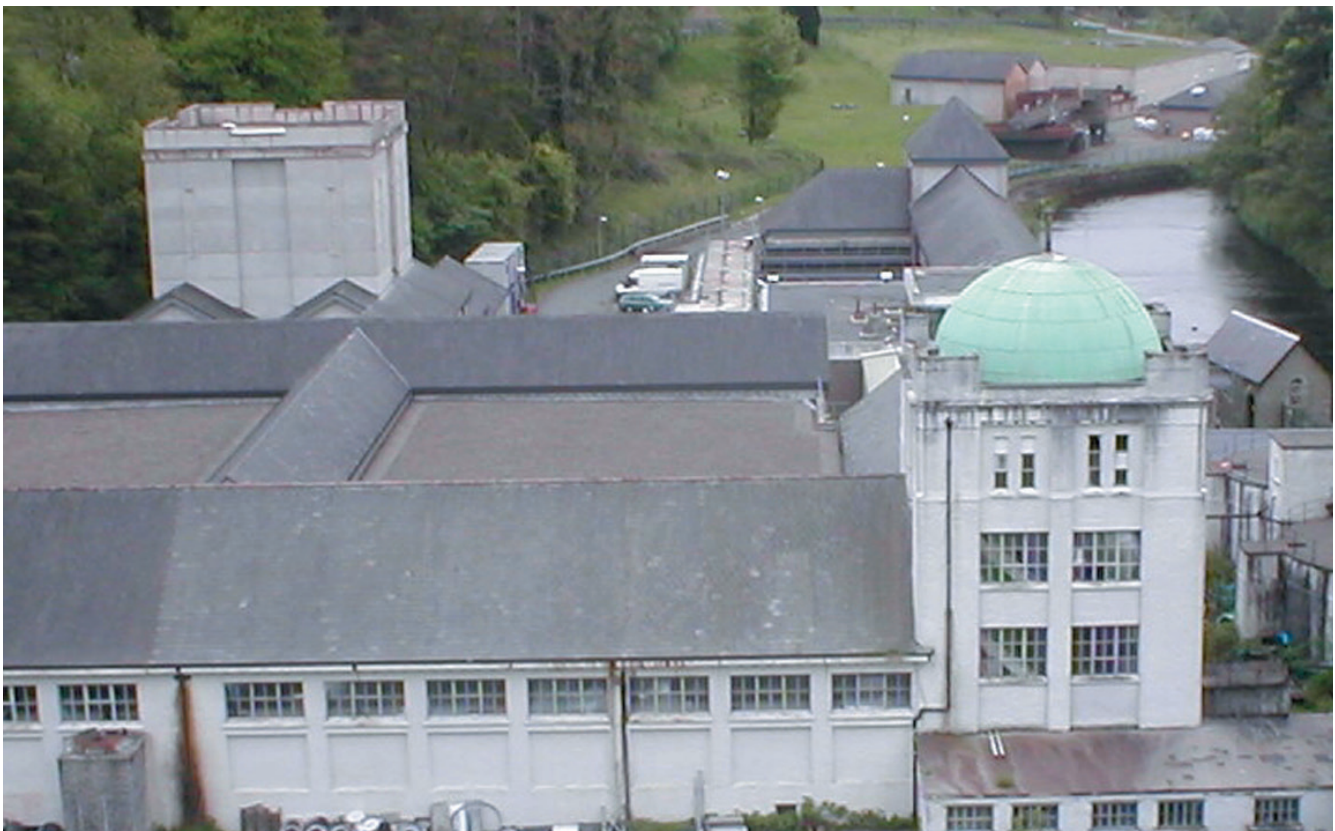


Pontsticill Water Treatment Works solving concrete corrosion problem at DAF plant

Pontsticill WTW nestles on the southern slopes of the Brecon Beacons, inside the national park boundary five miles north of Merthyr Tydfil. A water works (filter house) was built at the site in 1927 being fed by the recently completed Taf Fechan impounding reservoir. In 1995, the original works was abandoned after a new treatment plant was completed. This new works consisted of a DAF plant and primary and secondary rapid gravity filter stages complete with washwater recovery and sludge thickening process. The new works was designed to produce 105MLD, however since commissioning normal maximum daily flows have been 85 MLD. The majority of the water gravity feeds down the valley to Merthyr and beyond, some however is pumped from two 500³ reservoir tanks up to a high level reservoir and into distribution.



Pontsticill WTW showing filter house built 1927 (courtesy Welsh Water Alliance).

During investigations in 1998 to find why filter washwater volumes were greater than expected, severe erosion of the concrete was found. The erosion was enough to allow water to flow between the common inlet channel and dirty washwater channel wall to waste.

Further site investigations into the condition of the concrete throughout the works was undertaken, resulting in a recommendation that all surfaces of the DAF 1st stage filters and dirty washwater tanks be repaired and treated with a waterproof protective coating.

Samples of the concrete and water at several positions in the process were taken and analysis of the concrete indicated two facts:

- * constituent samples were as specified in the original construction contract;
- * an average of 5mm had been eroded from all surfaces throughout the works.

Black & Veatch Contracting Ltd (BVCL) became involved with the works in the spring of 2002, as part of *Dwr Cymru Welsh Water's AMP3* programme, when the risks of losing the process by a structure failure became apparent. It was clear that some concrete surfaces were in a worse condition than others – especially at corners and along the bottoms of walls. These were further compounded by material loss in areas of flow change and areas with higher water velocities.

Another challenge of the site is that no bypasses were available. Investigations could only be undertaken during shutdowns, where access to some areas was limited typically to 1-2 hours.

Corrosion potential

Water samples indicated the reason for the concrete being eroded. The phenomena of concrete corrosion with exposed aggregate exhibited at Pontsticill WTW is commonly observed in clarifiers and filters on works treating soft, low alkalinity waters. The corrosive

potential of water may be estimated from knowledge of its equilibrium pH value (pHs) which may be determined experimentally or calculated using alkalinity, calcium hardness and TDS values.

The pH values for the DAF inlet and outlet are 7.32 and 6.09 respectively. Using the pHs value the Langelier index (pH-pHs) can be determined. A water having a negative LI will be aggressive towards calcium carbonate and calcium bearing materials, including concrete, while a water possessing a positive LI will tend to deposit calcium carbonate until the equilibrium pH value is attained.

The LI values for the DAF inlet and outlet waters will be approximately -2.0 and -3.8. These values are indicative of fairly and very aggressive waters respectively. The quantity of calcium carbonate that the two waters will potentially have dissolved on reaching the equilibrium pH can also be calculated; these values are 8 and 27 mg/l as CaCO₃ respectively.

To undertake any repair work on the DAF and 1st stage filters, the common channels would require being removed from the process. To achieve this temporary bypasses had to be designed, manufactured and installed; all with consideration of how to connect in to the existing structures within the allowable very short shutdown period.

Extremely costly

To fulfil the requirement of repairing all concrete damaged throughout the works and coating all surfaces proved to be extremely costly. First estimates were in the region of £8.5m to complete the work including replacing the filter floors and installing bypasses. Consideration was also given to demolishing



Pontsticill WTW - general view of new works (courtesy Welsh Water Alliance).

the 1st stage filters and rebuilding with a CoCoDAFF (Counter Current Dissolved Air Flotation Filtration) which would allow the DAF to be abandoned.

Engineer's from BVCL came at the problem from a 'do-nothing' point of view which resulted in structural calculations being undertaken to check the integrity of the tanks and concrete walls. It was concluded that the structures were not subject to imminent catastrophic failure and by careful targeted repair, focussed on the most damaged areas; a reasonable life for the main structures of the plant could be obtained. This targeted repair process combined with a planned yearly monitoring system measuring any further erosion of the walls became the preferred option.

Concrete repairs

Laser Special Projects Ltd were employed to repair the concrete after detailed inspection of damage by *Black & Veatch Consulting Ltd*. Cementitious repair products were chosen from the *SIKA* range, as different products were available for the many types of repair required throughout the works, complete with DWI certification.

Before the 1st stage filters were removed from the process, various modifications were made to the DAFF with the aim of:

- * improving turbidity coming off the DAFF and so reducing the loading on the 2nd stage filters during repair period (improved recycle);
- * improving process flows, flow splitting and mixing in the flocculation stage prior to the DAF (improved DAF inlet works).

These process improvements are ongoing (June '03) but are successful allowing the potential to achieve the original maximum design flows of 105 MLD. This enabled the first stage of repairs to proceed with the 1st stage filters and 2 DAF cells bypassed and process flows reduced.

Now running at 90%

Concrete repairs to the 1st stage filter common channels and 3 of the 4 DAF cells are now complete. The treatment works is now running at process flows of 90% of normal maximum flows. Repairs on the remaining eroded concrete continue whilst the works is running. It is expected that repairs will be complete by the end of 2003 after 12 months work and with minimal disruption to process flows.

The final out-turn cost is expected to be in the region of £1.8m, a significant saving over the original estimate for ensuring this important asset remains operational for many years to come. ■



- Specialist Refurbishment and Repair Contractor
- Sprayed Concrete
- Hydrodemolition
- Waterproofing
- Joint Sealants
- Blast Cleaning
- Wire Sawing
- Protective Coatings
- Cathodic Protection
- Anti-skid Surfacing





Laser Special Projects are pleased to be associated with the refurbishment of Pontsticill WTW

Laser Special Projects Limited
Bredon House, Powick, Worcestershire, WR2 4SQ

Tel: 01905 832900 Fax: 01905 832901
Email: enquiries@laser-group.co.uk
www.laser-group.co.uk