

Poynton Lake
Report of the Result of a Periodic Inspection
under Section 10(5) of the Reservoirs Act 1975

On 20 May 2005

By [REDACTED] CEng, FICE, MCIWEM

August 2005

Halcrow Group Limited



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Contents Amendment Record

This report has been issued and amended as follows:

Issue	Revision	Description	Date	Signed
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**POYNTON LAKE
RESERVOIRS ACT 1975**
Report of the Result of an Inspection made under Section 10
PERIODICAL INSPECTION OF A LARGE RAISED RESERVOIR

1 Name and Situation of Reservoir

Poynton Lake is situated adjacent and to the east of the A523 at Poynton in the county of Cheshire at National Grid Reference SJ 923 845.

2 Name and Address of Engineer making the Report

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Halcrow Group Limited
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Telephone : ██████████
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3 Name of Panel of which the Engineer is a Member

All Reservoirs Panel (AR)

4 Name and Address of Undertakers

Macclesfield Borough Council
Stuart House
King Edward Street
Macclesfield
Cheshire
SK10 1DS

5 Date of Inspection

20 May 2005

6

Name and Address of Enforcement Authority

Environment Agency
Reservoir Safety
Manley House
Kestrel Way
Exeter
EX2 7LQ

7

Name and Address of Supervising Engineer

[REDACTED]
Halcrow Group Ltd
Deanway Technology Centre
Wilmslow
Handforth
Cheshire
SK9 3FB
Telephone [REDACTED]

8

Certificates, Reports and Previous Inspections and Other Items of Information available to the Engineer

- (a) Prescribed Form of Record for a large raised reservoir with respect of Poynton Lake.
- (b) Supervising Engineer's annual reports from 2003 and 2004 prepared by [REDACTED]
- (c) Previous Inspecting Engineers Reports under Section 10(2) of the Reservoirs Act dated 10 April 1996 by [REDACTED] and dated July 1985 by [REDACTED]
- (d) Water level and surveillance reports from routine visits.
- (e) Correspondence files relating to the reservoir.

General Description

9.1

Description of the Reservoir

The reservoir is an ornamental lake in the grounds of Poynton Park and is reported to have been built in about 1750. There is no information available on its construction or its maintenance prior to its coming into ownership of the Borough.

The reservoir has a surface area of approximately 6.8ha at a top water level of 90.711mAOD and an estimated value of 130,000m³.

9.2

Catchment

The reservoir has both a direct catchment and an indirect catchment. The direct catchment comprises an area of approximately 1.4km² of mostly rolling grassland with some urban development. The indirect catchment is estimated as 4.5km² and is connected to the reservoir by means of a culverted diversion of a stream which would otherwise by-pass the southern end of the lake. The capacity of the inlet culvert is restricted to a 225mm diameter pipe.

9.3

Embankment

The embankment is approximately 800m long and is orientated on a north-south axis. The reservoir has been formed on ground sloping gently to the west, with an embankment 2 to 3m high over most of its length forming the western rim of the reservoir. The maximum height of the embankment is some 7m across a narrow valley near the northern end of the reservoir. The A523 occupies a berm on the downstream face of the embankment. It is not known whether the berm formed part of the original construction along with the dam or whether it was constructed at a later date. There is a low masonry retaining wall at the upstream side of much of the road with a height of approximately 1.0m. In certain areas the masonry wall has been discontinued and the bank between the road and the main body of the dam is formed as a steepened slope of heights up to 2m.

The upstream slope of the embankment could not be determined and there are no record drawings. Inspection from the dam crest appears to indicate current slopes of about 1 in 4 (V to H) with silt deposits overlying the original fill. The upper part of the upstream face is not protected from erosion in a formal manner but tree roots do help to prevent erosion of the fill material. In areas where erosion of the upstream side of the crest has been occurring timber boards have been placed to provide a hard face and rock or other material filled behind.

The crest of the embankment varies considerable in width along its length. Typically the embankment crest comprises a nearly level area at approximately elevation 90.917mAOD, and has a width of about 10-12m but increases to as much as 20m at the southern end. There is a gravel footpath on the crest set back from the upstream edge by between 0.5 – 1m with a path width of about 2m. Downstream of the path the crest is grassed with extensive tree growth to the edge of the step (either retaining wall or steepened slope) to the upstream edge of the road. The road (including footpath) has a width of approximately 15m and occupies the full width of the berm.

The downstream face between the dam crest and the road on the berm is formed either as a vertical masonry retaining wall of height 1m or as a steepened bank of slope approximately 1 in 1.5 – 2.0 (V to H) with a maximum height of about 2m. The steepened slope is mostly grassed. The remainder of the downstream slope below the road berm is grassed and varies between 1 in 2.0 and 1 in 3.0 (V to H).

The level of the road along the berm is not constant and it varies with respect to the top water level of the reservoir between 0.3 and 1.0m below TWL.

9.4

Geology of the Dam

The reservoir is underlain by the Permo-Triassic Pemaian Mudstones.

9.5

Spillway

The spillway arrangement comprises a concrete intake structure with screens housing an overflow weir on the embankment. The length of the weirs is 4m and is formed in two sections with a central pier.

The two screens are hinged at the top to allow them to be opened up to provide clear access over the weir if necessary. Behind the weir the spillway drops into a chamber set with a floor level approximately 0.8m below sill level. The chamber in turn feeds to a 600mm diameter piped culvert with invert level set at chamber floor level. The 600mm dia pipe passes through the embankment to the downstream toe via two manholes with backdrops. One manhole is on the crest of the dam (close to the slope to the road) and the other is on the downstream side of the road. The flow remains in a 600mm dia buried culvert downstream of the dam and crosses a field to discharge into Poynton Brook approximately 250m from the toe of the embankment. There is a head wall at the discharge into the Brook.

9.6

Bottom Outlet

There is no known bottom outlet. Inspections have failed to find either an intake to a bottom outlet or an outlet point. If such a structure was originally constructed it is entirely possible that this has been discontinued many years ago and may have been covered over if the road berm was indeed constructed after the reservoir.

9.7

Inlets

Flows enter the reservoir from an indirect catchment at the southern end via a culverted diversion of a stream which bypasses the reservoir to the south. The flow from the indirect catchment is limited by the capacity of the 225m diameter pipe. The pipe discharges into an area of reeds at the southern end of the reservoir and there is no evidence of erosion.

9.8

Area Surrounding the Reservoir

The area around the reservoir comprises rolling grassland to the east and housing developments at the north and south ends of the reservoir. The slopes at the reservoir rim are generally very shallow and there is no evidence of erosion or instability. At the southern end the reservoir bank is reed covered and this is providing protection against erosion.

9.9

Access

The reservoir has excellent access directly from the A523. A car park at the northern end of the crest affords access along the crest and similarly the road along the southern end of the reservoir affords good access to the crest and the reservoir itself.

9.10

Valley Downstream of the Dam

In the event of failure of the embankment escaping water would tend to flow westward across the natural depressions and old ditchlines to enter Poynton Brook. The Brook flows in a northerly direction and passes some properties. The properties on the downstream side of the road on the berm would largely be unaffected by any breach water as it would tend to pass to the fields as they form the low points.

9.11

Method of Recording Water Levels

The water level in the reservoir is monitored during the routine surveillance visits and is measured relative to the elevation of the sill of the overflow structure which is taken as top water level.

Engineers Findings

10.1

General

The inspection was undertaken by the Inspecting Engineer on 20 May 2005 in the company of [REDACTED] (Supervising Engineer) and [REDACTED] of the Technical Services Department of the Borough of Macclesfield.

The weather at the time of the inspection was mostly dry but overcast with showers both before and after the inspection. The inspection followed a generally dry period. The ambient temperature was about 15°C.

At the time of the inspection the reservoir water level was approximately 50mm above top water level.

A selection of photographs taken during the inspection is included in Appendix A of this report.

10.2

Embankment Dam

The embankment dam appears to be in generally good condition. The upstream face is largely secure with some selected zones of erosion occurring (Photograph 1 & 2). The extensive tree roots are mostly preventing erosion of the bank and where erosion is occurring it is in the open areas. Where erosion has occurred timber boards have been set at the edges of the crest to prevent further erosion and the area behind backfilled. This ad hoc arrangement of repair as and when required appears to be working well.

The upstream slope of the embankment appears to be very shallow below water level but this may be partially due to siltation. The upstream face appeared secure and free from erosion or sink holes.

The crest of the embankment is protected by stone on the line of the footpath around the water's edge. This path is being well maintained and is free from settlement or other damage (Photograph 3 & 4). The crest is relatively extensive and a grassed area rises slightly downstream of the track on the crest. This grassed area is approximately 8-10m wide and is extensively covered in trees, some of which are relatively mature. There are also trees along the upstream edge of the crest. These are generally secure but some have been undercut and have fallen, or are in the process of failing, into the reservoir (Photograph 5, 6 & 7). It would be

prudent to monitor the condition of all of the trees on the crest and to cut these back as and when appropriate to avoid them falling.

The downstream face comprises a masonry retaining wall between the crest and the road to the east, the road constructed on a berm and a downstream slope below the road. The masonry wall is in generally serviceable condition with no evidence of significant movement or damage. In one area it is apparent that the wall is being disturbed and the joints are opening up. This is thought to be due to the effect of tree roots (Photograph 8 & 9).

The road along the berm is not level and appears to have been graded at some time in its life. In general the road appears free from settlement. The road is routinely monitored by the Highways Dept and it is anticipated that they would report any abnormalities. There is a low point on the upstream side of the road near the mid point of the dam and water ponds there when it has been raining. There was no evidence that this was having a detrimental effect on the dam.

The downstream face of the embankment below the roads is grassed and shows no evidence of slips, bulges or settlement (Photograph 10 & 11).

The road drainage appears to collect to a culvert which passes along side the pipe overflow from the reservoir and likewise discharges to the Poynton Brook. There was no evidence that this drainage system does not operate as intended.

10.3

Overflow

The concrete and brick overflow structure was found to be in good condition and free to discharge flood flows (Photograph 12). The steel screens on the upstream face of the overflow appeared to be collecting debris on the water and it was apparent that the screens are being routinely cleared. The drop chamber behind the sill was clear and free from obstruction and is working well to channel water to the 600mm drain culvert away from the dam.

The culvert appeared to be free to discharge and was operating as intended at the time of the inspection. The outfall structure on the culvert as it enters the Brook was found to be secure and was preventing erosion of the bank (Photograph 13). It was reported that the culvert was CCTV surveyed several years ago and that all joints were found to be tight and secure.

10.4

Outlet Works

The only outlet works to the reservoir is the spillway and there is no evidence of a pipe to allow drawing down of the reservoir below top water level.

10.5

Inlet Works

The reservoir receives water from an indirect catchment via a 225mm diameter pipe from a stream to the south of the reservoir. The pipe appeared clear and free to provide some limited inflow to the reservoir but due to its size would be incapable of carrying significant flows into the reservoir during a storm event. There is a risk that if out of bank flow occurred on the stream to the south some water may find its way to the reservoir by a surface route. It would be prudent to investigate this issue.

11 Conclusions

11.1 *Condition of Structures*

Generally the dam and spillway all appeared to be in satisfactory condition and are being adequately maintained. It would be prudent to carry out some minor maintenance works and these are listed in Section 12.3 below.

11.2 *Monitoring and Surveillance*

The crest level of the dam is surveyed periodically. It has been a while since the last survey and it would be prudent to do this again. It would be appropriate to seek to monitor the dam crest level every 5 years and to report the findings to the Supervising Engineer.

There is no seepage evident on the embankment nor any means of collecting and recording seepages. Given the fact that the dam is relatively modest in height with a significant section it would not appear necessary to monitor seepage flows other than for the Supervising Engineer to look out for wet spots during his annual inspection.

General surveillance visits are made to the reservoir and it is recommended that these be continued.

11.3 *Alterations or Additions*

There have been no alterations or additions to the reservoir since the previous inspection by an Inspecting Engineer.

11.4 *Surrounding Land*

There is no evidence of any movement of the land surrounding the reservoir or adjacent to the dam which might affect the stability of the reservoir.

11.5 *Reservoir Inflows, Spillways Capacity and Dam Freeboard*

It does not appear that a flood study has been undertaken for this reservoir. The Inspecting Engineer Reports of 1985 and 1995 do not make an assessment of the adequacy of the overflow arrangement. Previous Inspecting Engineers Reports do not give a reservoir categorisation.

It is determined that the Poynton Lake represents a Category B (minimum standard) reservoir with respect to the "Floods and Reservoir Safety: An Engineering Guide". This categorisation evaluates the potential effect of a dam

breach as endangering lives not in a community or resulting in extensive damage. Failure of Poynton Lake would be expected to pose a risk to the A523 and potentially to people using that road. The design flood inflow for a Category B dam where limited overtopping is acceptable is assessed as 0.3PMF or the 1,000 year flood.

The reservoir has been assessed using the rapid assessment method given in "Floods and Reservoir Safety : An Engineering Guide" 3rd Edition and the findings are summarised below:

0.3 PMF peak inflow	2.64	m ³ /s
0.3 PMF routed outflow	2.30	m ³ /s
Top Water Level	90.711	mAOD
Minimum Dam Crest Level	91.300	mAOD
Stillwater Flood Surcharge Level	91.196	mAOD
Wave Surcharge (minimum)	0.60	m
Wave Surcharge (Calculated)	0.21	m
Total Surcharge Level (Calc)	91.40	m
Freeboard to minimum crest level	-0.10	m

The assessment shows that a 0.3 PMF event would have a stillwater flood level about 100 mm below the minimum level of the dam crest. Because the dam crest slopes toward the reservoir this would mean that the footpath would be partially inundated. The higher ground behind the footpath would prevent significant overtopping. It is anticipated that any waves generated by winds during a flood event would cause limited wave overtop to the road but it is not anticipated that this would cause failure.

Given the significant width of the dam crest and shallow approach to the upstream face it is likely that any waves occurring during a flood event would dissipate in the shallow water on the upstream side of the crest, with only limited carry over.

Following such an event it may be necessary to do some repair works to the embankment and the road.

11.6

Discharge Outlets

There is no known outlet to the reservoir to allow it to be drained. In the event of an emergency it would be necessary to overpump the water. It would be possible to partially dewater the reservoir in an emergency by breaking out the front wall of

the overflow structure at the level of the culvert and allowing the water to drain through the lowered overflow sill. This would allow the reservoir water level to be dropped by about 0.6m.

11.7

Seismic Safety

The seismic safety of the reservoir has been assessed using the recommended criteria given in the 1991 BRE publication "An Engineering Guide to Seismic Risk to Dams in the UK" and the 1998 Application Note to the guide.

		Classification
Reservoir Capacity	130,000m	2
Water depth	7m	0
Evaluation Requirements	1-100	4
Potential Downstream Damage	Low	4
Total Classification Value		10
Dam Category		II
Return period for earthquake		3,000 year event
Level of Safety Evaluation		Eb

For a level of safety evaluation Eb, the guide recommends that particularly vulnerable features be assessed for seismic risk. In the case of Poynton Lake there are no features that would be considered at risk. There is a possibility that a tree may topple on the crest but this is unlikely to lead to failure of the embankment.

11.8

Prescribed Form of Record

The Prescribed Form of Record for Poynton Lake is kept by the Undertakers and maintained up to date. The following comments are made with respect to the Prescribed Form of Record.

- Part 3 - Update the Enforcement Authority to the Environment Agency. Update the current Inspecting Engineer and the Reports
- Part 7 - Section 3 in the box for water level for storage as top water level 90.917 metres.

Recommendations

12.1

Directions for Supervising Engineer

The Supervising Engineer should visit the reservoir at least once a year taking particular notice of matters listed below, which should be reported upon annually to the undertakers.

- (a) The condition of the upstream face of the embankment noting any erosion
- (b) The condition, line and level of the crest.
- (c) The condition of the trees along the crest.
- (d) The condition of the masonry retaining wall to the road.
- (e) The condition of the downstream slope.
- (f) The condition of the spillway overflow, the culvert and outfall structure.

In addition to the above the Supervising Engineer should make additional visits following any floods, which result in overtopping of the dam crest or seismic event in the vicinity of the reservoir. Reports of these additional visits should be attached to the Supervising Engineer's Statement to the Undertaker under Section 12(2) of the Act.

12.2

Regular Monitoring and Surveillance

The routine condition surveillance visits should be continued and the water level and condition of the screen (for blockage) noted.

Crest survey should be undertaken every five years and reported to the Supervising Engineer.

12.3

Maintenance Work

The following maintenance works is recommended:

- (a) Repair any areas of erosion along the upstream face.
- (b) Cut back any trees in danger of toppling.
- (c) Remove any trees which have fallen into the reservoir
- (d) Investigate the potential for out of bank flow from the Brook to the south of the reservoir to flow into the reservoir by an overland route rather than via the existing pipe.

12.4


Recommendations in the Interests of Safety

There are no recommendations made in the interests of safety.

12.5

Date of Next Inspection

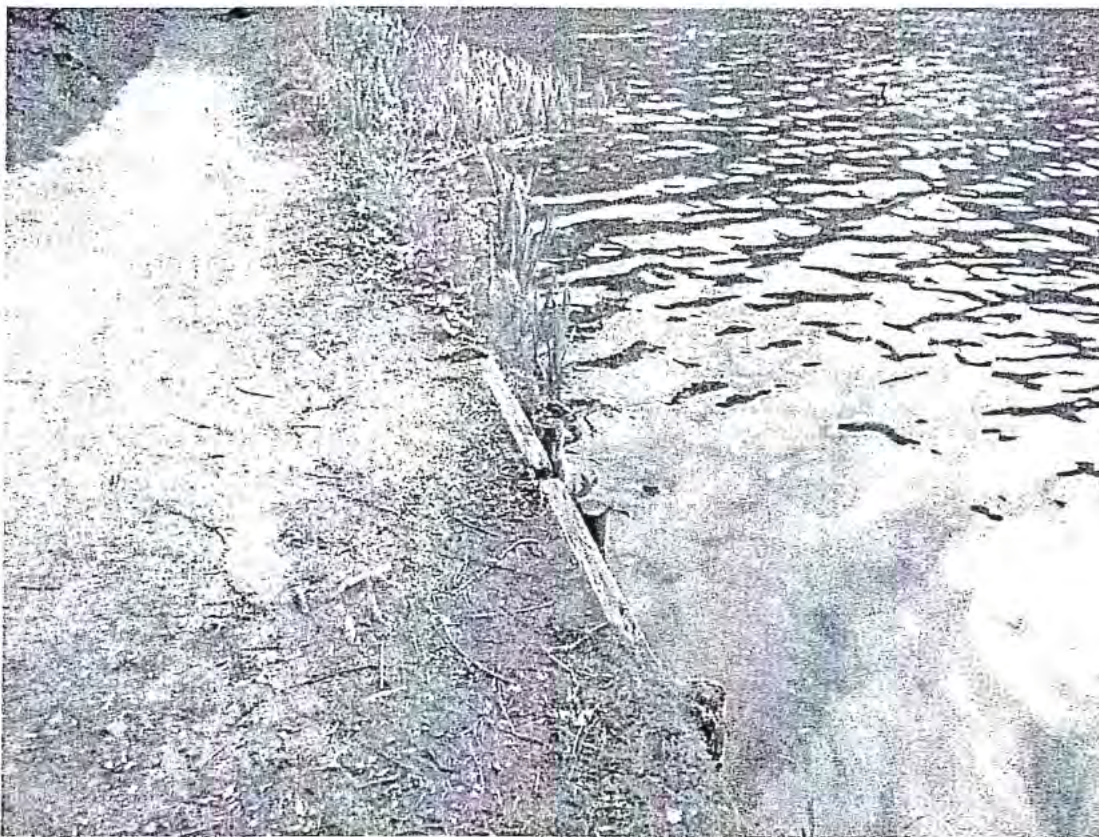
Subject to the requirements of the Supervising Engineer, the next Section 10 Periodic Inspection by an Engineer on Panel AR should be made within 10 years and no later than May 2015.


Inspecting Engineer

5 August 2005

Expiry date of 5 year panel appointment - 14 June 2009

APPENDIX A
PHOTOGRAPHS



Photograph 1 – Timber edging on upstream face



Photograph 2 – Timber edging and stone on upstream face



Photograph 3 – Dam crest



Photograph 4 – Dam crest



Photograph 5 – Leaning tree on dam crest



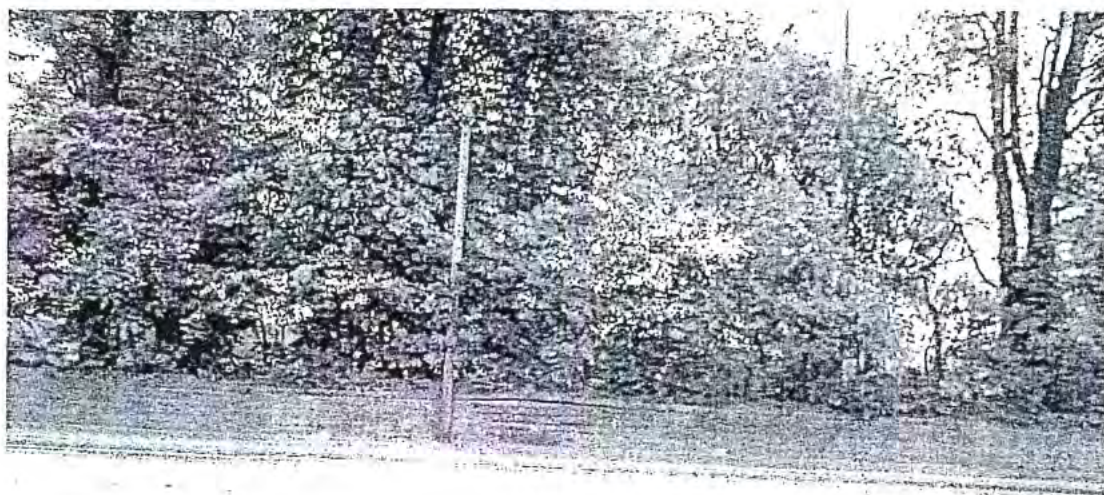
Photograph 6 – Trees on crest at waters edge



Photograph 7 – Fallen tree



Photograph 8 – Wall on downstream side of crest



Photograph 9 – Wall on downstream side of crest



Photograph 10 – Downstream slope



Photograph 13 – Line of overflow pipe to river at tree line



Photograph 11 – Downstream slope at highest point



Photograph 12 – Overflow spillway