100 years of experience, it is **clear** that we can find a solution for you.



Our vision is clear

[info.ewtuk@glv.com](mailto:info.ewtuk@glv.com) • [www.glv.com](http://www.glv.com)

A GLV COMPANY

back into the existing culverts which transfer existing settled sewage to the existing secondary treatment stage.

The new plant will be constructed in an area previously occupied by large rectangular percolating filters. An enabling works contract will clear away the remains of the old filters and includes for the removal of 200,000m<sup>3</sup> of earthworks material.

The programme for completion of the new elements will allow flow to be diverted via the new plant in February 2009 with a period of two months for the process commissioning following this flow diversion. At this point the existing primary tanks will be decommissioned and the area, including the existing storm tanks, subjected to major modifications to allow 6 existing tanks to operate as blind tanks and 12 tanks as flow through tanks. The existing M & E assets in the area will be refurbished and modified as necessary with a duration of approximately 9 months to be completed in December 2009. **The value of this phase is approximately £45 million. The process and outline is being carried out by Severn Trent, detailed civil design by Pick Everard, detailed M & E design, construction installation and commissioning is being carried out by Biwater North Midland Alliance.**

#### Phase 2 - Fisheries Directive Compliance

The existing secondary treatment process on site is activated sludge which is carried out in six separate treatment units (ASP 1-6). constructed at different times in the history of the site. The Units are served by a common flow distribution chamber and utilise a common final effluent collection system. Four of the existing units are served by a common air blower plant housed in the original blower house, with the newest two units served by a separate blower facility housed in an underground blower house. There are 24 aeration lanes on site with a total capacity of approx. 250,000m<sup>3</sup> and 54 circular radial flow final settlement tanks. The works currently operates to achieve the existing discharge consent of 15mg/IBOD, 25mg/l suspended solids and 5 mg/l ammonia.

**The Fisheries Directive requires the stricter ammonia consent of 3 mg/l. In order to achieve this the aerated activated sludge tank capacity needs to be increased by approx 45,000 m<sup>3</sup> which will be accommodated by the construction of a seventh activated sludge unit (ASP7).**

This Unit will consist of a four lane aeration tank, with anoxic selector zone of total capacity approx 60,000m<sup>3</sup> and eight additional 35.5m dia final settlement tanks. The hydraulic design of the Unit has been subject to detailed consideration to allow the proportion of the total flow (16%) being fed to the new Unit to flow under gravity from the settled sewage pumping station provided under Phase 1 prior to pumping, through the Unit to the outfall. This eliminates the need to pump this element of the flow and optimises the overall operating costs associated with the flow transfer to the secondary treatment stage of the works. The air supply to the new unit will be provided by a new dedicated air blower plant.

As part of this phase of work, the aeration process air demand for the existing six activated sludge plants has been assessed and reviewed to identify plant improvements which will be required to provide sufficient oxygen for the nitrification process and allow the stricter ammonia consent to be met. The existing air blowers will be upgraded and supplemented. The existing diffusers in the 24 lanes of the existing six plants will be replaced in sequence to ensure they meet the additional air demand.

Construction work on this phase is due to commence in September 2007 and is due to be completed by September 2009, to allow the final effluent to comply with the new standard by the end of AMP4. The value of this element of work is approximately **£42 million**,

Process design is being carried out by **Severn Trent** and the outline design by **Severn Trent, Biwater, & Pick Everard**. Detailed civil design will be by **Pick Everard** and detailed M & E design, construction, M & E installation & commissioning by **Biwater North Midland Alliance**.

#### Other schemes

Work to be carried out during AMP4 includes a wide range termed **Capital Maintenance**, which are to replace, upgrade or refurbish existing assets on site. There is also a scheme to improve the operation of the on-site power generating station, which provides a revenue stream for the works. Work under the **capital maintenance scheme** has a budget of £13 million and is to be completed within the AMP4 period to a programme which needs to be carefully executed around operational restrictions presented by the existing plant and processes. Work associated with the generating station has a budget of £1.5 million with a programme period of 12 months.

#### Progress At the time of writing (July '07)

##### Phase 1 - Storm water capacity improvements

Outline design of the new construction elements have been completed and the civil design work is progressing on the main structures. Final civil design of the primary settlement tanks and ground works has been completed and activities are now focussed on the large inlet works structure.

Excavation of the old percolating filters area down to a level corresponding to the bottom of the primary tank sidewall is now substantially complete, having commenced under an enabling works contract in autumn 2006. The excavation of the conical sections of the floors and hoppers is ongoing together with the buried pipework connections. The civil construction of the primary tanks is progressing with the casting of the hoppers, blinding base pours and wall formwork in nine tanks concurrently. A site batching plant has been established in a revised position. The CFA piling is progressing to the inlet works structure and excavation and construction of the ASP feeder culvert has commenced.

##### Phase 2

The process design work for ASP7 has been completed and options for the location of the new construction have been developed and evaluated. Design work to upgrade the existing air input equipment on the existing activated sludge plants is progressing with a contract for the diffuser replacement due to be awarded to the framework supplier for rubber membrane diffusers.

#### Other schemes

Work under the first phase of the **capital maintenance** scheme is progressing well with the civil and M & E works for the polyelectrolyte silo element having been completed and commissioned. The replacement of the first two gas compressors has been made and the new plant will be recommissioned soon to allow the next two units to be removed from service.

The sludge lysis plant has been completed and is in operation. Work is now being undertaken by Severn Trent to assess the performance of the plant and to measure the improvement in gas production from the anaerobic digesters that this plant has made. The works associated with the siloxane plant have been completed with the installation of the filters and associated plant. The contract for the exhausts replacement is progressing with parts in manufacture and site works due to be completed by December 2007. ■

**Note:** *The Editor & Publishers thank Biwater North Midland Alliance Project Managers for producing the above article, extensively cut in length, in the hope that we can describe in future editions the progress of this major work and its completion.*



*courtesy Biwater Ltd*



*courtesy Biwater Ltd*



*courtesy Biwater Ltd*



Engineering consultants for Minworth,  
Seven Trent Water's largest sewage treatment works.

[www.pickeverard.co.uk](http://www.pickeverard.co.uk)

**PICK EVERARD**

Architects, Consulting Engineers, Surveyors and Project Managers

Offices at: Bath Bury St Edmunds Derby Glasgow Inverness Leicester Taunton