Basic Details

Publish Date

02 September 2025

Case ID#

3266

Title

Collapse of a brick outlet culvert

Nation

England

Regulator Reference No.

530

Legal Status

Statutory

Reservoir Type

Impounding

Reservoir Capacity

25,000 - 99,999m3

Year of Construction

< 1800

Main Construction Type

Other

Dam Height

2 - 4.99 metres

Dam Flood Category

C

Hazard Class

High-risk reservoir

Reservoir Use

- Conservation (ornamental / heritage)

Owner Type

Registered charity

Incident Details

Date & Time of Incident

11 May 2025 - 12:00

Date Incident Closed

01 May 2026

Observations that Caused the Incident to be Declared

- Other (including pollution and unplanned scour release)

Describe the Incident

During the routine 6 monthly testing of the penstock valve, on the upstream end of an overflow culvert at an upper pond a large amount of brick rubble was carried through in the discharge to the lower pond. The penstock valve was immediately closed. The overflow culvert runs through the centre of the earth embankment dam and is 32 m in length. The upstream 20 m comprises a circular 530 mm dia concrete pipe. The final 12 m length comprised a brick arch culvert, 1080 mm high, 610 mm wide. There were no visible signs of embankment movement or crest settlement. A CCTV survey was undertaken, entering the culvert from the downstream end only, which identified a large void in the brick culvert section 8 m from the downstream end of the culvert. This survey also identified that the invert of the brick culvert comprised timber sleepers. Following consultation with the last Inspecting Engineer, a precautionary and controlled drawdown commenced. A further CCTV survey was completed, entering the culvert from both upstream and downstream ends, to help ascertain further information for the most appropriate repair. This revealed the full scale of the void, approximately 3 m in length and extending approximately 1.5 m away from either side of the original line of the brick culvert. The crest path was closed to both pedestrian and vehicular traffic and temporary pumps were brought in to continue the pre-cautionary drawdown at a rate of between 300 and 400 mm per day and hold the water level at an agreed level whilst a design solution was developed and repairs to the overflow were undertaken.

Supporting Photos

Collapse of a brick outlet culvert

Collapse of a brick outlet culvert

Collapse of a brick outlet culvert

Causes and Impacts

Natural Processes which Initiated or Contributed to the Incident

- None

Main Contributing Factors to the Incident Occurring

Dam Factors

- Failure or damage to pipes or culverts
- Spillway or overflow - blockage

External Factors

- None

Shortcomings

- Maintenance shortcoming
- Surveillance shortcoming

Root Cause of the Incident

The root cause of the incident was failure of the brick culvert overflow leading to potential instability of the homogeneous earth embankment dam.

Impacts on the Reservoir

- Failure or damage to tunnel or culvert
- Internal erosion (adjacent to structures)
- Internal erosion (fill deterioration)

Supporting Photos

Collapse of a brick outlet culvert

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Supporting Contributions and Studies

Human Factors which Influenced the Incident

The Undertaker promptly arranged for a CCTV survey to be undertaken to establish the condition of the overflow and extent of damage. The Undertaker and Supervising Engineer liaised closely with the most recent Inspecting Engineer, as the severity of the damage and the full composition (timber sleeper invert) of the culvert was established to close the embankment to the public and undertake a pre-cautionary drawdown. The Undertaker accepted the need for temporary pumps and secured their procurement promptly. The above team of personnel also promptly engaged with a couple local contractors to consider alternative repair options and established that an open-cut full length replacement of the overflow culvert was the preferred solution, driven by the presence of rotting timber sleepers forming the invert of the original brick culvert.

Instrumentation at the Reservoir

Not applicable

Was Instrumentation Effective?

Not Applicable

Assistance by External Parties and Impacts on Downstream Population

The path that runs across the crest of the embankment dam was closed to the public (walkers, horse riders etc).

Summary of Studies or Investigations Undertaken

A CCTV survey was undertaken on 28th May 2024, entering the culvert from the downstream end only, which identified a large void in the brick culvert section 8 m from the downstream end of the culvert. This survey also identified that the invert of the brick culvert comprised timber sleepers. A further CCTV survey was completed on 17th June, entering the culvert from both upstream and downstream ends, to help ascertain further information for the most appropriate repair. This revealed the full scale of the void and the extent of rotting/missing timber sleepers on the culvert invert. The Supervising Engineer engaged with two local contractors to consider potential repair options either re-lining and grouting or an open-cut replacement. A full length open-cut replacement of the overflow pipe was agreed, to provide the greatest longevity. The overflow culvert was replaced with a concrete pipe over the full length, including a concrete collar on the upstream end and a filter collar on the downstream end and the embankment re-instated with a cohesive Class 2A material between September 2024 and January 2025.

Supporting Photos

No images provided.

Lessons Learnt

Lesson 1

- Operation and maintenance
- Surveillance and Monitoring

At a previous six monthly visit (Nov 2022) the Supervising Engineer witnessed a large log at the downstream end of the overflow culvert. Almost too large to have fitted through the grille at the downstream end. The SE advised a CCTV Survey to be undertaken to check the culvert condition. However, the Undertaker believed that the log had been inserted into the culvert by children and no CCTV survey was completed. Potentially, this "log" may have been one of the old timber sleepers forming the culvert invert. If there is doubt about culvert condition, follow up with appropriate investigations to avoid re-active maintenance.

Lesson 2

- Operation and maintenance

Importance of testing scour valves, not only considers operation and sufficiency of valves but also the condition of any downstream overflow system, so always important to witness and confirm the discharge. Not in this case, but sometimes witnessing the discharge is problematic when the discharge point is a significant distance away and access is difficult due to land ownership arrangements and other physical constraints.

Lesson 3

Lesson 4

Closing Comments

Supporting Photos

No images provided.

Information provided has been sent from reservoir owners and engineers, and cleansed of personal information by the enforcement authority. We cannot guarantee the accuracy of the data, but if you find an error please contact the relevant enforcement authority.