Penny Anderson Associates Ltd
CONSULTANT ECOLOGISTS

CANAL & RIVER TRUST

REDBROOK RESERVOIR (NORTH)

BASELINE HABITAT AND PEAT DEPTH MAPPING REPORT

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Project Manager and Author
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This project has been undertaken in accordance with PAA policies and procedures on quality assurance.

Signed:__

Penny Anderson Associates Ltd
CONSULTANT ECOLOGISTS

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1. INTRODUCTION

Background

1.1 Canal & River Trust (CRT) are developing a proposal to undertake works on an area of land at Redbrook Reservoir, Marsden as compensation for the permanent loss of habitat associated with a proposed permanent access track to March Haigh Reservoir. The proposals at Redbrook Reservoir are to form an off-site compensation site in relation to Biodiversity Net Gain.

1.2 Initial discussion with CRT indicated the area had some potential for habitat restoration. Penny Anderson Associates Ltd (PAA) was commissioned by CRT to consider the suitability of Redbrook Reservoir (North) as a compensatory habitat site.

1.3 A baseline habitat survey was required to define more carefully where proposed restoration measures would be located and existing features that would need to be protected/avoided. In addition, a more detailed peat depth survey on a 30m grid was undertaken. This report provides the results of the survey work carried out by PAA in June 2023, along with recommendations for the compensatory habitat works.

The Site

1.4 The land at Redbrook Reservoir is owned and managed by CRT. It is located across the A62 Manchester Road, southwest of the town of Marsden, at grid reference NGR SE 025 099. The land of interest for the restoration scheme is the land north of the A62 within Kirklees District, referred to as Redbrook Reservoir (North) within this report and hereafter referred to as the 'Site'.

1.5 The Site is not within any designated areas[1] (for example, a SSSI[2], SAC[3] or SPA[4]), but is boarded by Standage Road Cutting SSSI to the southwest (along the A62) and the South Pennine Moors SSSI to the north and west. The Dark Peak SSSI is on land to the south and east of the A62 (within Peak District National Part Authority area). The South Pennine Moors SAC and the South Pennine Moors Phase 2 SPA overlaps with these three SSSI designations within this area. This information is presented in Appendix 1.

1.6 Within the Site itself (and, therefore, outside any designated land), the habitats mapped within MAGIC[1] (see Appendix 1) comprise two enclosed areas mapped as blanket bog (Priority Habitat) and grass moorland (non-Priority Habitat) in the north, with a small area of upland heath (Priority Habitat) mapped on the steeper slopes adjacent to the blanket bog. A small area of blanket bog (Priority Habitat) is also mapped within the southwest area of the Site. Other areas of the Site have no specific habitat mapped within MAGIC.

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[1] *Multi Agency Geographic Information for the Countryside, https://magic.defra.gov.uk/MagicMap.aspx (last accessed 19/06/2023)*

[2] *Site of Special Scientific Interest*

[3] *Special Area of Conservation*

[4] *Special Protection Area*

1.7 The Priority Habitats mapped for the wider area comprise the same range of moorland habitats along with areas of upland fens and flushes (Priority Habitat) and fragmented heath (non-Priority Habitat) on land to the east and south of the Site (within the Dark Peak SSSI).

1.8 Options considered as suitable enhancement proposals, following the desk review of available data on the Site, comprise:

- Purple moor-grass (*Molinia caerulea*)[5] diversification on deeper peat soils, and;
- Enhancement of spoil tip areas around former Engine House as acid grassland/heathland habitat.

1.9 The former Engine House (NGR SE 0253 1021) is a Grade II Listed Building, listed as Engine House, Engie Pit and Bye Pit, Red Brook (List Entry Number 1224052 – details provided in Appendix 2[6]). See also Figure 1, Building 1 (B1) for location.

1.10 Data provided by CRT (Heritage Advisor) indicates additional historic features are present as follows:

- Across the centre on an east-west access: Roman Road (MWY5127);
- Along the northwest boundary, features associated with the Standedge Tunnel (MWY3615, MWY4543) including a listed building represented on the map by the red triangle (1224052 Engine House, Engine Pit and Bye Pit), a tunnel shaft (MWY8980), and the site of construction workers cottages (MWY8978);
- At the south, the reservoir (MWY4536) itself along with its associated water management features, including leats radiating to the east and to the north; and
- To the southeast; Mesolithic settlements at Warcock Hill (MWY2051).

1.11 The area is not Registered Common Land but is Open Access land under the Countryside and Rights of Way Act 2000 (as amended)[7]. No Public Rights of Way cross the survey area[8], but the land has several informal but well-used tracks leading up to and around the Engine House and linking to an adjacent footpath along Thieves Clough that links back down to the A62, providing a circular route around the Site.

1.12 The above information has fed into the selection of the recommended areas and methods or habitat enhancement.

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[5] *Botanical species names follow Stace (2019)*

[6] *Obtained from https://historicengland.org.uk/listing/the-list/list-entry/1224052 (last accessed 19/06/2023)*

[7] *https://magic.defra.gov.uk/MagicMap.aspx*

[8] *https://www.kirklees.gov.uk/beta/countryside-parks-and-open-spaces/Search-for-public-rights-of-way.aspx (last accessed 20/06/2023)*

2. METHODOLOGY

2.1 The area of Redbrook Reservoir (North) considered for restoration works includes the land north and west of the A62 within CRT ownership (Figure 1). This amounts to approximately 7.9846ha of moorland habitat that has no statutory nature conservation designated status, such as SSSI, however, there area has a number of historic features and a listed building - the former Engine House (see Figure 1 - Building 1 and Appendix 2).

2.2 The habitat survey was completed on 12th June 2023 and the peat depth mapping on 15th June 2023. The habitat mapping results were used to inform the extent of the peat depth mapping survey, with areas considered unsuitable for restoration either due to a lack of peat soils and/or steep slopes being omitted. Illustrative photographs are presented in Appendix 3.

Vegetation Survey

2.3 The entire area was subject to a walkover and the main habitat types were mapped on a suitably scaled base map. Areas suitable for the selected habitat enhancement approach (purple moor-grass diversification) were identified and general descriptive notes and photographs taken to record the key characteristics of the habitat types.

2.4 Within any area suitable for habitat enhancement, a plant species list was collected, and the relative abundance of the plants noted using the DAFOR[9] scale. In addition, a series of 2m x 2m quadrats were taken. Both datasets were collected using a 'W'-walk across the habitat.

2.5 Within each quadrat, all vascular plants and mosses were recorded with an estimate of the percentage cover for each species. The mosses were generally recorded to species level, any leafy liverworts were not identified separately. The overall percentage vegetation cover can vary considerably from quadrat to quadrat depending on the complexity of the vegetation layers. Any bare ground or standing open water was also recorded.

2.6 Vegetation height was measured at the four corners of the quadrat (using blade height, not following stems) and an average height calculated for each quadrat. The growth phase of heather (*Calluna vulgaris*) (Gimingham 1972) was recorded when it occurred in a quadrat.

2.7 In addition to the vegetation data, additional peat depth data was recorded at the centre point of each quadrat.

Peat Depth Survey

2.8 A peat depth survey was undertaken using a predesigned 30m grid exported to QField software, and uploaded onto mobile tablets, along with Ordnance Survey base mapping and aerial photography. The surveyors worked methodically across the moorland, locating the survey points (*c.*3 to 5m accuracy) and recording the data.

2.9 Measurements were made using purpose-made, extendible calibrated peat depth probes. The probes used were extendable to 3m in length. The probe was inserted into the peat with pressure applied until the basal material is struck by the probe. At this point, the depth was generally measured from the probe to the nearest 1cm.

2.10 Occasionally, if additional points were thought to be useful or a predesignated point was considered atypical, additional points were recorded.

[9] *D = dominant, A = abundant, F = frequent, O = occasional, R = rare*

2.11 As well as the peat depth, the presence of key plant indicators was recorded in a similar manner to the earlier, broader survey undertaken by the National Trust's Volunteer Survey Group (VSG). The following species were recorded when they occurred in a 2m x 2m square at each sample point.

- Hare's-tail cottongrass (*Eriophorum vaginatum*);
- Common cottongrass (*Eriophorum angustifolium*);
- Heather; and
- *Sphagnum* moss.

2.12 The peat depth point measurements were used to generate a model of peat depth across the Site using an advanced statistical method in which values are interpolated using distance weighting, with the weighting dependent on the best fitted statistical model for the dataset.

Survey Personnel

2.13 The habitat assessment was completed by Sarah Ross MCIEEM[10], CEnv[11], and peat depth surveys were completed by Beth Howes and Alex Bull. All surveyors are experienced upland moorland Ecologists.

Survey Constraints

2.14 No significant constraints were encountered during the survey.

[10] *Full member of the Chartered Institute of Ecology and Environmental Management (CIEEM)*

[11] *Chartered Environmentalist*

3. RESULTS

Habitat Survey

3.1 Six key habitat areas were identified across the survey area (Figure 1) as follows:

- Area 1 - flatter area of purple moor-grass-dominated habitat readily accessible from adjacent access tracks. Purple moor-grass is 90% dominant across the area with few other plant species present (see Table 1 for plant species list). The habitat is likely to have developed over peat of variable thickness depending on underlying topography. There are two artificial moorland drains crossing the area that appear unmanaged and are now largely re-vegetated, although they are likely to still drain water from the Site under period of wet weather/high rainfall. Boundary walls (defunct) are present and the area as likely formerly enclosed. Identified as suitable for enhancement using purple moor-grass diversification techniques and possible ditch blocking;
- Area 2 – mixed acid grassland with creeping thistle (*Cirsum arvense*), bracken (*Pteridium aquilinum*) and soft-rush (*Juncus effusus*) on probable shallow peats with eastern edges likely disturbed from former road construction. Habitats have, therefore, developed over uneven terrain but still a relatively flat area. Possibly formerly enclosed land. Identified as having some suitability for vegetation diversification but limited by the difficult access and steep slopes on some areas;
- Area 3 – mixed acid grassland including wetter lower lying areas with soft-rush and purple moor-grass plus localised dense bracken patches. This area follows along the line of the Red Brook stream valley, resulting in ground that is sloping with dips and hummocks making access for machinery problematic, along with risk of unintended pollution if working close to the watercourse. Area overlaps with historic feature Roman Road (MWY5127) and other local features on historic interest. Mosaic of habitats has intrinsic value. Unsuitable as a habitat enhancement/compensation area;
- Area 4 – area of acid grassland developed over thin peat and mineral soils. Vegetation is dominated by a mix of creeping bent (*Agrostis stolonifera*), tufted hair-grass (*Deschampsia caespitosa*), soft-rush and Yorkshire-fog (*Holcus lanatus*). A plant species list is presented in Table 1. The area is likely a formerly enclosed inbye land for grazing. Area overlaps with historic feature Roman Road (MWY5127). Unsuitable for acid grassland diversification due to difficult ground access and small size of any accessible areas, plus historic feature interest;
- Area 5 – variable habitat, largely comprising steeper heather and bilberry[12]-dominated slopes with some purple moor-grass leading down to the Red Brook stream valley. Dry acid grassland, rocky outcrops and bracken are also present in this area. Area has some intrinsic habitat value and overlaps with features of historic value, rendering it unsuitable as a habitat enhancement/compensation area;
- Area 6 – flatter area of purple moor-grass-dominated habitat readily accessible from adjacent access tracks. Purple moor-grass is 90% dominant across the area with few other plant species present (see Table 1 for plant species list). The habitat likely to have developed over peat of variable thickness depending on underlying topography. The

[12] *Vaccinium myrtillus*

area is accessible from adjacent tracks. Identified as suitable for enhancement using purple moor-grass diversification techniques;

- Area 7 – spoil areas with steep slopes and friable ground, dominated by bare ground with sparse acid grassland species such as fescue (*Vulpia* sp.) and wavy hair-grass (*Avenella flexuosa*) and including small amounts of heath bedstraw (*Galium saxatile*) and heather. On the flatter tops the habitat has less grass coverage and become more dominated by bare ground and skeletal soils, with lichens, mosses, broad buckler fern (*Dryopteris* sp.), foxglove (*Digitalis purpurea*) and cat's-ear (*Hypochaeris radicata*) becoming occasional to locally frequent (see Table 1). The area has intrinsic habitat value, unstable ground condition with steep slopes and overlaps with features of historic value including the setting of the Grade II listed Engine House. It is, therefore, unsuitable as a habitat enhancement/compensation area, and;
- Area 8 – acid grassland immediately surrounding former Engine House Grade II listed building (Building 1). Unsuitable as a habitat enhancement/compensation area due to the proximity to Grade II listed building.

3.2 Eurasian skylark[13] (*Alauda arvensis*), curlew (*Numenius arquata*) and meadow pipit (*Anthus pratensis*) were all observed in the local area in small numbers (one or two individuals).

3.3 Areas 1 and 6 (total 2.0108ha) were, therefore, assessed in greater detail, including collecting ten 2m x 2m quadrats across the areas to provide a baseline vegetation dataset. The quadrat locations are presented on Figure 1 and data are presented in Table 2 (below).

Table 2 Plant Species Percent Cover Recorded in Areas 1 (Q1 to Q5) and Area 6 (Q6 to Q10)

Species Common Name	Species Scientific Name	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10
Vascular Plants											
Common bent	*Agrostis capillaris*								+		
Hare's-tail cottongrass	*Eriophorum vaginatum*			1							
Purple moor-grass	*Molinia caerulea*	90	90	90	90	90	90	90	80	90	90
Mosses and Liverworts											
Common feather-moss	*Kindbergia praelonga*				+				+	+	1
Heath plait-moss	*Hypnum jutlandicum*		8	5	8	4	1		1	3	6
Springy turf-moss	*Rhytidiadelphus squarrosus*		1								
Environmental Attributes											
Peat depth (cm)		38	83	89	>100	>100	79	>100	>100	64	55
Vegetation height (cm)		40.5	44.5	39.5	31.3	37	43	45.8	49.5	41	48.8
Litter (% cover)		10	20	20	25	20	40	50	30	30	30

[13] *The names of bird species noted during survey follow British Ornithologists' Union, 2017*

3.4 Across all ten quadrats, there is consistent purple moor-grass cover of 90% with on average a 3.6% cover of heath plait-moss and <1% cover of other species recorded. Litter was on average at 27.5% cover and generally formed a dense layer between low grass tussocks with any moss found beneath.

3.5 These results confirm the areas as being very species-poor, with the number of plant species per quadrat ranging from one to four, with an average of 2.5 species. Peat depth was on average calculated as 72.9cm deep across the dataset, somewhat deeper than the minimum depth of 40cm typically defined as blanket bog.

3.6 All other areas within the survey boundary were considered unsuitable for the proposed enhancement measures.

Peat Depth Survey

3.7 The peat depth data collected across the 30m sample grid have been used to create a peat depth map for the Site, including the habitats over peat identified for compensatory habitat enhancement works. The steeply sloping non-peat areas of the spoil heaps and along the edge of the A62 have been omitted from the survey. The peat depth measurements are shown in Figure 2a and the model output in Figure 2b.

3.8 Records of the four key species recorded at each peat depth point were very scarce, with hare's-tail cotton grass being recorded at two locations within habitat Area 1, common cottongrass at a single location in Area 4 and heather also only at a single location within Area 6. *Sphagnum* was not recorded on Site during the survey.

3.9 The peat depth is variable across the survey area with the majority of the peat depth samples being within the flatter areas (habitat Areas 1, 2 and 6) or along the valley bottom (Area 3). The most extensive areas of the deeper peats (100cm or deeper) occur on habitat Area 1 to the north of the survey Site. Some points recorded >200cm depths, indicating very deep peat deposits in localised areas. These areas supported occasional hare's-tail cotton grass.

3.10 Using the peat depth mapping data, the minimum peat depth recorded was 1cm and the maximum was 340cm, with the average across the entire dataset being 71cm.

3.11 No peat cores were taken as part of this work, however, the topography and habitat of Areas 1, 2 and 6 was consistent with blanket peat formation as opposed to fen peat formation associated with flushes or springs. Peat deposits within Area 3, along the stream, may be more typical of valley fen peat typically associated with watercourses. Areas 2 and 3 is not targeted for any restoration/enhancement measures.

4. DISCUSSION

Overview

4.1 The almost complete dominance of purple moor-grass over the northern and southern areas of the survey area (Areas 1 and 6 = 2.01ha) results in a low ecological value of this land. Both areas are considered suitable for enhancement towards a habitat with greater blanket bog characteristics in terms of plant species diversity.

4.2 Areas 2 to 5 are not recommended to be taken forward to enhancement as they are unsuitable for any significant areas of habitat restoration due to factors such as landform/access difficulty, non-peat substrates and/or habitats that have intrinsic value (such as heather/grass mosaics or watercourses). Some historic features also cross these areas, such as the route of a former Roman Road.

4.3 Areas 7 and 8 are on former spoil areas and associated with the Engine House Grade II Listed Building and other historic features such as Standedge Tunnel. These areas have steep slopes and unstable skeletal soils which provide suitable substrate for development of a sparse flora with a range of lichens and mosses. As such, these areas are considered unsuitable for habitat enhancement/creation proposals.

4.4 The purple moor-grass across Areas 1 and 6 creates a dense shade cover, both on the tussocks and in the space between them, resulting in a very poor vascular plant and bryophyte flora. This, in turn, reduces the value of the area for birds and other fauna. A build-up of litter typical on these vegetation types is also prone to spring and summer fires during periods of dry weather, which can damage both vegetation and peat deposits and encourage further dominance of purple moor-grass, as this species is able to survive fires and regrow rapidly afterwards. The purple moor-grass is, therefore, creating a monoculture of low-value vegetation on a peat substrate which could support a higher value habitat. All of Areas 1 and 6 within CRT ownership are considered suitable for enhancement measures.

4.5 The purple moor-grass is tussocky and dense which can be a significant deterrent to stock grazing, particularly sheep. Purple moor-grass is a palatable and nutritious grass in the spring, as the new shoots appear, but is often ignored by grazing stock when there is other vegetation available and more easily accessible. This means that grazing regimes alone are typically not enough to reduce the dominance of this species and additional restoration/enhancement measures are necessary.

4.6 The proposal is that Areas 1 and 6 will be subject to restoration measures to decrease the dominance of grasses and increase the floristic biodiversity of the Site. Tracks and informal paths will be unaffected by the proposals, as will areas of known archaeological and historic interest. Areas of peat will not be significantly disturbed under the enhancement proposals (with vegetation only being removed in a suitably managed way) therefore there is unlikely to be a need for any historic feature review beyond that contained within this report. The land is within the ownership and management control of CRT.

4.7 Restoration and enhancement options are outlined below.

Gully/Channel Blocking

4.8 There are two artificial drains (grips) on Area 1. These are already well-vegetated and do not appear to be maintained but are likely to still increase water flow off localised areas under prolonged wet conditions of periods of heavy rainfall. Installing some low-level timber dams or plastic piling at suitable points along these drains may be appropriate to help hold more water on the Site for longer. One drain is along the boundary with the adjacent landholding and agreement with the neighbouring landowner/manager may be required.

Reduction in Grass Dominance

4.9 The aim of any restoration works on Site is to reduce the abundance and dominance of purple moor-grass (Areas 1 and 6) and other grasses such as tufted hair-grass (Area 2) and create a more diverse moorland habitat.

4.10 The restoration proposal has a three-point plan:

1. Reduce the grass tussocks by flailing/cutting to decrease vigour;
2. Alter the grazing regime to utilise cattle, if possible, or increase the sheep stocking density on this area of the moor; and
3. Add additional moorland plant species to the area.

Reduction of Tussocks

4.11 The areas selected for enhancement will be flailed to decrease the vigour of the grass tussocks. The most effective way to achieve this is likely to be using a machine-mounted flail set at a height of approximately 20 to 15cm above ground level. This will cut the top off the majority of tussocks, immediately reducing their vigour. The type of flail and machine would be a decision made by a contractor or CRT. The Site is uneven with slopes and as such could present challenges for the use of some machinery.

4.12 Any vehicle brought onto the moorland should be fitted with suitable, low ground pressure tyres, to prevent damage to, and compaction of, the peat and vegetation. The access route to the different areas will be agreed prior to the works to minimise the potential damage to the peat.

4.13 The timing of the cut/flailing should be late summer/autumn (August to October) to avoid disturbance to nesting birds and disruption to other species which might utilise those areas. The flailed material can be left on the Site, as it rapidly breaks down and disperses naturally. It is recommended that flailing takes place in two consecutive years, with the height of cutting machinery lowered in the second year if practicable.

Grazing Regime

4.14 Cattle are the preferred grazing animal for managing purple moor-grass growth as they are less selective grazers and, therefore, take more of the coarse grass available, and their additional weight also helps disrupt/destroy the tussocks. Spring cattle grazing can be most effective at reducing purple moor-grass dominance and encouraging greater diversity. Cattle grazing may not be possible on this Site, however, due to the need to protect drinking water supplies.

4.15 Sheep grazing may also have the desired effect but, to achieve the required reduction in purple moor-grass dominance/abundance, a higher density of sheep than is currently in place would be required within the restoration area, at least initially, to check re-growth. This may prove difficult and/or time consuming to achieve. By cutting the tussocks the area will be more accessible for the existing stock. If they can be encouraged into this area by the placement of licks/supplements (if allowed in the existing stock agreement) that can have the effect of higher localised stocking levels and would have more impact on the grass regrowth.

4.16 Grazing is vital to sustain any reduction in the vigour of the purple moor-grass achieved by the flailing. The grazing of the moor is a matter for CRT to address with the existing agreements/stock in place or to negotiate an alternative regime.

Sward Diversification

4.17 The baseline data demonstrates a very limited range of species in the areas targeted for restoration, with an average of only 2.5 species per quadrat across the dataset.

4.18 Heather seed is relatively cheap and abundant and should be added to the Site rather than heather plug plants to reduce costs. Scattering heather brash, which may be able to be obtained from adjacent moorland (when creating fire breaks etc), would also be beneficial. Bilberry is present on the wider Site, and it is expected that this will be spread slowly, but naturally, by birds rather than necessitating adding plugs.

4.19 Planting plug plants of cross-leaved heath (*Erica tetralix*), crowberry (*Empetrum nigrum*) and occasional cowberry (*Vaccinium vitis-idaea*) would significantly diversify the dwarf shrubs on Site. Seed introduction would also be possible, but the overall success rate is likely to be lower for these species.

4.20 Hare's-tail cottongrass occurs at low abundance in very localised areas. Additional plug plants should be added, expanding these patches. It would be beneficial if tussocks of this species are avoided in any cutting/flailing regime (although they can recover from cutting, albeit slowly).

4.21 *Sphagnum* plug planting is recommended, targeted on the deepest peat that are more likely to retain moisture for longer and, therefore, be capable of supporting *Sphagnum* once re-introduced. No *Sphagnum* was recorded on the Site during the baseline assessments. It is unlikely that any propagules that might arrive naturally from adjacent land would establish through the dominant purple moor-grass vegetation.

4.22 It is recommended that the plug planting is not undertaken on a grid basis, rather in an appropriate microhabitat on Site, on a microtopographic scale, i.e. *Sphagnum*, cross-leaved heath and hare's-tail cottongrass on the wetter areas and crowberry and cowberry on the drier areas. Any plug plants should be obtained from a well-established provider, use locally native material and be suitably hardened before being planted out.

5. REFERENCE

Stace, C., 2019. *New Flora of the British Isles. Fourth Edition*. C & M Floristics.

6. ABBREVIATIONS

CEnv Chartered Environmentalist

CIEEM Chartered Institute of Ecology and Environmental Management

CRT Canal and River Trust

MAGIC Multi Agency Geographic Information for the Countryside

PAA Penny Anderson Associates

SAC Special Area(s) of Conservation

SPA Special Protection Area(s)

SSSI Site(s) of Special Scientific Interest

VSG Volunteer Survey Group

TABLE

Table 1 - Plant Species Recorded for Selected Habitats, Redbrook Reservoir (North)

Common Name	Scientific Name	Degraded Blanket Bog (Areas 1 and 6)	Sparsely Vegetated Spoil (Area 7)	Acid Grassland (Area 4)
Herbs, Grasses and Ferns				
Bilberry	*Vaccinium myrtillus*		R	
Bracken	*Pteridium aquilinum*	LF		
Broad buckler-fern	*Dryopteris dilatata*	R		
Buckler-fern species	*Dryopteris* sp.		O	
Cat's ear	*Hypochaeris radicata*		F	F
Common bent	*Agrostis capillaris*	R		F
Common nettle	*Urtica dioica*	R		
Common sedge	*Carex nigra*	R		
Common sorrel	*Rumex acetosa*			R
Creeping thistle	*Cirsium arvense*	R		R
Foxglove	*Digitalis purpurea*		O	
Hare's-tail cottongrass	*Eriophorum vaginatum*	O		
Heath bedstraw	*Galium saxatile*	R	O	F
Heath rush	*Juncus squarrosus*	O		
Heather	*Calluna vulgaris*		R	
Male-fern	*Dryopteris filix-mas*	O		
Marsh cinquefoil	*Comarum palustre*	D		
Sheep's-fescue	*Festuca ovina*	R	A	O-F
Soft-rush	*Juncus effusus*	O		LF
Spear thistle	*Cirsium vulgare*	R		
Tufted hair-grass	*Deschampsia caespitosa*			F-LA
Wavy hair-grass	*Avenella flexuosa*	R	F-LA	
Yorkshire-fog	*Holcus lanatus*	R		D
Mosses				
Common feather-moss	*Kindbergia praelonga*	R		
Common haircap	*Polytrichum commune*	R		
Heath plait-moss	*Hypnum jutlandicum*	O-F		
Heath starmoss	*Campylopus introflexus*		O	
Neat feather-moss	*Pseudoscleropodium purum*	R		
Campylopus flexuosus	*Rusty swan-neck moss*	R		
Springy turf-moss	*Rhytidiadelphus squarrosus*		O-LF	F

KEY

D-Dominant, A-Abundant, F-Frequent, O-Occasional, R-Rare, L-Locally

FIGURES

402400 402500 402600 402700 402800 402900

410300 410200 410100 410000

A62

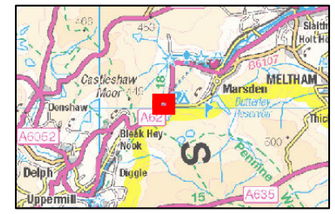
MANCHESTER ROAD

Building B1

Gilberts

ddersfield

row Canal



Legend

- Habitat survey area
- Habitat areas (1-8)
- Quadrat locations
- Track/footpath

British National Grid
Projection: Transverse Mercator
False Easting: 400000.000000
False Northing: -100000.000000
Central Meridian: -2.000000
Scale Factor: 0.999601
Latitude Of Origin: 49.000000

ISO A3

N

0 10 20 40 60 Metres

Canal & River Trust
Making life better by water

Penny Anderson Associates Ltd
Consultant Ecologists

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Parklea, 60 Park Road,
Buxton, Derbyshire, SK17 6SN.
Telephone 01298 27086

Project Name: March Haigh Reservoir

Discipline: Ecology

Title:

Redbrook Reservoir Habitat Areas

Scale	1:1,800	Drawing No.	Figure 1
Drawn By	CC	Originator: SRS	Date: 19/06/2023
Grid Ref.	402,609 410,153	Revision	1.0

G:\CART02_March_Haigh\Maps\CART02_4_CompensationRedbrook_Habitats\Figure 1 - Habitat Areas Redbrook Reservoir - CART02-4 CC 230619.mxd

402400 402500 402600 402700 402800 402900

410300 410200 410100 410000

1 2 3 4 5 6 7 8

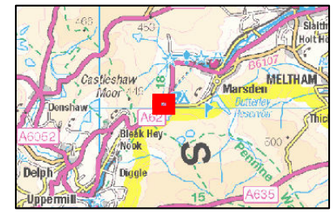
Building B1

A62 MANCHESTER ROAD A62

Gilberts

ddersfield

rrow Canal



Legend

- Habitat survey area
- Habitat areas (1-8)

Measured Peat Depth

- <5cm
- 5 - 9cm
- 10 - 19cm
- 20 - 39cm
- 40 - 59cm
- 60 - 99cm
- 100 - 149cm
- 150 - 199cm
- 200 - 299cm
- 300 - 399cm
- Track/footpath

British National Grid
Projection: Transverse Mercator
False Easting: 400000.000000
False Northing: -100000.000000
Central Meridian: -2.000000
Scale Factor: 0.999601
Latitude Of Origin: 49.000000

N

ISO A3

Metres

0 10 20 40 60

Canal & River Trust
Making life better by water

Penny Anderson Associates Ltd
Consultant Ecologists

Penny Anderson Associates Ltd,
Parklea, 60 Park Road,
Buxton, Derbyshire, SK17 6SN.
Telephone 01298 27086

Project Name: March Haigh Reservoir

Discipline: Ecology

Title:

Redbrook Reservoir Peat Depth Survey Results

Scale	1:1,800	Drawing No.	Figure 2a
Drawn By	CC	Originator	SRS
Date	19/06/2023		
Grid Ref.	402,609 410,153	Revision	1.0

G:\CART02_March_Haigh\Maps\CART02_4_Compensation\Redbrook_Habitats\Figure 2a - Redbrook Peat Depth - CART02-4 CC 230619.mxd

402400 402500 402600 402700 402800 402900

410300 410200 410100 410000

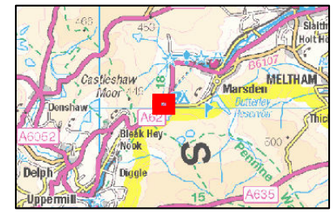
1 1 2 8 Building B1 4 7 3 5 6 6 5

A62 MANCHESTER ROAD A62

Gilberts

ddersfie

row Ca



Legend

- Habitat survey area
- Habitat areas (1-8)
- Track/footpath

rb_pdm_1c

Interpolated Peat Depth

- <5cm
- 5 - 9.9cm
- 10 - 19.9cm
- 20 - 39.9cm
- 40 - 59.9cm
- 60 - 99.9cm
- 100 - 149.9cm
- 150 - 199.9cm
- 200 - 299.9cm
- >300cm
- \+ Peat depth survey point

N

British National Grid
Projection: Transverse Mercator
False Easting: 400000.000000
False Northing: -100000.000000
Central Meridian: -2.000000
Scale Factor: 0.999601
Latitude Of Origin: 49.000000

ISO A3

Metres

0 10 20 40 60

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Telephone 01298 27086

Project Name: March Haigh Reservoir

Discipline: Ecology

Title:

Redbrook Reservoir Peat Depth Model

Scale	1:1,800	Drawing No.	Figure 2b
Drawn By	CC	Originator	SRS	Date	19/06/2023
Grid Ref.	402,609 410,153	Revision	1.0

G:\CART02_March_Haigh\Maps\CART02_4_Compensation\Redbrook_Habitats\Figure 2b - Redbrook Peat Depth Model - CART02-4 CC 230619.mxd

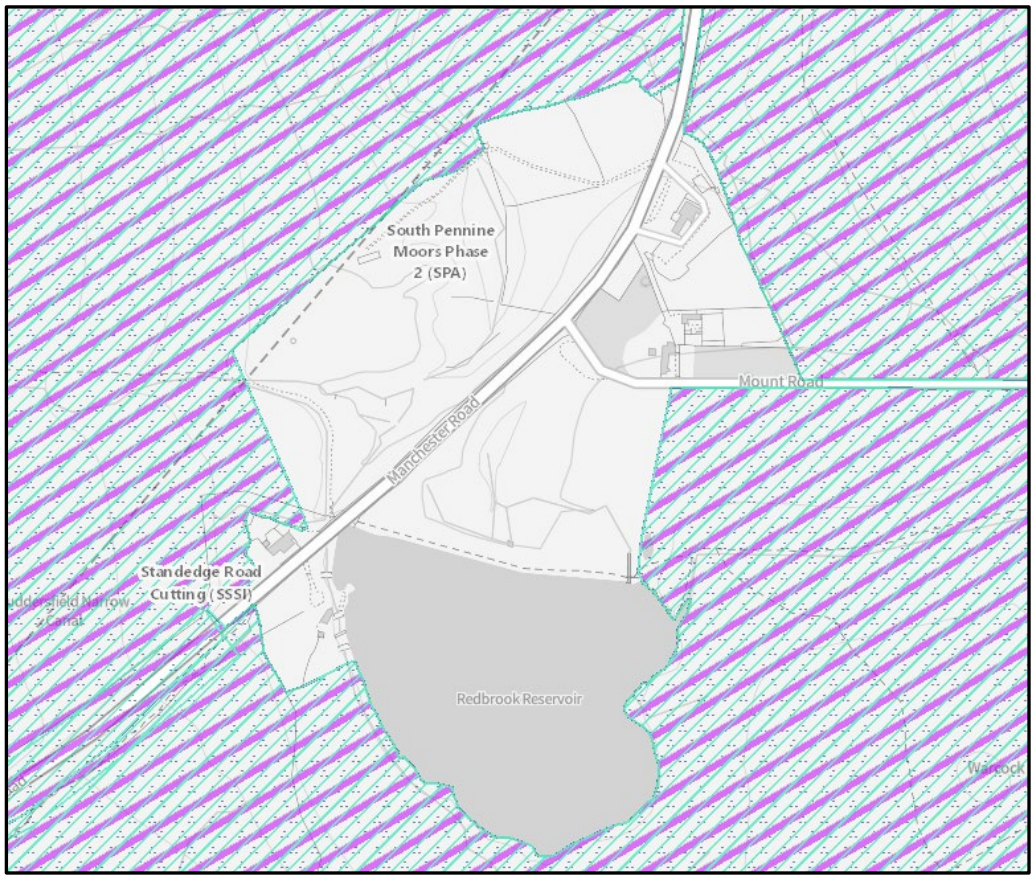
APPENDICES

APPENDIX 1

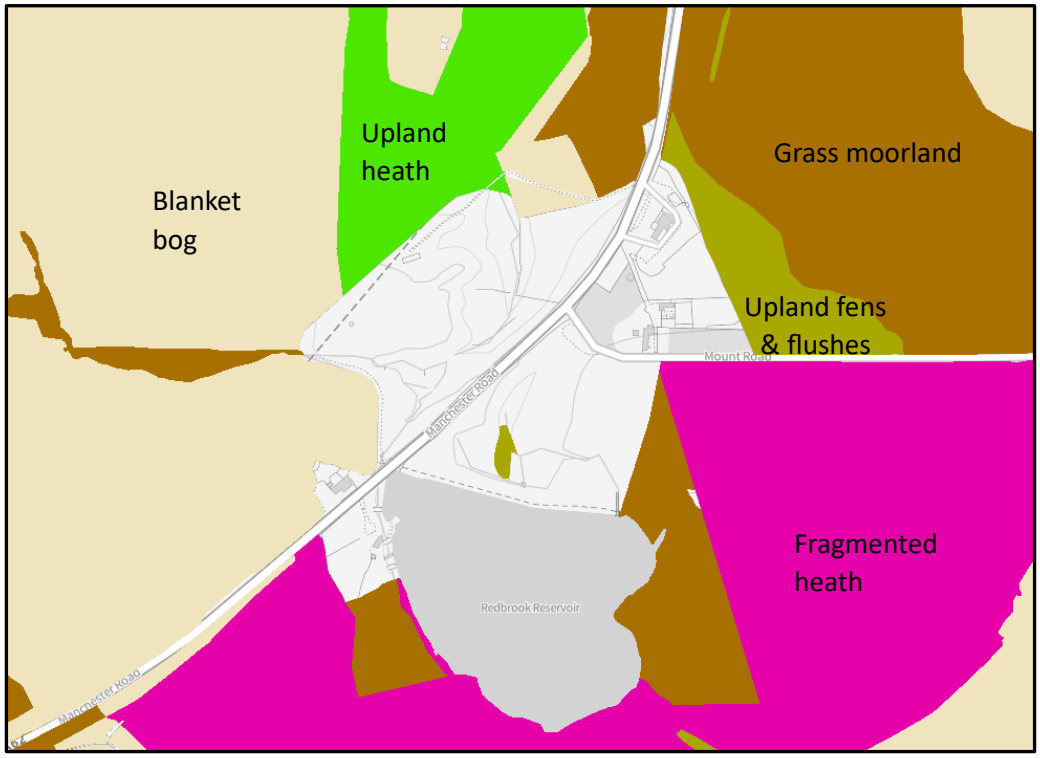
MAGIC Search Results for Redbrook Reservoir (North)

Appendix 1 MAGIC Search Results for Redbrook Reservoir (North)

1. Nature Conservation Designations



2. Habitat Types



APPENDIX 2

Engine House, Engine Pit And Bye Pit, Red Brook
Official List Entry

ENGINE HOUSE, ENGINE PIT AND BYE PIT, RED BROOK

Official list entry

Heritage Category: **Listed Building**

Grade: **II**

List Entry Number: **1224052**

Date first listed: **11-Jul-1985**

List Entry Name: **ENGINE HOUSE, ENGINE PIT AND BYE PIT, RED BROOK**

Statutory Address 1: **ENGINE HOUSE, ENGINE PIT AND BYE PIT, RED BROOK, STANEDGE**

This List entry helps identify the building designated at this address for its special architectural or historic interest.

Unless the List entry states otherwise, it includes both the structure itself and any object or structure fixed to it (whether inside or outside) as well as any object or structure within the curtilage of the building.

For these purposes, to be included within the curtilage of the building, the object or structure must have formed part of the land since before 1st July 1948.

Understanding list entries *(https://historicengland.org.uk/listing/the-list/understanding-list-entries/)*

Corrections and minor amendments *(https://historicengland.org.uk/listing/the-list/minor-amendments/)*

Location

Statutory Address: **ENGINE HOUSE, ENGINE PIT AND BYE PIT, RED BROOK, STANEDGE**

The building or site itself may lie within the boundary of more than one authority.

District: **Kirklees (Metropolitan Authority)**

Parish: **Non Civil Parish**

National Grid Reference: **SE 02525 10207**

Details

SE 0251 02 STANDEDGE Marsden 4/454 Engine House, Engine Pit - and Bye Pit, Red Brook

- II

Between 1798 and 1811. Engineer: Benjamin Outram (1764-1805). Engine house containing 2 pits. Deeply coursed rubble. Roof removed. Situated at roughly centre point of Standedge canal tunnel. South elevation: Ground floor: openings with segmental arched heads. Intermediate level: three openings as above (bricked up). High level: two openings as above. West elevation: Intermediate level: tall slender opening with segmental arched head. North elevation: Ground level: large segmental arch (openings blocked); two small openings (blocked). Intermediate level: two small openings (blocked) (one has segmental arched head). Interior: The building encloses the engine pit and bye pit, which were used to drain and work the central part of the tunnel. The pits are brick lined and circular in cross-section. A later square parapet has been built around each pit. The engine used was a 70-inch atmosphere engine of the Necomen type.

Listing NGR: SE0252510207

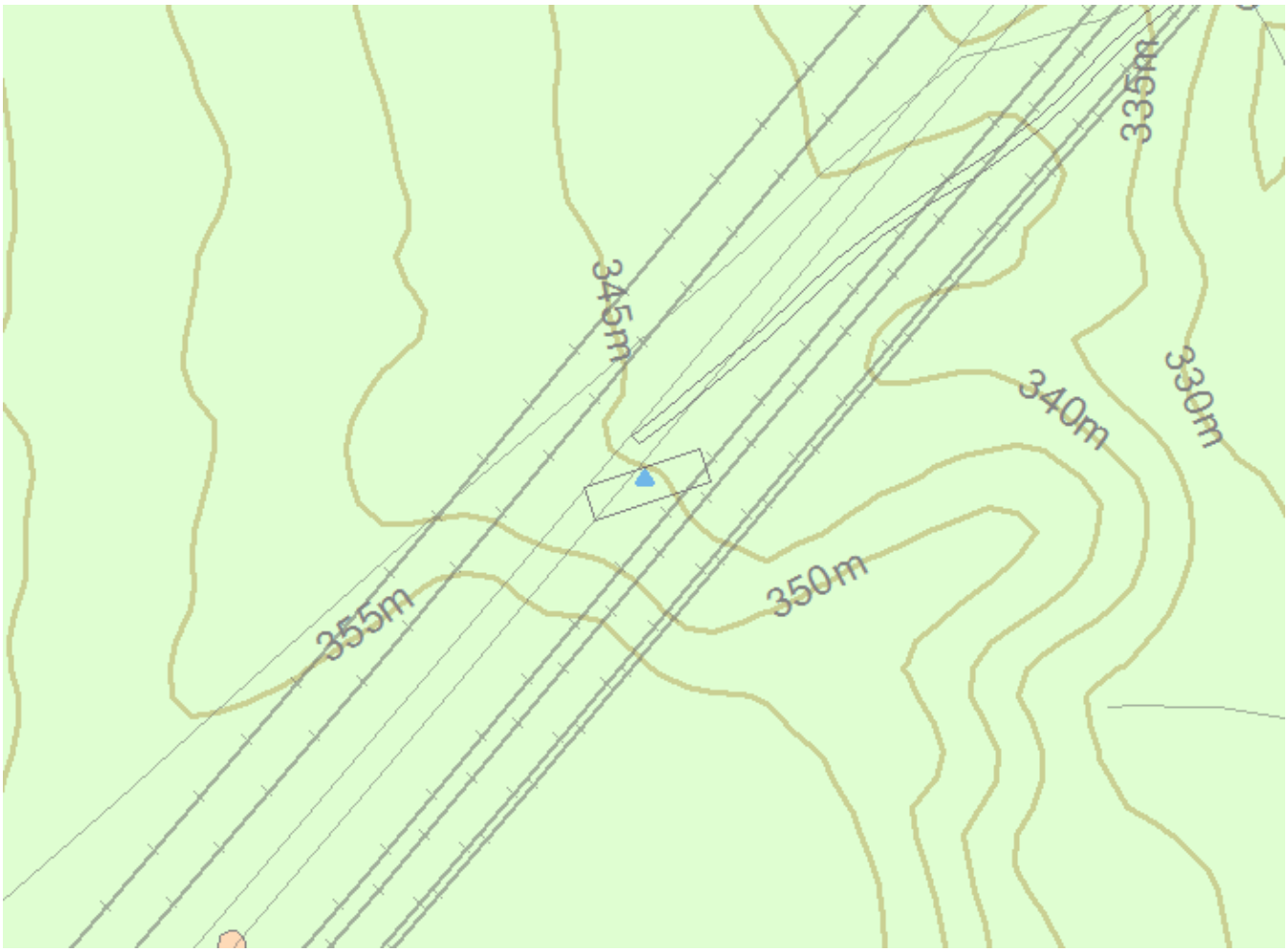
Legacy

The contents of this record have been generated from a legacy data system.
Legacy System number: **420021**

Legacy System: **LBS**

Legal

This building is listed under the Planning (Listed Buildings and Conservation Areas) Act 1990 as amended for its special architectural or historic interest.



Map

This map is for quick reference purposes only and may not be to scale. This copy shows the entry on 13-Jun-2023 at 11:33:22.

End of official list entry

APPENDIX 3

Photographs

Photograph 1
Area 1 – purple moor-grass-dominated degraded blanket bog

Photograph 2
Area 1 – close-up of species-poor purple moor-grass-dominated vegetation

Photograph 3
General view looking southeast up Red Brook Stream valley, showing steep slopes either side (Areas 4 and 5, with Area 7 to the right)

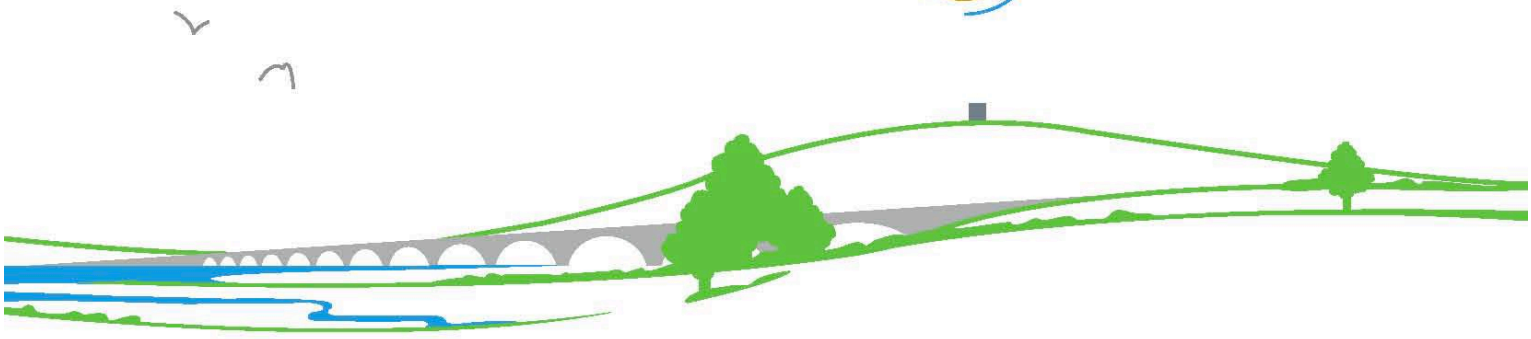
Photograph 4
Flatter top of spoil heaps (Area 7) with sparse vegetation, including mosses and lichen

Photograph 5
Area 6 – species-poor purple moor-grass-dominated vegetation

Photograph 6
General view of the upper section of Red Brook Stream valley (Area 3), from Thieves Clough footpath

Penny Anderson Associates Ltd

CONSULTANT ECOLOGISTS



Park Lea, 60 Park Road, Buxton, Derbyshire SK17 6SN

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