



Middleton St George Parish Council

MIDDLETON ST GEORGE RESERVOIRS
(otherwise known as the Fighting Cocks Reservoirs)

**REPORT ON AN INSPECTION UNDER SECTION 8 OF THE
RESERVOIRS ACT 1975**

Final

March 2023



Inspecting Engineer
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1. NAME AND SITUATION OF RESERVOIR

The reservoir is known as **MIDDLETON ST GEORGE RESERVOIRS**, situated on the outskirts of Middleton St George, Co. Durham. They were formerly owned and operated by the predecessors of Northumbrian Water Ltd and known as the Fighting Cocks Reservoirs.

National Grid Reference N2 138 342 lies within the site.

I have treated them as 'one reservoir' because of their close proximity to each other.

2. NAME AND ADDRESS OF ENGINEER MAKING THE REPORT

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3. PANEL OF WHICH THE ENGINEER IS A MEMBER

All Reservoirs Panel (appointed to the Panel until 31 May 2026).

4. NAME AND ADDRESS OF OWNER AND/OR UNDERTAKER

Middleton St George Parish Council
c/o 55 Woodlands Green
Middleton St. George
Darlington
Co. Durham
DL2 1EE

Contact: Alan Macnab, Parish Clerk
Email: msgclerk@aol.com
Address: 5 Whitebridge Drive, Darlington, DL1 3TY

5. NAME AND ADDRESS OF ENFORCEMENT AUTHORITY

Environment Agency
Manley House
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Sowton Industrial Estate
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6. DATE OF INSPECTION

First formal visit 4th March 2019
S8 inspection date 12th December 2022

7. NAME AND ADDRESS OF SUPERVISING ENGINEER

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8. CERTIFICATES, REPORTS OF PREVIOUS INSPECTIONS AND OTHER ITEMS OF INFORMATION WHICH WERE PROVIDED TO THE ENGINEER

8.1 Certificates

No Certificates relating to the reservoirs are known.

8.2 Reports

No reports known.

8.3 Supervising Engineers Statements

No Statements produced before.

8.4 Other Information including Drawings

Various drawings supplied by Northumbrian Water – see Appendix D.

9. GENERAL DESCRIPTION

9.1 Description of Reservoir

At Middleton St George there were four but there are now three reservoirs which share common embankments.

When two or three reservoirs are in close proximity but sufficiently far apart that the failure of one would not affect the other, then they are treated as individual reservoirs but in the case of these three reservoirs they actually join and thus in my opinion they should be treated as one reservoir in terms of their volume and consequence of failure.

Without a new, detailed topographical survey it is difficult to give a precise volume for the three reservoirs above natural ground level but my calculations would suggest the following:-

No. 1 Reservoir	-	31,119* cubic metres
No. 2 Reservoir	-	21,672 cubic metres
No. 3 Reservoir	-	6,804 cubic metres
Total	-	<u>59,595 cubic metres</u>

(figures from Alan Blacklee)

* in view of this figure alone would put it under the Reservoirs Act 1975, I **recommend a bathymetric survey be undertaken to establish the volumes above the level of the natural ground of each reservoir.**

The reservoirs have been registered with the Regulator – the Environment Agency.

9.2 Geology of the Site

The geology of the area includes the coal measures of the Carboniferous Series and it is likely that the whole site is covered with Boulder Clay deposits.

9.3 Catchment

The reservoirs are seen to be non-impounding, in as much as they sit above ground level on all sides. As such they are filled, it would appear, only by direct rainfall.

9.4 Dam Details

The reservoirs are retained by earthfill embankments. Little is known about their construction. They are probably homogenous in nature and not be equipped with a puddle clay core. The embankments geometry is such that they have upstream and downstream slopes which appear to be at about 1 in 2.5. The crests have a width of about 3 metres (10 ft) and in general carry a footpath. The downstream face is grassed and the upstream face seems to have some stone/concrete protective layer, at least in the upper part..

The function of the grass on the downstream face is to protect the face against erosion caused by rainfall whilst the protective system on the upstream face is to protect the face from erosion caused by a varying water levels and wind and wave action. The crest has to be protected against pedestrians and any windblown spray.

9.5 Details of Modifications, Remedial Works and History

Historical Setting & Purpose

The Reservoirs Act 1975, as amended by the Water Act of 2003 and the Flood and Water Management Act 2010, applies to any structure which holds or can hold more than 25,000 cubic metres of water above the level of the natural ground adjoining the site. Changes in 2010 moved that threshold to 10,000 cubic metres, but this has yet to be enacted in England – it has already commenced in Scotland and Wales and so I believe it is only a matter of time before this volume is adopted in England.

Whether the reservoirs are such that they come within the ambit of the Reservoirs Act 1975 or not, the owner (presumably Middleton St George Parish Council) still have a duty of care under the Law of Tort (Common Law) viz. Rylands v Fletcher and there would be a claim against the Council should any losses be felt by any parties.

If under the auspices of the Reservoirs Act 1975, as amended by the Flood and Water Management Act 2010, then a claim would be a criminal lawsuit.

It is quite clear under the Reservoirs Act 1975 that the ‘owner’ is responsible for reservoir safety. Clause 22 (5) of the Act states that:-

(5) Where an offence committed by a body corporate under this section is proved to have been committed with the consent or connivance of any director, manager, secretary or other similar officer of the body corporate, or any person who was purporting to act in any such capacity, he as well as the body corporate shall be guilty of that offence, and shall be liable to be proceeded against and punished accordingly. Where the affairs of a body corporate are managed by its members, this section shall apply in relation to the acts and defaults of a member in connection with his functions of management as if he were a director of the body corporate.

Volume / Definition

The volume of a reservoir is that volume measured – from the base of the streambed where the embankment is formed, in the case of an impounding reservoir (a reservoir built across a stream and subject to floods) – in the case of a non-impounding reservoir as in the case of Middleton St George reservoirs, it would be the level of the reservoirs – the point at which water overflows from the reservoir and which controls the water level. Any water that is ‘flood water’ or rainwater stored above the overflow does not contribute to the calculation of the volume of the reservoir. This is due to the fact that the reservoir is defined as ‘designed to hold or capable of holding’.

A simple way of understanding the ‘volume’ of the reservoir as defined by the Reservoirs Act 1975 is to consider the ‘escapable contents’ should a structure that has

been engineered as an unnatural embankment fail then if the volume is greater than 25,000 cubic metres (at the moment) then that is a reservoir.

History of the Site

The three reservoirs occupy some land just outside the village of Middleton St George.

Originally there were four reservoirs on the site owned and operated by Tees Valley Water Board. They were known as the Fighting Cocks Reservoirs and there was also a Pumping Station, a Superintendent's House and a Board Room on the site.

The reservoirs were known as No. 1, No. 2, No. 3 and No. 4; No. 1 being the nearest to the road. No. 1 has been emptied and modified to form a tennis court.

The reservoirs are now known locally as:-

No. 1 Reservoir	-	used by the model boating club (formally No. 2)
No. 2 Reservoir	-	formally No. 3; and
No. 3 Reservoir	-	formally No. 4

The reservoir was transferred to Northumbrian Water Authority presumably at the time of formation of that company and then later to the Council.

Original Layout

There are a number of plans, detailed in Appendix A which gives some indication as to the form and operation of the reservoirs.

Reservoir No. 1 – now no longer a reservoir

Now the tennis court, had an 18 inch diameter outlet in the east side (nearest the road) into a distribution system in the road and also met the 30 inch main which skirts around the site.

There was a drain (an 18 inch diameter drain) into a sewer in the road.

The length of the embankments are approximately 380 metres and the surface area is about 8,200 square metres.

The site cannot store any water and although not formally discontinued at the time, is no longer considered to be a reservoir.

Reservoir No. 2 – now known as Reservoir No 1

The old main continues down the road adjacent to the reservoir.

The length of the embankments are approximately 350 metres.

The reservoir is rectangular in plan and has a common embankment with Reservoir No. 2.

Reservoir No. 3 – now known as Reservoir No. 2

A main from No. 2 (now No. 1) was shown running down the road skirting around the Board Room and passing through a chamber which connects to the pumping station but goes onto meet the outlet from No. 1 and the distribution system.

The top water level (TWL) of No. 2 (No. 1) is shown as 168.86 ft (51.46 metres AOD).

The reservoir is rectangular on plan with a ‘common’ embankment between Reservoir No. 1 and Reservoir No. 2 and also No. 2 and No. 3.

The length of the embankment was approximately 400 metres and the surface area is about 9,300 square metres.

Reservoir No. 4 – now known as Reservoir No. 3

Reservoir No. 3 is at the west end of the site and is the largest in plan area and thus also volume.

The drawings show a drawoff on the north side again connecting to the distribution mains.

The length of the embankment is approximately 500 metres and the surface area is approximately 13,500 square metres and there is a common embankment between Reservoirs No. 2 and No. 3.

Original Function of the Reservoirs

The reservoirs were obviously originally constructed for water supply. A drawing of the distribution system indicates a 30 inch main running north of the site – it is not thought to be live and not connected to the reservoirs - into which each reservoir was connected via a valved connection in the centre of the northern side of each reservoir.

The drawing also shows that No’s. 2 and 4 (now known as 1 and 3) were connected to an abandoned main running parallel, but south of the main noted above.

Reservoir No. 1 (tennis courts) was connected to a much smaller local distribution system as was Reservoir No. 2 (now Reservoir No. 1) – so No. 1 and 2 could be inter-connected.

The same drawing shows that Reservoir No. 1 (tennis court) was isolated by capping off the main in the road and then filling the main from the reservoir to the capped end with concrete. The drawing states ‘main filled with concrete below ground level’.

Reservoir No. 2 (now No. 1) shows again the outlet/inlet on the north side filled with concrete, presumably up to the capped end – ‘main filled with concrete below ground level’.

The pipeline controlled by a valve and bellmouth halfway along the eastern side again was cut and capped on the small diameter distribution system. The drawing states 'bellmouth cut off and main filled with concrete below ground level'.

The drawing gives no information on how the pipes cut off/into the reservoirs on the north side were dealt with. The mains are shown to be capped – and one presumes they also were filled with concrete.

It is thus apparent that the reservoirs have been isolated from the mains system and the only way in which the reservoirs appear to be filled is via direct rainfall.

No details of any other modifications are known.

9.6 Overflow

Reservoirs and dams are usually provided with overflows to prevent the water level rising to a point where overtopping of the embankments might occur or the freeboard (the distance between the overflow and the top of the bank) is reduced causing waves to pass over the embankment.

There appears to be an overflow to Reservoir No. 1 in the middle of the north side but the size is not known.

The middle reservoir (No. 2) also seems to have a piped overflow on the north side but again the size could not be measured.

Any overflow in Reservoir No. 3 could not be identified although one ought to exist.

9.7 Inlet and Outlet Pipework and Valving Arrangements

There does not appear to be any functioning pipework and valves on any of the reservoirs.

9.8 Scour

There do not appear to be any scour facilities functioning at the reservoirs.

9.9 Instrumentation

There is no instrumentation on or in the embankments.

9.10 Method of Recording Water Levels

Water levels are not recorded at the moment.

9.11 Access

Access to the site is available off the adjacent public road system via tarmacadam surfaced roads to the toe of the embankments on the north side. A housing development is under construction on the southern side which again may well give better access to the embankments on this side in the future.

9.12 Valley Downstream of the Dam

There are open fields on the north side but very quickly housing on the edge of the village of Middleton St George and the public road system exists.

On the west side buildings and habitation are in close proximity to the toe.

On the south side a large housing development is under construction with housing planned to be in close proximity to the toe of the embankments.

On the east side again, there are open fields but there are houses beyond those fields.

10. GENERAL DESCRIPTION OF THE INSPECTION MADE AND THE CONDITIONS FOUND

10.1 General

I first inspected the site on the 4th March 2019. I was accompanied by Councillors Catherine Gilsenan and Maggie Beadle of Middleton St. George Parish Council and Ernest Lazenby, Secretary of the Model Boating Club.

My most recent visit was on the 12th December 2022. I was unaccompanied on this visit.

The weather was dry but cold and windy with an overnight frost and in the preceding two weeks had been changeable with showers, heavy at times but also sunshine.

The general principal applying to the control of vegetation on embankment dams is that there should be no trees, coarse vegetation (brambles/shrubs etc) and that the embankments have good grass cover to resist erosion by rainfall, animals, people etc and in the extreme to protect the embankment should the reservoirs overflow and then overflow.

Grass should be regularly cut – say three or four times a year to keep coarse vegetation down, and to ensure grass does not exceed 150 mm in length to allow inspection/examination.

The general position for an owner of dams is that they have to be maintained to ensure that the fabric of the dam does not deteriorate and that the dam is regularly examined/inspected to watch for changes in the condition of the dam. In addition, improvements are sometimes required if changes are made to engineering and safety standards.

Periodic examinations and inspections are normally carried out by experienced engineers to advise the owners on the condition of their dams and to advise them on actions for the future.

This report seeks to give that advice both from a legal point of view from an operational point of view.

10.2 Catchment

The reservoirs are seen to be non-impounding in as much as they sit above ground level on all sides. As such they are filled, it would appear, only by direct rainfall.

I am told however, that the levels do not seem to vary very much even during hot weather – does that mean that there is a small flow fed from adjacent pipework? I consider this to be unlikely and so the embankments do hold water very effectively.

10.3 Reservoirs

Reservoir No. 1

Reservoir No. 1 is 'operated' and maintained by the model boating club and as such is better maintained than the other two reservoirs.

The downstream face (i.e. not the water side) of No. 1 is generally in a good condition with good line and level and a good grass cover. Most of the face is well kept with short grass. **I recommend all grassed surfaces are cut regularly to ensure the grass does not exceed 150 mm in length to encourage a good sward and allow examination/inspection.**

There are a number of stepped access points up the face. It is important that erosion due to pedestrians does not take place.

On the east side (opposite the tennis court), there are areas of coarse vegetation and trees. **I recommend any coarse vegetation on the face be removed and a good grass cover established. I recommend any trees are either removed or 'managed' by trimming and pollarding to ensure they do not become too big.**

On the south side adjacent to the to the housing development there was little grass cover. I recommended the trees and saplings on the south side of all three reservoirs be drastically thinned and saplings/trees removed so that a good grass cover can be established and this has been done.

The upstream side (the water side) was seen to be in a satisfactory condition with good line and level.

The lower part of the basin appears to be a concrete (?) lined structure with a drawoff vertical wall supporting the base of the rest of the slope, which is grass covered. There are one or two saplings which should be removed. **I recommend any saplings on the upstream side of the dam be removed.** The slope also carries a number of stepped fishing access structures.

The crest appeared to be in a good condition with good line and level and no visible defects.

Reservoir No. 2

Reservoir No. 2 sits with a water level at a much higher elevation than Reservoir No. 1.

On both the upstream and downstream faces there is grass cover but also a significant amount of coarse vegetation, saplings and trees. **I recommend a removal of all coarse vegetation and saplings and management of the trees be undertaken. I recommend a good grass cover be established.** The waterline on No. 2 is not as straight as No. 1 which indicates some historic settlement and movement.

The crest appeared to be in a good condition with good line and level.

There is some reed growth in the basin which is useful in that it is able to absorb the energy of waves etc.

On the south side (the development side) there appears to be a 'supplementary' structure built on the crest on its downstream side. The line and level is good. The coarse vegetation has been thinned/removed.

Reservoir No. 3

The line and level of the crest was satisfactory.

Both the upstream and downstream faces have good line and level but carries significant numbers of trees and saplings and little grass cover. The grass cover is very sparse. Again, **I recommend that a significant number of saplings and trees be removed from all the face and a grass cover established.**

It appears the fishing club on the reservoir has formed substantial fishing platforms which have cut deeply into the upstream face of the dam. This has severely weakened the dam, and so **I recommend the fishing platforms be refilled where they have been cut into the embankment.** This has been recommended before but not actioned.

10.4 Overflow Structure and Channels

Reservoir No. 1

There is said to be a small diameter pipe able to discharge water off the site as a syphon. However, there is another unknown chamber on the site which might be an overflow. **I recommend the chamber on the dam be investigated and the results presented to an All Reservoirs Panel Engineer.**

Reservoir No. 2

There is a visible overflow on the corner of the reservoir.

There is a significant amount of reeds around the overflow. These reeds could cause a blockage of the overflow. **I recommend the approach to the overflow be kept free from reeds.**

The route of the overflow is not known. **I recommend the route of the overflow be investigated so that maintenance can be used to ensure the efficiency of the overflow.**

Reservoir No. 3

An overflow could not be found – either it uses the overflows at Reservoir No. 2 or it is on the north side of the site.

I recommend the site be investigated to establish whether there is an overflow.

In general, **I recommend the route of all overflows be traced and it is established that all overflows are free from obstruction.**

10.5 Valve Shaft and Tunnel

There do not appear to be any valve shafts or tunnels. However, there are a number of chambers which were part of the original facilities.

I recommend that any chambers on the site be opened and investigated to establish what facilities exist on site and their condition and whether they are operational.

10.6 Inlet and Outlet Pipework and Valves

There is apparently no operational valves and pipework on the site. However, there is clearly some pipework through the divide banks at a high level connecting reservoirs. High level pipework is not necessarily an issue but low level pipework could cause problems in that they can form preferential leakage paths through an embankment.

Thus, I recommend a review of the site to establish what valves and pipework exist at the site and a plan be drawn with the results shared with an All Reservoirs Panel Engineer who would direct any improvement works thought necessary.

10.7 Seepages/Drainage Flows

I saw no signs of seepages or drainage flows.

10.8 Settlement and Movement

I saw no signs of settlement or significant movement to give me cause for concern.

10.9 Instrumentation

There is no instrumentation on or in the embankments.

10.10 Method of Recording Water Levels

There are no means of recording water levels and as the reservoirs remain essentially full I do not require water levels to be recorded.

10.11 Access for Maintenance and Emergency

Vehicle access for maintenance and emergency can be made from the public road to the toe of all embankments on the northern side. With the development taking place to the southern side, there should also be access from that side.

I consider that access for maintenance and emergency to be adequate.

10.12 Control of Inflow from Direct and Indirect Catchments

The reservoir does not appear to have any catchments either direct or indirect.

10.13 Movement of Surrounding Land which Might Affect the Stability of the Reservoir

I saw no signs of movement of the surrounding land which might affect the stability of the reservoir.

10.14 Area Downstream of the Dam

There are open fields on the north side but very quickly housing on the edge of the village of Middleton St. George and the public road system.

On the west side buildings and habitation are in close proximity to the toe.

On the south side a large housing development is progressing with housing planned to be in close proximity to the toe of the embankments.

On the east side again, there are open fields but there are houses beyond those fields.

However, with the development progressing for the area to the south of the reservoirs. **I would recommend that a 2 metre strip of land is maintained beyond the toe of the southern embankment to allow maintenance to be provided to the downstream face on the southern side and also a vehicle access be provided.**

10.15 Reservoir Risk Analysis

The most likely modes of failure are associated with instability and leakage (piping through the embankments).

11. ADEQUACY AND CONDITION OF WASTE WEIR AND OVERFLOW AND CHANNELS IN CONNECTION THEREWITH

11.1 Flood Assessment

11.1.1 Categorisation

Although not really applicable to non-impounding reservoirs but with the development planned, after consideration of the publication 'Floods and Reservoir Safety: An Engineering Guide – 4th Edition' published by the Institution of Civil Engineers in 2015, I consider that the dam falls within Category A, a dam where a breach would cause loss of life in a community.

Under this categorisation the design flood is the 10,000 year flood event and the safety check flood is the Probable Maximum Flood (PMF). The design flood is the inflow that must be discharged under normal conditions with a safety margin provided by an accepted freeboard limit. The safety check flood is the inflow beyond which the safety of the dam cannot be assured (i.e. key components exhibit marginally safe performance for this flood condition).

11.1.2 Freeboard Details, etc

The general level of the top of the embankment walls and top water level is such there is significant freeboard, well in excess of 1 metre.

Average annual rainfall is quoted as 612 mm.

11.1.3 Flood Flow Capacity Assessment

The average annual rainfall on the catchment is 612 mm as derived from the various maps included with the *Flood Studies Report* published in 1975.

11.1.4 Summary of Flood Study Analysis

No flood study has been carried out because it is a non-impounding reservoir.

If subject to extreme rainfall say 250 mm, and if a wave could be generated, say 300 mm, thus at least 550 mm freeboard is needed. There is much more than that.

I therefore consider there is adequate freeboard.

11.2 Alterations to Overflow Sill

There do not appear to have been any alterations to the overflow sill recently.

11.3 Any Alteration in Level to which the Water may be Stored

I consider that the water may continue to be stored up to 'top water level'.

11.4 Efficiency of Scour Pipe and Other Means of Lowering the Water in and Controlling the Inflow to the Reservoir

There appears to be no means to evacuate water quickly and so **I recommend an onsite pumping plan be written.**

12. SEISMIC RISK

Consideration of the publication 'An Engineering Guide to Seismic Risk to Dams in the United Kingdom' published by BRE in 1991 results in the dam being placed in Category II based on the following classification factors:-

Capacity Classification Factor	0
Height Classification Factor	0
Evacuation Requirements Classification Factor	4
Potential Downstream Damage Classification Factor	<u>4</u>
Total Classification Factor	<u>8</u>

The dam lies within Zone B; a zone with a moderate chance of earthquakes but larger events are rare. The Guide states that under this classification "it may be sufficient to examine the embankment and any ancillary works for any feature which would be particularly susceptible to damage by earthquakeseismic analysis would only be undertaken where such an initial appraisal defines features which are a serious cause for concern.

The risk of an escape of water is likely only to be associated with sufficient deformation of the downstream slope and I do not consider that any significant deformation would occur. I am also mindful of the comments in Section 7.10 of the guide where it notes *It is unlikely that earthquakes will cause major damage to well built dams on stable foundations in Britain. International experience has indicated that virtually any well built embankment dam can withstand moderate earthquake shaking with peak accelerations up to 0.2g with no detrimental effects. The probability of the occurrence of an earthquake of significantly greater severity at any UK dam is relatively low* I consider that the dam is in a good condition on the basis of obvious visual evidence and the monitoring records, and I do not consider that the seismic risks are sufficient to pose a significant risk to the dam.

I don't believe there is any seismic risk and so I do not require any further analysis.

13. SUPERVISION PROVIDED BY THE OWNER/UNDERTAKER

The site is heavily frequented by members of the public who should detect problems and warn the Council and obviously the model boating club have a vested interest in looking after the asset.

Visual surveillance is an important part of trying to ensure the reservoir remains safe and as such **I recommend that someone from the Council or the model boating club walk the site at least once a week to look for defects.**

The Supervising Engineer Designate visits the site once a year.

I consider the level of the supervision to be acceptable.

14. CORRECTNESS OF PARTICULARS IN THE PRESCRIBED FORM OF RECORD REQUIRED TO BE KEPT UNDER SECTION 11 OF THE ACT

There is no Prescribed Form of Record (PFR) for the reservoirs. **I recommend a digital copy of the new format of PFR is obtained and completed and then kept up to date.**

15. EMERGENCY PLANNING

I recommend an onsite pumping plan be written.

16. FINDINGS AND RECOMMENDATIONS OF THE ENGINEER

16.1 Findings

My findings as a result of the inspection are that:-

- (i) the dam falls within Category A as defined by the publication *Floods & Reservoir Safety (fourth edition)*;
- (ii) the dam falls within Category II as defined by the publication *An Engineering Guide to Seismic Risk to Dams in the United Kingdom* and the *Application Note*;
- (iii) the reservoirs/dams are maintained and generally is in a satisfactory condition;
- (iv) the overflow arrangements appear to be adequate and satisfactory to pass any flows;
- (v) the margin between the top of the dam and the overflow level is more than recommended in *Floods and Reservoir Safety*,
- (vi) there are no effective means of lowering the reservoir level;
- (vii) no movement of the surrounding land has been noted which might affect the stability of the reservoir;
- (viii) the Undertakers are complying with their obligations under Section 11 of the Act.
- (ix) there have been no previous inspection reports it would seem.

16.2 Recommendations as to Measures to be taken in the Interests of Safety under Section 10(3)(c) of the Act

(These recommendations are enforceable by the Enforcement Authority)

I recommend that:-

- (i) a bathymetric survey be undertaken to establish the volumes above the level of the natural ground of each reservoir - **I recommend these works are carried out within 24 months of the date of this report..**
- (ii) an onsite pumping plan be written - **I recommend these works are carried out within 6 months of the date of this report.**

16.3 Recommendations as to Measures to be taken under Section 10(3)(b) of the Act (Maintenance).

(These recommendations are enforceable by the Enforcement Authority but do not require Supervision by a Qualified Civil Engineer within the Meaning of the Act)

I recommend that:-

- (i) the chamber on Reservoir No. 1 be investigated and the results presented to an All Reservoirs Panel Engineer – **I recommend these works are carried out within 24 months of the date of this report.**
- (ii) the route of the overflow from Reservoir No. 2 be investigated so that maintenance can be used to ensure the efficiency of the overflow – **I recommend these works are carried out within 24 months of the date of this report.**
- (iii) the fishing platforms on Reservoir No. 3 be refilled where they have been cut into the embankment – **I recommend these works are carried out within 12 months of the date of this report.**
- (iv) the site be investigated to establish whether there is an overflow - **I recommend these works are carried out within 18 months of the date of this report.**
- (v) any chambers on the site be opened and investigated to establish what facilities exist on site and their condition and whether they are operational - **I recommend these works are carried out within 18 months of this report.**
- (vi) a review of the site to establish what valves and pipework exist at the site and a plan be drawn with the results shared with an All Reservoirs Panel Engineer who would direct any improvement works thought necessary operational - **I recommend these works are carried out within 18 months of this report.**

16.4 Other Recommendations, as to Measures to be taken in Respect of Maintenance

(These recommendations are not enforceable by the Enforcement Authority and do not require Supervision by a Qualified Civil Engineer within the Meaning of the Act)

I recommend that:-

- (i) all grassed surfaces are cut regularly to ensure the grass does not exceed 150 mm in length to encourage a good sward and allow examination/inspection.
- (ii) any coarse vegetation on the faces be removed and a good grass cover established.
- (iii) any trees are either removed or 'managed' by trimming and pollarding to ensure they do not become too big.
- (iv) any saplings on the upstream sides of the dams be removed.
- (v) a good grass cover be established.
- (vi) the approach to the overflows be kept free from reeds.
- (vii) the route of all overflows be traced and it is established that all overflows are free from obstruction.
- (viii) a 2 metre strip of land is maintained beyond the toe of the southern embankment to allow maintenance to be provided to the downstream face on the southern side and also a vehicle access be provided.

16.5 Measures Recommended in the Interests of Improving Monitoring and Supervision under Section 11 of the Act

I recommend that:

- (i) someone from the Council or the model boating club walk the site at least once a week to look for defects.
- (ii) digital copy of the new format of PFR is obtained and completed and then kept up to date.

16.6 Recommendations in the Matters of Safety Relating to Personnel/Public

None.

The comments with respect to Health and Safety relate only to those elements of Health and Safety associated with the owner and his staff and any other individuals associated with the safety of the dam. They relate only to issues noted during the inspection and should not be considered to be exhaustive or complete. The comments in no way relate to issues associated with others and in particular members of the general public or those using facilities at or visitors to the site.


16.7 Matters to be watched by the Supervising Engineer in accordance with Section 10(4) of the Act

I recommend that the Supervising Engineer visits the site at least once a year and pays attention to any leakage, seepage or settlement and in particular ensures that:-

- (i) a Prescribed Form of Record is obtained and complete and kept up to date.
- (ii) the overflows and approaches are kept free of debris.

16.8 Recommendations as to the Date of the Next Inspection

The next inspection by an Inspecting Engineer under Section 10(2) of the Act should be undertaken within 10 years of this inspection, i.e. before 12th December 2032.

Dated this 29th day of March 2023 Signed 
Member of Panel AR
as constituted under the Reservoirs Act 1975

This inspection report results from a visual inspection of the reservoir's condition on the date of the inspection. No liability can be accepted in respect of any defects not visually apparent or that arise subsequent to the date of the visit. It is important that the Undertaker or their agents, reports as soon as possible any change in the condition of the reservoir to the Supervising Engineer.

Appointment to All Reservoirs Panel until 31 May 2026.

APPENDIX A

Recommendations from Previous Report and Status

RECOMMENDATIONS FROM PREVIOUS REPORT AND STATUS

Not applicalbe, no previous reports

APPENDIX B

Preliminary Failure Mode Assessment

Mode of Failure	Credible & Significant ?	Means to Manage/Mitigate
Internal Erosion into foundation	Credible & Significant	Regular surveillance for leakage at toe drains and abutments.
Internal erosion along contact with outlet / culvert	Credible & Significant	Regular surveillance for leakage at downstream end of culvert.
Internal erosion along contact of dam with abutment / spillway etc during elevated flood levels	Credible & Significant	Surveillance
Blockage of spillway overtopping dam leading to scour	Credible & Significant	Keep spillway clear
Slope stability failure	Credible & Significant	Regular surveillance / emergency plan
Spillway failure / break-up	Credible & Significant	Surveillance / maintenance

APPENDIX C

Photographs



Crest



Crest



Damage to upstream face



Crest



Fishing platform



Damage behind fishing area



Crest



Clearance of downstream face



Crest and cleared downstream



Downstream face



Upstream face



Upstream face



Crest

APPENDIX D

Drawing List

List of drawings

<u>Drawing No</u>	<u>Title</u>	<u>Date</u>
45/24	Contoured Site Plan	1 st November 1945
45/6	Layout of Pumping Station and Roadways	16 th November 1945
78/9B	Amendment to Section A.A (this is a section shown in Reservoir No. 4 (No. 3) on Drg. 78/9	29 th June 1976
78/9	Record of Levels	February 1978
77/31	Layout of Pipework showing Blanking and Abandonment of Mains	June 1977
	Utility Diagram	May 2018