

# Alnwickhill Clearwater Tank Repairs

## rectifying low-level bacterial failures

**A**lnwickhill WTW is an historic site; where phased construction started in 1876 and was completed in 1879<sup>1</sup>. The works was built to provide safe drinking water to a large population of Edinburgh's residents and currently has an output of 55MI/d serving approximately 120,000 people in the east of the city. The main process is slow sand filtration, followed by chloramination, pH adjustment and phosphate dosing for plumbosolvency control with 18 hours storage in two separate 4.5 million gallons (20MI) clear water tanks. The first 4 slow sand filters and clear water tank were completed in 1879, with the tank known as the 'Old Tank'. The second tank, completed in 1888, and is still known as the 'New Tank'.



Alnwick clearwater repairs

photo courtesy Scottish Water Solutions

Over the past 127 years, Alnwickhill WTW has seen a number of upgrades to increase plant throughput, to take advantage of the progress made in technology, and to fall in line with the low manning requirements of today's water industry. Major upgrades were carried out in 1888, 1895 and 1904, with a modernisation project carried out in 1993.

Throughout the upgrades, the original process and tanks have gone on producing water steadily since Victorian times. The outstanding design and construction of the Victorian builders has led to the tanks and their associated buildings being designated as having historical importance and being added to the listed building register, whilst still maintaining their original purpose. It is a testament to the skill and quality of the architects and engineers that the tanks have lasted way beyond the current horizon for modern structures.

The interiors of these tanks are beautifully laid out, with elegant supporting arches and columns. The tiled valve chambers would not look out of place in an up market steam room, a reminder that in by gone days public utilities could be aesthetically pleasing as well as beneficial to the health of the population of Scotland's capital city.

Despite the quality of the workmanship, time has taken its toll on these structures. In autumn 2004, low level bacterial failures on the treated water pointed to a problem with the tanks and led to an investigation to discover the source of the contamination. A project was established to rectify the problem and prevent any further

bacterial failures. The £300,000 project was funded from Scottish Water's £140m Capital Maintenance budget, managed by *Scottish Water Solutions*.

*MJ Gleeson*, a Scottish Water Solutions in-house partner, was appointed as principle contractor. They appointed *Concrete Repairs Ltd*, a specialist concrete repair firm, as a subcontractor and utilised Scottish Water Solutions structural engineers..

One of the main challenges encountered by the project team was that Alnwickhill WTW is a strategically critical works. This meant that any work done on the tanks could not interrupt supply to the city. To deliver the project without risking supply failure a phased approach was undertaken, taking one tank out of service at a time, working on that tank and then bringing it back into service.

The first phase of inspections and repairs was on the 'New Tank'. It was first drained down and then inspected. A large crack was found in one of the supporting brick arches, this crack and a number of other minor cracks were sealed by the specialist concrete repair contractor using a high pressure resin injection method.

Since questions were raised over the long term structural integrity of the tank, a series of electronic 'tell tales' were installed by *Data Monitoring and Geotechnical Ltd.*, to monitor existing cracks ensuring that further movements, and therefore, contamination potential will be detected. This phase was completed in December 2004.

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Phase two of the project was started in the spring/summer of 2005 after several months of satisfactory operation from the 'New tank'. The 'Old tank' was drained down and inspected and a number of leaks sealed. These leaks appeared to be from the adjoining slow sand filters and were not thought to be responsible for the bacterial contamination, The tank was disinfected and brought back into service.

Further inspections concluded that there was some rain water ingress into the outlet chambers from the valve house roof. Phase three dealt with the rainwater ingress through the mortar joints of the stone slab roof above the CWT valve house. Since the valve houses are part of the tanks and are listed buildings, additional care had to be taken to ensure that the repairs were in character with the existing structure. Traditional Victoria materials and methods were

employed by MJ Gleeson's subcontractor, *Concrete Repairs Ltd.*, to comply with listed buildings requirements.

Final phase in February of the project was handed over and signed off by Scottish Water in February 2006. Monitoring of the cracks in the 'New Tank' is on-going, movement has been detected in the past six months, however, the scale of the movement is typical of temperature changes and pressure differences associated with water levels in adjoining slow sand filters. The movement recorded to date does not indicate structural failure. There have been no reported failures from the tanks since completion.■

1. Leslie A.M 1883. The Edinburgh Waterworks. Taken from the minutes of the Proceedings of the Institution of Civil Engineers Vol LXXIVv Session 1882-1883 Vol 1V

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