

Watchgate WTW

water quality improvements

by Ian Davies BSc, CEng, MChemE
Eur. Ing. Graham Whibley BSc(Eng), CEng, MICE, MCIWEM
David Morgan BEng(Hons), CEng, MICE

Watchgate, United Utilities largest water treatment works, situated 4 miles North of Kendal, just outside the Lake District National Park, treats raw water from Haweswater and Windermere by microstraining (at times of poor raw water quality), rapid gravity filtration, chlorine disinfection and pH correction. The existing plant was completed in 1972 and originally included ozonation downstream of the filters for colour removal. It has a treated water output of up to 630 MI/d and supplies parts of Greater Manchester, Lancaster and South Cumbria via Haweswater Aqueduct. It can also supply water to the Thirlmere Aqueduct when required. The current project was conceived in response to amendments to the Water Quality (Water Supply) Regulations for *cryptosporidium* (1999) and trihalomethanes (THM) (2000) and compliance with those regulations is the primary purpose of the project.



96" Haweswater Aqueduct diversion (courtesy Montgomery Watson Harza)

A single process solution was identified to deal with both of the regulatory drivers. The provision of fully optimised coagulation upstream of the existing filters would allow the plant to operate a direct filtration process. The enhanced treatment would allow *cryptosporidium* to be filtered from the raw water and would also remove dissolved organics, the precursors of THM formation. This preferred process solution was arrived at using value management techniques and was piloted to ensure that it was robust enough to consistently achieve the required throughput as well as compliant quality. The new process was piloted on one of the existing 56 filters at a maximum throughput of 12.4 MI/d.

Major elements of the project include:

- * an inlet works comprising reception chamber, dosing and mixing of chemicals for enhanced coagulation and microfloculators;
- * a washwater recovery plant comprising lamella clarification;
- * a sludge processing plant comprising sludge thickening, sludge dewatering and a new press house;
- * a new chemical building;
- * a 2 MI emergency storage lagoon;
- * uprated power supplies;
- * improved control and monitoring;
- * major aqueduct diversions within the existing site boundary.

Separate projects currently on site will provide a new stand alone chlorine drum store, to replace the existing bulk store that is housed in the same building as the plant's operators, and also major repairs to the site's contact tanks. Refurbishment and maintenance issues that are critical, either to the continued operation of the plant, or to maintaining quantity or regulatory quality compliance, are also being addressed.

Total value of the projects on site at Watchgate is in excess of £30 million.

The water quality improvements project has presented some significant challenges, often due to the sheer scale of the scheme. Three major aqueducts enter the site and two leave it. Major diversions and tie-ins have been required on the raw water aqueducts so that the new process can be integrated within the existing site.

Largest of the aqueducts is 96" diameter and is a steel main cased in concrete. It will be cut in three places and will have a total new length of 100m laid. It will also be fitted with three new 96" 45° angle branches and two 96" gate valves. The overall height of the main gate valves is 6951mm with each weighing 30 tonnes.

Keeping the water flowing, and the existing process operating, during the project is also vital. Many hours have been spent analysing water resource demands, planning outages and planning large diameter pipework diversions and new pipework within the site. The new process will be fully streamed in two halves, including concrete channels and chambers, power supplies, controls and standby generation to ensure that the plant will be able to maintain supplies, even in the unlikely event of significant plant failures.

With the sensitive site location on the edge of the Lake District National park (within an "Area of Special Landscape Character") and the surface water draining to the River Sprint (which is a site of Special Scientific Interest), environmental considerations have been a high priority. Care has been taken to avoid any possibility of contamination of the River Sprint via site drainage and some 45,000m³ of excavated material will be placed on site, being incorporated into the new screening and landscaping scheme.

Although it has been necessary to remove some trees to make way for new structures, another 20,000 trees and shrubs will be planted to provide screening.

A disciplined approach to risk management has been adopted from the outset. Open design development, with the full involvement of UU operations and asset management staff has promoted an environment in which proposals can be rigorously challenged, ensuring fit for purpose solutions. Risks were limited during design development by production of detailed commissioning plans, by production of operational procedures (to mitigate potential operational risks) and by financial risk mitigation.

MWH are acting as Engineering Services Provider (ESP) for United Utilities and are providing programme management, project management, construction management, conceptual design and procurement services. The water quality improvement project is being implemented via one major contract, awarded to a joint venture between *Morgan Est* and *Biwater Treatment (MBJV)*. *Entec* are undertaking civil design and *Biwater* are carrying out process, mechanical and electrical design.

The largest sub-contracts are with *Interface Contracts*, for electrical installation, and *UKR* for reinforced concrete. Other major sub-contracts have been let for supply of equipment: *Waterlink*, for washwater lamella clarifiers; *Baker Hughes Process*, for sludge presses; *Portasilo*, for lime storage and batching equipment; *Statiflo*, for static mixers; *Moorside Metals* for large diameter steel pipe; *Aries Coatings* for DWI approved coatings on new pipework; *Glenfield Valves* for 96" and 40" gate valves; *Gee and Co.*, for chemical dosings systems; *KSB Amri*, for 96", 60" and 40" butterfly valves and *Lostock Electrical* for MCC panels.

Construction began with site possession in July 2001. At the time of writing (April 2002) all major earthworks and structures are substantially complete, whilst aqueduct work and M & E procurement are well advanced. Process commissioning is due to commence in January 2003, following dry and wet testing later this year. Target for completion of the project is March 2003. ■

Note on the authors: *Ian Davies* is Principal Process Engineer at MWH; *Graham Whibley* is Project Implementation Manager for United Utilities; *David Morgan* is Project Engineer and Civil Engineer for MWH.



96" Hawsewater Aqueduct
(courtesy Montgomery Watson Harza)

Inlet structure - microflocculator cells
(courtesy Montgomery Watson Harza)

