

Sulby Water Treatment Works

£12m new WTW takes IOM water supply into 21st Century

by
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Islle of Man Water Authority is committing the most significant Capital Expenditure it has ever undertaken on new works in order to replace its existing ageing small water treatment plants. The first new water treatment works is being built at Sulby to serve the North and West of the Island, to be followed by another plant to serve the South of the Island and its capital Douglas. Together, these new treatment facilities will replace the existing five works with modern plants capable of sustaining the Island's economy well into the 21st Century.



Sulby, IOM: Elevated view looking towards Gable end of existing works; chemical storage area prior to construction in foreground; river to right and retention of mature trees. photo courtesy Earth Tech Engineering.

Background

The Isle of Man is a self governing Crown dependency which, through its ancient parliament Tynwald, enjoys a high degree of domestic legislative and political autonomy. The Isle of Man Water Authority is a statutory Board and is charged with ensuring the economic, efficient and effective provision of the services and infrastructure necessary to meet the Island's needs in terms of a wholesome supply of drinking water.

The population of the Island is over 76,000, which annually peaks to around 120,000 during TT race fortnight.

The Island benefits from a special relationship with the European Union and, although independent from the UK, the Plants are to be designed and constructed in accordance with the latest EC legislation and DWI directives and current best practice in the UK is to be adopted. The Isle of Man also operates its own employment laws and

work permits are required. There is also a need to use contractors and sub-contractors who are registered on the Government's list of Approved Contractors and the Scheme for Certification of Craftsmen.

Scheme

In the mid-nineties, faced with an increasing population and flourishing economy the Water Authority recognised that the existing regime of five ageing, predominantly pressure filter installations could not cope with increasing demand and the ever tightening water quality requirements. The WRC were engaged to carry out a number of studies into the condition and performance of the existing assets to provide data to establish options for future improvements and ultimately a strategy for future development.

Montgomery Watson were engaged to develop the strategy which, taking into account projected demands, reliable yield forecasts and the types of treatment processes available, looked at a variety of

options from replacement of the existing five works **to a new two works strategy**. The two works strategy was chosen as the preferred option, based on lower capital and operating cost, least environmental impact, the option with the most reduced programme and offering the simplest operation and maintenance.

The Water Authority gained Government approval in 1999 to procure the two new treatment works on a design and construct basis under an IChemE 'Red Book' lump sum contract. *Montgomery Watson Harza* were appointed as Project Management Consultants together with *EC Harris* as Cost Consultants and *Holmes Grace Bullen* as Planning Supervisor.

Earth Tech Engineering were appointed to undertake design and construction of the Sulby plant, with the proposed plan for Douglas on hold until Planning could be agreed.

The contract in the sum of £12.3m was awarded to Earth Tech in April 2003.

Process

Sulby Water Treatment Works will be capable of producing between 5 and 21 MLD of potable water and will replace the existing works on the site. Raw water to the works is to be supplied from Sulby impounding reservoir, via 3.2 kilometres of new 400mm diameter DI main linked into an existing main used by the Manx Electricity Authority for hydropower generation.

Water from the Sulby source has moderate levels of colour (average value of 26.5° hazen), low levels of turbidity (average 1.31 (NTU) occasional peaks of iron and manganese and low levels of alkalinity (typically <5mg/l as CaCO₃).

The plant will consist of the following treatment stages:

- * the two raw water gravity mains from existing Sulby and Block Eary impounding reservoirs will be provided with fish/eel traps on each gravity main;
- * an inlet blending chamber will be provided for the blending of raw water from the two sources and supernatant from the dirty washwater clarifier;
- * carbon dioxide for re-mineralisation will be dosed via a side stream, followed by lime slurry addition. Two minutes contact time will be provided in pipe, following lime addition;
- * ferric sulphate coagulant addition and powdered activated carbon addition will be provided in two parallel flash mixer streams;
- * the plant will be designed with an equal flow split to the clarification plant comprising four parallel streams of flocculation and dissolved air flotation;
- * a recycle water saturation system will be incorporated comprising compressors, saturation vessels and recycle pumps;
- * pH adjustment with lime at an inline channel mixer and provision for occasional polyelectrolyte dosing to assist flocculation is to be included;
- * an equal flow split to six first stage filters;
- * a clean backwash water tank holding sufficient water for two complete first stage filter backwashes;

- * pH adjustment with lime and sodium hypochlorite addition at an inline mixer and an equal flow split to four second stage filters with provision of a trim sodium hypochlorite dose to be added downstream of the filters if necessary. Hypochlorite will be generated on site;
- * an equal flow split to two parallel chlorine contact tanks with each tank providing a t₁₀ of 19.5 minutes at half maximum plant throughput;
- * orthophosphoric dosing for plumbosolvency control with provision for future hexafluorosilic acid dosing and lime slurry dosing;
- * delivery of treated water to Ballakerka service reservoir by treated water pumps from two treated water sumps;
- * collection of backwash water, sludge thickener supernatant and works drainage in two agitated dirty washwash balancing tanks;
- * thickening of dirty backwash water in one dirty washwater clarifier with recovery of supernatant to the inlet blending chamber;
- * blending of dirty washwater clarifier sludge and DAF sludge in one agitated sludge transfer sump;
- * thickening of the blended sludges in two sludge thickeners;
- * storage of thickened sludges in two agitated thickened sludge tanks;
- * dewatering of thickened sludge in a single membrane press. Pressate will be routed to the sludge transfer sump with provision for disposal to a trade waste tank;
- * the Plant will be provided with 'Intelligent' MCC's a recent innovation and one being promoted by *Earth Tech*.

Each MCC starter contains an 'intelligent' overload with 'hard wired' interlocks connected directly to the overload without additional components. The 'intelligent' overload is then connected to the PLC network enabling the PLC to read the status of the 'hardwired' signal points as inputs. Generally, intelligent starters have less electrical components and therefore take up less space in the MCC, resulting in smaller MCCs. Cabling between starter and the PLC is also reduced, hence, providing simplified testing, commissioning and maintenance.

Environmental & Planning

Proposed site for the new treatment works lies within one of the most scenic areas of the island at Sulby Glen. This, coupled with the extremely tight nature of the site, dictated that both environmental and planning considerations were high on the agenda when considering construction of the permanent works. A colony of bats is resident in the far gable end of the existing treatment works and provision to suspend work if they were sighted was included in the contract to allow for their relocation. A rare lizard was discovered on site during mobilisation that necessitated the creation of a new environment away from the construction area before works could commence.

The Sulby River runs alongside the proposed works and as a Salmon water, steps had to be taken during construction to prevent pollution from excavation arisings. This necessitated the installation of a coffer dam and dewatering system to channel groundwater and prevent uncontrolled egress to the river.



Sulby, Water Treatment Works under construction

courtesy Earth Tech Engineering.

The building itself has been designed to be broken into different levels and is to be constructed from Manx stone over a structural steel frame. This will replicate the appearance of the existing works and present a finished plant constructed in natural materials in keeping with the surroundings..

During the tender period the size of the proposed building was reduced, whilst keeping the same architectural appearance, to give a smaller footprint to ease construction and present a more visually acceptable final structure.

Unlike the UK, planning legislation on the Island required resubmission of a full planning application to gain approval for the reduction in size. Although this impacted slightly on the programme, the revised footprint gave significant benefits to the ability to construct on such a tight site and revised planning approval was obtained.

Another issue to be considered during construction was the fact that the Island is known as the “Road race Capital of the World” and for four weeks of the year considerable disruption could be expected during both the TT and Manx Grand Prix fortnights. This was allowed for by including a number of non-working days in the contract programme.

Construction phase

M & E access was scheduled for early August 2004, with completion of Civil Works by late November 2004. Commissioning is programmed to commence in April 2005 with water into supply in June 2005 and completion of Performance Tests in July 2006.

Given that the site is in one of the most scenic parts of the Island and can only be accessed through Sulby village, a key part of the success to date has been ongoing communication with the local population. This has involved newsletters and meetings with village parties and close liaison with the local school, including the provision of fluorescent vests for all pupils to make them visible to construction traffic.

Partnering

Although the form of contract as ‘lump sum’ is not conducive to partnering, the Water Authority has been keen to adopt a partnering ethos on the project. This has contributed to the project remaining within budget and on programme to provide the Isle of Man with a secure modern water treatment facility.

Main parties to the project are:

Purchaser: *Isle of Man Water Authority;*

Design & Construct Contractor: *Earth Tech Engineering Ltd;*

Civil Subcontractor: *Charles Brand (Civil & Structural Design W S Atkins);*

Project Management Consultant; *Montgomery Watson Harza;*

Planning Supervisor: *Holmes Grace Bullen;*

Cost Consultant: *E C Harris..* ■

Note on the authors:

Jonathan Kay is a Senior Project Manager with Earth Tech, based at the Company’s Tankersley office near Sheffield; Neil Caine is Project Sponsor based at the Isle of Man Water Authority’s Head Office in Douglas, IOM; Tony Withey is Earth Tech’s Site Manager, based on site at Sulby on the IOM.