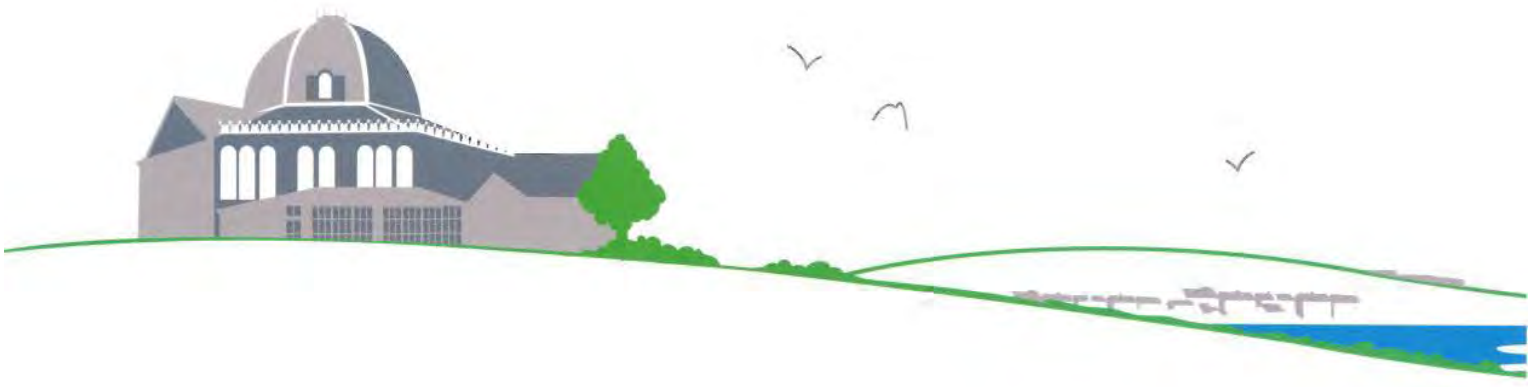
Penny Anderson Associates Ltd
CONSULTANT ECOLOGISTS

CANAL & RIVER TRUST

MARCH HAIGH PROPOSED ACCESS TRACK

PHASE 1 AND NVC SURVEY REPORT



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PHASE 1 AND NVC SURVEY REPORT

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

Signed:_____

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1. INTRODUCTION

Background

1.1 Penny Anderson Associates Ltd (PAA) was commissioned by Canal & River Trust to undertake a botanical Phase 1 Habitat Survey and National Vegetation Classification (NVC) survey of the habitats either side of the alignment of a proposed permanent track to March Haigh Reservoir, which would follow the route of a previously installed temporary track. The latter temporary track was subject to a ground surface restoration scheme agreed with the local authority in 1999, through which it was covered over and revegetated. The route of the proposed permanent track (hereafter referred to as the 'site') is located off the minor road (Black Lea Road) leading to White Hall Farm north of Marsden starting at grid reference SE02818 12718 and running west towards March Haigh Reservoir.

1.2 The survey was undertaken to provide a baseline dataset for the proposed construction of a permanent vehicular access track legally required as a measure in the interest of safety under the Reservoirs Act (1975) for essential safety works, ongoing inspection, maintenance, and emergency access and the erection of fencing at March Haigh Reservoir.

1.3 This report presents the methods and results of the Phase 1 habitat and NVC surveys undertaken by PAA in June 2021.

1.4 In summary, the survey comprised:

- a walkover of the entire route of the previous track and buffer strip either side of approximately 50m;
- mapping and description of distinct Phase 1 habitat types, as identified in the field;
- compilation of a complete botanical species list for each separate habitat, recording relative abundance using the DAFOR[1] rating;
- mapping and description of distinct NVC[2] community types within the protected area, with NVC quadrat sampling within the separate habitats as necessary and subsequent analysis in the office; and
- photographs to aid description of the habitats within the site.

1.5 The location of the site and the conservation designations are shown on Figure 1. The proposed permanent track crosses an area of moorland which is within the South Pennines SSSI[3], the South Pennine Moors (Phase 2) SPA[4], and the South Pennine Moors SAC[5]. The designations relate to the occurrence of Priority Habitats and the bird interest of the area. The citations for the SSSI, SPA and SAC are provided in Appendix 1.

[1] Where D = dominant, A = abundant, F = frequent, O = occasional, R = rare, L = locally

[2] *NVC - National Vegetation Classification*

[3] *SSSI – Site(s) of Special Scientific Interest*

[4] *SPA = Special Protection Area(s)*

5 SAC = Special Area(s) of Conservation

1.6 The survey area includes parts of the SSSI management Units 141, 142 and 149 all of which are in unfavourable recovering condition.

1.7 A separate bird survey (PAA 2021) has been undertaken to identify the breeding birds in the locality of the track. Birds are not considered further in this report.

2. METHODS

Phase 1 Habitat Survey

2.1 A botanical assessment of the habitats along the line of the route and a buffer of 50m either side of it (see Figure 1) was undertaken by Katharine Longden (Senior Ecologist); the surveys were undertaken over three visits during June 2021

2.2 The survey was undertaken in accordance with the best practice methodology detailed by the Joint Nature Conservation Committee (JNCC 2010). The purpose of the Phase 1 survey was to provide a record of habitats that are present on site.

2.3 Areas of distinct habitat were identified in the field and mapped by drawing their boundaries onto paper copies of high-resolution aerial photography of the site. Aerial photography and inbuilt GPS (Global Position System) in a tablet (Samsung Galaxy) were also used to aid positioning and to map the habitats.

2.4 A botanical species list and DAFOR rating was compiled for plant species in each habitat.

Peat Depths

2.5 In the Phase 1 habitat survey methodology several of the moorland habitats are partially determined by the depth of the peat substrate. Therefore, where appropriate, the peat depth was recorded using a peat pit with graduations marked to assist in the allocation of habitat classes. This was not a full systematic peat depth survey.

NVC Survey

2.6 Following the Phase 1 survey, additional work was undertaken to attribute NVC communities to the habitats within the protected area[6] of the survey boundary (starting at grid reference SE02376 12892).

2.7 The NVC vegetation mapping broadly followed Rodwell (2006); firstly, the vegetation was divided into structurally and floristically homogeneous stands (i.e. units that appeared to have broadly similar characteristics when judged by eye), these stands were given a preliminary classification according to the surveyor's knowledge of the NVC and field sampling of the vegetation.

2.8 Each stand was mapped to NVC community or sub-community level using standard NVC coding following Rodwell (1991,1992). The NVC types allow for some degree of variation in the community composition, to cover known variation within a habitat type (often reflecting management history or local variations in topography, soils and climate). If a stand was identified as deviating significantly from standard NVC types, this has been described by the habitat type and the dominant species.

2.9 The NVC provides a comprehensive classification and description of the plant communities of Britain, each systematically named and arranged and with standardised descriptions. The general approach is phytosociological and depends upon the rigorous recording of floristic data, as well as consideration of supporting information about the site such as topography, management, soils and climate. It can be used to map and characterise vegetation and to assess its value in nature conservation terms.

[6] *'Protected area' is a term used to describe the area of the study site within the SSSI, SPA and SAC.*

2.10 Mapping of mosaics was restricted to where the repeated community/sub-community elements covered less than 0.5ha. These were identified by standard NVC codes separated by a dash, e.g. (U5a-U4).

NVC Quadrat Recording

2.11 NVC quadrat samples were taken from the identified homogenous stands of vegetation, to provide quantitative data to enable checking against the floristic tables in the relevant volume of *British Plant Communities* (BPC) (Rodwell 1991, Rodwell 1992). Samples were only taken where the communities could not be identified decisively by eye. The survey gathered three to seven quadrats in the main mire and grassland communities.

2.12 A total of 15 locations were sampled. In the case of small stands of vegetation where the surveyor was confident in the decision made 'by eye' in the field, the vegetation was not sampled.

2.13 All NVC quadrat samples in the mire, grassland and flushes were 2m x 2m. Botanical data included full vascular and bryophyte species lists and percentage cover for all species was recorded. In addition, the cover of litter was recorded when appropriate, and there was no bare ground.

NVC Data Analysis

2.14 The percentage cover for the botanical species within the quadrats was then converted to the Domin Scale, Table 1.

Table 1 The Domin Scale

Percentage Cover	Domin
91 – 100%	10
76 – 90%	9
51 – 75%	8
34 – 50%	7
26 – 33%	6
11 – 25%	5
4 – 10%	4
<4% with many individuals	3
<4% with several individuals	2
<4% with few individuals	1

2.15 The data within each quadrat was subsequently analysed using MATCH software (Thompson 2004) to determine the closest fit NVC community and sub-community. A set of quadrats which showed clear affinity with the same NVC (sub-) community were analysed as a constancy table using MATCH.

2.16 The final assignment to NVC category used the MATCH result in conjunction with consultation with the descriptions and species tables in BPC, along with surveyor knowledge.

Survey Constraints

2.17 There were no survey constraints impacting on the survey result. The botanical and NVC surveys were undertaken at an optimal time of year for botanical survey and weather conditions were suitable for survey. The results are considered to be robust.

2.18 During the Phase 1 habitat mapping, areas classified as ‘garden’ were not accessed and the species are not included in the species lists provided.

3. RESULTS

General Site Description

3.1 The area surveyed includes a zone of habitat around a former track alignment that runs from White Hall Farm to the spillway of March Haigh Reservoir in a west north-westerly direction.

3.2 A former track was constructed in 1999 to facilitate access to the Reservoir to undertake essential repair works. The peat and vegetation were removed following an approved Method Statement and a stone track laid. Following completion of repairs the peat/soil along the track route was replaced to a depth of *c.*20cm over the stone track rather than removing the geotextile barrier and stone.

3.3 The route of the previous track was located outside the SSSI boundary as far as possible and avoided deep peat (40cm or over) where practical. The route of the previous track was, therefore, mainly on the cusp of the deep and shallow peat (less than 40cm) where the peat becomes thinner closer to the change in slope associated with the edge of Haigh Clough to the south of the track.

3.4 Parts of three SSSI management units are included within the survey area, 141, 142 and 149. The majority of the SSSI is grazed by cattle which have free access across the moorland area in summer. The woodland area, in the far south-eastern section of the survey area, was fenced but this is no longer stock-proof and cattle regularly access this area.

3.5 The Phase 1 survey started at the abrupt 90° bend in Blake Lea Lane southeast of White Hall Farm and included habitats outside the protected area (Figures 2a and 2b).

3.6 The results of the botanical and NVC survey are presented below. The scientific names of all plant species observed within each Phase 1 habitat are listed with DAFOR rating in Appendix 2.

3.7 The plant species recorded within the NVC quadrats are presented in Appendix 3. Vascular plant species nomenclature follows Stace 2019, and common names only are used in the text (except for NVC classifications). Bryophytes follow Atherton *et al* 2010 and scientific names only are used for lower plants in the text.

Phase 1 Habitats

3.8 The area surveyed contains the following habitats (Phase 1 code shown in brackets):

- Broadleaved woodland – plantation (A.1.1.2);
- Mixed woodland – plantation (A1.3.2);
- Scrub (A2.2);
- Acid grassland – unimproved (B1.1);
- Acid grassland – semi-improved (B1.2);
- Neutral grassland - semi-improved (B2.2);
- Marshy grassland (B5);
- Bracken (C1.1);
- Tall ruderal (C3.1);
- Wet modified bog (E1.7);
- Flush and spring – acid (E2.1);

- Running water (G2);
- Amenity Grassland (J1.2); and
- Ephemeral /short perennial (J1.3).

3.9 Additional habitats include 'Bare Ground (J4)' and 'Other Habitats (J5)' including a horse ménage.

Woodland, Scrub and Isolated Trees

3.10 The woodland within the survey area is largely young plantation woodland with a few self-sown scattered willow species along the line of the proposed track and some natural regeneration of trees in the woodland adjacent to Haigh Clough.

3.11 TN1 (Target Note) is a new, recently planted broadleaved plantation with a mixture of birch, oak, alder, willow and hawthorn planted in an area dominated by rush. The trees are generally 2-3m tall and are protected from damage by stock with plastic tree guards. The ground flora in this area is a flush community with frequent to locally dominant sharp-flowered rush, abundant to locally frequent soft-rush and locally occasional compact rush. Other occasional species include; marsh thistle, common marsh-bedstraw, greater bird's-foot trefoil and locally abundant *Sphagnum fallax* and S. *palustre*.

3.12 There is a much larger and older area of woodland planting on the steeply sloping south-facing side of Haigh Clough (TN2). This area is within the protected site boundary. The trees are predominantly sliver birch, sessile oak and rowan. They are generally 6-8m tall with space to walk between the trees. The ground flora at the top of the slope is remnant acid grassland with creeping soft-grass, common bent, wavy hair-grass and some bracken. The bracken dominates the lower slopes. There are a small number of wet flushes within the woodland which are species-poor and dominated by soft-rush and tufted hair-grass. There is no woodland ground flora.

3.13 The two small areas of mixed conifer and broadleaved planting close to the buildings at White Hall Farm comprise a mixture of relatively young trees up to 5m tall but with little to no ground flora under the heavy canopy shade.

3.14 At the northern end of the reservoir embankment there is a small patch of goat willow scrub, comprising five to six individual shrubs, 4-5m tall in a small, fenced area (TN3). The ground flora is damp acidic grassland dominated by soft-rush with ferns, bilberry and foxglove.

Acid Grassland

Unimproved Acid Grassland

3.15 This habitat is a major component of the vegetation within the SSSI section of the survey area. Overall, this grassland is generally a mixture of wavy hair-grass, common bent, sweet vernal-grass, mat-grass and sheep's-fescue with a very variable component of purple-moor-grass and heath wood-rush. Heath bedstraw is locally frequent as is tormentil, but other forbs are localised in occurrence. There are also localised patches of oval sedge and common sedge.

3.16 Areas of grassland where purple moor-grass comprises over 25% cover are separately categorised as 'Marshy grasslands' in the Phase 1 habitat definitions and are, therefore, described below.

3.17 TN4 is an area of grassland, unfenced, to the north of the access track to White Hall Farm. It has a variable topography with localised steep sections and several small flushes and is included within the protected area although separated from the bulk of the area by Black Lea Lane. It is unmanaged and is a mosaic of habitats but is predominantly an unimproved acid

grassland incorporating small flushes and seepages, areas of bracken and areas of locally dominant purple moor-grass and patches of ferns. The flushes are too small to map and are generally species-poor.

3.18 TN5 is within the protected area and is an area of steeply sloping, clough side grassland dominated by a mixture of wavy hair-grass, common bent, sweet vernal-grass and mat-grass with locally frequent purple moor-grass and Yorkshire-fog. There are few forbs, with localised heath bedstraw, meadow buttercup, foxglove and occasional soft-rush.

3.19 Most of the remaining unimproved acid grassland within the protected area is of a very similar composition both on steeply sloping clough sides and on the flatter areas amongst the soft-rush and purple moor-grass dominated areas. A key feature of this habitat is the high degree of very local variation of the dominant grass species and low diversity of the forbs.

3.20 There are very small, rare to occasional patches of heather and bilberry within the acid grasslands areas, increasing in frequency towards the west of the survey area. The cover of the dwarf shrubs is low and not high enough to warrant any area to be mapped as heath although some areas may have been heathland historically.

Semi-improved Acid Grassland

3.21 The majority of the semi-improved acid grassland occurs in the fields outside the SSSI, with the exception of the reservoir embankment.

3.22 TN6 is a large semi-improved acid grassland field which has been partially planted with trees (TN1). In addition to the typical acid grassland grasses; common bent, sweet vernal-grass and mat-grass, there are other agricultural species such as perennial rye-grass and crested dog's-tail indicating agricultural improvement as does the frequent occurrence of white clover. The indications of improvement are more frequent in the western half of the field adjacent to a semi-improved neutral grassland field.

3.23 The grassland on the reservoir bank (TN7) is again dominated by grasses; Yorkshire-fog, sheep's-fescue, wavy hair-grass, common bent, sweet vernal-grass and rough meadow-grass all frequent or locally frequent. Other species include locally frequent sheep's sorrel, white clover, creeping buttercup, field wood-rush and heath bedstraw with occasional soft-rush, bilberry, heath rush and tormentil. The regular mowing of the bank has impacted on the vegetation in addition to the cattle grazing.

3.24 An area of bracken has been removed from the reservoir bank, the rhizomes are still visible, and it has partly colonised with creeping soft-grass, white clover and occasional common ragwort and agricultural grasses. The mosses, *Rhytidiadelphus squarrosus* and *Hypnum jutlandicum* are abundant and occasional to locally frequent respectively on the bank.

Neutral Grassland

3.25 There are some fields of neutral grassland to the east of White Hall Farm. TN8 is a grass dominated pasture with crested dog's-tail and perennial rye-grass the most abundant species. Other frequent grasses include common bent, smooth meadow-grass, red fescue and sweet vernal-grass along with common forbs including white clover, creeping buttercup and occasional creeping thistle.

3.26 TN9 is an area of taller, rank, currently unmanaged grassland. Similarly grass-dominated and supporting the species recorded in TN8 but with additional grass species including cock's-foot, tufted hair-grass, rough meadow-grass. The forbs are dominated by abundant white clover and creeping buttercup with locally occasional self-heal, oval sedge, daisy and red clover.

3.27 The narrow strip of approximately 5m width on top of the reservoir embankment is also classed as neutral semi-improved grassland. It is fenced from the dam bank and has frequent to locally

abundant occurrences of perennial rye-grass, crested dog's-tail and white cover indicating agricultural improvement but also supports a range of typical neutral grassland species including; Yorkshire-fog, sweet vernal-grass, red fescue and cat's ear.

Marshy Grassland

3.28 Marshy grassland is a very diffuse category in the Phase 1 definitions. On this site there are two very different categories of marshy grassland:

- vegetation with greater than 25% cover of soft-rush; and
- vegetation with a greater than 25% cover of purple moor-grass, on less than 0.5m of peat.

3.29 To differentiate between these two descriptions of marshy grassland on the site the Phase 1 code has 'Mc' to show it is the purple moor-grass-dominated vegetation or 'Je' indication it is soft-rush marshy grassland.

Rush Dominated Marshy Grassland

3.30 TN10 describes a large field of soft-rush-dominated marshy grassland with elements of semi-improved acid grassland. The field is divided by an electric fence and the smaller section to the east supports less rush and is more highly improved, particularly in the southern section which horses are able to access directly from the stable block. The increase in agricultural grasses here may to be due to the localised poaching of the ground in winter by the horses and germination of seed from the fodder or by direct seeding to re-vegetate the bare ground.

3.31 The main field is dominated by soft-rush with a range of locally frequent grasses including: sweet vernal-grass, Yorkshire-fog, red fescue and locally frequent oval sedge and common sedge. Mat-grass, common bent, heath rush and lesser spearwort were recorded as occasional to locally frequent with common sorrel and heath bedstraw occasional and marsh thistle rare.

3.32 The eastern section supports the same species as the main field but at lower abundances with perennial rye-grass being occasional to locally abundant; crested dog's-tail, creeping buttercup and white cover all frequent to abundant. Overall, soft-rush is still abundant and well over the 25% cover threshold to determine 'marshy grassland' although heavily grazed in the southern section.

3.33 TN11 is very similar to TN10 but with a greater abundance of sweet vernal-grass and more widespread sedge patches, although these are heavily grazed. Sheep's-fescue and cat's ear are both locally occasional and there were occasional clumps of *Polytrichum* moss.

3.34 TN12 is a small, rectangular, fenced section of the field described in TN11. It was an area used to stockpile peat and soils during the creation of the former track in 1999 until the material was used to re-cover the track. The area has an uneven surface and is dominated by a tall stand of soft-rush with a very thick litter layer. Yorkshire-fog, tufted hair-grass, common bent and red fescue are all locally abundant with sheep's-fescue locally frequent. Heath bedstraw is locally occasional. There are lots of small mammal runs and tracks through this dense vegetation. Within this area there is a small area of tall herb vegetation with frequent common nettle.

3.35 A similar, soft-rush-dominated fenced section of the marshy grassland (TN10) is denoted by TN12a. This area was also utilised during the original track construction and fenced following restoration. Within the areas of dominant rush there are frequent patches of the commoner wet grassland species very similar to those listed above.

3.36 TN13 is a narrow line, 3-5m wide, of rush-dominated marshy grassland which corresponds with a large section of the previous track route. This section of the proposed track route is dominated by soft-rush over shallow (generally less than 20cm) peat which has been replaced over the track as part of the restoration. The ground surface is uneven and occasionally wet,

with small variable depressions. There are frequent occurrences of *Sphagnum* species particularly *S. fimbriatum* and *S. fallax* with occasional patches of *S. palustre* and one patch of *S. squarrosum*. The moss *Polytrichum commune*, velvet bent and bulbous rush are all frequent to locally abundant on the line of track in this section.

Rush-Dominated Marshy Grassland/Acid Grassland Mosaics

3.37 Two areas, both within the protected area and grazed as part of the open moorland, have been classified as mosaics of unimproved acid grassland and marshy grassland. The grassland elements of the habitat are very clearly acid grassland and are significantly different from the more neutral grassland species frequently recorded in the marshy grassland habitats. The scale of the variation is such that the different habitats cannot be mapped.

3.38 In one area (TN14) of mosaic the marshy grassland element is a mixture of soft-rush, purple moor-grass and velvet bent with other species recorded as occasional including; sweet vernal-grass, marsh thistle, broad buckler fern, common marsh bedstraw, heath bedstraw, Yorkshire-fog, bog stitchwort and the moss *Rhytidiadelphus squarrosum*. The acid grassland element is similar to the communities previously described; sweet vernal-grass, sheep's-fescue, purple moor-grass, mat-grass and wavy hair-grass but with more Yorkshire-fog and *Rhytidiadelphus squarrosum.*

3.39 The vegetation described by TN15 is similar with distinct areas of soft-rush and acid grassland but on more steeply sloping ground. The acid grassland elements bear a very strong resemblance to those described by TN5 and the rush areas are less species-rich than those described in TN14.

Purple Moor-grass-Dominated Marshy Grassland

3.40 The Phase 1 description defines purple moor-grass-dominated marshy grassland as 'vegetation with a greater than 25% cover of purple moor-grass, on less than 0.5m of peat'. Purple moor-grass-dominated vegetation on peat with a depth of greater than 0.5m is defined as 'wet modified bog' (see below).

3.41 Peat depth samples have been taken across areas of continuous purple moor-grass-dominated vegetation to attempt to separate the area of grassland (under 50cm depth) and the areas of wet modified bog (over 50cm depth).

3.42 The purple moor-grass-dominated areas of this moorland site support very little else but occasionally have very low abundances of typical acid grassland species; wavy hair-grass, common bent, sweet vernal-grass, mat-grass and sheep's-fescue. These areas often have a cover of greater than 90% of purple moor-grass. They are generally south of the line of the proposed track as the peat depth decreases closer to the edge of Haigh Clough and the track was originally designed to avoid as much deep peat as practical.

3.43 In one area of purple moor-grass-dominated vegetation, on shallow peat, close to the foot of the reservoir embankment common cottongrass was recorded in this grassland habitat. If peat depths had not been taken, this area may have been described as wet modified bog. The line between the purple moor-grass-dominated wet modified bog and grassland on this site is a rather artificial division.

Purple Moor-grass-Dominated Marshy Grassland/Acid Grassland Mosaics

3.44 Areas have been defined as mosaics of marshy grassland, purple moor-grass-dominated and unimproved acid grassland for the same reasons as described above for the rush-dominated marshy grasslands; the acid grassland communities within these areas are generally distinct from the purple moor-grass areas.

3.45 There is one particular area of this habitat south of the track where there is a higher cover of heather than elsewhere on the site. The heather-dominated patches can be distinguished on the aerial photographs as darker vegetation (TN16a). The plants are generally fairly mature and woody, over 20 years old, and generally heavily grazed.

Purple Moor-grass and Soft-rush Marshy Grassland Mosaics

3.46 There are two area (TN16 and TN17) where the vegetation is on shallow peat and where purple moor-grass and soft-rush are both abundant. The area of TN16 appears to be a patch of shallower peat within the bog habitat and is characterised by an increase in the cover of soft-rush and *Sphagnum*. There are also very faint depressions which may have been some drainage features in this area in the past but it is rather inconclusive.

3.47 TN17 is an area of shallower peat with an increased cover of soft-rush, alongside an increase in rosebay willowherb and foxglove but within a purple moor-grass matrix.

3.48 The scattered nature of the rush and *Sphagnum* in both areas and the abundance of the purple moor-grass means that these areas do not meet the Phase 1 habitat definition of a flush.

Tall Herb and Fern

3.49 Two tall herb and fern communities were recorded in the survey, 'Bracken' and 'Tall Ruderal' communities.

Bracken

3.50 Where bracken has been mapped it is generally considered to be continuous and dense with little ground layer. Where there is a ground layer it is generally grass-dominated with a mix of acid grassland species and very species-poor.

Tall Ruderal

3.51 This category comprises stands of tall perennial forbs such as rosebay willowherb, common nettle and creeping thistle. This community is located around the edges of the buildings, on small areas of generally unmanaged ground. It is most extensive west of the farm buildings and north of the wall which forms the north-eastern boundary of the protected site.

3.52 This area along the wall has been used as an area for piling manure and rubble onto the existing vegetation and this has allowed the ruderal community to develop, TN18. Common marshy grassland and acid grassland species occur within this community at low levels.

Wet Modified Bog

3.53 This habitat is generally found on drying degraded blanket bogs with a peat depth greater than 50cm. On this site the dominant vegetation on the degraded deeper peat is purple moor-grass with locally occasional patches of common cottongrass. Other typical species of this habitat such as heather, crowberry, and hare's-tail cottongrass were very rare within the survey area on the deeper areas of peat.

3.54 There were, however, small patches of *Sphagnum* moss, generally *S, fimbriatum*, *S. fallax* and *S. palustre* with rare patches of *S. papillosum*. Other mosses were generally sparse with *Hypnum jutlandicum* the most common.

3.55 Other species recorded in this habitat included localised patches of soft-rush, rosebay willowherb, and one area of bladder sedge (TN19).

Flush and Spring – Acid

3.56 There is a small, but mappable area of vegetation that fits the description of 'flush and spring' in the Phase 1 Handbook, TN20. It is soft-rush and purple moor-grass-dominated with locally occasional foxglove, marsh thistle and velvet bent and occasional patches of *Sphagnum fallax*.

3.57 A smaller seepage/flush which appears to have been disturbed previously by the track construction is also target noted as TN21. This is also a soft-rush-dominated flush with locally abundant Yorkshire-fog. Other species recorded include locally occasional common sedge, foxglove, heath woodrush, bog stitchwort, cuckooflower and red fescue. *Sphagnum* was not recorded in association with this flush, *Rhytidiadelphus squarrosus* was the dominant moss.

3.58 The habitat is typical of some of the wetter areas of marshy grassland habitat. This area is target noted as it is close to the track and on the fringe of the marshy grassland habitat rather than in the middle of a marshy grassland habitat.

Running Water

3.59 There are several streams within the survey area. Most run at 90° to the proposed route of the permanent track and are contained within rocky stream beds with a very narrow fringe of wetland vegetation. The vegetation on the banks to the streams is generally typical of the adjacent acid grassland habitats with a higher occurrence of soft-rush and cuckooflower than in the wider grassland.

3.60 At the eastern end of the site a small ditch appears adjacent to the stone wall marking the north-eastern boundary of the protected area. This ditch then becomes a more natural stream from TN22, southwards. Additional wetland species were limited with many of the species also occurring in the adjacent marshy grassland. Water figwort, round-leaved crowfoot, blinks and floating sweet-grass were all recorded as locally occasional with Himalayan balsam as rare.

Ephemeral/Short Perennial

3.61 There is a relatively small area of short patchy vegetation associated with the area east of the reservoir overspill at the northern end of the reservoir (TN23). The vegetation here will be periodically disturbed by the water as it overtops the overflow as well having been disturbed by the previous reservoir works in 1999 and 2011. In addition, this area is regularly accessed by the public. The vegetation is thin over a free draining and stony substrate with a lack of dominant species. Acid grassland species were recorded in association with more neutral grassland species. Colt's-foot is typical of ephemeral communities and was the obvious, additional species in this area alongside an increase in the abundance of annual species noticeably lesser trefoil.

Additional Habitats

3.62 Miscellaneous ('J' habitat categories) have been allocated to several areas within the survey area. An area used as a car park (TN24) with a base of crushed stone and tracks around the stable area have been classed as 'J4 - bare ground' as they could support plant communities in the future although they are almost bare now. Likewise, a small field, TN25, is described as bare ground as it is used by pigs and there is less than 5% vegetation in the area. It is likely that this area was previously part of the larger semi-improved neutral grassland field adjacent to the east before being fenced and used more intensively for pigs.

3.63 Around White Hall there are a number of small pockets of grassland which are within the property boundaries and best described as garden (J1.2). This covers areas of tall rank grassland and areas of closely mown grasslands. Other areas described as 'J1.2' are outside

the immediate property boundary but mown as lawns and are planted or partially planted with garden plants. Species lists have not been prepared for these areas.

Notable and Invasive Non-native Plants

3.64 There was one invasive non-native, Schedule 9 plant species observed within the survey area, Himalayan balsam. As described above, it was located on the fringe of a small stream, within the protected site on a short section close to the footpath adjacent to White Hall Farm (TN24). There were only a few stems *c*.20, recorded.

3.65 No notable plants or Local Biodiversity Action Plan (BAP)[7] species were recorded during the survey.

3.66 On a local level, the area of bladder sedge is of interest (TN19). Dwarf shrubs are relatively uncommon on the site particularly cross-leaved heath, crowberry and bell heather which were all rare across the site.

The NVC Survey

3.67 The NVC survey covered a smaller area than the Phase 1 survey (Figures 3a and 3b). It included the habitats within the protected site and those within an approximate range of 50m either side of the line of the proposed route of the permanent track.

3.68 Overall, 15 quadrats were recorded and these data were analysed using MATCH software (Thompson 2004) to determine the closest fit NVC community and sub-community. The analysis was undertaken on the combined quadrats for the purple moor-grass-dominated vegetation (five quadrats), the wet grasslands (three quadrats) and the acid grasslands (seven quadrats). In addition, the individual acid grassland quadrat data were also analysed to potentially draw out smaller scale differences in the grassland communities. The results are given in Appendix 4 and Appendix 5 respectively).

3.69 There is no direct conversion of Phase 1 habitat types to NVC communities although there are some similarities in the habitats mapped on this site. The main vegetation types within the survey area comprise:

- Purple moor-grass-dominated bog on deep (over 40cm peat);
- Purple moor-grass-dominated vegetation on shallow peat (less than 40cm);
- Acid grassland;
- Wet grasslands with frequent to abundant soft-rush; and
- Small species-poor flushes.

3.70 Sample quadrats were taken in areas of purple moor-grass-dominated vegetation generally on deep peat; acid grasslands and in wet grassland areas. The results are described below with the raw data presented in (Appendix 3) with the six best fit sub communities provided in Appendix 4.

Purple Moor-Grass-Dominated Vegetation

3.71 Purple moor-grass-dominated modified bog covers the majority of the site north of the track in the protected area and also for a small section to the south of the track in the central zone, until

[7] *https://www.kirklees.gov.uk/beta/delivering-services/pdf/biodiversity-species.pdf (Accessed 22.07.21)*

the slope of the ground steepens towards Haigh Clough. This corresponds with the 'wet modified bog' Phase 1 habitat description.

3.72 Five sample quadrats were taken in this community and all are very species-poor with a maximum of five species in any quadrat. The quadrats were analysed together as they all have a similar species complement.

3.73 Overall, when run through MATCH, they have a poor fit with any NVC community achieving a maximum correlation co-efficient of 29.7 (Appendix 4) which is very low. A new category has been assigned 'BBMc' indicating the habitat is blanket bog (on deep peat) but dominated by purple moor-grass rather than other vegetation which can be assigned to an NVC community. This habitat is typical of some areas of the South Pennines where historic land management has resulted in an almost complete dominance of purple moor-grass. This habitat is a good fit for the Phase 1 designation of wet modified bog E1.7.

3.74 No quadrats were taken in the purple moor-grass-dominated vegetation on the thinner peats which generally occur to the south of the proposed route of the permanent track. The vegetation does not fit the mire communities which purple moor-grass is normally associated with such as M23 – *Juncus effusus/acutiflorus-galium palustre* rush-pasture, M24 *Cirsio-Molinieum caeruleae* fen-meadow, M25 *Molinia caerulea-Potentilla erecta* mire or M26 *Molina caerulea-Crepis paludosa* mire. This is because of the overwhelming dominance of purple moor-grass.

3.75 It was felt useful to separate the purple moor-grass communities on the deeper and shallower peats although floristically the communities are very similar. As there are no grassland NVC communities dominated by purple moor-grass, a second new category has been assigned to this vegetation GMc and this fits well to the Phase 1 category B5Mc.

3.76 This community, on the shallower peat, is effectively a bog/acid grassland transition vegetation with very little species diversity or interest. It has most likely developed from potentially more varied bog edge communities, possibly even a wet heath vegetation.

Wet Grassland

3.77 At the eastern section of the study area there is a mosaic area of marshy grassland and acid grassland (TN14). Three quadrats were sampled from the wet grassland areas here and three from the dryer grassland areas.

3.78 The wetter rush-dominated areas here have a good MATCH correlation coefficient of 43.9 to the M23 *Juncus effusus/acutiflorus-Galium palustre* rush-pasture community, *Juncus effusus* sub-community M23b.

3.79 This is an ill-defined vegetation community characterised by the abundance of soft-rush or sharp-flowered rush in a ground flora of mesotrophic herbs in agricultural grasslands. The vegetation can also include occasional to locally frequent purple moor-grass as is the case here as well as frequent Yorkshire-fog and occasional to locally frequent common marsh bedstraw, velvet bent, marsh thistle, and the mosses *Rhytidiadelphus squarrosus* and *Eurhynchium praelongum*.

3.80 This mire community is also the best fit for the vegetation to the south of TN14, which although supporting a higher soft-rush cover also contains mesotrophic grassland species in the wetter areas and lacks *Sphagnum* which rules out some other mire communities.

Acid Grassland

3.81 Most of the grasslands within the protected area are acid in nature. There are subtle changes across the site but on a very small scale which is unimportant for this project. In general, the dominant species of the acid grassland are: wavy hair-grass, common bent, sheep's-fescue, sweet vernal-grass and mat-grass with variable purple moor-grass cover.

3.82 Seven quadrats were recorded in the acid grassland communities across the site. They were initially analysed together and then individually in MATCH to see if there were distinct areas of any different vegetation types.

3.83 When all seven quadrats were analysed together the result produced a correlation co-efficient of 51.3 for the U5a *Nardus stricta-galium saxatile grassland,* species-poor sub-community, showing a good correlation to the community.

3.84 When the quadrat data were run independently through MATCH the coefficents were lower for six of the quadrats ranging from 35.6 to 41.1 whilst one had a higher coefficient of 56.6. Five quadrats matched best to U5a, one to U5b (the *Agrostis canina-Polytrichum commune* sub-community and the final quadrat fitted best to U6d *Juncus squarrosus-Festuca ovina, Agrostis capillaris-Luzula multiflora* sub-community (Appendix 5).

3.85 The U5a grassland is a typical habitat on the moorland fringes in this area especially in grazed landscapes where the more palatable grasses are grazed first leaving the less palatable mat-grass at a competitive advantage.

3.86 Seven quadrats will not capture all the variation within the acid grasslands on the site and small areas of U4 *Festuca ovina-Agrostis capillaris-Galium saxatile* grassland are likely to occur within the grassland mosaic.

3.87 This grassland community also occurs in thin strips along the route of several of the water courses, where the soils are thinner and the purple moor-grass is less abundant.

3.88 There is a relatively large area of grassland mapped as U5a.

3.89 The southern slopes, which lead into Haigh Clough, support large stands of bracken. Quadrat data were not taken in this habitat but the areas surveyed show a good fit to U20 – *Pteridium aquilinum-Galium saxatile* community, with most being the species-poor sub community although the habitats were not divided to this level.

Flushes

3.90 There are several areas of flush across the study area, most are small, species-poor and only identified by a localised increase in soft-rush. Quadrat data were not recorded from these areas although it was noted that there was a lack of small sedges in the flushes and seepages, and that they were species-poor. These areas are best described species-poor versions of M6c communities, *Carex echinata-Sphagnum recurvum/auriculatum* mires.

3.91 The proposed route of the permanent track as described above (para 3.36, TN13) is dominated by soft-rush in the central area and has a high cover of *Sphagnum* species and *Polytrichum commune*, and although no longer a truly ‘semi-natural’ habitat this is best described as M6c.

3.92 Similarly, a larger area close to the north-eastern corner of the survey area (TN16) has been classed as M6c due to the increased cover of soft-rush amongst the purple moor-grass and increased cover of *Sphagnum* and *Polytrichum commune* although the cover of the mosses is still relatively low. Common cottongrass was locally occasional amongst the tussocks of rush in this area and this can be a component of the M6c community.

4. DISCUSSION

Habitats and Botanical Interest

4.1 The wider Phase 1 survey area contains a range of moorland and moorland fringe habitats typical for this region of the country. The South Pennines is known to have large tracts of species-poor purple moor-grass vegetation on deep and shallow peats as a result of the past management of the moorland habitats.

4.2 The range of semi-improved neutral and acid grasslands are also typical of the area with numerous damper patches in the acid grasslands which, if frequent enough, can alter the habitat definition to marshy grassland largely due to the cover of soft-rush in the area. The more improved areas are often those closest to the farm and livestock housing/stables.

4.3 Within the SSSI the habitats are much less varied and are limited to areas dominated by purple moor-grass, areas of relatively species-poor acid grasslands, bracken beds and areas of rush-pasture vegetation.

4.4 There are no areas of particularly high botanical value. Bladder sedge is of local interest, it was located within a relatively discrete area north of the track and marked as a target note.

4.5 There is a localised occurrence of the Schedule 9 invasive non-native Himalayan balsam just inside the SSSI boundary at the eastern end. Prompt management of this area would prevent the spread of this species at this early stage of establishment.

4.6 The main value of the moorland area is as part of a much larger unit of largely unimproved habitat which also provides habitat for the birds of interest in the region.

Priority Habitats

4.7 Much of the area surveyed within the protected area is classed on the MAGIC[8] website as 'Blanket bog Priority Habitat' but with a low confidence as the information is from the Dark Peak Environmentally Sensitive Area (ESA) Land Cover survey of 1995 and was classed as '*Molinia*-dominated grassland'.

4.8 The route of the previous track has been omitted from the Priority Habitat layer as have the steepest slopes, with shallow soils, leading to Haigh Clough.

4.9 In the UK BAP Priority Habitat Description[9], there is no agreed minimum depth of peat which can support blanket bog vegetation, and the definition states that 'peat depth is also very variable, with an average of 0.5-3m being fairly typical but depths in excess of 5m is not unusual'. The principal vegetation (NVC) types covered by the blanket bog definition are M1, M2, M3, M15, M17, M18, M19, M20 and M25, together with their intermediates. Although these communities are not allocated to the vegetation on site, the current vegetation will have been derived from at least one of these communities in the past.

[8] *Multi Agency Geographic Information for the Countryside*

[9] *https://data.jncc.gov.uk/data/aadfff3d-9a67-467a-ac65-45285e123607/UKBAP-BAPHabitats-03-BlanketBog.pdf*

The Vegetation of the Proposed Track Route

4.10 The route of the previous track, through the central portion of the SSSI, remains visible on the aerial photographs and to some extent on the ground as a line of vegetation dominated by soft-rush with occasional scattered trees which have developed as a result of fencing sections of the track post works preventing grazing stock access.

4.11 Outside the SSSI to the east, the area used as a stockpile for the storage of peat/soils during the creation of the track in 1999, is also visible as soft-rush-dominated vegetation.

4.12 Soft-rush seed can persist for many years in the soil/peat seedbank and can germinate many years later following disturbance. The soft-rush seedbank in the peat prior to the works in 1999 has clearly responded well to the disturbance and is now the dominant species in large sections along the route.

4.13 The fencing of the route, following the recovering of the track with the peat/soil, will have protected the soft-rush from grazing and given it a further competitive advantage in the re-colonisation of the peat substrate.

4.14 The retention of the track *in situ* appears to have benefited the soft-rush by potentially altering the flow of water though the soils/peat and surface vegetation, allowing localised water-logging to occur.

4.15 The frequency of *Sphagnum* on the track line is also significantly higher than in the adjacent vegetation and it is likely that this relates to the altered water flow across the slope. It may also be that soft-rush doesn't shade the moss layer as much as purple moor-grass and can provide a structural framework to help the *Sphagnum* to develop and expand. The removal of stock during the restoration period will also have benefited the formation of large *Sphagnum* patches through lack of disturbance.

4.16 Photographs with short explanatory notes at various points on the track from the reservoir in the west to the SSSI boundary in the east are presented in Appendix 6.

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6. ABBREVIATIONS

BPC	British Plant Communities
GPS	Global Position System
NVC	National Vegetation Classification
PAA	Penny Anderson Associates Ltd
TN	Target Note(s)
SSSI	Site(s) of Special Scientific Interest
SPA	Special Protection Area(s)
SAC	Special Area(s) of Conservation
BAP	Biodiversity Action Plan
MAGIC	Multi Agency Geographic Information for the Countryside
ESA	Environmentally Sensitive Area

FIGURES

401500 402000 402500 403000

413000 412500

March Haigh Reservoir
March Haigh Flat
South Pennine Moors SSSI
Hard Head Clough
Head Clough
Higher Green Owlers
Haigh Clough
White Hall
Green Owlers Clough
Lower Green Owlers
Park Clough SSSI
Bank Top Farm
BLAKE LEA LANE
Willykay Clough

Legend

- Works area red line
- Site of Special Scientific Interest (SSSI)
- South Pennine Moors Special Protection Area (SPA)
- South Pennine Moors Special Area of Conservation (SAC)

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

0 25 50 100 150 Metres

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

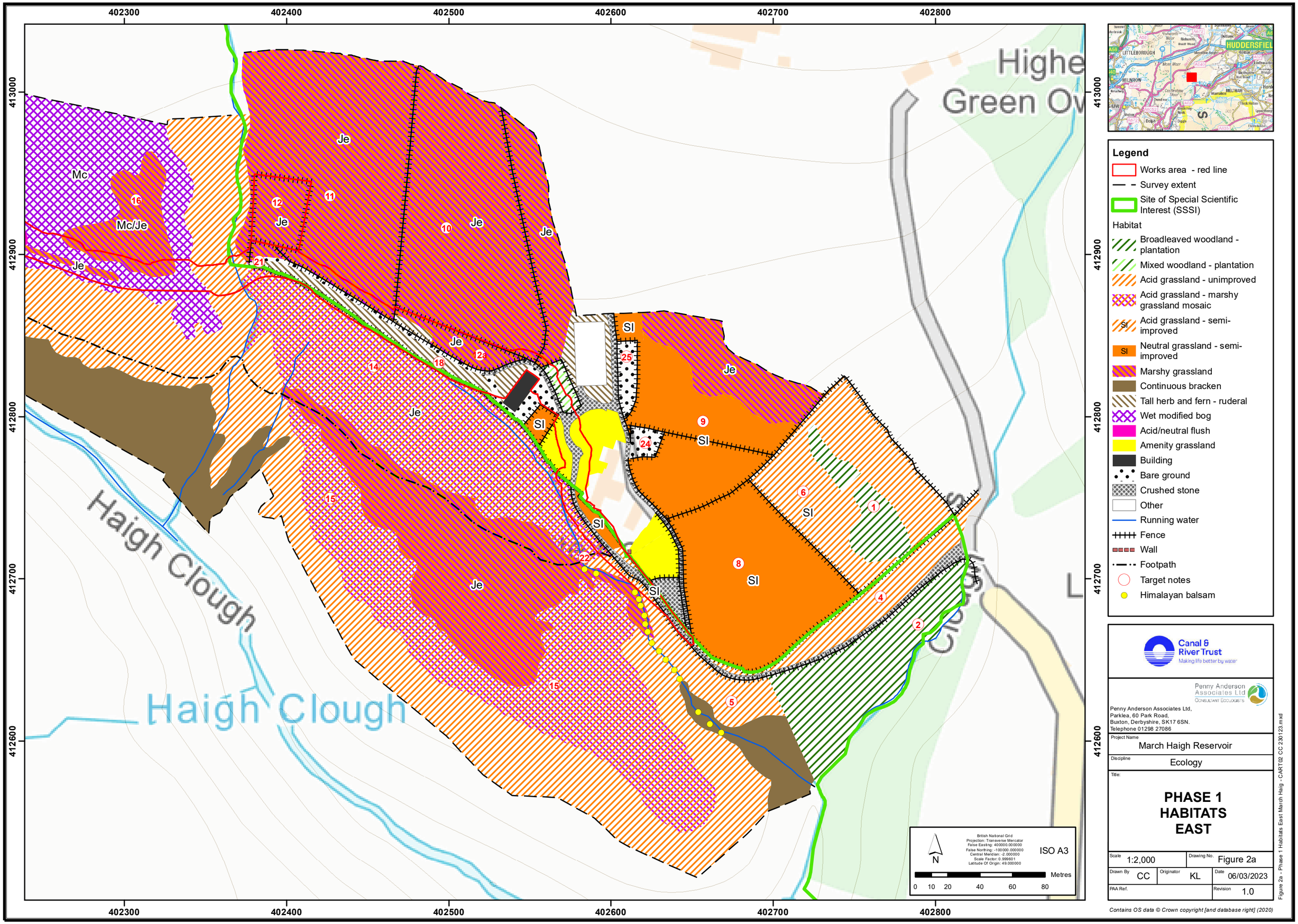
Discipline: Ecology

Title:

LOCATION MAP

Scale	Drawing No.		
1:5,000	Figure 1		
Drawn By: CC	Originator: KL	Date: 06/03/2023	
PAA Ref.		Revision: 1.0	

Figure 1 - Site Location March Haig - CART02-1 CC 230306_.mxd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14
18
12a
15
22
5
Haigh Clough
Haigh Clough
Higher Green Ov
Legend
Works area - red line
Survey extent
Site of Special Scientific Interest (SSSI)
Habitat
Broadleaved woodland - plantation
Mixed woodland - plantation
Acid grassland - unimproved
Acid grassland - marshy grassland mosaic
Acid grassland - semi-improved
Neutral grassland - semi-improved
Marshy grassland
Continuous bracken
Tall herb and fern - ruderal
Wet modified bog
Acid/neutral flush
Amenity grassland
Building
Bare ground
Crushed stone
Other
Running water
Fence
Wall
Footpath
Target notes
Himalayan balsam
N
British National Grid
Projection: Transverse Mercator
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False Northing: -100000.000000
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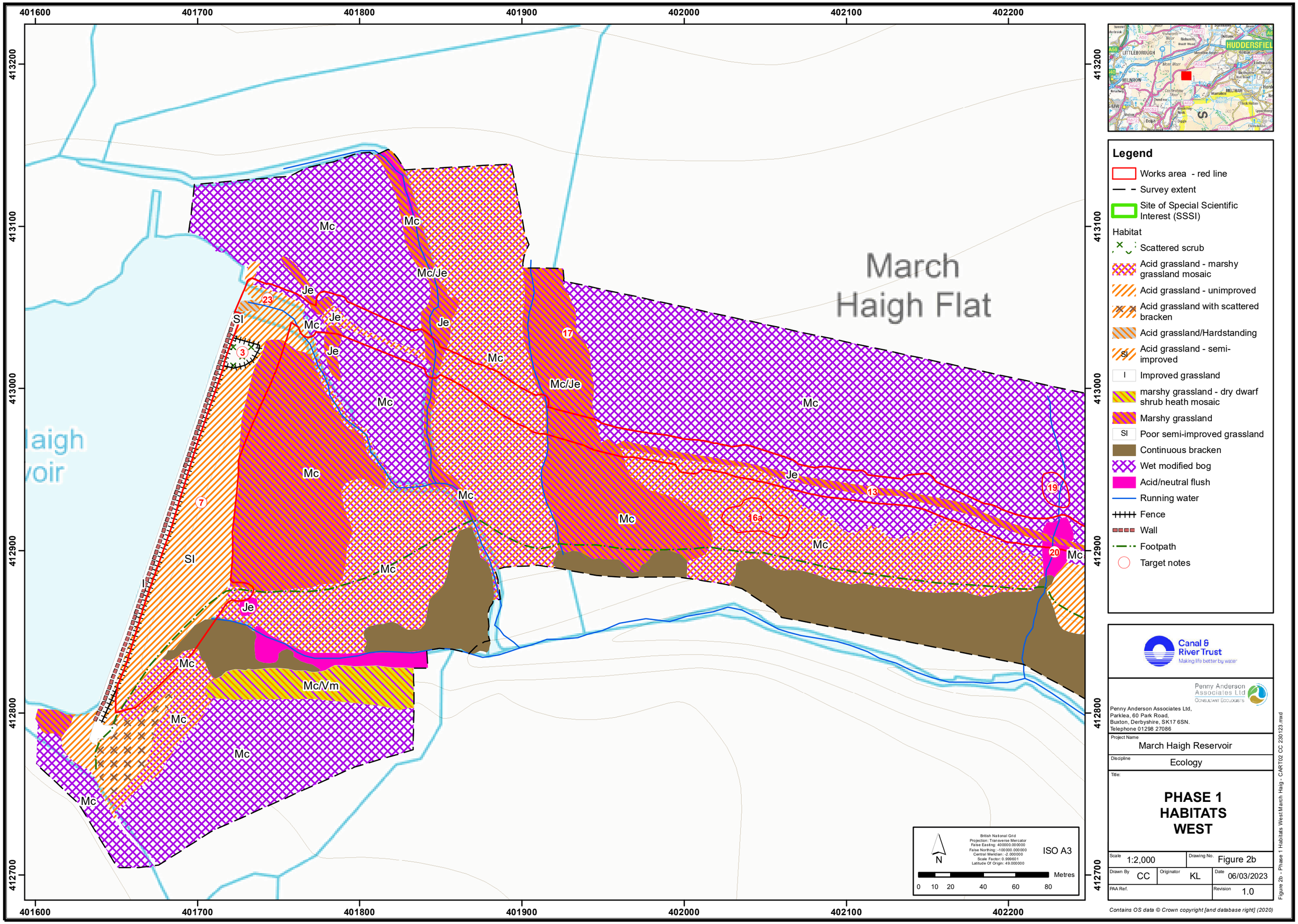
Project Name
March Haigh Reservoir
Discipline
Ecology
Title:
PHASE 1 HABITATS EAST
Scale 1:2,000
Drawing No. Figure 2a
Drawn By CC
Originator KL
Date 06/03/2023
PAA Ref.
Revision 1.0
Figure 2a - Phase 1 Habitats East March Haig - CARTO2 CC 230123.mxd
Contains OS data © Crown copyright [and database right] (2020)



Legend

- Works area - red line
- Survey extent
- Site of Special Scientific Interest (SSSI)

Habitat

- Scattered scrub
- Acid grassland - marshy grassland mosaic
- Acid grassland - unimproved
- Acid grassland with scattered bracken
- Acid grassland/Hardstanding
- Sl Acid grassland - semi-improved
- I Improved grassland
- marshy grassland - dry dwarf shrub heath mosaic
- Marshy grassland
- Sl Poor semi-improved grassland
- Continuous bracken
- Wet modified bog
- Acid/neutral flush
- Running water
- Fence
- Wall
- Footpath
- Target notes

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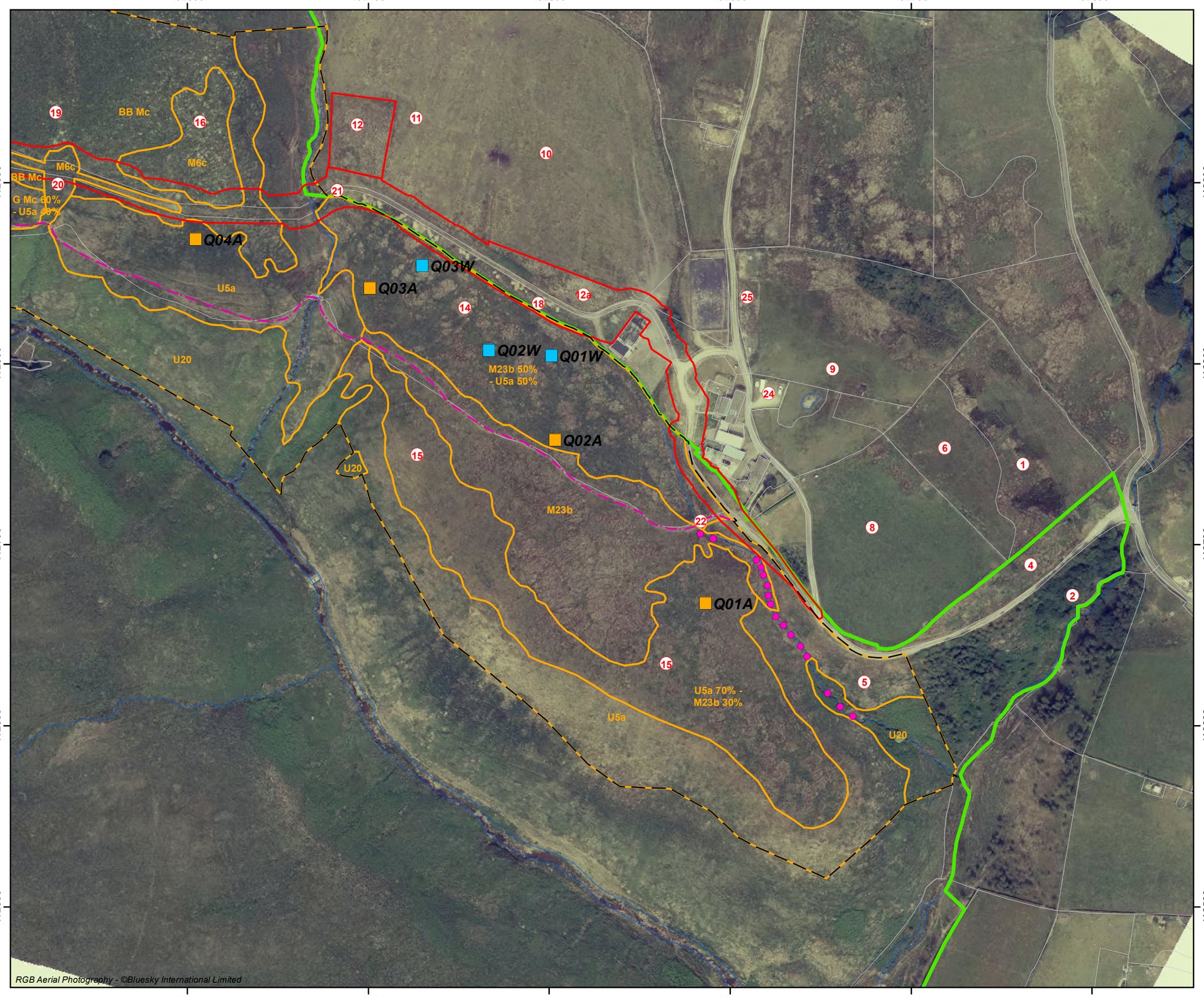
Discipline: Ecology

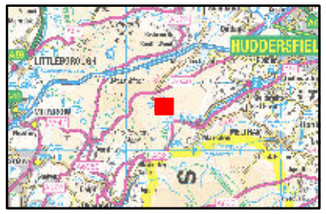
Title:

PHASE 1 HABITATS WEST

Scale	1:2,000	Drawing No.	Figure 2b
Drawn By	CC	Originator	KL
Date	06/03/2023		
PAA Ref.		Revision	1.0

Figure 2b - Phase 1 Habitats WestMarch Haig - CART02 CC 230123.mxd





Legend

- Works area - red line
- South Pennine Moor SSSI, SAC and SPA
- NVC community
- Survey extent

Quadrats

- Acid grassland quadrat
- Purple moor-grass dominated quadrat
- Wet grassland quadrat
- Target notes
- Footpath
- Himalayan balsam

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

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Title:

NATIONAL VEGETATION CLASSIFICATION (NVC) SURVEY EAST

Scale	1:2,000	Drawing No.	Figure 3a
Drawn By	CC	Originator KL	Date 06/03/2023
PAA Ref.		Revision	1.0

Figure 3a - NVC East March Haig - CART02 CC 230123.mxd

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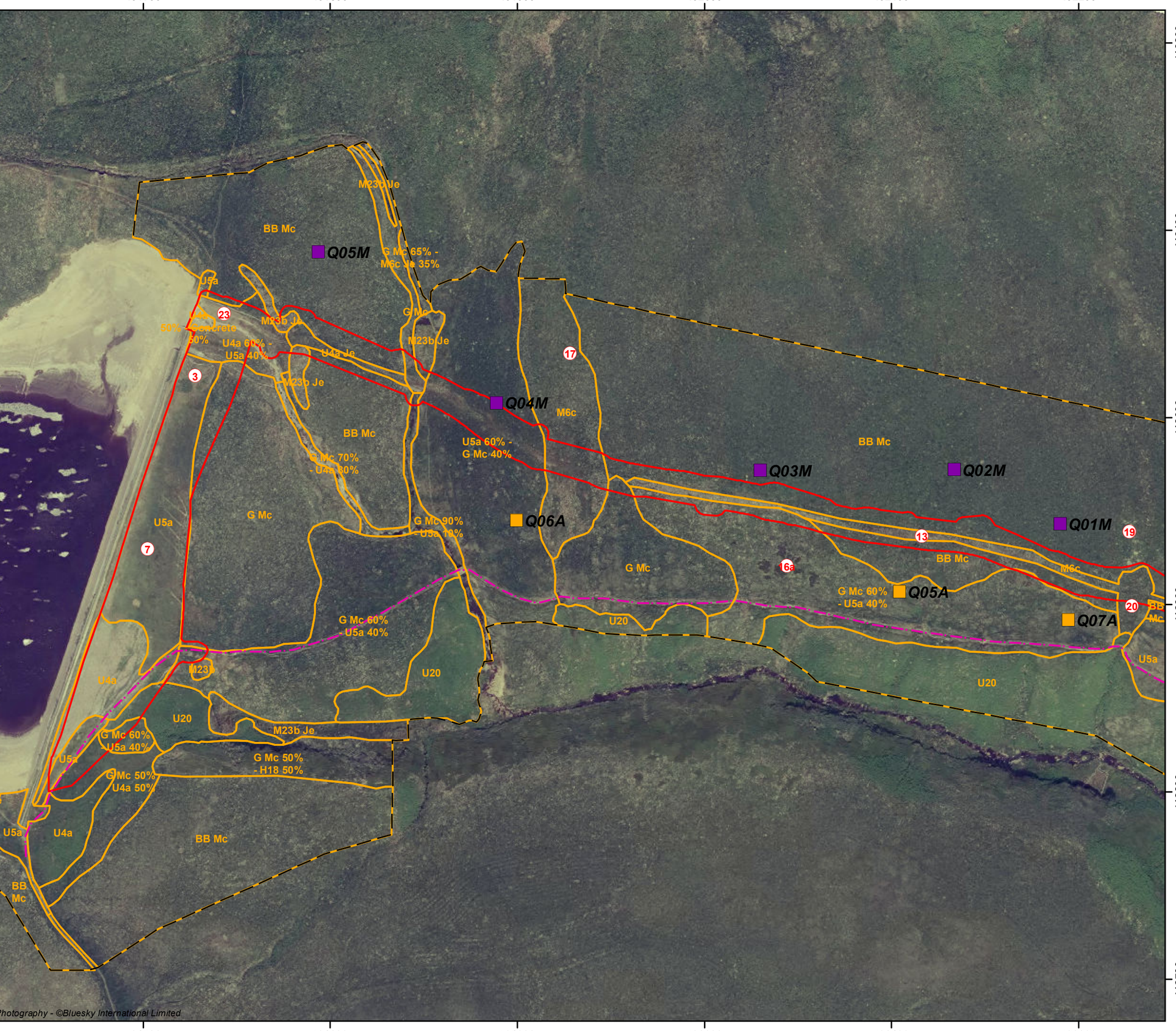

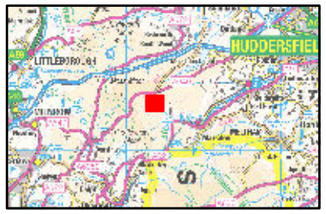

Legend

- Works area - red line
- South Pennine Moor SSSI, SAC and SPA
- NVC community
- Survey extent

Quadrats

- Acid grassland quadrat
- Purple moor-grass dominated quadrat
- Wet grassland quadrat
- Target notes
- Footpath

British National Grid
Projection: Transverse Mercator
False Easting: 400000.000000
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Latitude Of Origin: 49.000000

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ISO A3

Metres

0 10 20 40 60 80

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Discipline: Ecology

Title:

NATIONAL VEGETATION CLASSIFICATION (NVC) SURVEY WEST

Scale	1:2,000	Drawing No.	Figure 3b
Drawn By	CC	Originator CB	Date 06/03/2023
PAA Ref.		Revision	1.0

Figure 3b - NVC West March Haig - CART02 CC 230123.mxd

APPENDICES

APPENDIX 1

Citations of the Conservation Designations Covering the Site

County: West Yorkshire, Lancashire, Greater Manchester, North Yorkshire.

Site Name: South Pennine Moors

District: Bradford, Calderdale, Kirklees, Leeds, Craven, Burnley, Pendle, Oldham, Rochdale.

Status: Site of Special Scientific Interest (SSSI) notified under Section 28 of the Wildlife and Countryside Act, 1981

Local Planning Authority:
Bradford Metropolitan District Council
Calderdale Metropolitan Borough Council
Kirklees Metropolitan District Council
Leeds City Council
Craven District Council
Burnley District Council
Pendle District Council
Oldham Metropolitan Borough Council
Rochdale Metropolitan Borough Council

National Grid Reference: SD 920300 **Area:** 20,938.05 (ha)

Ordnance Survey Sheet 1:50,000: 103, 104, 109, 110 **1:10,000:**
SD 82 NE
SD 83 SE
SD 91 NW, NE, SW, SE
SD 92 NW, NE, SW, SE
SD 93 NW, NE, SW, SE
SD 94 SW, SE
SE 00 NW
SE 01 NW, SW
SE 02 NW, SW
SE 03 NW, SW, SE
SE 04 NW, SW, SE
SE 14 NW, NE, SW, SE

Date Notified (Under 1981 Act): 26 September 1994 **Date of Last Revision: –**

Other Information:
1. This site incorporates the existing Haworth Moor, Derby Delph, Pule Hill and Standedge Road Cutting SSSIs.
2. This site includes land which has been proposed for designation as a Special Protection Area under the EC Directive 79/409 on the Conservation of Wild Birds.

Description and Reasons for Notification:
This site forms part of the Southern Pennines lying between Ilkley in the north and the Peak District National Park boundary in the south. The majority of the site is within West Yorkshire but it also covers areas of Lancashire, Greater Manchester and North Yorkshire. The largest moorland blocks are Ilkley Moor, the Haworth Moors, Rishworth Moor and Moss Moor.

The underlying rock is Millstone Grit which outcrops at Boulsworth Hill and on the northern boundary of Ilkley Moor. The moorlands are on a rolling dissected plateau between 300m and 450m AOD with a high point of 517m at Boulsworth Hill. The greater part of the gritstone is overlain by blanket peat with the coarse gravely mineral soils occurring only on the lower slopes.

The site is the largest area of unenclosed moorland within West Yorkshire and contains the most diverse and extensive examples of upland plant communities in the county. Extensive areas of blanket bog occur on the upland plateaux and are punctuated by species rich acidic flushes and mires. There are also wet and dry heaths and acid grasslands. Three habitat types which occur on the site are rare enough within Europe to be listed on Annex 1 of the EC habitats and Species Directive (92/43) EEC. These communities are typical of and represent the full range of upland vegetation classes found in the South Pennines.

This mosaic of habitats supports a moorland breeding bird assemblage which, because of the range of species and number of breeding birds it contains, is of regional and national importance. The large numbers of breeding merlin *Falco columbarius*, golden plover *Pluvialis apricaria* and twite *Carduelis flavirostris* are of international importance.

The southern end of the site has good exposures of the Millstone Grit series and three localities are described under the heading 'Geology'.

Vegetation:
The blanket bogs of the South Pennine Moorlands are dominated by cotton-grass *Eriophorum* spp., and heather *Calluna vulgaris*. Other dwarf shrubs such as crowberry *Empetrum nigrum* and bilberry *Vaccinium myrtillus* occur in varying amounts. Crowberry is abundant on the eroding margins of the blanket bogs of the South Pennine Moors. Unusually it is also abundant in some areas of the cotton grass and heather moors. This crowberry dominant moor is restricted to the South Pennines and is particularly extensive on Ilkley Moor. Areas of wet heath containing cross-leaved heath *Erica tetralix* and cranberry *Vaccinium oxycoccos* have also developed on the blanket mires.

The lower slopes are dominated by heather moorland with large areas of acid grassland. Some parts of the heather moors are burnt for red grouse *Lagopus lagopus* and sheep management. Other dwarf shrubs occur on the heather moors including bilberry, crowberry and the locally uncommon cloud berry *Rubus chamaemorus*.

The large areas of acid grassland on former heathland reflect patterns of heavy grazing and burning. These grasslands are dominated by mat-grass *Nardus stricta* and wavy hair-grass *Deschampsia flexuosa*. On wet slopes purple moor grass *Molinia caerulea* is dominant with the wettest areas supporting heath rush *Juncus squarrosus*.

The most species rich and diverse habitats are the acidic flushes, mires and seepage lines. The more acidic flushes on the blanket peat are dominated by cotton-grass *Eriphorum vaginatum* with sedges like carnation sedge *Carex panicea*, star sedge *C. echinata* and commons sedge *C. nigra* present. In some of these flushes bog asphodel *Narthecium ossifragum* is present or even dominant amongst the moss *Sphagnum* spp/*Polytrichum* spp carpets which also often have dense populations of cranberry. The majority of flushes are less acidic and soft rush *Juncus effusus* tends to dominate in these wetlands with a few herbs like marsh bedstraw *Galium palustre* or bog stichwort *Stellaria alsine* present. Where the waters are richer in minerals, e.g. below springs, a wider range of herbs occur. Marsh violet *Viola palustris*, marsh

pennywort *Hydrocotyle vulgaris* and blinks *Montia fontana* are most common but in a few places rarer species like bogbean *Menyanthes trifoliata* and round-leaved sundew *Drosera rotundifolia* occur. The latter is now very rare in West Yorkshire. The most notable species in these flushes is the pale forget-me-not *Myosotis stolonifera*. This nationally scarce plant is found in only 32 1km squares in Britain, but occurs at two locations on the South Pennine Moors.

There are several regionally important plant communities within the site. Green Withins holds the largest population of bog pondweed *Potamogeton polygonifolius* within West Yorkshire and Ilkley Moor has the only known locality for chickweed wintergreen *Trientalis europaea* in the county. The latter is close to the site where the famous 17th century botanist John Ray found this species in the 1600s. Crags within the cloughs have ungrazed ledge communities which include ferns not found in other parts of the moors. The beech fern *Phegopteris connectilis* which is now very rare in West Yorkshire survives in at least on clough at the southern end of the site.

Birds:
The moorlands support nationally important numbers of golden plover *Pluvialis apricaria*, curlew *Numenius arquata*, merlin *Falco columbarius* and twite *Carduelis flavirostris*.

These species and the rest of the moorland breeding bird assemblage require the mosaic of habitats and large area of the moors for their survival. The blanket bogs are the main breeding grounds for the golden plover and dunlin *Calidris alpina*. These birds need relatively short vegetation to nest in and access to wet areas to feed, a combination provided by the blanket mires. The South Pennine Moors hold 1.3% of the British breeding population of golden plovers. The very large number of meadow pipits *Anthus pratensis* nesting on the bogs are a major food source for the merlin.

The deeper cover provided by the heather provides nest sites for a range of other species. The merlin population of the South Pennine Moors is particularly important. 4.7% of the British population nests on these moors and the numbers appear to be increasing. Merlin prefer nest sites in the older leggy heather, bracken beds or small trees on the moorland edge and they feed on skylarks *Alauda arvensis* and meadow pipits. Most reliant on the heather moors are the red grouse *Lagopus lagopus scoticus* a sub-species of the willow grouse restricted to the British Isles. Their stronghold is on the managed moors of the Haworth Moors complex. Golden plover are also known to nest on recently burnt areas of heather.

Curlews favour the wet acid grasslands and semi-improved areas on the edge of the moors to breed. A significant number (0.8%) of the British curlew population breed on the South Pennine Moors sharing this habitat with lapwing *Vanellus vanellus* and in the wettest areas snipe *Gallinago gallinago* and redshank *Tringa totanus*.

Twite *Carduelis flavirostris* on the South Pennine Moors represent 1% of the British breeding population. These birds are an isolated southern out-post of the race *pipilans* that occurs only in Scandinavia and the British Isles and is itself isolated from the rest of the world population in the mountains of Central Asia. The birds on the South Pennine Moors are vital to maintain the present world distribution. Twite use virtually all the moorland habitats at different stages of their lifecycle. They prefer heather for nesting but also use bracken, boulder screes, grass tussocks and dry stone walls. Feeding on small seeds they utilise grassy areas throughout the moorlands, weedy areas on the moorland edge, semi-improved pastures and even areas of burnt *Molinia* grassland.

Peregrine *Falco peregrinus* nest in small numbers on suitable crags and disused quarries and up to three pairs of short-eared owl *Asio flammeus* have nested in recent years. The moors also support wheatear *Oenanthe oenanthe*, whinchat *Saxicola rubetra*, ring ouzel *Turdus torquatus* and in some years stonechat *Saxicola torquata*.

The large reservoirs within and adjacent to the site provide feeding areas for moorland nesting birds like dunlin as well as nesting habitat for common sandpiper *Actitis hypoleucos* and grey wagtail *Motacilla cinerea*.

Two more unusual species that nest on the reservoirs are the little ringed plover *Charadrius dubius* and the shelduck *Tadorna tadorna*. The pair of shelduck nesting at Blackstone Edge reservoir are believed to be the highest altitude (1100 feet) nesting birds of this species in Britain. The streams draining the reservoirs and the moors support small numbers of dippers *Cinclus cinclus*.

Geology:
Three locations of special geological interest are identified within the South Pennine Moors: two areas of deltaic sedimentary rocks and a type locality for two diagnostic fossils.

Derby Delph Quarry (SE 017161). This quarry is of considerable sedimentological interest, it displays sandstones of Namurian age displaying two distinct bed form types, one consisting of large scale cross-bedded units and the other showing undulatory bedding. The latter type of structure was first described from this locality, and its relationship to the cross-bedded units is clearly visible. The interpretation of these structures has been a key factor in establishing a model for coarse sediment deposition in distributary channels, and thus for deltaic sedimentation as a whole.

In layman's terms, the quarry and rock outcrops within this site provide excellent exposures of sandstone layers of the Namurian Series, formed during the Carboniferous Period of geological history, about 315 million years ago. The sandstones originally accumulated on the bed of a major river delta, perhaps comparable to the modern Mississippi delta. The form of the sandstone layers is remarkably well displayed and detailed research here has enabled geologists to understand for the first time some of the characteristics of sand deposits formed in river deltas. This is thus an important site for geological study of the Namurian which has made a significant contribution to the understanding of river-bed deposits.

Standedge Road Cutting (SE 018095-023098). This site provides one of the most complete sections through the Namurian Kinderscout Grit, almost in their entirety, with the Butterly Marine Band intervening. The readily accessible sequence presents an excellent example of deltaic cyclotherms, with shales and sandstones capped by seat earths and thin coals.

A key section of great sedimentological interest in a thick stratigraphically important sandstone sequence.

In layman's terms, this road cutting provides important exposures of the Kinderscout Grit which formed during the Carboniferous Period of geological time, about 320 million years ago. The rock sequence consists of thick sandstone layers separated by layers of shale, clay and thin coal seams. The rocks accumulated on a large river delta and contain important layers rich in the fossilised remains of marine animals which accumulated during periods when the delta became flooded by the sea. The rock layers accumulated in a repeated (or cyclic) sequence characteristic of sediments formed on a river delta. This is an important site for geological

study of the Namurian series, and is of special interest as a reference section for comparative purposes.

Pule Hill (SE 032112-0321117). The section here exposed contains the Namurian Pule Hill Grit, at its type locality, overlying a sequence of goniatite-bearing shales. These constitute the type locality of the stratigraphically diagnostic goniatites *Reticuloceras bilingue* and *R. gracile*. The Pule Hill Grit is of particular interest at this locality for containing abundant bivalve and gastropod fauna. A key locality for studies of Upper Carboniferous goniatites with important implications for stratigraphic studies of the late Namurian (Marsdenian Stage).

In layman's terms, the quarry faces and rock outcrops within this site provide excellent exposures of rocks of the Namurian Series originally formed during the Carboniferous Period of geological history, about 320 million years ago. The rocks consist of shales overlain by a thick sandstone layer known as the Pule Hill Grit, both rock-types containing fossils of particular interest. The most important fossils here are the remains of marine animals known as goniatites which can be used to accurately date the rocks for the purposes of comparison with rock sequences elsewhere in Britain and overseas. Pule Hill is the locality where two particularly useful goniatites were first found and described. This is an important site for geological study of the Namurian Series especially in respect of the fossils used for dating rocks of this age.

EC Directive 79/409 on the Conservation of Wild Birds: Special Protection Area

SOUTH PENNINE MOORS
(SOUTH PENNINE MOORS, PHASE 2)

The South Pennine Moors proposed Special Protection Area is an upland of international importance. It provides habitat for an important assemblage of breeding moorland and moorland fringe birds.

The South Pennine Moors (phase 2) qualifies under Article 4.1 of the EC Directive on the Conservation of Wild Birds (79/409) by supporting nationally important breeding populations of two species listed in Annex 1. The most recent count is of 28 pairs of merlin *Falco columbarius* (4.3% of the British breeding population) and 292 pairs of golden plover *Pluvialis apricaria* (1.2%). The density of breeding golden plover is high compared to other regional populations in northern England and Scotland.

The site qualifies under Article 4.2 by supporting, in summer, a diverse assemblage of breeding migratory birds of moorland and moorland fringe habitats including: golden plover, lapwing *Vanellus vanellus*, dunlin *Calidris alpina*, snipe *Gallinago gallinago*, curlew, redshank *Tringa totanus*, common sandpiper *Actitis hypoleucos*, short-eared owl *Asio flammeus*, whinchat *Saxicola rubetra*, wheatear *Oenanthe oenanthe*, ring ouzel *Turdus torquatus* and twite *Carduelis flavirostris*. The population of twite in the South Pennines is geographically distinct and isolated from others in northern Britain, Ireland and Europe.

The South Pennine Moors support the southernmost assemblage in Britain of breeding merlin, red grouse *Lagopus lagopus*, golden plover, dunlin, short-eared owl and twite. These species are either extremely local, rare or absent further south. Together with the scattered populations of merlin, golden plover, dunlin and twite in Ireland these are the most southwestern breeding populations in the world. The South Pennine Moors thus have an important role in maintaining the breeding range of these species.

CAR
January 1995

This citation / map relates to a site entered in the Register of European sites for Great Britain.
Register reference number UK9001022
Date of registration 03 SEP 1998
Signed .....
on behalf of the Secretary of State for the Environment

EC Directive 92/43 on the Conservation of Natural Habitats and of Wild Fauna and Flora

Citation for Special Area of Conservation (SAC)

Name:	South Pennine Moors
Unitary Authority/County:	Barnsley, Bradford, Calderdale, Cheshire, Derbyshire, Kirklees, Lancashire, Leeds, North Yorkshire, Oldham, Rochdale, Sheffield, Staffordshire, Tameside
SAC status:	Designated on 1 April 2005
Grid reference:	SK144960
SAC EU code:	UK0030280
Area (ha):	64983.13
Component SSSI:	Dark Peak SSSI, Eastern Peak District Moors SSSI, Goyt Valley SSSI, Leek Moors SSSI, South Pennine Moors SSSI

Site description:

This site covers the key moorland blocks of the Southern Pennines from Ilkley Moor in the north to the Peak District in the south. The moorlands are on a rolling dissected plateau formed from rocks of Millstone Grit at altitudes of between 300m – 600m and a high point of over 630m at Kinder Scout. The greater part of the gritstone is overlain by blanket peat with the coarse gravely mineral soils occurring only on the lower slopes. The moorlands as a whole support a breeding bird community of national and international importance.

The site is representative of upland dry heath which covers extensive areas, occupies the lower slopes of the moors on mineral soils or where peat is thin, and occurs in transitions to acid grassland, wet heath and blanket bogs. The upland heath of the South Pennines is strongly dominated by *Calluna vulgaris – Deschampsia flexuosa* heath and *C. vulgaris – Vaccinium myrtillus* heath. More rarely *C. vulgaris – Ulex gallii* heath and *C. vulgaris – Erica cinerea* heath are found. On the higher, more exposed ground *V. myrtillus – D. flexuosa* heath becomes more prominent. The smaller area of wet heath is characterised by cross-leaved heath *Erica tetralix* and purple moor grass *Molinia careulea*. The site also supports extensive areas of acid grassland largely derived from dry and wet heath. In the cloughs, or valleys, which extend into the heather moorlands, a greater mix of dwarf shrubs can be found together with more lichens and mosses. The moors support a rich invertebrate fauna, especially moths, and important bird assemblages.

This site also contains areas of blanket bog, although the bog vegetation communities are botanically poor. Hare's-tail cottongrass *Eriophorum vaginatum* is often overwhelmingly dominant and the usual bog-building *Sphagnum* mosses are scarce. Where the blanket peats are slightly drier, heather *C. vulgaris*, crowberry *Empetrum nigrum* and bilberry *V. myrtillus* become more prominent. The cranberry *Vaccinium oxycoccus* and the uncommon cloudberry *Rubus chamaemorus* is locally abundant in bog vegetation. Bog pools provide diversity and are often characterised by common cottongrass *E. angustifolium*. Substantial areas of the bog surface are eroding, and there are extensive areas of bare peat. In some areas erosion may be a natural process reflecting the great age (up to 9000 years) of the South Pennine peats.

Around the fringes of the upland heath and areas of bog are blocks of old sessile oak woods, usually on slopes. These tend to be dryer than those further north and west, such that the bryophyte communities are less developed (although this lowered diversity may in some instances have been exaggerated by the effects of 19th century air pollution). Other

components of the ground flora such as grasses, dwarf shrubs and ferns are common. Small areas of alder woodland along stream-sides add to the overall richness of the woods.

The moorland also supports a range of flush and fen habitats associated with bogs, cloughs, rivers and streams. Although generally small scale features they have a specialised flora and fauna, which makes a great contribution to the overall biodiversity of the moors. Acid flushes are the most common type and these include transition mires and quaking bogs characterised by a luxuriant carpet of bog mosses *Sphagnum* spp., rushes and sedges.

Qualifying habitats: The site is designated under **article 4(4)** of the Directive (92/43/EEC) as it hosts the following habitats listed in Annex I:

- Blanket bogs*
- European dry heaths
- Northern Atlantic wet heaths with *Erica tetralix*. (Wet heathland with cross-leaved heath)
- Old sessile oak woods with *Ilex* and *Blechnum* in the British Isles. (Western acidic oak woodland)
- Transition mires and quaking bogs. (Very wet mires often identified by an unstable 'quaking' surface)

This citation relates to a site entered in the Register of European Sites for Great Britain.
Register reference number: UK0030280
Date of registration: 14 June 2005
Signed: Trevor Salmon
On behalf of the Secretary of State for Environment, Food and Rural Affairs

APPENDIX 2

Botanical Species List

Appendix 2 Botanical Species List

Common Name	Scientific Name	A1.1.2 Woodland and Scrub	B1.1 Unimproved Acid grassland	B1.2 Semi-improved	B2.2 Semi-improved	C3.1 Tall Ruderal	E1.7 Wet Modified Bog	E2.1 Flush	G2 Streams	B5 Marshy Grassland
Herbs, Grasses and Ferns										
Alder	*Alnus glutinosa*	o-lf								
Bell heather	*Erica cinerea*						r			
Bilberry	*Vaccinium myrtillus*	r-lo	r	r			lo			
Bladder sedge	*Carex vesicaria*						o-lf			
Blinks	*Montia fontana*								lo	r
Bog stitchwort	*Stellaria alsine*							lo		lo
Bracken	*Pteridium aquilinum*	f-la	r-lo							
Broad buckler-fern	*Dryopteris dilatata*	lo	o-lf				r-lo			o-lf
Broad-leaved dock	*Rumex obtusifolius*			r		o-lf				o-la
Bulbous rush	*Juncus bulbosus*								o	f-la
Cat's ear	*Hypochaeris radicata*		r-lo	lo						
Cleavers	*Galium aparine*					r-lo				
Cock's-foot	*Dactylis glomerata*		o-lf	o-lf	lo	o-lf				o-lf
Colt's-foot	*Tussilago farfara*			o-lf *						
Common bent	*Agrostis capillaris*	f-la	f-la	o-lf	f					
Common chickweed	*Stellaria media*				r-lo					
Common cottongrass	*Eriophorum angustifolium*						lo			r
Common marsh-bedstraw	*Galium palustre*		lo						r	r-lf
Common mouse-ear	*Cerastium fontanum*		r	r-lo						
Common nettle	*Urtica dioica*		lo	lo	lo	f-la			lo	o-lf
Common ragwort	*Jacobaea vulgaris*		lo-lf	r						lo
Common sedge	*Carex nigra*		o-lf	lf			lo	lo		o
Common sorrel	*Rumex acetosa*		lo					lo		o
Common water-starwort	*Callitriche stagnalis*								lo	r
Compact rush	*Juncus conglomeratus*	lo							lo	
Creeping bent	*Agrostis stolonifera*					lo				lo
Creeping buttercup	*Ranunculus repens*		f	lo-lf	o-lf	o-lf				
Creeping soft-grass	*Holcus mollis*	f-la								
Creeping thistle	*Cirsium arvense*		r	o-lf	o	f-la				
Crested dog's-tail	*Cynosurus cristatus*			o-la	f-la					
Cross-leaved heath	*Erica tetralix*						r			
Crowberry	*Empetrum nigrum*						r			
Cuckooflower	*Cardamine pratensis*		lo	lo				lo		r-lo
Daisy	*Bellis perennis*				lo					
Downy birch	*Betula pubescens*	o								
Field wood-rush	*Luzula campestris*		r-lo	lo						
Floating sweet-grass	*Glyceria fluitans*								lo	
Foxglove	*Digitalis purpurea*	lo	lf	r	r-lo			lo	r	lo
Goat willow	*Salix caprea*	lf	r							

Common Name	Scientific Name	A1.1.2 Woodland and Scrub	B1.1 Unimproved Acid grassland	B1.2 Semi-improved	B2.2 Semi-improved	C3.1 Tall Ruderal	E1.7 Wet Modified Bog	E2.1 Flush	G2 Streams	B5 Marshy Grassland
Great willowherb	*Epilobium hirsutum*				lo	o-lf				r-lf
Greater bird's-foot trefoil	*Lotus pedunculatus*	lo								
Hairy bitter-cress	*Cardamine hirsuta*									o
Hard-fern	*Blechnum spicant*								r	
Hare's-tail cottongrass	*Eriophorum vaginatum*						r-lo			
Hawthorn	*Crataegus monogyna*	la								
Hazel	*Corylus avellana*	o								
Heath bedstraw	*Galium saxatile*		lf	o-f			r			o-lf
Heath rush	*Juncus squarrosus*		lo-lf	o-lf			lo			o
Heath wood-rush	*Luzula multiflora*		o-lf	lo				r-lo		r
Heather	*Calluna vulgaris*		r-lf				r			
Himalayan balsam	*Impatiens glandulifera*								r-lo	
Lady-fern	*Athyrium filix-femina*		r						r	
Larch species	*Larix* sp.	o-lf								
Lemon-scented fern	*Oreopteris limbosperma*							r	r	
Lesser spearwort	*Ranunculus flammula*			r					o-lf	o-lf
Lesser trefoil	*Trifolium dubium*			r-lo *						
Male-fern	*Dryopteris filix-mas*		lo							r-lo
Marsh foxtail	*Alopecurus geniculatus*								o-lf	
Marsh thistle	*Cirsium palustre*	lo	lo				r	lo		o
Marsh violet	*Viola palustris*		r							lo
Marsh willowherb	*Epilobium palustre*	lo							r	r-lo
Mat-grass	*Nardus stricta*		f-la	r						lo
Meadow buttercup	*Ranunculus acris*		o-lf	lo						
Meadow foxtail	*Alopecurus pratensis*				lo	f				
Norway spruce	*Picea abies*				r					
Oval sedge	*Carex leporina*		o-lf	lo	lo					
Perennial rye-grass	*Lolium perenne*			o-la	f-la					lo-lf
Procumbent pearlwort	*Sagina procumbens*									r-lo
Purple moor-grass	*Molinia caerulea*		o-la	r			a-ld	f-la		a
Red clover	*Trifolium pratense*				r-lo					
Red fescue	*Festuca rubra*		f	f-la	lo-lf			lo		o-lf
Ribwort plantain	*Plantago lanceolata*		lo	lo						
Rosebay willowherb	*Chamaenerion angustifolium*		o-lf			f-la	r-lo			la
Rough meadow-grass	*Poa trivialis*			o-lf	o-lf					lf
Round-leaved crowfoot	*Ranunculus omiophyllus*								lo	r
Rowan	*Sorbus aucuparia*	f-la	r							
Scaly male-fern	*Dryopteris affinis*		r						r	r
Scots pine	*Pinus sylvestris*	o-lf								
Selfheal	*Prunella vulgaris*				r-lo					
Sessile oak	*Quercus petraea*	f-la								
Sharp-flowered rush	*Juncus acutiflorus*	lf-la								

Common Name	Scientific Name	A1.1.2 Woodland and Scrub	B1.1 Unimproved Acid grassland	B1.2 Semi-improved	B2.2 Semi-improved	C3.1 Tall Ruderal	E1.7 Wet Modified Bog	E2.1 Flush	G2 Streams	B5 Marshy Grassland
Sheep's sorrel	*Rumex acetosella*		o-lf	lf						
Sheep's-fescue	*Festuca ovina*		o-lf	o-lf						lo
Silver birch	*Betula pendula*	f-la	r							
Smooth meadow-grass	*Poa pratensis*			o	f					r-lo
Smooth-stalked sedge	*Carex laevigata*									
Soft-rush	*Juncus effusus*	lf-la	lo	f-la	la		lo-lf	a-ld	o-lf	a-ld
Spear thistle	*Cirsium vulgare*					r				
Sweet vernal-grass	*Anthoxanthum odoratum*		f-la	f-la	lf					o-lf
Sycamore	*Acer pseudoplatanus*	o								
Timothy	*Phleum pratense*			lo	lo					
Toad rush	*Juncus bufonius*									lo
Tormentil	*Potentilla erecta*		o-lf	lo						r
Tufted hair-grass	*Deschampsia caespitosa*	lo	lo	o-lf	f	f			o-lf	o-lf
Velvet bent	*Agrostis canina*							lo-lf		o-lf
Water figwort	*Scrophularia auriculata*								o-lf	
Water horsetail	*Equisetum fluviatile*		vlo							
Wavy hair-grass	*Avenella flexuosa*	f-la	f-la	o-lf			f			o-lf
White clover	*Trifolium repens*			lo-lf	f-la					r-lo
Willow species	Salix sp.	o								
Willowherb species	*Epilobium* spp.		r							lo
Yorkshire-fog	*Holcus lanatus*		f-la	o-lf	lo	f-la		f-la		f
Mosses										
Blunt-leaved bog-moss	*Sphagnum palustre*	o-la					o			o-lf
Bog-moss species	*Sphagnum* sp.						o			
Common feather-moss	*Kindbergia praelonga*		o-lf							o-lf
Common haircap	*Polytrichum commune*						f-la			
Flat-topped bog-moss	*Sphagnum fallax*	o-la					o-lf	o		
Fringed bog-moss	*Sphagnum fimbriatum*						o-lf			o-lf
Haircap species	*Polytrichum* sp.						r-lo			
Heath plait-moss	*Hypnum jutlandicum*						o-lf			lo
Lustrous bog-moss	*Sphagnum subnitens*						o-lf			
Papillose bog-moss	*Sphagnum papillosum*						lo			
Rough-stalked feather-moss	*Brachythecium rutabulum*									o-lf
Spear-moss	*Calliergon cuspidatum*									f
Spiky bog-moss	*Sphagnum squarrosum*									r
Springy turf-moss	*Rhytidiadelphus squarrosus*		f-a	a			o-lf			a-ld

KEY

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

*Species denoted by * were only recorded in the Ephemeral-short perennial vegetation close to the reservoir overflow*

APPENDIX 3

Quadrat Data – All Quadrats

Appendix 3 Quadrat Data - All Quadrats

		Purple Moor-grass-dominated					Wet Grassland			Acid Grassland						
		Q01M	Q02M	Q03M	Q04M	Q05M	Q01W	Q02W	Q03W	Q01A	Q02A	Q03A	Q04A	Q05A	Q06A	Q07A
Scientific Name	**Common Name**															
Herbs, Grasses and Ferns																
Agrostis canina	Velvet bent						2	20	15							
Agrostis capillaris	Common bent														5	
Anthoxanthum odoratum	Sweet vernal-grass						2		1	25	20	5	2			
Avenella flexuosa	Wavy hair-grass				2							10	20	35	15	20
Carex leporina	Oval sedge										3					
Cerastium fontanum	Common mouse-ear														<1	
Chamaenerion angustifolium	Rosebay willowherb			1												
Cirsium palustre	Marsh thistle						1	2	2							
Digitalis purpurea	Foxglove						2									
Dryopteris dilatata	Broad buckler-fern			1		3	<1	<1								
Epilobium palustre	Marsh willowherb								5							
Eriophorum vaginatum	Hare's-tail cottongrass		<1													
Festuca ovina	Sheep's-fescue				5					15	30	30	30		40	10
Galium palustre	Common marsh-bedstraw								15							
Galium saxatile	Heath bedstraw				2		5						5	2		10
Holcus lanatus	Yorkshire-fog						5	2	10	35	10	5				
Juncus effusus	Soft-rush						30	60	40							
Juncus squarrosus	Heath rush										5			5	2	
Luzula multiflora	Heath wood-rush						<1				1	2	2		5	
Molinia caerulea	Purple moor-grass	100	99	97	90	95	50	10	5	3	20	20	40	40	40	50
Nardus stricta	Mat-grass									10		10	3	5		
Poa annua	Annual meadow-grass									1						
Potentilla erecta	Tormentil									2						
Stellaria alsine	Bog stitchwort			<1					4							
Urtica dioica	Common nettle								2							
Vaccinium myrtillus	Bilberry												3		1	
Mosses																
Brachythecium rutabulum	Rough-stalked feather-moss						2	5								
Hylocomium splendens	Glittering wood-moss															5
Hypnum jutlandicum	Heath plait-moss		<1			10						10		15	15	15
Kindbergia praelonga	Common feather-moss		1				2			3	5					
Rhytidiadelphus squarrosus	Springy turf-moss				1		20	10		10	15	10	5			
Sphagnum fallax	Flat-topped bog-moss		<1													
Sphagnum fimbriatum	Fringed bog-moss			<1												
Sphagnum subnitens	Lustrous bog-moss						<1									
Leafy liverworts		<1	<1	<1	<1	<1	<1	<1								
Litter									10	5	10	10	5	10	5	5
Peat depth (cm)		50	100	70	20	55										

APPENDIX 4

MATCH Results for Combined Quadrats in the Different Habitats

Appendix 4 MATCH Results for Combined Quadrats in the Different Habitats

Matches for constancy aggregated from samples in purple moor-grass dominated vegetation Q01M-Q05M

Matches against communities

Community	Coefficient		
U2	27.6	2	subcommunities
M6	24.4	4	subcommunities
M15	23.7	4	subcommunities
M4	22.8	0	subcommunities
M17	22	3	subcommunities
M25	22	3	subcommunities

Matches against sub-communities

Community	Coefficient		
U16c	29.7	0	subcommunities
M15d	29.6	0	subcommunities
U2	27.6	2	subcommunities
M6d	27.2	0	subcommunities
M25a	26.6	0	subcommunities
U2a	26.2	0	subcommunities

Matches for constancy aggregated from samples in wet grassland vegetation Q01W-Q03W

Matches against communities

Community	Coefficient		
M23	43.9	2	subcommunities
M25	37	3	subcommunities
M27	33.7	3	subcommunities
M6	33.4	4	subcommunities
M28	28.9	3	subcommunities
M24	25.9	3	subcommunities

Matches against sub-communities

Community	Coefficient		
M23	43.9	2	subcommunities
M23b	43.1	0	subcommunities
M25c	42.3	0	subcommunities
M27c	41.2	0	subcommunities
M23a	37.7	0	subcommunities
M25	37	3	subcommunities

Matches for constancy aggregated from samples in acid grassland vegetation Q01A-Q07A

Matches against communities

Community	Coefficient		
U5	49.9	5	subcommunities
U6	47.4	4	subcommunities
U20	43.6	3	subcommunities
U2	43.4	2	subcommunities
U4	43.2	5	subcommunities
U16	35	3	subcommunities

Matches against sub-communities

Community	Coefficient		
U5a	51.3	0	subcommunities
U5	49.9	5	subcommunities
U5b	48.9	0	subcommunities
U4e	48.2	0	subcommunities
U16c	47.8	0	subcommunities
U5d	47.4	0	subcommunities

APPENDIX 5

MATCH Results for Acid Grassland Quadrats

Appendix 5 MATCH Results for Acid Grassland Quadrats

Matches for sample Q01A - acid grassland

Matches against communities

Community	Coefficient		
U5	34.9		
M25	34.6	5	subcommunities
U4	34.1	3	subcommunities
U20	32.5	5	subcommunities
		6	subcommunities

Matches against sub-communities

Community	Coefficient		
U5a	37.9		
U5d	37.3	0	subcommunities
M25b	37.3	0	subcommunities
U20a	37.2	0	subcommunities

Matches for sample Q02A - acid grassland

Matches against communities

Community	Coefficient		
U6	28.6	4	subcommunities
U5	28.2	5	subcommunities
U4	26.7	5	subcommunities
U20	25.3	3	subcommunities

Matches against sub-communities

Community	Coefficient		
U6d	39.5	0	subcommunities
U5c	31.9	0	subcommunities
U5b	31.1	0	subcommunities
U4d	30.9	0	subcommunities

Matches for sample Q03A - acid grassland

Matches against communities

Community	Coefficient		
U5	36.5	5	subcommunities
U4	31.3	5	subcommunities
U20	30.5	3	subcommunities
U6	28.6	4	subcommunities

Matches against sub-communities

Community	Coefficient		
U5a	41.1	0	subcommunities
U5b	40	0	subcommunities
U6d	39.2	0	subcommunities
U5	36.5	5	subcommunities

Matches for sample Q04A - acid grassland

Matches against communities

Community	Coefficient		
U5	49.8	5	subcommunities
U20	41.2	3	subcommunities
U2	38.9	2	subcommunities
U6	38.1	4	subcommunities

Matches against sub-communities

Community	Coefficient		
U5a	56.5	0	subcommunities
U5b	51.8	0	subcommunities
U5	49.8	5	subcommunities
U4e	49.8	0	subcommunities

Matches for sample Q05A - acid grassland

Matches against communities

Community	Coefficient		
U5	32.3	5	subcommunities
U2	31.2	2	subcommunities
U6	29.5	4	subcommunities
M15	24.7	3	subcommunities

Matches against sub-communities

Community	Coefficient		
U5a	37.6	0	subcommunities
M15d	34.2	0	subcommunities
U5b	33.3	0	subcommunities
U5	32.3	5	subcommunities

Matches for sample Q06A - acid grassland

Mires, Mesotrophic grasslands, Acid grasslands + montane

U5	34.6	5	subcommunities
U6	34.6	4	subcommunities
U2	32.7	2	subcommunities
U4	28.2	5	subcommunities

Matches against sub-communities

Community	Coefficient		
U5b	39.7	0	subcommunities
U5a	37.4	0	subcommunities
U4e	36.5	0	subcommunities
M15d	36.2	0	subcommunities

Matches for sample Q07A - acid grassland

Mires, Mesotrophic grasslands, Acid grasslands + montane

U2	32	2	subcommunities
U5	30.4	5	subcommunities
U20	29.5	3	subcommunities
U6	26.9	4	subcommunities

Matches against sub-communities

Community	Coefficient		
U5a	35.6	0	subcommunities
U20c	33.5	0	subcommunities
U2a	32.2	0	subcommunities
U1e	32.1	0	subcommunities

APPENDIX 6

Photographs along the Route of the Re-instated Temporary Track; Figure A6.1 Location of Photographs Points Along Track

Appendix 6
Photographs along the Route of the Re-instated Temporary Track

T1 looking west towards the reservoir, close to the western end

T1 looking east, dry narrow path used by public to access reservoir overflow/spillway.

T1a Route of track through blanket bog and deep peat.

Almost a double wheeled track, substrate hard but has been wet and rutted in the past. Some stone near the surface. Looking east

T2 River crossing closest to reservoir

A small rush dominated section of track by stream crossing, looking east

T3 Second stream crossing, wet

Wet patch on the line of the track, pipe probably blocked.

T4 Line of track visible as a line of rushes – looking east

T4 Line of track less visible looking back, west toward reservoir.

T5 Rushes, variable peat depth, some ruts in substrate, variable, looking east

T5 Rushes, looking west to reservoir

T6 Clear line of rushes, looking east, very wet substrate, surface c30cm below adjacent ground level.

T6 Route of track clear not the distance as line of rushes, looking west

T7 Looking east, slightly drier to the east than the last section and ground less variable.

T7 Looking west, back at wetter section

T8 looking east

T8 looking west, line clearly visible.

T9 Looking east, line visible, soft-rush and tufted hair-grass increasing again on the line

T9 Looking west, line visible

T10 Looking east, wide section of soft-rush, very wet, frequent *Sphagnum*

T10 Looking west

T11 Looking east, east of this point there are small amounts of common cottongrass on track line

T11 Looking west

T12. Gate is the boundary of the SSSI. Looking east out of the SSSI, East of here the vegetation is acid grassland and very thin soils.

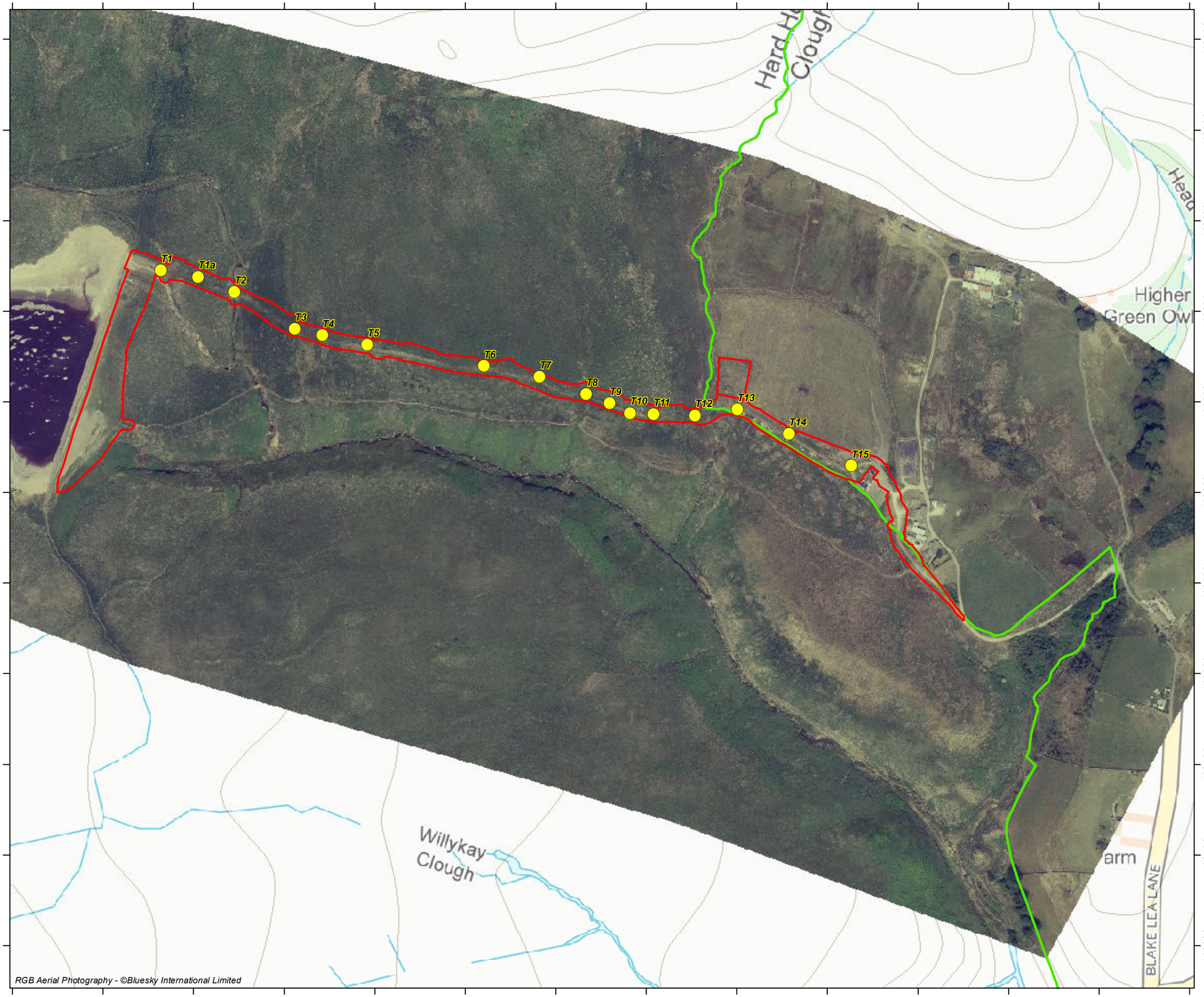
T12 Looking west at the soft-rush and cottongrass

T13 East, outside SSSI, small flush in foreground

T13 West into the SSSI and first stream crossing

T14 Track looking west with disturbed fenced section to north (right)

T15 Eastern end of the track by the barn, looking west, dry surface but clearly gets muddy.



Legend

- Red line application boundary
- Site of Special Scientific Interest (SSSI)
- Photograph location

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 25 50 100 150 Metres

Canal & River Trust
Making life better by water

Penny Anderson Associates Ltd
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Telephone 01298 27086

Project Name: March Haigh Reservoir

Discipline: Ecology

Title:

LOCATION OF PHOTOGRAPH POINTS ALONG TRACK

Scale	Drawing No	
1:4,000	Figure A6.1	
Drawn By: CC	Originator: KL	Date: 07/03/2023
PAA Ref.	Revision: 1.0	

Figure A6-1 - Photograph Locations - CART02-1 CC 230306.mxd

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