



Liberty Construction Ltd

MARLBROOK QUARRY RESERVOIR

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

Final

October 2019



Inspecting Engineer
Dr A K Hughes
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Church Lane
North Clifton
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NG23 7AP

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1. NAME AND SITUATION OF RESERVOIR

The reservoir is known as **MARLBROOK QUARRY RESERVOIR**, situated about 4 km north east of Bromsgrove in the County of Worcestershire. Site address – Old Marlbrook Quarry, Alvechurch Highway, Bromsgrove B60 1PA.

National Grid Reference SO 980 750 lies within the site.

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 2021).

4. NAME AND ADDRESS OF OWNER AND/OR UNDERTAKER

Liberty Construction Ltd
20 Westley Street
Dudley
West Midlands
DY1 1TS

5. NAME AND ADDRESS OF ENFORCEMENT AUTHORITY

Environment Agency
Manley House
Kestrel Way
Sowton Industrial Estate
EXETER
EX2 7LQ

6. DATE OF INSPECTION

29th April 2019.

7. NAME AND ADDRESS OF SUPERVISING ENGINEER

No Supervising Engineer – under the ‘control’ of the Construction Engineer.

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

8.1 Certificates

- (1) Inspecting Engineers Certificate under Section 10(5) of the Reservoirs Act 1975 by Mr P Kelham dated 6th March 2013.

8.2 Reports

- (1) Inspecting Engineer’s Report under Section 10 of the Reservoirs Act 1975 by Mr P Kelham dated 6th March 2013.
- (2) Inspecting Engineer’s Report under Section 8 of the Reservoirs Act 1975 by Mr R Mann dated January 2015.

8.3 Supervising Engineers Statements

None seen although some have been produced in the past.

8.4 Other Information including Drawings

- (1) Prescribed Form of Record Relating to the Reservoir

9. GENERAL DESCRIPTION

9.1 Description of Reservoir

Marlbrook Quarry Reservoir is a non impounding reservoir formed by the construction of an embankment built from ‘landfill materials’ across the Catshill Brook – on part of a much larger landfill exercise. Originally, before Liberty Construction’s involvement, the embankment formed part of an active landfill, [REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

The embankment was constructed between 1940 and 1987. [REDACTED]

[REDACTED] resulting in the formation of what was deemed to be a reservoir under the Reservoirs Act 1975. This is said to have happened in about 1987. [REDACTED]

[REDACTED]

[REDACTED]

A notice issued by the Environment Agency dated 22nd September 2014 required the appointment of a Construction Engineer under Section 8 of the Act. Up to that time the reservoir had been subject to periodic inspections under Section 10 of the Act, with identified remedial measures in hand supervised by an appointed Qualified Civil Engineer (QCE) under Section 10(6) of the Act, with a Supervising Engineer duly appointed under Section 12 of the Act.

Robert Mann was appointed as Construction Engineer (CE) until recently – he resigned and I took over confirmed by a letter/email from Liberty Construction dated 27th March 2019.

My appointment as CE was confirmed by the EA on the 4th April 2019 by email.

9.2 Geology of the Site

The 'geology' of the site has been modified as a result of the development of the site. Superficial deposits are not indicated as being present at the site. The overburden of sands and gravel at the site was worked as a quarry and has in most parts been excavated and removed.

The immediate bedrock is Clent Breccia, which comprises a sub-angular breccia of volcanics and other strata within a mudstone matrix. This is underlain unconformably by Carboniferous Sandstone and Mudstone of the Salop Formation (Enville Member). The Triassic Sandstones form a major aquifer in the region.

It is understood that the strata excavated comprised the base conglomerate horizon of the Kidderminster Formation of the Sherwood Sandstone group. The Kidderminster Formation encountered at the site consists of an approximately 16 metres thick unit of very poorly cemented pebbles with little sand matrix. The strata dip to the south-south-west at an angle of about 7 degrees. A section about 9 metres high supposedly was formed in the north-east of the quarry (SO 982 747) was logged in 1980. This report apparently recorded beds of loose conglomerate up to 3 metres thick with beds of pale red, coarse, cross bedded sandstone up to 1 metre high. Approximately 150 metres south of the site is the junction between the conglomerate band and the overlying pebbly sandstone of the Kidderminster Formation.

9.3 Catchment

The 'catchment' quoted by the last Inspection Engineer is 0.59 square kilometres. The catchment comprises open fields with some areas of woodland in the valley of the incoming stream. The catchment rises to a raised elevation of about 300 metres AOD.

The Alvechurch Highway crosses the valley just upstream of the reservoir at an elevation of approximately 204 metres AOD. At the crossing there is a culvert under the highway. The culvert is said to be 800 mm wide by 900 mm high.

The invert of the culvert is said to have an invert level of 200.7 metres AOD.

There is no indirect catchment.

9.4 Dam Details

[REDACTED]

The crest level is about 215 metres AOD and the invert about 200.7 metres AOD.

A topographic survey has been carried out which suggests that between 2007 and 2009 the bank was raised from 19 metres to 27 metres. At a previous S10 in 2013 it quoted an embankment of about 75 metres in length.

[REDACTED]

The downstream slopes of the site and the dam appear to have a gradient of about 1 in 3.7 and upstream slopes in the region of the reservoir ranging from about 1 in 4 to 1 in 1.5.

9.5 Details of Modifications, Remedial Works and History

[REDACTED]

Some of the downstream side on the west side and the extreme south sides were top soiled and returned to pasture by 2013.

It is understood there has been a dispute with Bromsgrove Borough Council about finished levels and an order has prevented for the earthworks for many years. [REDACTED]

[REDACTED]

9.6 Overflow

[REDACTED]

9.7 Inlet and Outlet Pipework and Valving Arrangements

[REDACTED]

[Redacted text block]

9.8 Scour

There is no scour facility.

9.9 Instrumentation

There is no instrumentation associated with reservoir safety apart from some elderly piezometers (2 No.) [Redacted]

9.10 Method of Recording Water Levels

Water levels are recorded by reference to a water level board which is fixed to the downstream headwall to the culvert under the Alvechurch Highway.

9.11 Access

[Redacted text block]

9.12 Valley Downstream of the Dam

Immediately downstream of the dam are a number of houses and the village and public roads.

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

10.1 General

I inspected the site on the 29th April 2019. I was accompanied in part by Eddie McIntosh but also Marie McIntosh for the whole of the walkover.

The weather at the time of inspection was fine, dry, sunny and mild and in the preceding two weeks had generally been good with warm periods and some rain; showers and heavier periods.

The flow in the stream was fairly low at the time of the visit [REDACTED]

The 'inspection' covered the whole of the site, the road [REDACTED] the downstream area and the embankment ancillary elements.

It is understood site operations to complete the earthworks were stopped in April 2011 when the local authority ordered a cessation of operations on the basis that the site had been overfilled. It is not the purpose of the report to comment on works that have been undertaken.

10.2 Catchment

The catchment was seen to be limited in extent, but quite steep and to include arable farmland and some woodland.

The culvert under the road and its associated headwalls were examined. The headwalls appeared to be in a satisfactory condition. [REDACTED]

10.3 Dam

I am aware that there have been reports previously which repeat recommendations that relate to the capping of the whole of the site. This has been an issue with the Planning Authority which has led to restrictions on site. This can create a situation where reservoir safety can be compromised. As an All Reservoirs Panel Engineer (ARPE) acting under the Reservoirs Act 1975, my role is to try to ensure reservoir safety and as stated within the Act to 'protect persons and property against an escape of water'. As

such my role relates to the dam which retains the reservoir and its appurtenant structures and no other part of the site which may be called the landfill.

I consider the embankment, although difficult to be define previously, is as shown on the drawing in the Appendix. Thus, my comments and recommendations relate **only** to that part of the site and the associated channels and structures downstream.

The reservoir has been in existence for more than ten years and the grass, vegetation, saplings and trees have become established.

The upstream face of the embankment and the inside slopes of the basin were seen generally to be in a satisfactory condition with stable slopes which are in the main, because of the dispute with Bromsgrove Borough Council at about finished levels. [REDACTED]

[REDACTED] Some filling had been done since the last inspection which has improved stability particularly on the left hand side of the basin.

The main part of the upstream face of the embankment appeared to have a satisfactory line and level and good grass cover. There are a number of saplings on the face.

The crest is a little uneven in places but has a satisfactory line and level and good grass cover. [REDACTED]

The downstream face appeared to have a satisfactory line and level although clearly the restoration of the lower part of the slope is much better than in the upper part of the slope. However, even the upper part of the slope the situation appears satisfactory with good grass cover and no signs of instability. In my opinion, if attempts were made to 'improve' the site then one would have to remove material that had been in place for more than ten years without problem – and this would be a retrograde step.

The surface drainage channels traverse the downstream slope, taking water to a settlement pond which also takes outflow water from the reservoir.

From this settlement pond water is discharged to the Catshill Brook [REDACTED]

I recommend the grass to all surfaces of the embankment is cut frequently and at least once a year to ensure the grass is cut short and coarse vegetation is cut off, to encourage a good sward, [REDACTED]

10.4 Overflow Structure and Channels

[Redacted text block for section 10.4]

10.5 Valve Shaft and Tunnel

[Redacted text block for section 10.5]

10.6 Inlet and Outlet Pipework and Valves

[Redacted text block for section 10.6]

[Redacted] recommend a CCTV survey of the culvert be undertaken to check its condition with the results reported to me as Construction Engineer.

[Redacted text block]

[REDACTED]

10.7 Seepages/Drainage Flows

I saw no signs of seepage or drainage flows to give me cause for concern.

I recommend the piezometers, if operable, are read at least 6 monthly and the results plotted and analysed to identify any changes or trends.

10.8 Settlement and Movement

I saw no signs of settlement or significant movement anywhere on the site [REDACTED]

The site has been essentially undisturbed for many years. Parts have been fully restored and parts have not. Grass cover has established itself over most of the site and there is some shrub and sapling growth. [REDACTED]

Mr Kelham in his report of 2013, reports that the advice from AECOM in 2012 was to ensure stability of the slopes by making them 1 in 4.

[REDACTED]

However, since Mr Kelham's inspection, as confirmed by Mr Mann, the site has been capped with 'clay' and areas also covered with topsoil. Since Mr Mann's inspection areas have been covered because of concern about erosion channels and loss of fill. Over the last three or four years, [REDACTED] grass has become established. Thus, whilst I do not require 300 mm of soil over the **whole** site, I consider that many areas within the basin that are not top soiled, should be top soiled and then if any areas of instability are noted over the years the advice of an All Reservoirs Panel Engineer should be sought. However, any work to topsoil areas should not destroy areas of good grass cover already existing. [REDACTED]

[REDACTED]

10.9 Instrumentation

There are said to be two piezometers [REDACTED]

10.10 Method of Recording Water Levels

Water levels are recorded by reference to a water level board fixed to the headwall to the culvert under the Alvechurch Highway.

I recommend water levels are recorded at least monthly and daily at times of significant impoundment.

10.11 Access for Maintenance and Emergency

[REDACTED]

10.12 Control of Inflow from Direct and Indirect Catchments

[REDACTED]

There is no indirect catchment.

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

Immediately downstream of the dam are a number of residential properties associated with Lower Marlbrook and Upper Catshill in the natural valley of the stream before it passes under the M42.

10.15 Reservoir Risk Analysis

[REDACTED]

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

11.1 Flood Assessment

11.1.1 Categorisation

[REDACTED]

[Redacted text block]

11.1.2 Freeboard Details, etc

[Redacted text block]

11.1.3 Flood Flow Capacity Assessment

[Redacted text block]

11.1.4 Summary of Flood Study Analysis

[Redacted text block]

11.2 Alterations to Overflow Sill

There do not appear to have been any alterations to the “overflow sills” since the time of the last inspection. [Redacted text block]

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

[Redacted text block]

[Redacted text block]

- Part 1 **I recommend water levels are recorded at least monthly.**
- Part 2 No comment
- Part 3 **Amendments are required as a result of this inspection.**
- Part 4 No comment
- Part 5 No comment
- Part 6 No comment
- Part 7 No comment
- Part 8 No comment
- Part 9 No comment
- Part 10 No comment
- Part 11 No comment
- Part 12 **Additions are required as a result of this inspection.**
- Part 13 No comment
- Part 14 No comment
- Part 15 No comment
- Part 16 No comment

15. EMERGENCY PLANNING

I recommend an onsite emergency plan be written.

16. FINDINGS AND RECOMMENDATIONS OF THE ENGINEER

16.1 Findings

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

(i) [REDACTED]

(ii) [REDACTED]

- (iii) the reservoir/dam is adequately maintained and generally is in a satisfactory condition;
- (iv) [REDACTED]
- (v) the margin between the top of the dam the overflow level is more than recommended in *Floods and Reservoir Safety*,
- (vi) [REDACTED]
- (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) I have reviewed the previous report and can confirm that any previous recommendations in the interests of safety have been carried out or are no longer required or are repeated, and an explanation is given where appropriate.

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) an onsite plan be written [REDACTED]
- (ii) a strategy is prepared and adopted for events where the road is flooded to ensure police are informed of flooding events that require the road to be closed to traffic.

I recommend these works are carried out within 1 year 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) [REDACTED]

I recommend these works are carried out within 1 year of the date 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) [REDACTED]
- (ii) [REDACTED]
- (iii) the grass to all surfaces of the embankment is cut [REDACTED]
- (iv) [REDACTED]
- (v) [REDACTED]
- (vi) [REDACTED]
- (vii) [REDACTED]

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

I recommend that:

- (i) the piezometers, if operable, are read at least 6 monthly and the results plotted and analysed [REDACTED]
- (ii) water levels are recorded at least monthly and daily at times of significant impoundment.
- (iii) [REDACTED]

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 twice a year and [REDACTED] in particular ensures that:-

- (i) the Prescribed Form of Record is complete.
- (ii) [REDACTED]

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 2 years of the Final Certificate being issued. I intend to issue a Final Certificate once the works recommended in Sections 16.2 and 16.3 are carried out.

Dated this 19th day of October 2019 Signed [REDACTED]
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 2021.

APPENDIX A

Recommendations from Previous Report and Status

RECOMMENDATIONS FROM PREVIOUS REPORT AND STATUS

(i)	Re-grade the upstream slopes of the embankment around the shores specified maximum slope of 1 Vertical in 4 Horizontal	Mostly done
(ii)	Complete restoration soils over the upstream slopes of the embankment around the shores of the reservoir area to a minimum 300 mm depth and include a growth medium to establish suitable grass cover	Partly done
(iii)	Re-profile the erosion channels on the left shore of the reservoir pool and extend the restoration soil layer specified to the areas draining from the site to the channels and the reservoir shores, in conjunction with re-profiling of the steep parts of the upstream face	Done
(iv)	Complete the restoration soils over the unrestored areas of the site to a minimum 300 mm depth and include a growth medium to establish suitable grass cover, [REDACTED]	Within 12 months
(v)	[REDACTED]	Done
(vi)	Provide a data logger in piezometer L4A to record water/leachate levels as advised in the stability assessment report and directed below, and provide survey monitoring points on completion of the restoration soils	Done
(vii)	[REDACTED]	Done
(viii)	[REDACTED]	Within 12 months
(ix)	Repair the polymer lining of the drainage channels where disrupted, or replace it with a suitable alternative, [REDACTED]	Done
(x)	Modify the flood studies to take account of the altered impounding height and related surface area and volume. [REDACTED]	Being done by others
(xi)	Next inspection 2 years after Final Certificate.	

APPENDIX B

Preliminary Failure Mode Assessment



APPENDIX C

Photographs



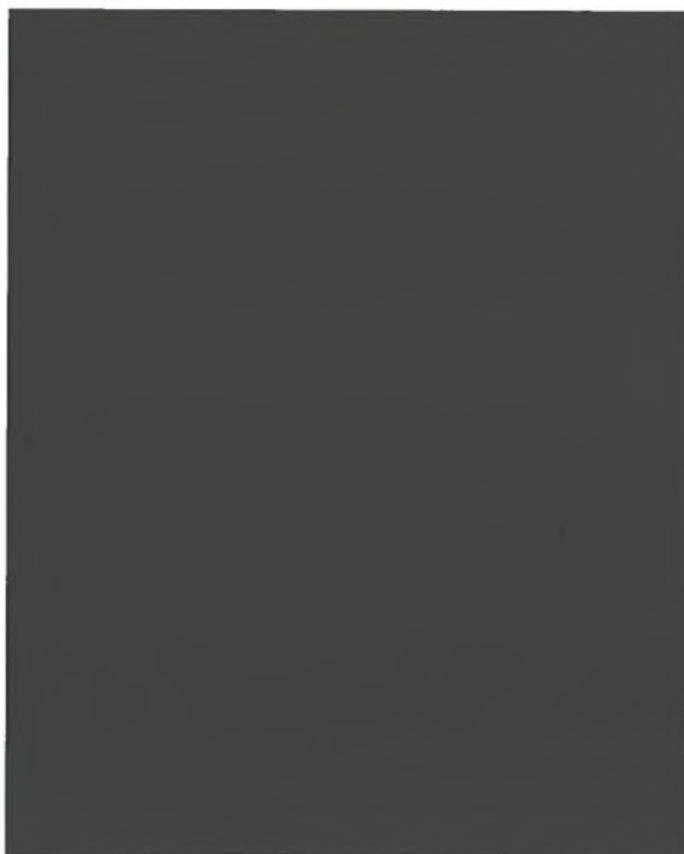
Basin



View towards dam



Basin





Basin



Basin



View back to road



Main road



Main road





General view







Downstream face



Downstream face



Property downstream



Basin/crest at right side



Basin



Basin

