

Cadney Reservoir

repairs to cracks and joints at a key reservoir to restore structural stability by preventing water infiltration and reducing the risk of leaks or failures

by Anglian Water's @one Alliance

The Cadney Reservoir, located in Brigg in North Lincolnshire, is a key water storage facility managed by Anglian Water. The reservoir was constructed in 1989 and stores raw water to ensure a steady supply for treatment and distribution to nearby communities. The reservoir also supports local biodiversity, serving as a habitat for many types of wildlife in the area. The issues with the reservoir were first identified by the Anglian Water Operations team during a low-water inspection on 3 December 2019. During this inspection, deposits of sand, gravel and concrete were found on the north-eastern revetment of the reservoir.



Cadney Reservoir mid-repair - Courtesy of @one Alliance

Introduction to the issue

Concerns were raised on the integrity of the reservoir structure and the 'toe beam' located below low water level. Specialist surveys utilising both bathymetric (below water) analysis and 3D laser scanning were completed over a period to ascertain toe beam condition and identify potential movement.

Whilst movement from the 'as constructed' position was detected, the surveys showed no subsequent change across the period of the surveys and specialist analysis concluded that any movement of the toe beam was historical. Gravel deposits witnessed at the north-east corner of the reservoir were attributed to be the result of release of gravel from below the concrete slabs which form the reservoir revetment. Water movement within the reservoir (particularly between the normal top and bottom water levels) had over time allowed water to ingress below the concrete slabs via construction joints and cracking of the concrete slabs.

Whilst the detailed surveys provided confidence on the structural integrity of the reservoir (indicating no recent movement), the

ongoing release of gravel from below the concrete slabs forming the revetment prompted concern on the long-term condition of the reservoir.

The solution

Surveys of the revetment identified potential for release of gravel from cracks and construction joints greater than 10mm in width between bottom and top water levels. The repair strategy was to prevent water ingress, and subsequent release of gravel, via sealing of cracks and joints, whilst retaining potential for movement in construction joints.

Crack & joint repairs

Approximately 6935m of the embankment required repair. Construction joints greater than 10mm in width required sealing to prevent further water ingress whilst still permitting movement (in line with their original purpose). Joints were filled with SikaSil® DW sealant from Sika; an approved product for use in drinking water applications. The business worked closely with Sika to ensure that the significant quantities of sealant required were available

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when needed. During application, monitoring and logging of temperature was completed to ensure that the curing conditions for the product were achieved. In the event of wet or cold weather, works were suspended.

Cracks in the precast concrete slabs between 10mm and 40mm in width were also addressed utilising Sikasil® DW. Prior to sealant application all surfaces were primed using Sika's primer product. For instances of cracks in concrete revetment exceeding 40mm in width, repairs were completed utilising NATCEM® 35 from Natural Cement, a repair mortar approved for use with drinking water applications. Ahead of application, loose concrete was removed and cracks 'straightened' via disc-cutting to aid application of repair mortar. As with the application of Sikasil® DW all repairs were completed in line with the product curing requirements, utilising temperature logging to confirm compliance.

Specialist surveys & data

A key aspect of the project was the use of specialist surveys to guide the repair work. These surveys included both underwater bathymetric surveys and 3D laser scanning, which helped assess the movement of the toe beam, the extent of gravel deposits, and the overall condition of the embankment. The surveys confirmed that while the toe beam had moved historically, there had been no significant change in recent years. This information was invaluable in ensuring that the repairs were focused on areas requiring the most attention, helping avoid unnecessary interventions and ensuring that resources were used efficiently.

The data also allowed for a more precise approach to the repairs, ensuring that the work carried out was based on accurate, up-to-date information. The surveys highlighted areas where further movement or deterioration could occur, allowing for targeted repairs that minimized the risk of future issues.

Cadney Reservoir Repairs: Supply chain - key participants

- **Project delivery:** @one Alliance
- **Principal contractor:** Skanska
- **Concrete repair design:** Binnies
- **Concrete repair & Sika application:** Stonbury
- **Badger surveys:** ESL (Ecological Services) Ltd
- **Dive surveys:** Taylor Diving & Marine Ltd
- **Surveys & inspections:** Flythru Ltd
- **Site set up:** BCS Group
- **Security:** Wireless CCTV Ltd
- **Site electrical set up:** Electrical Design Installations Ltd
- **Sealants:** Sika
- **NATCEM® 35 repair mortar:** Natural Cement
- **Solar generator for on-site welfare power:** Nixon Hire

The benefits of this solution

The applied solution provided many key benefits, addressing both engineering and operational needs to ensure the reservoir's continued functionality.

The repairs restored the reservoir's structural stability by addressing the cracks and joints, this prevents the water infiltration and reduces the risk of leaks or failures for many years to come. Using high-quality materials like Sikasil® DW sealant and MIC-certified mortar, the repairs are designed to last 25 years, ensuring resilience and minimising future maintenance needs. Also, the swift response by Anglian Water and the @one Alliance mitigated potential severe structural issues and avoided disruptions to the water supply and environmental harm.

Conclusion

The £2.5m repair works started in late May 2023 and were all completed and signed off in November 2023, in line with the obligation date. Works to complete the repairs were scheduled to

ensure that requirements for reduction in water level would have no impact on normal operational activities. Surveys and inspections were carried out periodically to ensure the repairs were effective and that the reservoir remained safe throughout the process.

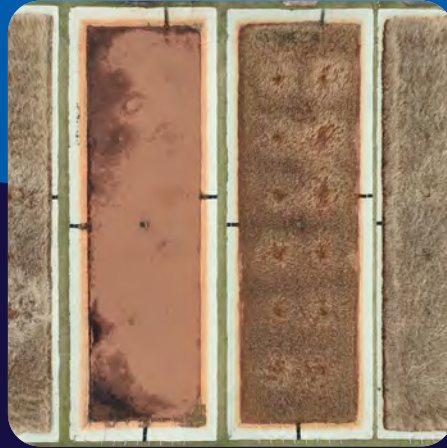
The repairs carried out on the reservoir's embankment successfully addressed the issues identified during earlier inspections, restoring the structure's integrity and ensuring its long-term function. The solution provided a range of benefits, from enhanced safety and durability to significant cost savings and risk reduction. By relying on specialist surveys and targeted repairs, the project was completed efficiently, ensuring that the reservoir would continue to meet the needs of local communities and the surrounding environment for years to come.

The editor and publishers would like to thank Anglian Water's @one Alliance for providing the above article for publication.

The @one Alliance is a collaboration of eight partner companies that each provide specialist knowledge allowing the Alliance to deliver complex delivery projects in the most efficient way, reducing the cost to Anglian Water's customers. The partners are Anglian Water, Balfour Beatty, Barhale, Binnies, Mott MacDonald Bentley, MWH Treatment, Skanska and Sweco.



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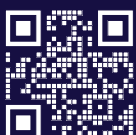
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