

Minworth STW

£145 million upgrade - A Beacon Project for the Capital Delivery Programme

by
Richard Thomson & Paul Fisher

Minworth is Severn Trent's largest Sewage Treatment Works serving a population equivalent of 1.75 million from Birmingham. The plant also treats a high volume of imported sludge from industry and regional works. Average flow is 450 MI/d (5.8 m³/s) with full flow to treatment of 1,070 MI/d (12.4 m³/s). The UWWD UID requires 61,000 m³ of additional storm tank capacity which will be achieved by the conversion of existing rectangular primary tanks. A new inlet works and primary tank island has been constructed to improve process performance with the added benefit of increasing the quantity and quality of sludge which will enhance production of renewable energy from the 9MVA generation station. The Fisheries Directive ammonia consent will be reduced from 5 to 3mg/l to improve the quality of the River Tame necessitating upgrade to the existing Activated Sludge Plant 1-6 and provision of an additional ASP 7 configured for the BNR process in preparation for new drivers in AMP5. The scheme also features an extensive programme of capital maintenance of existing assets.



Minworth STW: Settled Sewage Pump Station (front) and Primary Tank Island (rear)

Courtesy of Biwater North Midland Alliance

Workplace

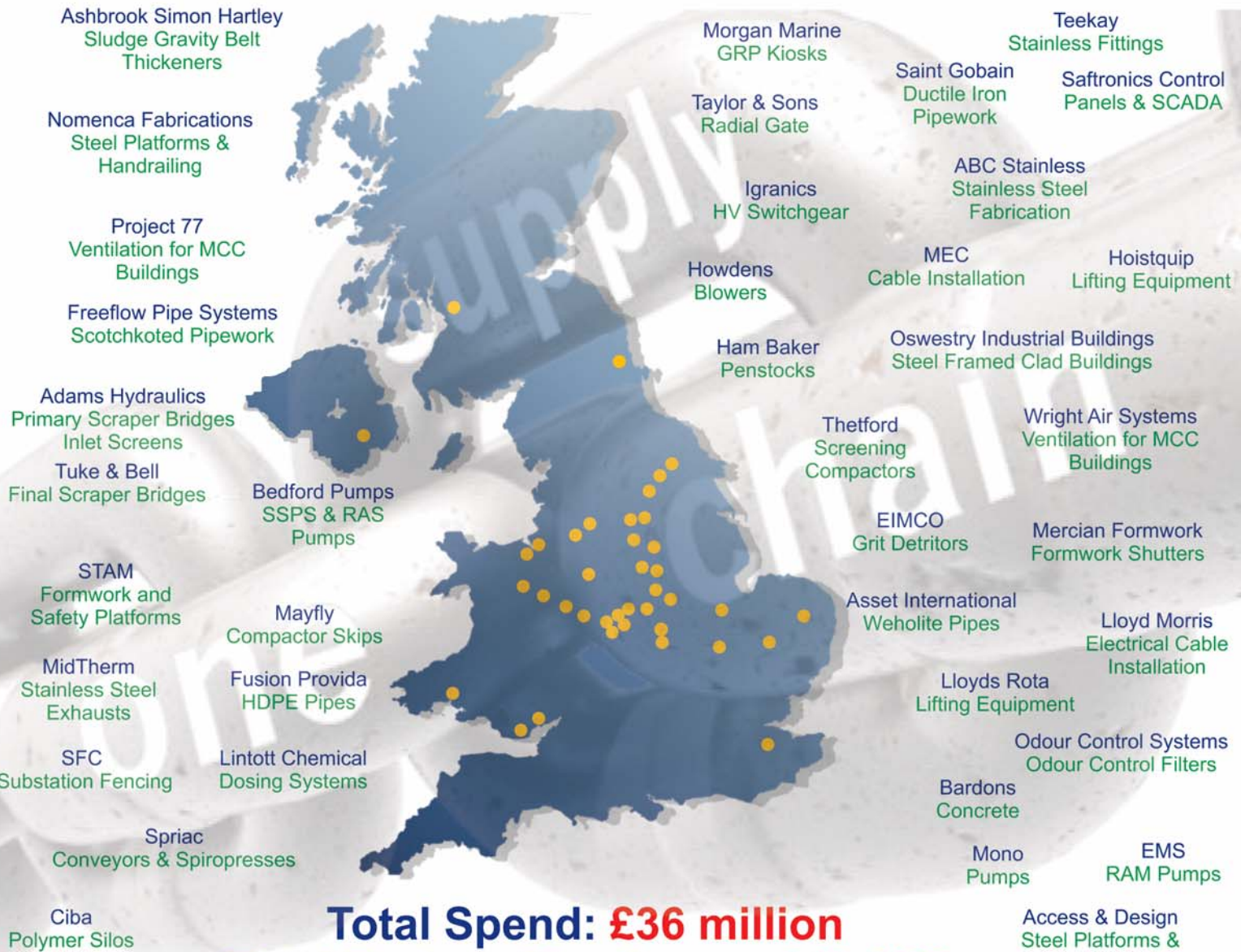
A large co-located office was set up in 2006 to accommodate a collaborative team of over 100 staff from Severn Trent Asset Delivery, the Biwater North Midland Alliance and Pick Everard the Consultant for the civil design and hydraulic modelling. A key success factor in designing and constructing such a complex multi-phase project has been the “face to face” communication where issues can be reviewed and resolved to achieve tight deadlines. The team has worked as one, drawing on the combined skills and

expertise of each member to create an environment of mutual trust and respect.

Operational Liaison

The project has benefited from close working relationships with STW Operations who have explained site constraints, supported design development, prioritised asset maintenance and co-ordinated the works interface. Their positive attitude towards the construction team has been critical in achieving complex shutdowns and outages.

Investing in UK Manufacturing



Total Spend: £36 million
Total Factory Man-hours: 310,037
Total Installation Man-hours: 161,885

MINWORTH TEAM ALLIANCE

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Turn of Flows

The turn of flows was achieved on 17th March 2009 which was testament to the high degree of planning and collaboration to overcome the obstacles which inevitably manifest themselves. A ceremony was held with Sir James Perowne, Chair of the Central & Eastern Area for the Consumer Council for Water, unveiling a commemorative plaque.

RoSPA Commendation Award

The Minworth Alliance was presented with a commendation certificate by RoSPA President, Lord Jordan of Bournville at the prestigious annual awards for Excellence in Health & Safety at Work in the Water Sector. Best Practices have been promoted and Near Miss reporting has been encouraged with early corrective actions implemented. Mindsafety™ training was delivered to over 315 staff and site operatives from 22 companies within the supply chain to promote the behavioural safety culture and improve attitudes in order to raise standards.

Innovation

The intelligent iMCC's & SCADA have been commissioned to provide extended information and historian trending for energy management and condition monitoring.

Accurate flow control has been achieved using the first Radial Gate to be deployed on a sewage works in the UK. Modulation has been tuned during storm conditions demonstrating how well surges are controlled to achieve stable flow to full treatment of 12.4m³/s. The plant shutdown interlocks have been tested and back-up penstocks with fast acting actuators offer dual redundancy.

A scum reception process has been pioneered which blends scum with warm digested sludge to mitigate the risk of handling problems frequently encountered.

3D modelling has been utilised to design man access interfaces on the buildings, Inlet works and Primary Island to ensure a safe workplace for Operation and Maintenance. 3D helps visualisation of plant areas and secures end user ownership.

Cost Avoidance Drives Value

Cost out plans have focused the designers and contract teams on cost avoidance and value engineering to add value throughout the whole life of the scheme. Production line efficiency has reduced programmes and eliminated waste. £15m of savings have been made across the whole scheme.

Generation Station Green Energy Increase on Target

There has been a significant increase in the power output from the Generation Station due to the increased gas production from the new primary sludge tanks and sludge route. Average output has risen from 4MVA to 6MVA which is in line with Severn Trent's strategic intention to maintain their position as the largest producer of green electricity in the water sector.

Environment and Sustainability

Ecological and Environmental issues have been high on the agenda as the site is classified as a nature conservation area. A woodland area has been planted to maintain wildlife biodiversity and a comprehensive bird study identifying 43 species was issued to the RSPB. The deepest bentonite wall in Europe has been constructed



Innovative Radial Gate Flow Control Device

Courtesy of Bewater North Midland Alliance

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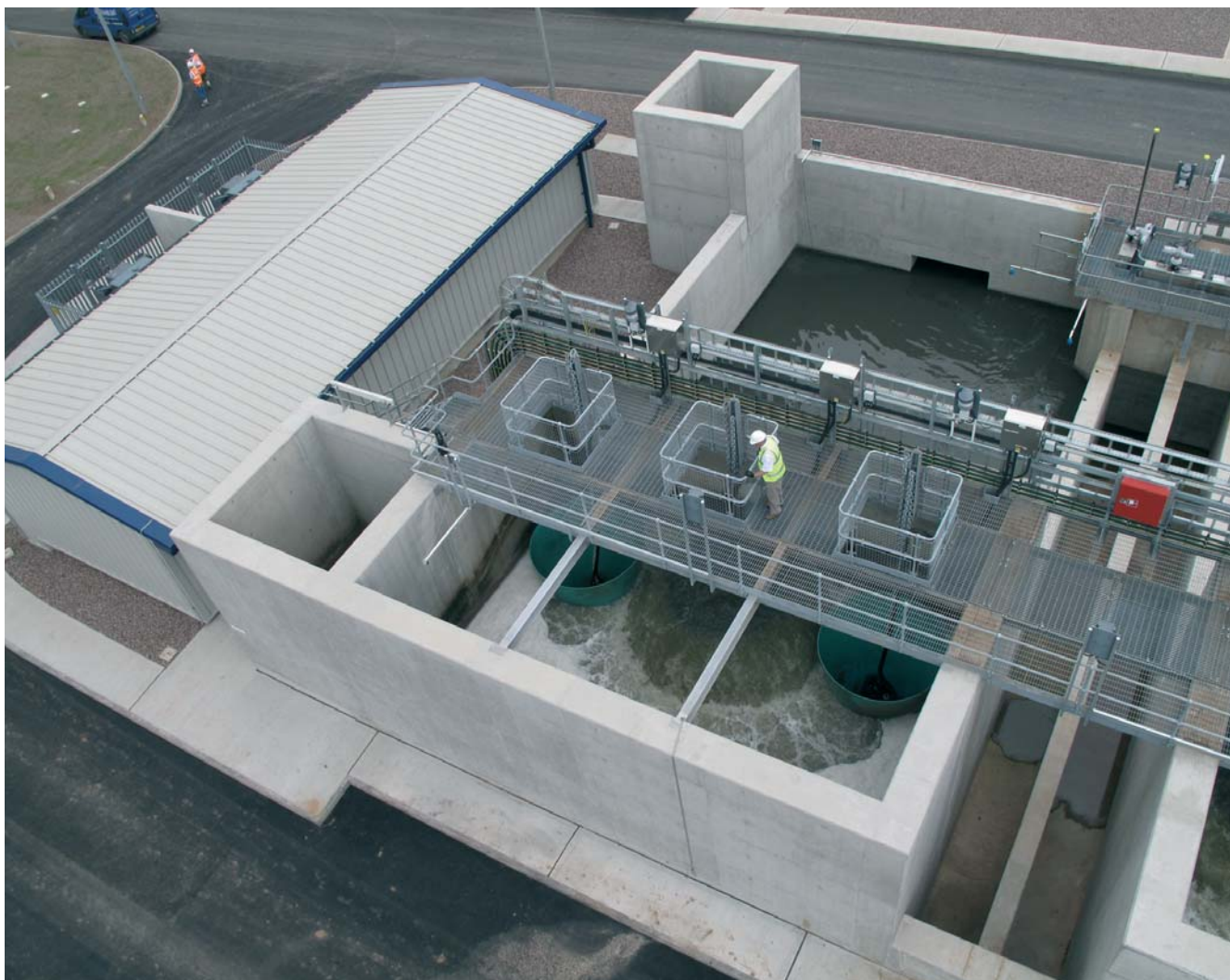
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Settled Sewage Pump Station

Courtesy of Bewater North Midland Alliance

around the landfill site to protect the water course from contamination. Sustainable practices have been a priority with a WRAP report by students at Nottingham Trent University revealing that the recycled content for the whole project is 50.78% much higher than Government Guidelines.

Corporate Responsibility

The Minworth Alliance won the Severn Trent Water Corporate Responsibility Award in the category of Community to honour the commitment to community involvement including charities, academic institutions, Parish Councils, residents, neighbours and the local economy.

Being the Best Awards

The Alliance team had a stand at Severn Trent’s Quality Working Day, an exhibition held internally. The Alliance “cleaned up” winning Being the Best Awards as follows: Bronze for Collaboration, Silver for Highest Standards and Gold for Health & Safety.

Phase 1.1 - Primary Tank Island (£25m)

The 22 primary settlement tanks (30m Dia) are performing well with the auto desludge system operating in the range of 1-2% dry solids. The scum removal system has been upgraded due to a high proportion of grease in the flow.

Phase 1.2 - Inlet Works (£17m) and Settled Sewage Pump Station

The eight lane inlet works is operational with process performance exceeding expectations. The Adams inlet screens (6mm) remove 100 tonnes of screenings per week compared with 30 tonnes at the old works. Spirac made improvements to their screw conveyor drain deck



Primary Tank Island and Culverts

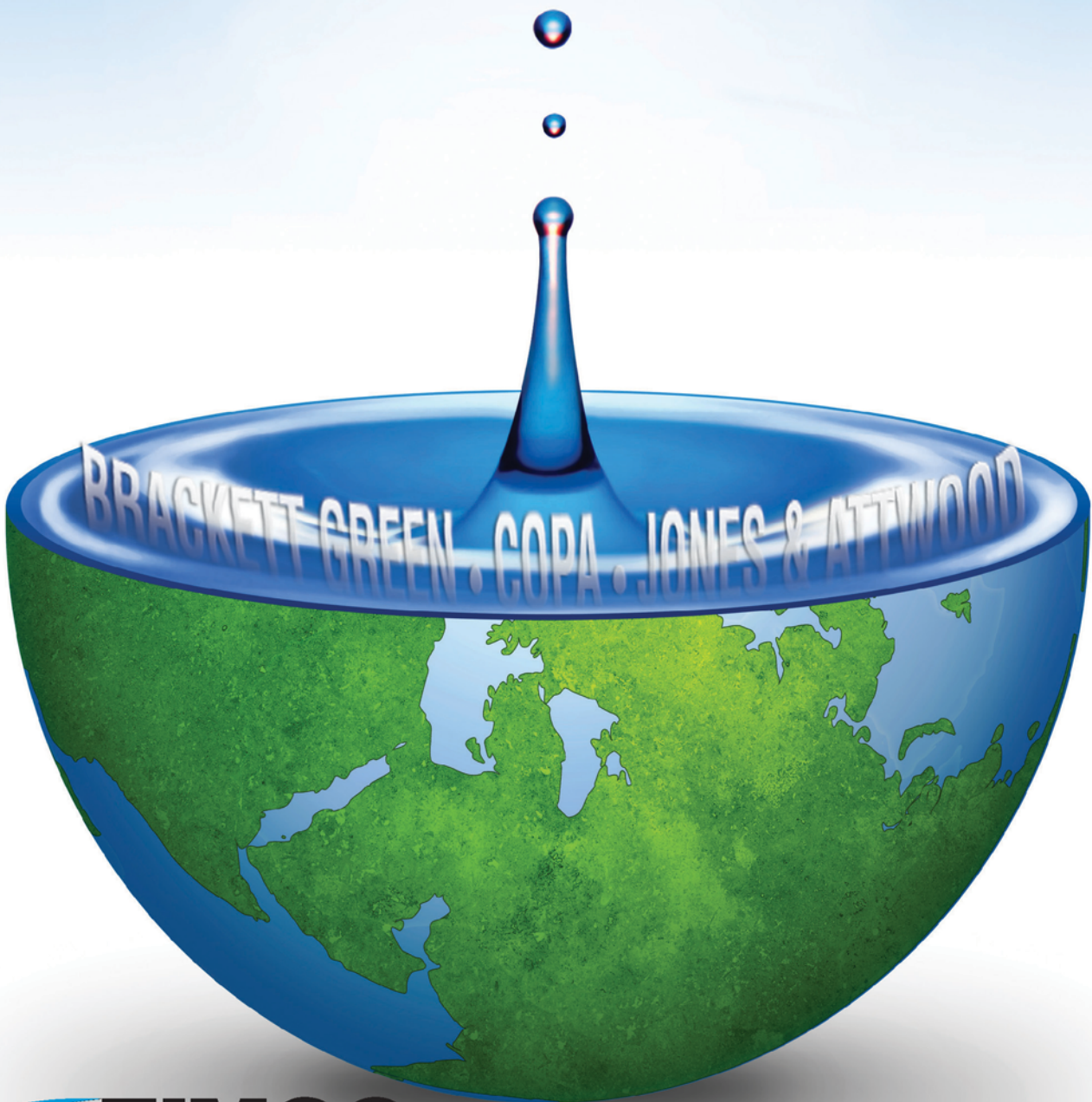
Courtesy of Bewater North Midland Alliance

designs to give the operators safer access for cleaning and increased Spiroress dewatering capacity. The EIMCO grit detritors are the star performers on the plant. The superb quantity and quality of the grit removed is testament to the design velocity profile and robust nature of the equipment installed producing 60 Tonnes/week of recyclable by-product. The settled sewage pumping station control philosophy has been tuned to ensure minimal power consumption by keeping the impressive axial flow pumps on their efficiency curves.

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Screen Approach

Courtesy of Bewater North Midland Alliance



Impressive Grit Removal Performance Courtesy of Bewater North Midland Alliance

Phase 1.3 - Storm Tank Conversion (£12.9m)

The redundant primary tanks are being converted to storm tanks. This has benefited from joint solution development with a team challenge to the concept and revision of the configuration of the tank feeds to reduce the initial budget of £16m down to a £12.9m Target Price. Value engineering is forecast to deliver further gains as the storm return pumping arrangement has been re-configured to offer a more robust and flexible solution also mitigating the risk of refurbishing old assets.

Phase 2.1 - New Activated Sludge Plant ASP 7 (£30m)

Construction of the megastructure 120m long x 90m wide x 7.5m

deep is complete and M&E installation of the diffusers, air mains, mixers and penstocks is advanced. The tank is configured for the biological nutrient removal process and at 6m water depth is the largest and deepest in Severn Trent delivering optimum oxygen transfer efficiency. The 8 No. Final Settlement tanks at 35.5m diameter represent a good example of challenge to the design manual to save cost and improve layout. Severn Trent's first 3/4 scraper bridges with McKinney baffles have been successfully installed by Tuke & Bell. Phase 2 is forecast to be commissioned 3 months early due to the proactive site team which have driven the supply chain hard and delivered budget savings with initiatives such as the use of Weholite pipelines and pre-fabricated chambers.



ASP 7 Construction and M&E installation well advanced

Courtesy of Bewater North Midland Alliance



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First ¾ Bridge for large diameter FST

Courtesy of Biwater North Midland Alliance

Phase 2.2 - Improvements to ASP 1-6 (£20m)

The replacement of the diffusers, air mains, and DO probes is marching ahead with 16/24 lanes complete and operating under the updated control system optimising power. The 12 No. SG60 Howden Blowers have been re-gearred and fitted with 450kw motors to increase output to meet the tighter ammonia consent and are running reliably. The 4 No. additional SG80 blowers have been retrofitted into the subterranean building and Operations are impressed with the improved operational flexibility, noise abatement and adiabatic motor cooling systems which have improved their work environment.

Capital Maintenance 1 – 24 No. FST scraper bridges (£4m)

A rolling programme of replacement is substantially complete with 18 bridges installed and 24 peripheral pathways including handrailing with fall arrest systems finished.

Capital Maintenance 2.1 Primary Thickening Sludge Plant (£6m)

The primary sludge and SAS thickening plant gives Minworth the largest installed capacity in Europe. The 9 No. new Ashbrook Simon Hartley three metre wide gravity belts are now operational and successfully thickening the sludge from 1% to 5%. Through



(Left) RoSPA Award Presented to the Minworth Team Alliance and (right) Commemorative Plaque presented by Sir James Perowne to Robert Moyles, John Abraham, Paul Fisher, Martin Kane, Nick Thomson

Courtesy of Biwater North Midland Alliance

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collaboration a STW Operator devised a cleaning system which greatly improved the safe maintenance of the belts.

Liquor Treatment Plant (£1.3m)

The LTP has been operational since May and the process performance is improved delivering the benefit of reducing ammonia load from the MAFF sludge centrate.

Summary

Tony Wray CEO of Severn Trent praised the scheme as a beacon project which confirmed that collaboration was the way forward for the AMP5 programme. The whole supply chain should be proud of the numerous achievements at Minworth.

In the current economic climate it is refreshing to see a high proportion of the equipment manufactured in the UK and installed by a loyal workforce.

Biwater and NMC Nomenca have both been selected for AMP5 as Framework Core Contractors through a rigorous procurement process. We have really been able to raise our game on this incredible journey and the lessons learnt will be invaluable for business improvements to secure long term partnerships.

Note: The Editor and Publishers wish to thank Paul Fisher, Delivery Manager with Severn Trent Water and Richard Thomson, M&E Manager with the Biwater North Midland Alliance for preparing the above article. Special thanks goes to Mark Lee, Project Manager, Ady Brown, Construction Manager, Glynn Cunliffe & Vicky Gillibrand, Marketing Managers and Mark Jones, Commercial Manager, all with BNMA and to Ron Ashton, Project Manager with Pick Everard for assisting with the article. ■



Primary Tank Island and Culverts Courtesy of Biwater North Midland Alliance

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