A57 Link Roads
TR010034
6.5 Environmental Statement Appendix 8.1 Biodiversity Baseline and Preliminary Assessment

APFP Regulation 5(2)(a)

Planning Act 2008 Infrastructure Planning (Applications: Prescribed Forms and Procedure) Regulations 2009

June 2021

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1. Introduction

1.1.1 This Technical Appendix presents the detailed biodiversity baseline including full methodologies, results, and a preliminary ecological assessment of the value of each ecological receptor associated with the A57 Link Roads Scheme (previously known as Trans Pennine Upgrade Programme) and herein after referred to as 'the Scheme'.

1.1.2 The impact assessment, design, mitigation and enhancement measures are provided in the Biodiversity chapter (Chapter 8) of the Environmental Statement (TR010034/APP/6.3).

1.1.3 This Technical Appendix has been prepared in accordance with best practice guidance for ecological impact assessment of road schemes including the Design Manual for Roads and Bridges (DMRB) LA 108[1], LD 118[2], LA 104[3] and the Chartered Institute of Ecology and Environmental Management (CIEEM) Guidelines for Ecological Impact Assessment[4].

1.1.4 In compliance with the Protection of Badgers Act 1992[5], and to prevent the release of badger sett locations, all detailed desk study and survey information related to badgers is presented in a confidential appendix (Appendix 8.2, TR010034/APP/6.5). This confidential appendix will only be released to the Planning Inspectorate and to other individuals as deemed appropriate (upon request).

[1] DMRB LA 108 Biodiversity (formerly Volume 11, Section 3, Part 4 Ecology and Nature Conservation and IAN 130/10) Revision 1.
[2] DMRB LD 118 Biodiversity Design (formerly LA 118 which superseded HA 59/92, HA 67/93, HA 80/99, HA 81/99, HA 84/01, HA 97/01, HA 98/01, HA 116/05, IAN 116/08, IAN 116/08(W)) Revision 0.
[3] DMRB LA 104 Environmental assessment and monitoring (formerly HA 205/08, HD 48/08, IAN 125/15, and IAN 133/10) Revision 1.
[4] CIEEM (2018) Guidelines for Ecological Impact Assessment in the UK and Ireland: Terrestrial, Freshwater, Coastal and Marine version 1.1. Chartered Institute of Ecology and Environmental Management, Winchester.
[5] https://www.legislation.gov.uk/ukpga/1992/51/contents

2. Methodology

2.1 Desk Study

2.1.1 A desk study has been undertaken for records of protected and priority species in the UK, locally important species of conservation concern and statutory and non-statutory designated sites of nature conservation interest. Only records returned within the last ten years were assessed (specifically 2010 onwards).

2.1.2 The Multi-Agency Geographic Information for the Countryside (MAGIC) website[6] was used to obtain information on statutory designated sites within 2 km[7]. This included:

- Special Areas of Conservation (SAC)
- Candidate SAC (cSAC)
- Potential SACs (pSAC)
- Special Protection Area (SPA)
- Potential SPA (pSPA)
- Ramsar sites and proposed Ramsar sites (pRamsar)
- Site of Special Scientific Interest (SSSI)
- National Nature Reserve (NNR)
- Local Nature Reserve (LNR).

2.1.3 In addition, any priority habitats, Ancient Woodland and any granted European Protected Species (EPS) mitigation licences were searched within 2 km of the Scheme using Magic Map[6].

2.1.4 Desk study records for non-statutory designated sites of nature conservation interest, notable, and legally protected species were obtained from the relevant Local Environmental Record Centre (LERC) or local conservation group. This included searches for any Local Wildlife Sites (LWS), potential LWS (pLWS), Sites of Biological Importance (SBI), and Nature Improvement Areas (NIA) within 2 km of the Scheme. This was extended to 5 km for bats and barn owls. These records, including distances obtained, are outlined within Table 2-1.

Table 2-1: Data search requests

Data source	Type and date of consultation	Information requested/ issues discussed
Derbyshire Biological Records Centre (DBRC)	By email – 4 October 2019 By email – 1 October 2020 (for non-statutory site citations for nature conservation)	Data received 8 October 2019 for protected and notable species records within a 2 km (extended to 5 km for barn owls) search radius of the Scheme where this search area fell within Derbyshire. Data received 15 October 2020 for non-statutory site citations within 50

[6] Magic Website: http://www.magic.gov.uk/. [Accessed October 2020]
[7] This was extended to 30 km for any Special Areas of Conservation with bats as the qualifying feature

Data source	Type and date of consultation	Information requested/ issues discussed
		m of the affected road network (ARN)[8] as required by LA 105.
Greater Manchester Local Record Centre (GMLRC)	By email – 4 October 2019 By email – 28 September 2020 (for 5 km bat and notable bird records & non-statutory site citations)	Data received 11 October 2019 for protected and notable species records within a 2 km (extended to 5 km for bats and barn owls) search radius of the Scheme where this search area fell within Greater Manchester. Data received 6 October 2020 for 5 km bat and notable bird records & non-statutory site citations within 50 m of the ARN.
Derbyshire Bat Group	By email – 3 April 2020	Data received 08 April 2020 for records of bats within a 5 km search radius of the Scheme where this search area fell within Derbyshire.
Derbyshire & Nottinghamshire Entomological Society	By email – 23 March 2020	Invertebrate species records within a 1 km search radius of the Scheme. Data received on 28 January 2021.
Pennine Edge Barn Owl Group	By email – 2 September 2020	Data received 2 September 2020 for local records of barn owl within 1 km of the Scheme.

2.1.5 Records of ancient, veteran, and notable trees were obtained from the Woodland Trust's Ancient Tree Inventory[9] within 2 km of the Scheme.

Limitations

2.1.6 The search for water bodies within 500 m of the DCO boundary was undertaken by using Ordnance Survey plans and aerial photographs only. These sources may not show all ponds and or water bodies within 500 m of the DCO boundary and therefore, some water bodies may not have been identified.

2.1.7 The desk study reviewed the Woodland Trust's Ancient Trees Inventory. This provides records of veteran trees, but is not an exhaustive list and other ancient, veteran, or notable trees may be present in the area. The extended Phase 1 habitat survey and aboricultural survey aimed to identify such features within the survey area, and no trees were identified as being ancient, veteran, or notable and as such, this is not considered a constraint.

2.1.8 DBRC and GMLRC records are not exhaustive, and the absence of records does not demonstrate the absence of species.

2.1.9 It is not considered that the limitations outlined have significantly affected the ability to undertake the assessment and therefore, the outlined results are valid.

[8] All roads that trigger the traffic screening criteria and adjoining roads within 200 m.
[9] https://ati.woodlandtrust.org.uk/ [Accessed 2 November 2020]

2.2 Extended Phase 1 Habitat Survey

Field Survey

2.2.1 An ecological walkover survey of areas within and adjacent to the Scheme, including land up to 50 m from the DCO boundary, where access was allowed (the Survey Area), was undertaken on 9th, 10th and 15th October 2019 using the extended Phase 1 habitat survey methodology[10] as guidance. The walkover survey recorded information on the habitats within the survey area and also included a search for evidence of the presence of, and the potential of each habitat to support, protected and priority species as recommended by CIEEM[11]. Vascular plant names recorded during this survey followed Stace[12].

2.2.2 This survey method comprised mapping habitats present according to the JNCC Phase 1 habitat survey methodology[10], with target notes (TNs) used to record specific details on the plant species composition of the habitats, current management and quality. TNs were also used to record features of ecological importance (e.g. ponds, complex habitat mosaics). In addition, the survey comprised assessing the suitability of the habitats present for, and recording any activity of the following species:

- amphibians (terrestrial and aquatic habitats), including an assessment of aquatic habitat for its suitability to support great crested newts[13]
- bats[14]
- badger
- breeding and wintering birds
- hazel dormouse[15]
- reptiles[16]
- priority invertebrates[17]
- water vole[18], otter and white-clawed crayfish[19]
- hedgehog
- brown hare.

2.2.3 Evidence of the presence of the following invasive species was recorded where seen:

[10] Joint Nature Conservation Committee (2010) Handbook for Phase 1 habitat survey - a technique for environmental audit.
[11] CIEEM (2017) Guidelines for preliminary ecological appraisal. 2nd Edition.
[12] Stace (2019) New Flora of the British Isles 4th edition
[13] Oldham R.S., Keeble J., Swan M.J.S. & Jeffcote M. (2000) Evaluating the suitability of habitat for the Great Crested Newt (*Triturus cristatus*) Herpetological Journal 10 (4), 143-155 (2000).
[14] Collins, J. (ed.) (2016) Bat Surveys for Professional Ecologists: Good Practice Guidelines (3rd edition). The Bat Conservation Trust, London
[15] English Nature (2006). The Dormouse Conservation Handbook (2nd edition).
[16]Froglife (1999) Reptile Survey: an introduction to planning, conducting and interpreting surveys for snake and lizard conservation. Froglife advice sheet 10
[17] As relevant to the location, identified through the desk study
[18] Dean, M. et al The Water Vole Mitigation Handbook (2016). Mammal Society.
[19] Peay S. (2003) Monitoring the White-clawed Crayfish *Austropotamobius pallipes* Conserving Nature 2000 Rivers Monitoring Series No. 1. English Nature, Peterborough.

- Evidence of animal species as listed on the Invasive Alien Species (Enforcement and Permitting) Order 2019; Chinese mitten crab, red swamp crayfish, signal crayfish, spiny cheek crayfish, muntjac deer, ruddy duck, Egyptian goose, and grey squirrel
- Evidence of the presence of the following invasive species: Japanese knotweed, giant knotweed, hybrid knotweed, giant hogweed, Himalayan balsam, rhododendron, New Zealand pigmy weed, Virginia creeper, variegated yellow archangel, and cotoneaster. These are listed on Schedule 9 of the Wildlife and Countryside Act 1981 (as amended) and subject to strict legal control
- In addition to those listed above, evidence of plant species as listed on the Invasive Alien Species (Enforcement and Permitting) Order 2019: Nuttall's waterweed, Chilean rhubarb, floating pennywort, curly waterweed and parrot's feather, fanwort, water hyacinth and floating water primrose.

2.2.4 As a result of the findings of the extended Phase 1 habitat survey, desk study and the subsequent assessment of the presence or likelihood of occurrence of any legally protected, noteworthy and/ or invasive species within the survey area, a suite of further surveys were undertaken, the methodologies for which are detailed in the following sections below. The only exception to this is badgers, which are dealt with in a separate 'confidential' Appendix 8.2 (TR010034/APP/6.5).

Standing water bodies and watercourses

2.2.5 Detailed methodology and results regarding standing water bodies and watercourses are outlined within Appendix 8.3 (TR010034/APP/6.5) and are not discussed further within this report.

Limitations

2.2.6 The list of invasive plant species included on Schedule 9 of the Wildlife and Countryside Act 1981 (as amended) is extensive and these plants are found in a range of different habitats, including aquatic habitats. The extended Phase 1 habitat survey checked for the presence of several invasive plants, including, but not limited to, Japanese knotweed, giant knotweed, hybrid knotweed, giant hogweed, Himalayan balsam, rhododendron, New Zealand pigmyweed, Virginia creeper, variegated yellow archangel, and cotoneaster species. It also included a check of aquatic habitats for Nuttall's waterweed, Chilean rhubarb, floating pennywort, curly waterweed, parrot's feather, fanwort, water hyacinth, and floating water primrose. It may be possible that certain invasive species have not been identified, however, updated walkover surveys would be undertaken at regular intervals to ensure that the baseline is up to date.

2.2.7 Ecological surveys are limited by factors which affect the presence of plants and animals such as the time of year, migration patterns and behaviour. The extended Phase 1 habitat survey has not therefore produced a complete list of plants and animals and the absence of evidence of any particular species should not be taken as conclusive proof that the species is not present or that it will not be present in the future. The above limitation/s has been addressed through taking the precautionary approach within the appraisal.

2.3 Hedgerows

2.3.1 A Hedgerow Survey was undertaken on 28 and 29 June 2017 to assess if hedgerows within the Survey Area conformed to the definition of 'Important' under the Hedgerow Regulations (1997). These survey results were ground-truthed as part of the updated extended Phase 1 habitat survey undertaken in October 2019 and updated accordingly in response to any changes within the Survey Area following the methodology outlined below.

2.3.2 In accordance with the Hedgerow Survey Handbook[20] a Hedgerow is defined as:

> *"as any boundary line of trees or shrubs over 20 m long and less than 5 m wide at the base, provided that at one time the trees or shrubs were more or less continuous. It includes an earth bank or wall only where such a feature occurs in association with a line of trees or shrubs. This includes 'classic' shrubby hedgerows, lines of trees, shrubby hedgerows with trees and very gappy hedgerows (where each shrubby section may be less than 20 m long, but the gaps are less than 20 m)".*

2.3.3 Surveys involved walking the length of all hedgerows within the Survey Area and recording the following features:

- Number of woody species per 30 m length
- Height
- Width
- Amount of gaps
- Number of mature trees
- Ground flora
- Estimated age
- Presence of a bank or ditch
- Number of connections to other hedgerows.

2.3.4 During the survey, the start and end points of each hedgerow were recorded with a National Grid Ordnance Survey (OS) grid reference, accurate to at least 8 figures. In order to aid the assessment of the number of connections to other hedgerows, publicly accessible aerial imagery was reviewed alongside the field survey results. Hedgerows scoped into the assessment are provided within 0 with locations provided on Figure 8.4 (TR010034/APP/6.4).

2.3.5 Hedgerows were classed as important if it meets the following criteria:

- It has existed for 30 years or more; and,
- It satisfies at least one of the criteria listed in Part II of Schedule 1[21], in summary, these are as follows:

[20] Defra (2007) *Hedgerow Survey Handbook*. A standard procedure for local surveys in the UK. Defra, London.
[21] http://www.legislation.gov.uk/uksi/1997/1160/contents/made

- Contains species that are protected at all times under the Wildlife and Countryside Act 1981 (as amended) within Schedules 1 (birds), 5 (animals) and 8 (plants) or Red Data Book species
- Is referred to in a record held by a biological record centre as having contained protected or Red Data Book species (in the case of animals and birds, within a five-year period and the case of plants, within a ten-year period)
- Includes at least seven woody species
- Includes at least six woody species, and three associated features:
    - Includes at least six woody species, including rare species (i.e. black poplar, large-leaved lime, small-leaved lime and wild service-tree)
    - Includes at least five woody species and four associated features
    - Is located adjacent to a bridleway, footpath/ road used by the public, path/ byway open to all traffic and included at least four woody species and at least two additional features.

2.3.6 Associated features referred to in the list above include:

- a bank or wall which supports the hedgerow along at least one half of its length
- gaps which in aggregate do not exceed 10% of the length of the hedgerow
- where the length of the hedgerow does not exceed 50 metres, at least one standard tree
- where the length of the hedgerow exceeds 50 metres but does not exceed 100 m, at least 2 standard trees
- where the length of the hedgerow exceeds 100 m, such number of standard trees (within any part of its length) as would when averaged over its total length amount to at least one for each 50 m
- at least 3 woodland species within one metre, in any direction, of the outermost edges of the hedgerow
- a ditch along at least one half of the length of the hedgerow
- a parallel hedge within 15 m of the hedgerow.

Limitations

2.3.7 Surveys were undertaken in 2017 which is beyond three years. The habitats within the DCO Boundary are not considered to have changed significantly since this time, and the results of these surveys were ground-truthed in 2019. It is therefore considered that these results are still valid and constitute an appropriate survey effort.

2.4 National Vegetation Classification (NVC) Survey

2.4.1 NVC surveys were undertaken in July 2017, and they broadly followed the published methodology appropriate to the vegetation being surveyed[22,23] with reference to the National Vegetation Classification: User's Handbook[24] and updates to vegetation types published on the JNCC website[25].

2.4.2 Habitats subject to survey were selected based on results of an extended Phase 1 habitat survey in June and August 2016 and consideration of the Scheme design at that point in time.

2.4.3 Homogenous stands of vegetation were identified within the woodland, and these were sampled with quadrats, size appropriate to the vegetation being surveyed, as outlined in the National Vegetation Classification: User's Handbook[24]. Quadrats were recorded in typical vegetation and were not required to be random or evenly spread. Based on the size of the woodland subject to survey, replicate 4 m x 4 m or 10 m x 10 m quadrats were recorded for the field and ground layers and then combined.

2.4.4 Within each quadrat, all species were recorded with an estimate of percentage cover/ abundance using the Domin scale[26]. The location of each quadrat was recorded accurately on a plan and a GPS coordinate taken.

Data Analysis

2.4.5 The data collected was analysed to provide the 'best' approximation to a published NVC type. The data recorded in the quadrats from each homogenous stand of vegetation were tabulated and a constancy value for each species calculated for each defined group of quadrats, as follows:

Scale:

- I = 1% - 20%
- II = 21% - 40%
- III = 41% - 60%
- IV = 61% - 80%
- V = 81% -100%

2.4.6 The tables produced were used to assign the vegetation types to one of the published plant community types through use of the keys provided in the published volumes and by visual comparison of the collected data with the published data. In addition, a computer programme (TABLEFIT) was used to facilitate comparison of the data sets with published data.

2.4.7 Further details are provided within Appendix B.

[22] •Rodwell, J.S. (ed.) (1991 et seq) *British Plant Communities*. Vol 1 to 5. Cambridge University Press.
[23] Hall, J.E., Kirby, K.J. & Whitbread, A.M. (revised 2004) *National vegetation classification field guide to woodland*, JNCC, Peterborough
[24] Rodwell JS (2006). National Vegetation Classification: User's Handbook. Joint Nature Conservation Committee. Peterborough. Available at https://hub.jncc.gov.uk/assets/a407ebfc-2859-49cf-9710-1bde9c8e28c7 [Accessed 24/11/2020]
[25] https://jncc.gov.uk/our-work/nvc/ [Accessed 24/11/2020]
[26] 1 = few individuals; 2 = some individuals; 3 = many individuals; 4 = 4% - 10%; 5 = 11% - 25%; 6 = 26% - 33%; 7 = 34% - 50%; 8 = 51% - 75%; 9 = 76% - 90%; 10 = 91% - 100%

Limitations

2.4.8 Phase 2 botanical surveys are limited by a variety of factors which affect the presence of flora (e.g. climatic variation and season). A lack of evidence of a species during a survey does not mean that the species is absent; hence the survey also records and assesses the suitability of habitats to support such species. The time frame in which the survey is implemented provides a snapshot of botanical make up within the survey area and cannot necessarily detect all evidence of use by a species (i.e. plant species may be under-recorded, unidentifiable or not visible due to the time of year the survey was carried out. This is of particular relevance to woodland flora that flower early in the year). However, the surveys were carried out at the optimal times of the year, and in good weather conditions, thus maximising the potential of identifying species, if present.

2.4.9 Surveys were undertaken in 2017 which is beyond three years. The habitats within the DCO Boundary are not considered to have changed significantly since this time, and the results of these surveys were ground-truthed in 2020 through undertaking condition assessments to inform the biodiversity metric calculation. It is therefore considered that these results are still valid and constitute an appropriate survey effort.

2.5 Biodiversity Metric Calculation

2.5.1 Biodiversity Metric Calculations have been undertaken informed by field survey visits using the UK Habitat (UKHab) Classification[27]. During the field surveys, undertaken between June and September 2020, a habitat type was assigned to each area following the methodology within the UKHab User Guide and assigned a condition of ‘poor’, ‘moderate’ or ‘good’. Habitat types were assigned to a hierarchical level (Level 1-5) of increasing detail. Where possible[28], at least Level 4 was assigned, although Level 5 and secondary codes were often used where this level of detail was appropriate.

2.5.2 A ‘condition score’ was also assigned according to the methodology and criteria outlined within the Biodiversity Metric 2.0 technical supplement[29]. This involved checking features against the relevant Technical Supplement list of criteria for the particular habitat type. It relies on professional opinion and is based on the data collected during the field surveys. Where a condition did not fit precisely into one of the three categories, an intermediate condition of fairly good or fairly poor could also be assigned at the surveyors’ discretion.

[27] Butcher, B., Carey, P., Edmonds, R., Norton, L., and Treweek,J. (2020) *The UK Habitat Classification User Manual Version 1.1.* Available at: https://www.UKhab.org. [Accessed 23/11/2020]
[28] Certain habitats do not go beyond level 3.
[29] Crosher, I., Gold, S., Heaver, M., Heydon, M., Moore, L., Panks, S., Scott, S., Stone, D. and White, N. (2019) The Biodiversity Metric 2.0: Auditing and accounting for biodiversity value: Technical supplement (Beta version, July 2019). Natural England

Data Analysis

Baseline Habitats

2.5.3 Project design drawings were converted from Computer-Aided Design (CAD) software to a Geographic Information System (GIS) environment where it was overlaid on habitat mapping data. The habitat mapping data was processed to remove small overlaps and gaps between polygons that result from digitising at low resolution.
The habitat survey data was finally clipped to exclude habitat data outside of the DCO boundary[30]. GIS was then used to calculate the area (in ha) of each habitat type which was to be lost, retained or enhanced within the DCO boundary and was further broken down by condition to give the overall area of each habitat type of each condition level for each intervention type.

Post-works Habitats

2.5.4 Landscape planting proposals were converted from CAD to GIS and areas of each proposed planting type calculated. Any habitats identified as retained in the baseline were removed from the calculation to avoid double-counting. Each proposed planting type was translated into a UKHab classification category and a target condition assigned based on the likely achievable condition. The likely achievable condition was determined using professional judgement and with reference to the Outline Construction Environmental Management Plan: First Iteration (CEMP), including the Landscape masterplan and planting schedules.

Calculating Biodiversity Unit Change

2.5.5 The Defra Biodiversity Metric 2.0 Calculation Tool[31] was used to calculate the predicted change in biodiversity units between the baseline and post-development scenarios.

2.5.6 The metric uses a number of measures to quantify baseline biodiversity value for each habitat type within the Scheme area. These measures include the habitats' intrinsic value (i.e. it's distinctiveness), its condition (as assessed during field surveys) and its area (in hectares). In addition, spatial multipliers such as the connectivity of the habitat and the strategic significance of the Scheme are used to give an overall score in biodiversity units.

2.5.7 A habitat's distinctiveness score is derived from its intrinsic biodiversity value, reflecting the rarity of the plant community, the time it takes to reach maturity, its value to fauna, and its ecosystem function. This score is pre-assigned and is pre-populated in the metric.

2.5.8 The calculation for baseline biodiversity units for any habitat parcel is as follows:

$$Baseline\ biodiveristy\ units = Area\ of\ habitat\ parcel\ (ha) \times distinctiveness \times condition \times strategic\ location \times conecctivity$$

[30] The predicted construction area includes both permanent and temporary land take.
[31] Downloaded 13/07/2020. The Defra 2.0 metric is still in beta test version with regular updates being published.

2.5.9 Post-works biodiversity units are calculated using values for habitat distinctiveness, target condition and area, along with the spatial multipliers for connectivity and strategic significance. In addition, negative values may be applied to account for the time any given habitat takes to reach its target condition and the difficulty of creating any given habitat (i.e. the risk). These temporal and risk related multipliers are set by Defra and cannot be changed. Where habitat creation is off-site, an additional negative multiplier is applied based on the distance of the habitat creation to the site of habitat loss. For details of the definitions of these multipliers and how the values for each multiplier are assigned to each habitat, refer to the Biodiversity Metric 2.0 Technical Supplement[32].

2.5.10 The calculation for post-works biodiversity units for any habitat parcel is as follows:

$$\begin{aligned} &Post\text{-}works\ biodiveristy\ units \\ &= \ area\ of\ habitat\ parcel\ (ha) \times distinctiveness \times condition \\ &\times strategic\ location\ \times conecctivity\ \times difficulty \\ &\times time\ to\ target\ condition\ \times off\ site\ risk \end{aligned}$$

N. b. bold indicates a multipler that is 1 or less than 1, so it can reduce rather than increase the total.

2.5.11 Following guidance within the Biodiversity Metric 2.0 user guide[33], habitats of medium or lower distinctiveness were assigned low connectivity and habitats of high or above distinctiveness assigned moderate connectivity.

2.5.12 In order to determine the strategic significance of the Scheme, a review of statutory and non-statutory designated sites within 2 km of the Scheme was undertaken using MAGIC[34] and data requested from GMBRC and DBRC (See Table 2-1). The Tameside Unitary Development Plan[35] and High Peak Local Plan[36] were also reviewed.

2.5.13 In order to calculate the overall net change in biodiversity units the baseline units are subtracted from the post works units as follows:

$$Net\ change = \ post\text{-}works\ biodiveristy\ units - baseline\ biodiversity\ units$$

2.5.14 The multiplier scores relating to distinctiveness, condition, connectivity, strategic significance, time to target condition, difficulty of habitat of habitat creation and off-site risk are shown in Appendix C.

[32] Crosher, I., Gold, S., Heaver, M., Heydon, M., Moore, L., Panks, S., Scott, S., Stone, D. and White, N. (2019) The Biodiversity Metric 2.0: Auditing and accounting for biodiversity value: Technical supplement (Beta version, July 2019). Natural England
[33] Crosher, I., Gold, S., Heaver, M., Heydon, M., Moore, L., Panks, S., Scott, S., Stone, D. and White, N. (2019) The Biodiversity Metric 2.0: Auditing and accounting for biodiversity value: User guide (Beta version, July 2019). Natural England
[34] https://magic.defra.gov.uk/magicmap.aspx
[35] Tameside Metropolitan Borough Council (2004) Tameside Unitary Development Plan. Adopted November 2004. Accessed on 29/10/2020 at: https://www.tameside.gov.uk/Planning/Unitary-Development-Plan-(UDP)
[36] High Peak Borough Council (2016) High Peak Local Plan. Adopted April 2016. Accessed on 29/10/2020 at: https://www.highpeak.gov.uk/article/646/The-Adopted-Local-Plan-2016

Limitations

2.5.15 At the time of the preparation of this report, the metric has been published as a 'beta test' version. Whilst the metric is being currently tested, and before its official release, the metric is undergoing periodical fixes/ corrections. Due to the use of the "beta test" version, it is acknowledged that there may be errors within the calculations. However, this currently remains the most appropriate tool for biodiversity unit calculations. As such, this is not considered to be a limitation to the assessment.

2.5.16 For areas of lowland dry acid grassland (a very high distinctiveness habitat requiring bespoke compensation), the bespoke compensation was taken to be replacement habitat at a 1:1 ratio, with any additional habitat being additional and so counted in the calculations.

2.5.17 For the purposes of this assessment the area of floodplain mire has been input as Floodplain Wetland Mosaic, as due to the non-peat forming nature and small area of this habitat bespoke compensation was considered disproportionate to the impacts. It is considered that the habitat fits this description due to the mosaic of habitat types defined by the level of inundation, particularly given its current usage as equine pasture. As this habitat type is of high distinctiveness, it is considered that the habitat value is captured appropriately within the calculations.

2.5.18 Areas of temporary land take outside of highways boundary and within private land will be returned to the landowners following construction. At present, there is no agreement or commitment in place to manage these areas post construction, nor is it known how the land will be used in the future. Therefore, it has been assumed that the land will return to the same habitat type and baseline condition. While it is acknowledged that some habitats such as woodland may not be reinstated, given the lack of control over these plots of land, this assumption is considered appropriate.

2.5.19 It is acknowledged that there is a slight discrepancy in the areas of habitat loss and habitat creation, amounting to 0.11 ha. This is attributed to rounding error within the metric, and while efforts were made to minimise this by combining all habitat areas of the same type and condition prior to rounding, discrepancies still remain. It is also possible that some very small gaps or overlaps remain within the mapping, also contributing to the discrepancy. The discrepancy accounts for approximately 0.18% of the total scheme area and, is therefore considered an acceptable margin of error within the context of this assessment.

2.5.20 The likely achievable condition was determined with reference to the Biodiversity Metric 2.0 technical supplement, using professional judgement and assumes the habitats will be maintained for a minimum of 30 years in order to reach their target condition.

2.6 Bats

Previous Surveys

2.6.1 Previous assessment of bats in relation to the Scheme was undertaken in 2017 and 2018[37]. This involved preliminary roost assessments of trees and structures, climbed inspections of trees, emergence/ re-entry surveys of trees and structures (where necessary), habitat assessments, transect activity surveys and automated detector surveys. This information was reviewed as part of the desk study and to inform the requirements for further survey effort.

Survey Area

2.6.2 The bat surveys were designed based on information collected during the extended Phase 1 habitat surveys undertaken in October 2019 and results of previous assessments undertaken in 2017.

2.6.3 The bat survey area was determined following good practice guidelines[14], considering existing information on bat species distribution, population size, known roosts in the area, the habitat composition within the DCO boundary and the context and composition of this habitat within the wider landscape. The bat surveys assessed the habitats and structures within and up to 50 m from the DCO boundary (hereafter referred to as the bat survey area) for their suitability to support foraging, commuting and roosting bats.

Field Surveys

Surveyor Competencies

2.6.4 All bat surveys have been carried out by a suitably experienced ecologist assessed to be at least capable following the Chartered Institute of Ecology and Environmental Management (CIEEM) competency framework[38] and Atkins Competency Framework[39]. All surveys have been undertaken in accordance with good practice guidance[14] and CIEEM competencies for undertaking bat surveys[38]. All work that was considered likely to result in disturbance of bats or their roosts was led by holders of Natural England licences to 'take and disturb' bats.

Ground Level Tree Assessments

2.6.5 All trees within the bat survey area were inspected for suitability to support roosting bats and evidence of roosting bats. The aim of the roost assessments was to determine the locations of trees with features suitable to support roosting bats, identify evidence and/ or presence of roosting bats where possible and determine the need for further survey.

[37] Highways England (2019) Trans-Pennine Upgrade (TR010034). 6.8.1 Appendix 8.1: Biodiversity Baseline and Preliminary Assessment
[38] CIEEM (2013) Competencies for Species Survey: Bats. The Chartered Institute of Ecology and Environmental Management, Winchester.
[39] https://www.atkinsglobal.com/~/media/Files/A/Atkins-Corporate/group/services-documents/ecology_competencies_criteria_and_process_2019.pdf

2.6.6 Ground level tree assessments (GLTAs) were undertaken in June 2020. Trees were assigned a level of roost suitability as per Table 2-2, based on best practice guidance[14]. The assessment involved a detailed inspection of the tree from ground level (and with the aid of binoculars) to compile information about the tree, any potential roosting features, and any visual evidence of bats (including staining, droppings, or feeding remains).

Table 2-2: Guidelines for assessing bat roost suitability

Suitability	Description
Negligible	Negligible habitat features on site likely to be used by roosting bats.
Low	A structure with one or more potential roost sites that could be used by individual bats opportunistically. However, these potential roost sites do not provide enough space, shelter, protection, appropriate conditions and/ or suitable surrounding habitat to be used on a regular basis or by larger numbers of bats (i.e. unlikely to be suitable for maternity or hibernation). A tree of sufficient size and age to conation potential roost features but with none seen from the ground or features seen with only very limited roosting potential.
Moderate	A structure or tree with one or more potential roost sites that could be used by bats due to their size, shelter, protection, conditions and surrounding habitat but unlikely to support a roost of high conservation status (with respect to roost type only – the assessments in this table are made irrespective of species conservation status, which is established after presence is confirmed).
High	A structure or tree with one or more potential roost sites that are obviously suitable for use by larger numbers of bats on a more regular basis and potentially for longer periods of time due to their size, shelter, protection, conditions and surrounding habitat

Tree Climbing Surveys

2.6.7 In accordance with best practice guidelines[14], all trees that had moderate to high roosting suitability were subject to two (for moderate) or three (for high) tree climbing surveys where safe and appropriate. Tree climbing surveys were also undertaken on trees with low roosting suitability if it was not possible to see all features from the ground during the GLTA surveys as a precaution. These surveys were undertaken by trained tree-climbing surveyors and led by individuals with a Class 2 bat survey licence. Climbed surveys were conducted between July to September 2020, in accordance with best practice guidelines[14]. The climbed surveys involved accessing potential roost features using a harness and ropes to carry out a detailed internal inspection using torches, mirrors and endoscopes to verify their suitability and to search for evidence of bats. Based on the results of the climbed surveys, the bat roost suitability gathered during the GLTAs were updated.

Hibernation Surveys

2.6.8 Fourteen trees were assessed as having suitability for hibernating bats. In accordance with best practice guidelines[14], these trees were subject to two tree climbing surveys between December 2020 and February 2021 (Survey dates are provided within Appendix D).

2.6.9 These surveys were undertaken by trained tree-climbing surveyors and led by individuals with a Class 2 bat survey licence. Features were inspected using torches and endoscopes to search for bats or evidence of the presence of bats (e.g. droppings) following best practice guidance[14].

Walked Transect Activity surveys

2.6.10 Habitats within the bat survey area were assessed for their suitability to support commuting and foraging bats in accordance with best practice guidance[14] and as outlined within Table 2-3.

Table 2-3: Habitat suitability for foraging and commuting bats

Suitability	Description
Negligible	Negligible habitat features on site likely to be used by commuting or foraging bats.
Low	Habitat that could be used by small numbers of commuting bats such as a "gappy" hedgerow or unvegetated stream, but isolated, i.e. not very well connected to the surrounding landscape by other habitat. Suitable, but isolated habitat that could be used by small numbers of foraging bats such as a lone tree (not in a parkland situation) or a patch of scrub.
Moderate	Continuous habitat connected to the wider landscape that could be used by bats for commuting such as lines of trees and scrub or linked back gardens. Habitat that is connected to the wider landscape that could be used by bats for foraging such as trees, scrub, grassland or water.
High	Continuous, high-quality habitat that is well connected to the wider landscape that is likely to be used regularly by commuting bats such as river valleys, streams, hedgerows, lines of trees and woodland edge. High-quality habitat that is well connected to the wider landscape that is likely to be used regularly by foraging bats such as broadleaved woodland, tree lined watercourses and grazed parkland. Site is close to and connected to known roosts

2.6.11 Activity surveys were carried out along two transects (Transect 1 and Transect 2) as shown in Figure 8.9 (TR010034/APP/6.4). These transects were designed through considering the habitat composition of the bat survey area and suitable habitats which may be severed or impacted by the Scheme (e.g. hedgerows or watercourses) and accessibility.

2.6.12 Bat activity surveys on each transect were undertaken monthly, following best practice guidelines[14], during the bat survey season in October 2019 and between April-September 2020 during suitable weather conditions for bats. In accordance with best practice guidance[14], one survey for each transect consisted of a dusk and a dawn survey in the same 24-hour period.

2.6.13 Surveys commenced at sunset and lasted for approximately two hours. Bat activity was recorded using an Anabat Walkabout bat detector and supplemented with a heterodyne detector. The following information was recorded, where possible, during each survey:

- Time and location of bat activity
- Species of bat
- Behaviour (foraging, commuting)

- Direction of flight
- Number of bats.

2.6.14 Full details of these surveys, including dates and weather conditions, are provided within Appendix E

Automated Detector Activity Survey

2.6.15 Songmeter SM4Bat static detectors were used to record bat activity over five nights a month at six locations across both transects (three per transect) during suitable weather conditions for bats in line with best practice guidance[14]. Static detectors were placed evenly across the Scheme and placed in locations where bats were likely to forage or commute (i.e. along hedgerows, tree lines, or watercourses). Locations of the automated static detectors are shown in Figure 8.9 (TR010034/APP/6.4) and habitat descriptions near each location are described in Table 2-4, below.

Table 2-4: Static detector locations

Monitoring location	Grid reference	Habitat description
1	SJ9890195977	Stream (Hurstclough Brook) with dense edge vegetation comprising primarily Hawthorn and Willow scrub. Improved grassland with a small number of defunct species-poor hedgerows to the west. Poor semi improved grassland to the north east. Neutral semi improved grassland to the south-east. Adjacent to the east there is also a small pond and a band of mixed plantation on the edge of amenity grassland.
2	SJ9926696090	Located on the edge of a patch of semi-natural broadleaved woodland. There is improved grassland to the east and the semi-natural broadleaved woodland continues to the south east.
3	SJ9950896077	Pond with mature trees and scrub scattered around the banks. The surrounding habitat consisted of neutral semi-improved grassland, with some defunct Hawthorn hedgerows and a small ditch, areas of rush pasture and scattered mature trees.
4	SJ9997595675	Scattered scrub surrounded by improved grassland.
5	SK0029095660	Field edge with coniferous plantation woodland to the west. Stream, improved grassland to the north. Poor semi-improved grassland to the south.
6	SK0090595579	River Etherow corridor with mature riparian vegetation. Poor semi-improved grassland to the west. Improved grassland to the east of the river.

2.6.16 Static detectors were set to record from 0.5 hours prior to sunset until 0.5 hours after sunrise. Each night of monitoring comprised two separate dates, as surveys commenced in the evening and continued until the following morning. Survey nights are discussed with reference to the night that the recording started. Static deployment dates are provided within Table 2-5.

Table 2-5: Static detector deployment dates

Survey number	Month and year	Deployment dates
1	Oct 19	25/10/2019 – 30/10/2019 (All statics)
2	Apr 20	22/04/2020 – 27/04/2020 (Static 1, 2, 4, 5, and 6) 21/04/2020 - 26/04/2020 (Static 3)
3	May 20	02/05/2020 – 07/05/2020 (All statics)
4	Jun 20	09/06/2020 – 14/06/2020 (Static 1, 2, 4, 5, and 6) 20/06/2020 – 25/06/2020 (Static 3)
5	Jul 20	11/07/2020 – 16/07/2020 (Static 2, 4, 5, and 6) 15/07/2020 – 20/07/2020 (Static 1) 07/07/2020 – 12/07/2020 (Static 3)
6	Aug 20	20/08/2020 – 25/08/2020 (All statics)
7	Sep 20	04/09/2020 – 09/09/2020 (Static 2, 4, 5, and 6) 13/09/2020 – 18/09/2020 (Static 1 and 3)

2.6.17 Echolocation data generated during static detector surveys were analysed to identify the species present, using Wildlife Acoustics Kaleidoscope Lite[40] analysis software. All calls were identified to species level where possible using echolocation call parameters, where this was not possible (e.g. with myotis sp.) calls were identified to the species group only. All calls were then taken through a quality assurance process, to ensure the accurate identification of the species. 10% of all pipistrelle calls and all calls from other bat species were reviewed by a suitability qualified ecologist.

Previous Surveys

2.6.18 Due to Covid-19, updated internal householder inspections and interacting with local residents (via door knocking) was not deemed acceptable due to the amount of properties that would need interacting with. Therefore, no buildings within the bat survey area could be surveyed externally or internally (including bat emergence surveys). Therefore, the existing data set (from previous 2017 and 2018 surveys with an updated and expanded local records search, and the known historic presence of bat roosts within the building as recorded in 2005 (Hyder, 2007c)) will be used with mitigation provided on a 'worst-case' scenario. Further details are provided within Appendix F.

[40] https://www.wildlifeacoustics.com/products/kaleidoscope

Bat Roost Assessment Surveys - Structures

2.6.19 During the 2017 and 2018 surveys, all structures within the DCO boundary were inspected in detail externally and (where access was granted) internally to compile information on suitable bat entry/ exit points, suitable bat roosting locations, and any evidence of bats found. Where internal access was not possible (due to access restrictions) a 'worst-case' assessment was undertaken based on the information available from the external inspection and the known historic presence of bat roosts within the building as recorded in 2005 (Hyder, 2007c).

Emergence/ Re-entry Surveys

2.6.20 Due to restrictions posed by Covid-19, as outlined previously, emergence/ re-entry surveys of the buildings could not be updated. Therefore, the existing data set (from previous 2017 and 2018 surveys) has been used alongside an updated and expanded local records search with mitigation provided on a 'worst-case' scenario.

2.6.21 Emergence/ re-entry surveys were previously undertaken between May and September 2017 and May and August 2018 in appropriate weather conditions for bats.

2.6.22 Dusk emergence surveys started a minimum 0.25 hours before sunset and lasted until at least 1.5 hours after sunset. Dawn re-entry surveys started 1.5 to 2 hours before sunrise and finished at approximately sunrise.

2.6.23 During each survey, a record of the number of bat passes of each species, together with additional information such as direction of flight, emergence/ re-entry point and activity, was recorded. Surveyors used time expansion Pettersson D-240X bat detectors connected to a digital recording device. Recordings were analysed using BatSound Pettersson Elektronik AB real-time spectrogram software.

Limitations

2.6.24 Ecological surveys are limited by factor which affect the presence of animals, such as time of year, migration patterns and behaviour. Therefore, the absence of evidence of roosting bats in a given tree/ structure should not be taken as conclusive proof that they are not present or that they will not be present in the future.

Roosting Surveys

2.6.25 Updated bat roosting surveys (including external and internal inspections) were originally scheduled to be undertaken in spring 2020. This involved arranging access through sending out letters to homeowners in spring 2020 prior to any surveys commencing to request permission to undertake the survey. However, due to the low response rate (most likely due to the onset of Covid-19 restrictions in March 2020), it would have only been possible to organise and undertake the surveys through door knocking and interacting in person with the residents which was not deemed appropriate nor safe to do so within the current climate.

2.6.26 It was not considered that social distancing could be implemented appropriately without first interacting in person with several residents. An amended approach was adopted to ensure the safety of all parties involved. This included focusing on the existing bat roosting data set (from previous 2007 and 2017 surveys with an updated and extended local records search) and provide mitigation based on a 'worst case' scenario. This will mean that the survey data will be around 3 - 4 years old at the time of DCO submission in 2021, however, provides mitigation for all roosts, species, and numbers that could potentially be present and is considered to be sufficient.

2.6.27 One of the structures (S24) could not be surveyed either externally or internally due to lack of access permission. Emergence/ re-entry surveys of this structure could also not be undertaken. As such, the presence/ absence of bat roosts within this structure is currently unknown. As S24 will not be directly affected by the chosen option of the Scheme, this is not considered to be a constraint to the assessment.

2.6.28 It was not possible to undertake internal inspections of several structures within the survey area due to lack of access permission. For these structures, a 'worst-case' assessment of bat roosting suitability was undertaken based on the information available from the external inspection and the known presence of bat roosts within the building (Hyder, 2007c). An appropriate number of emergence/ re-entry surveys, in accordance with Collins (2016) was subsequently undertaken at these structures within the optimal survey season for bats in 2017 and 2018 and, as such, it is considered that their current bat roosting status was established with confidence.

2.6.29 The occupier of S20 did not allow access to the property to conduct a dawn survey. Three dusk survey visits were therefore undertaken. As all three survey visits were undertaken during optimal weather conditions for bats and all three recorded bats emerging from the structure, it is considered that the current bat roosting status of this structure was established with confidence.

2.6.30 Due to land access issues, emergence/ re-entry surveys of S14 could not be undertaken until early September 2017. A full internal and external inspection of this structure found no signs of bat occupation. One dusk emergence survey was undertaken on 4 September 2017 during favourable conditions for bat activity and no bats emerged. Based on the results of both surveys, it is considered that the current bat roosting status of this structure was established with confidence at the time of the survey.

2.6.31 Due to land access issues, emergence/ re-entry surveys of S34 could not be undertaken. A building inspection determined that the structure had high bat roosting suitability. Pre-construction surveys will need to be undertaken to determine whether the building supports a bat roost.

2.6.32 On four occasions during dawn re-entry surveys of S8, S10, S18, S29 and S30 the temperature was below 10°C although bat activity was still recorded during these surveys. Additionally, a total of three surveys was undertaken for all these structures, with optimal conditions for bat activity recorded during dusk survey visits. As such, this is not considered to have an effect on the assessment.

Activity Surveys

2.6.33 During five of the walked transect surveys (October, April, June and the September pre-dawn survey) the temperature fell below 10°C. However, bat activity was still recorded during October, April and June. No bats were recorded in the September pre-dawn survey. However, as surveys were undertaken across April – October it is considered that a reasonable level of survey effort has been used and sufficient data provided to enable identification of species present within the DCO boundary and to determine activity.

2.6.34 Bat activity is seasonally dependant and can be influenced by weather conditions and other factors such as availability of prey. Therefore, bats may make use of foraging/ commuting habitat within the Scheme outside of the survey dates. However, it is considered that a reasonable level of survey effort has been used and sufficient data provided to enable identification of species present with the Scheme area and a measure of activity. The absence of evidence of any particular species should not be taken as conclusive proof that the species is not present or that it will not be present in the future.

2.6.35 Several UK bat species (e.g. brown long-eared) produce quiet calls that are directional and not always detected by the equipment. In order to reduce the significance of this limitation, visual observation was used to complement detector recordings, which enabled the location of such species during the surveys, where possible.

2.6.36 It is not usually possible to separate calls from *Nyctalus*, *Myotis* and *Plecotus* bat species with acoustic analysis alone. *Pipistrellus* species can also be difficult to separate high frequency calls from common pipistrelle with soprano pipistrelle, or low frequency calls from common pipistrelle with Nathusius'' pipistrelle, as these can overlap. To reduce the significance of this limitation, visual observations were used during the surveys in combination with acoustic recordings to distinguish species-specific behaviour, where possible. Where it was not possible to identify a bat call to species level, the genus is provided. If recorded calls were of insufficient quality to identify to any genus/ species level, they have been categorised as unknown vesper bat calls.

2.6.37 In situations of low lighting it is not always possible to visually detect bats and therefore record their behaviour, in these situations the peak frequency and other indicators (such as habitat, time) are used to identify to species/ genus level.

Statics and Bat Call Analysis

2.6.38 Due to malfunctions with the static bat detectors (due to errors in the system settings or running out of power mid survey), on certain occasions the dates between statics within a respective month may differ. On all occasions, static data was collected within the same month and as close as possible to the other statics. As the data was still collected within the same month, it is not considered that this would be a significant limitation to the analysis.

2.6.39 There is much overlap between the call parameters of some bat species. Additionally, all bat species vary their calls according to the habitat in which they are flying. Definite identification to species level from acoustic data alone is therefore difficult and often not possible. A proportionate effort to identify bat calls to species level was made based on the volume of data collected and the necessity to ascertain whether as species (particularly those which are rare in the area) is present. The following considerations were made:

- Myotis bats – Although there are seven species of Myotis bats in the UK, only four are known to occur in Greater Manchester and Derbyshire: Daubenton's bat, Natterer's bat, Brandt's bat, and whiskered bat. Identification of Natterer's bat from time-expanded calls is generally easier than for other Myotis species as their calls are of very short duration and are often extremely broadband. Daubenton's bats can often be identified from their flight behaviour (together with the bat call) if seen foraging from insects off the surface of water
- 'Big bats' – This group includes noctule, Leisler's, and serotine bats. Noctule bats are common and widespread in England. Leisler's bats are mainly restricted to southern and eastern England, although there are a few records in the Peak District and adjacent areas. Serotine bats are rather uncommon in the UK, with a distribution mainly confined to southern England, and the closest known records are from south Derbyshire and north Wales. If not feasible to identify to species level, they were either identified to genus level or grouped as 'big bat'
- Pipistrelle bats – Both common pipistrelles and soprano pipistrelles are common and widespread in the UK. Nathusius' pipistrelles have been recorded in Greater Manchester and Derbyshire but are rare in both regions. These three species are relatively easy to tell apart based on the peak frequency of their call, but they often overlap. In that case, they were grouped as common/ soprano pipistrelle or common/ Nathusius' pipistrelle
- Long-eared bats – Echolocation calls of long-eared bats are extremely quiet and can only be recorded within 5 m of the individual. As such, this group of species is often under recorded. Brown long-eared bats are common and widespread throughout the UK. Grey long-eared bats are restricted to the south coast and south west of England and have never been recorded in Greater Manchester or Derbyshire. These two species are difficult to tell apart based on their echolocation parameters and have been therefore considered as a group in this report. However, as the study area is well outside of the known range of the grey long-eared bat, it is very unlikely that this species is present
- Myotis and long-eared species – Both genus have FM sweeps, but the majority of the long-eared species call is usually below 30 kHz. However, sometimes there is not a clear distinction between both calls and, in that instances, Myotis and long-eared species were grouped.

2.7 Birds

Desk Study

2.7.1 In October 2020 the Greater Manchester Ecology Unit (GMEU) and the Derbyshire Biological Records Centre (DBRC) were contacted to obtain records of legally protected and priority species within 5 km of the Scheme boundary including:

- Species listed in Schedule 1 of the Wildlife and Countryside Act;
- Species listed in Annex I of the Birds Directive of the European Commission[41];
- Species included in the UK Biodiversity Action Plan (UKBAP) list of Priority Bird Species (2007)[42];
- Species of Principal Importance for the Conservation of Biodiversity listed under Section 41 of the Natural Environment & Rural Communities Act 2006 in the England Biodiversity List[43]; and,
- Species listed on the Birds of Conservation Concern Red and Amber List species[44].

2.7.2 The Multi-Agency Geographic Information for the Countryside (MAGIC) website[45] was reviewed for the following information:

- Designated sites of nature conservation importance (statutory sites only) within 5 km for nationally and internationally designated sites: Site of Special Scientific Interest (SSSI), Special Protection Areas (SPAs), Wetlands of International Importance (Ramsar Sites) and Special Areas of Conservation (SACs); and,
- Important Bird Areas (IBAs).

Field Survey

Field Survey Method

2.7.3 All field surveys were carried out by suitably experienced ecologists assessed to be at least of capable experience following the Chartered Institute of Ecology and Environmental Management (CIEEM) competency framework and Atkins internal Competency Framework.

[41] https://ec.europa.eu/environment/nature/conservation/wildbirds/threatened/index_en.htm (accessed 12/10/2020)
[42] UK Biodiversity Action Plan, List of UK BAP Priority Bird Species (2007) https://hub.jncc.gov.uk/assets/98fb6dab-13ae-470d-884b-7816afce42d4 (accessed 12/10/2020)
[43] Section 41 of the Natural Environment and Rural Communities (NERC) Act 2006 requires the Secretary of State to publish a list of species of flora and fauna and habitats considered to be of principal importance for the purpose of conserving biodiversity; this is known as England Biodiversity List. Forty-nine bird Species of Principal Importance (SPI) are included on the England Biodiversity List.
[43] UK Biodiversity Action Plan, List of UK BAP Priority Bird Species (2007) https://hub.jncc.gov.uk/assets/98fb6dab-13ae-470d-884b-7816afce42d4 (accessed 12/10/2020)
[44] Eaton MA, Aebischer NJ, Brown AF, Hearn RD, Lock L, Musgrove AJ, Noble DG, Stroud DA and Gregory RD (2015) Birds of Conservation Concern 4: the population status of birds in the United Kingdom, Channel Islands and Isle of Man. British Birds 108, 708–746.
[45] www.magic.gov.uk (accessed 12/10/2020)

2.7.4 The Breeding Bird Survey Area comprised the Scheme footprint, including temporary impact areas, and a 100 m buffer from the Scheme boundary. The extent of the Survey Area was based on professional judgement, taking into account the likely impacts of the Scheme and the predicted radius within which breeding birds could be displaced or disturbed by these impacts.

2.7.5 The transect routes were designed such that the surveyors passed within 50 m of all parts of the Survey Area and all suitable habitat for breeding birds within the Survey Area was surveyed. The routes of the survey transects are provided in the Transect Route Plans provided in Figure 8.6 (TR010034/APP/6.4).

2.7.6 In order to achieve the objective of the survey, the principles of the Common Birds Census (CBC) territory mapping methodology, developed by the British Trust for Ornithology (BTO)[46,47], were broadly followed. The CBC mapping methodology is the most accurate and practical way to determine the numbers and local distribution of breeding birds within a particular study site. The CBC adopts ten survey visits as the standard approach in order to provide data which is accurate and precise as possible, although to detect the presence of any one species all ten visits are rarely needed.

2.7.7 To generate enough encounters with birds to produce clusters of registrations for the purpose of territory mapping, and to minimise the risk of overlooking scarce species and/ or species of conservation concern, it is recommended at least four to six survey visits are undertaken between March and July inclusive[48,49].

2.7.8 To provide sufficient baseline data to inform the impact assessment, two transects were surveyed over six visits which were spread at least 10 days apart between April and July. This survey effort (rather than the maximum 10 visits outlined in the CBC methodology) was considered appropriate in order to meet the objective, based on the size and predicted impact of the Scheme.

2.7.9 Six survey visits were undertaken between April and July 2018 inclusive[50]) and by Atkins between the 17 April 2020 and the 8 July 2020.

2.7.10 The 2020 surveys focused on habitats which had been identified as being suitable for breeding birds during previous extended Phase 1 habitat surveys undertaken by Atkins in October 2019. These habitats included:

- The numerous areas of woodland, hedgerow networks, scrub and ruderal vegetation
- Agricultural buildings, semi-urban and garden areas, barns and trees
- Watercourses and waterbodies
- Arable, pasture and improved agricultural fields.

2.7.11 All the above suitable habitats are illustrated on the extended Phase 1 habitat survey plan (Figure 8.3 (TR010034/APP/6.4)) as detailed in the ES.

[46] Gilbert, G., Gibbons, D.W. and Evans, J. (1998) Bird monitoring methods: A manual of techniques for key UK species. RSPB: Sandy.
[47] Bibby, C.J., Burgess, N.D., Hill, D.A. and Mustoe, S.H. (2000) Bird Census Techniques: Second Edition. Academic Press: London.
[48] Hinsley, S.A., Bellamy, P.E., Newton, I. and Sparks, T.H. (1995) Habitat and landscape factors influencing the presence of individual species in woodland fragments. Journal of Avian Biology: 26, 94-104.
[49] Amar, A., Hewson, C., Thewlis, R.M., Smith, K.W., Fuller, R. J., Lindsell, J. A., Conway, G., Butler, S. And MacDonald, M. A. (2008) What's happening to our woodland birds? BTO Research Report Number 169.
[50] Common Birds Census (CBC), https://www.bto.org/sites/default/files/u31/downloads/details/cbc.pdf (accessed 28/01/2019)

2.7.12 The aim of the survey was to record all resident and migratory breeding species present during the survey period. Emphasis was placed on minimising surveyor bias on bird detection by carrying out the surveys in a systematic and standardised approach in order to provide data which was accurate and precise as possible.

2.7.13 Survey visits were undertaken in the early morning and avoided the first hour before sunrise, as per the CBC methodology as described in Gilbert et al. 1998[51], and lasted for approximately two to four hours. Surveys were undertaken in fair weather conditions (i.e. not in heavy rain, poor visibility or wind greater than Beaufort Scale 4). The dates and times of the survey visits, along with local weather conditions, are provided in Table 2-6 below. The transect was walked at a fixed, steady pace and the direction of the transect route was alternated between survey visits in order to minimise any bias in bird detection along particular points of the transect.

Table 2-6: Survey dates, times and weather conditions

Survey Number	Month	Transect	Date	Start/End Time	Weather conditions
1	April	North	17/04/2020	06:15/11:00	Dry, good visibility, 3/8 cloud cover, strong breeze, 6°C
		South	16/04/2020	06:26/11.29	Dry, good visibility, 0/8 cloud cover, calm, 11°C
2	May	North	07/05/2020	05:40/10:23	Dry, good visibility, 7/8 cloud cover, calm, 5°C
		South	06/05/2020	05:22/09:32	Dry, good visibility, 2/8 cloud cover, calm, 1°C
3		North	14/05/2020	05:30/09:31	Dry, good visibility, 0/8 cloud cover, calm, 1°C
		South	15/05/2020	05:30/09:45	No rain but damp, 8/8 cloud cover, calm, 3°C
4		North	28/05/2020	05:10/09:20	Dry, good visibility, 2/8 cloud cover, calm, 10°C
		South	27/05/2020	05:05/08:56	Dry, good visibility, 2/8 cloud cover, light breeze, 7°C
5	June	North	17/06/2020	05:00/09:13	No rain but damp, misty, 8/8 cloud cover, calm, 13°C
		South	16/06/2020	05:00/08:06	Dry, good visibility, 8/8 cloud cover, calm, 14°C
6	July	North	08/07/2020	05:10/09:05	No rain but damp, good visibility, 8/8 cloud cover, light breeze, 11°C
		South	01/07/2020	05:00/09:35	No rain but damp, good visibility, 8/8 cloud cover, calm, 12°C

[51] Gilbert, G., Gibbons, D.W. and Evans, J. (1998) Bird monitoring methods: A manual of techniques for key UK species. RSPB: Sandy.

2.7.14 The surveyors, with the aid of binoculars, recorded all observations of birds within the Survey Area either by sight or sound. The positions of the recorded birds were plotted as accurately as possible (to the nearest 10 - 20 m) on a suitably scaled base, i.e. a 'visit' map. Standard BTO codes and symbols were used for mapping species (including sex and age, e.g. juvenile, immature or adult) and bird activity, including singing, alarm-calling, nest-building and location of the nest, carrying food or faecal sacs, territorial disputes and copulation. Bird observations immediately outside of the Survey Area were also recorded to ensure that any species whose territories may overlap the Survey Area boundary (in particular priority species) were assessed.

Kingfisher Habitat Assessment

2.7.15 Any suitable nesting habitat for kingfishers within the Breeding Birds Survey Area was mapped during the course of the surveys. Any habitat within the Survey Area involving stone-free sandy soil suitable for excavating a nest burrow in a riverbank was recorded as kingfisher nesting habitat.

Winter Birds

2.7.16 The Scheme is not located within close proximity (within 30 km) to any SPAs designated for important assemblages of wintering birds and it is not considered likely that the habitats within the DCO boundary would be used as functionally linked habitat to such sites. The Scheme is not located in close proximity or associated with any coastal or large wetland areas that may be regularly used by wintering bird assemblages. The data search (as outlined within Table 2-1) did not return any records of important wintering bird assemblages within the study area. It is not considered that the Scheme contains discrete habitat features whereby habitat loss or disturbance would be significant, such as affecting a large area of wetland or large water body which is a finite resource in the wider landscape. Therefore, wintering bird surveys have not been deemed necessary.

Assessment

2.7.17 The importance of breeding birds in relation to the Scheme has been valued in a geographical context following the guidance within Table 3.9 of LA 108 of the Design Manual for Roads and Bridges (DMRB)[52].

2.7.18 The data captured over the six survey visits was analysed to provide an estimate of the number of territories for each recorded species and their locations. This was done by using species records to create individual 'species maps'. For the majority of species, this would then ideally show clusters of records which can be used to determine the locations of distinct pairs over the survey period which can be related directly to breeding territories. These species maps are provided in Figure 8.6 (TR010034/APP/6.4).

2.7.19 Registrations of birds were judged to be 'breeding', 'probable breeding', 'possible breeding', or 'non-breeding' according to the criteria in Table 2-7 below.

[52] Highways England et al (2020). Design Manual for Roads and Bridges: LA108. Biodiversity.

Table 2-7: Registrations required to assess breeding territories

Breeding Status	Registration Description
Confirmed breeding territory	At least two registrations of a particular species displaying breeding behaviour[53] within a territory range
	A single record of a nest containing eggs or young
	Two registrations of a difficult species (e.g. nocturnal species such as most owls or woodcock) within a territory range
Probable breeding territory	Present in suitable habitat in the same location (within normal territory range) on two occasions
	Displaying breeding behaviour on one occasion only
Possible breeding territory	Present in suitable habitat on one occasion only
Non-breeding	Present in habitat not suitable for breeding
	Immature birds (e.g. herring gull first breeds at four years of age)

2.7.20 The CBC methodology requires a minimum of two registrations for a territory to be mapped, if a survey comprises fewer than eight effective visits. The CBC methodology does not require breeding territories to be defined as 'confirmed', 'probable' or 'possible' but it was considered appropriate to use the methodology defined in Table 2-7 which includes these categories when undertaking the territory analysis.

2.7.21 The analysis for semi-colonial species differed slightly from that used for other species. Semi-colonial species breed in loose colonies formed of many individuals in close proximity to each other and where "territories" are often very small or non-existent. Such species include house sparrow, barn swallows and linnet. The number of territories of semi-colonial species has been estimated based on the number of pairs recorded within 'group clusters', i.e. close, associated groups of breeding pairs of the same species. Where gender data is missing and actual breeding pairs cannot be determined, the group cluster is assumed to be comprised equally of males and females. Where an odd number of birds has been recorded the non-paired bird is treated as a male. The peak count of male birds recorded during one visit is then taken to be the maximum number of pairs within that group cluster. The breeding status of a group cluster of territories was taken to be that of the highest level assigned to one constituent pair, and it does not necessarily reflect all pairs within that group cluster. The approximate maximum number of pairs in each group cluster is shown in red text adjacent to each group cluster on the species maps of semi-colonial species in Appendix G.

[53] Breeding behaviour includes displaying, singing, territorial activity, agitated or defensive behaviour, pair of adults together.

Limitations

2.7.22 Bird surveys are affected by a variety of factors which affect the presence of birds, such as season, weather, climate, migration patterns, food availability, species behaviour and the presence of predators. Consequently, the surveys may not have produced a complete bird list and the absence of evidence of any particular species or evidence of breeding of any particular species within the Survey Area (or a part of the Survey Area) should not be taken as conclusive proof that the species is not present or that it will not be present in the future.

2.7.23 Many species of birds are highly mobile, elusive and widely distributed and the accurate number of birds within any one Survey Area is generally unknown. However, the survey effort undertaken was considered sufficient to meet the objective of the survey.

2.7.24 CBC analysis does not work particularly well for species which range widely within any one Survey Area or species which do not exhibit much territorial behaviour, in particular semi-colonial species such as linnet. This difference in behaviour between bird species can result in bias, with some species being over-recorded and some species being under-recorded. Nor does CBC analysis provide a precise estimate of the exact number of birds present within any one Survey Area. In addition, no evening or nocturnal survey visits were undertaken and, therefore, crepuscular and nocturnal bird species, such as owls, may have been under-recorded.

2.7.25 The territories shown on the species maps in Figure 8.6 (TR010034/APP/6.4) are indicative of the estimated number and location of territories only and do not necessarily reflect the actual territory boundaries held by individuals of the relevant species. This is especially the case with species that nest semi-colonially which will often hold minimal territories that can comprise of the nest site only. Additionally, sometimes it was not possible to collect data regarding the gender ratios of semi-colonial groups in the field. Therefore, the analysis for semi colonial species, as described in Section 2.3, differed slightly from that used for other species in order to account for this. Despite these limitations, it is considered that the methodology undertaken, and subsequent analysis has given an indication of the breeding bird assemblage within the Survey Area.

2.8 Barn Owl

Desk-based Scoping Survey

2.8.1 This report provides the findings of the barn owl survey and assessment. The barn owl survey area comprised the Scheme footprint including temporary impact areas, and a 500 m buffer from the Scheme boundary for Potential Foraging Habitat (PFH) and a 1.5 km buffer for any evidence of potential or confirmed barn owl roosting or nesting sites.

2.8.2 The importance of barn owl in relation to the Scheme has been valued in a geographical context following the guidance within DMRB LA 108[54].

[54] Highways England et al (2020). Design Manual for Roads and Bridges: LA 108. Biodiversity.

2.8.3 All survey methodologies used were informed by the barn owl survey guidelines[55] and carried out by suitably experienced ecologists assessed to be at least of capable experience following the Chartered Institute of Ecology and Environmental Management (CIEEM) competency framework[56] and Atkins internal Competency Framework.

2.8.4 As per barn owl survey guidelines[57] before on-site scoping commenced, potentially suitable barn owl foraging habitats within 500 m of the Scheme were identified with the aid of aerial imagery[5855]. Barn owls use a wide variety of habitats but are most commonly associated with rough, un-grazed grassland which is characterised by a tall tussocky structure with a deep litter layer to support their prime food source: field voles and other small mammals. Other habitats used include arable field margins, young conifer plantations and woodland edges. Such habitats act as a primary indicator of the likely suitability for barn owls.

2.8.5 Alongside this, aerial imagery[59] was used to identify any structures (mostly barns, sheds, farm buildings and similar structures) that may have suitability for nesting or roosting barn owl (suitable trees and barn owl nest boxes were identified solely by field surveys due to constraints of spotting such small features using aerial imagery). This was conducted for all land within 1.5 km of the footprint of the Scheme and temporary impact areas. All land within 1.5 km of the Scheme and temporary impact areas is the predicted Ecological Zone of Influence (EZoI) for barn owl in relation to the Scheme, in line with survey guidance[55].

2.8.6 Areas considered unsuitable for barn owl, such as urban habitats, major infrastructure, or dense woodland interiors were screened out of further field surveys.

On-site Scoping Survey

Potential Foraging or Commuting Habitat (PFH)

2.8.7 Habitats within 500 m of the Scheme were classified as one of four habitat types dependent on their suitability to provide a foraging and commuting resource to barn owls in the area in accordance with current guidance[4]. These habitat types are described in Table 2-8 below. A 500 m buffer was used in order to identify not only the potential barn owl habitats near the Scheme but also those that could act as potential commuting and foraging corridors that could draw barn owl towards the Scheme from the wider area.

[55] Shawyer, C. R. 2011. Barn Owl Tyto alba Survey Methodology and Techniques for use in Ecological Assessment: Developing Best Practice in Survey and Reporting. IEEM, Winchester.
[56] CIEEM Competencies for species survey: barn owl. Technical Guidance Series.
[57] Shawyer, C. R. 2011. Barn Owl Tyto alba Survey Methodology and Techniques for use in Ecological Assessment: Developing Best Practice in Survey and Reporting. IEEM, Winchester.
[58] Google Maps (2020) https://www.google.com/ (accessed 15/12/2020)
[59] Google Maps (2020) https://www.google.com/ (accessed 15/12/2020)

Table 2-8: Classifying PFH[55]

Type	Typical Features
Type 1 habitat	Type 1 habitats are those that provide optimal breeding, foraging and sheltering habitat to field voles and provide the most valuable foraging habitat to barn owl. These are usually heterogenous grasslands with minimal management and will comprise of grasses of varying heights with a thick understory litter layer and many tussocks.
Type 2 habitat	Type 2 habitats are of sub-optimal value to field voles and therefore of a lesser value to barn owl than type one habitats. These habitats are usually managed, will have a more even sward height, only occasional tussocks and a lack a significant litter layer.
Type 3 habitat	Type 3 habitats offer minimal value to field voles and other small mammals, and therefore are of low value to barn owl. Type 3 habitat is characterised by being short in height and lacking tussocks or any litter layer. These habitats are usually intensively mown or grazed throughout much of the year and may be amenity grasslands. Due to the lack of value to barn owl Type 3 habitats will not be mapped.
Other habitats	Any non-grassland habitats including arable fields, woodlands and hard standing are classified as other as these provide negligible value as a foraging habitat. Due to the lack of value to barn owl these habitats will not be mapped.

2.8.8 Only Type 1 and 2 habitats were mapped. Because of their poor suitability for barn owl, Type 3 and 'Other habitats' were omitted from mapping. These mapped habitats are provided in the Barn Owl Survey Results Plans in Figure 8.7 (TR010034/APP/6.4).

Features potentially suitable for nesting or roosting barn owl

2.8.9 During the on-site scoping surveys any buildings within 1.5 km of the Scheme, that were previously identified during the desk study as potentially suitable for barn owl nesting or roosting, were checked to ensure that they still existed (structures can be demolished at any time) and also to confirm that they had potential entry points for barn owl (well-sealed buildings have no significant value to barn owl and were scoped out of further survey).

2.8.10 Any trees with large cavities or barn owl nest boxes (which cannot be reliably identified using aerial imagery) identified during the extended Phase 1 survey, other species surveys or the on-site scoping walkover surveys were also assessed in the same way, and any mature trees within the line of sight of surveyed buildings during on-site scoping visits were also assessed. Those features that met these criteria were then subjected to full investigative field survey. Any additional suitable features not previously identified in the desk study were scoped in during site visits and site walkovers, mapped and subjected to further survey.

Investigative Field Surveys

2.8.11 Investigative field surveys were undertaken on the on the 25th and 26th of June 2020, 15th of September 2020 and the 22nd and 29th of October 2020. All field surveys were carried out by suitably experienced ecologists assessed to be at least of capable experience following the CIEEM competency framework[60] and Atkins internal Competency Framework. At least one ecologist present was accredited on a barn owl survey licence.

2.8.12 These surveys involved a detailed internal inspection of features identified in the desk study and confirmed by the on-site scoping survey to assess if they could be considered as a Potential Nest Site (PNS), Active Roost Site (ARS), Temporary Rest Site (TRS) or Potential Roost Site (PRS). The descriptions of the different site classifications are detailed in Table 2-9 below. All the site classification categories listed above are taken from guidance written by Colin Shawyer (2011)[55] excepting the Potential Roost Site (PRS) category. The PRS category was added as an enhancement to the original methodology in order for the survey results to be expressed in more detail which in the context of the Scheme was considered to be beneficial.

2.8.13 Any PNS, ARS, TRS or PRS identified were mapped and taken forward to a nest verification survey.

Table 2-9: Classifying sites[55]

Site type	Typical Features
Potential Nest Site (PNS)	PNSs are defined as any place with a dark hole or cavity that is of a suitable size for a barn owl to nest in. To be of a suitable size where the cavity entrance should be at least 80 mm in diameter and have a floor space of 250 mm x 250 mm or larger. Some area of flat floor space should be present to create a suitable platform without significant tilt or protrusions that would render it unsuitable for nesting. Any features not meeting these requirements or that are too open, or light should not be considered as a suitable PNS. Suitable PNSs include, but are not limited to: • Agricultural buildings with a loft or roof space; • Disused buildings with an open joist or blocked chimney; • Mature trees with a large cavity; • Bale-ricks; and • Any building, tree or other feature with a barn owl nest box attached. Where a cavity or hole was identified a ladder was used (where required) to inspect the suitability as a PNS, inspections that required a ladder close to the PNS or held a risk of disturbing any barn owls potentially present were carried out by a surveyor who holds a barn owl survey licence from Natural England.
Active Roost Site (ARS)	An ARS is any place where a barn owl regularly perches or roosts but does not breed. These can be in similar locations to PNS sites but can also be in more open locations and closer to the ground than a PNS and can include beams and upright posts.

[60] CIEEM Competencies for species survey: barn owl. Technical Guidance Series.

Site type	Typical Features
	An ARS is identified by the presence of droppings (also called splashing), as well as pellets and occasionally moulted feathers. Only pellets and feathers can be used to confidently say that the roost is that of a barn owl and not another raptor species. When an ARS was identified it was classified as either occasionally or frequently used dependent on the amount of evidence found. As well as the frequency of roost any pellets found should be used to assess the time of year the ARS is used as well as if it has been used within the last three years or if it is a historic roost (no signs of use in the last three years).
Temporary Rest Site (TRS)	TRSs are locations used infrequently as a stopping off point for barn owl but not regularly enough to be an ARS. These are usually distinguished by small amounts of splashing and the occasional pellet or feather, although these may not always be present. Only pellets and feathers can be used to confidently say that the TRS is that of a barn owl and not another raptor species.
Potential Roost Site (PRS)	PRSs are structures or tree cavities that are suitable for use by barn owl as a roost site, e.g. have access points that could be used by barn owls or suitable perching opportunities but have no evidence of barn owl use found in relation to it.

2.8.14 Further details of the structures surveyed are presented in the Barn Owl Survey Results Plans in Appendix H with locations provided on Figure 8.7 (TR010034/APP/6.4).

Nest Site Verification Survey

2.8.15 Where a PNS or ARS was found a detailed inspection of the site was undertaken to determine if it is, or has previously been, an Occupied Breeding Site (OBS). This involved surveyors inspecting the PNS or ARS, with a ladder or other climbing equipment, long pole and endoscope (if required) and looking for any evidence that breeding has occurred. Evidence indicating breeding includes;

- Adult barn owls
- Barn owl chicks
- Barn owl eggs or eggshells
- Barn owl feathers
- Barn owl pellets
- juvenile down
- blowflies around the entrance of a potential nest.

2.8.16 Any OBS found were mapped and are shown in Figure 8.7 (TR010034/APP/6.4).

Limitations

Field surveys

2.8.17 Due to land access constraints, including refused access or being unable to identify landowners and restrictions on visiting properties due to risks associated with COVID 19 (features 26, 35, 37, 42, 43), it has not been possible to access all land parcels and associated buildings which were scoped-in for detailed barn owl field surveys.

2.8.18 Within those land parcels for which access was granted, some areas could still not be accessed for survey. Reasons for this include livestock in fields (only where livestock was deemed to be dangerous by the surveyors) preventing safe access and buildings being unsafe to enter.

2.8.19 Where features were accessible, they were not always able to be fully assessed due to either practicality or health and safety reasons. This was often because it was unsafe to erect a ladder for inspection or the feature was out of reach. In addition, the layout of some buildings made it difficult to see all locations that may be used by nesting or roosting barn owls, and evidence may have been missed in these locations.

2.8.20 Due to the very large number of trees within 1.5 km of the Scheme (the predicted EZoI for barn owl) it was not possible to survey every tree individually, however, walked transects were undertaken across the study area to cover as much land as possible. Due to the general lack of tree cover, it was possible to see larger isolated trees within the landscape. However, it is possible that a number of potential barn owl features within trees may not have been recorded within the EZoI. Where detailed surveys of mature woodlands and treelines were undertaken, potential barn owl features were found to be very rare and therefore the number of barn owl features in trees not recorded by the surveys is likely to be very small. This finding is supported by data presented in “Barn Owl Survey Methodology and Techniques for use in Ecological Assessment: Developing Best Practice in Survey and Reporting” by Colin Shawyer (2011)[55] which shows that, in the area of the country in which the Scheme is located, 90 – 100 %of natural breeding sites are found in buildings as opposed to 0 to 10% found in trees. Therefore, this is not considered to be a significant constraint to this assessment.

Approach to missing information

2.8.21 During the surveys, if a feature was identified as having potential for barn owl but was not able to be fully assessed, a precautionary approach was taken, and the feature was recorded as a Potential Nest Site.

2.8.22 Where it has not been possible to achieve complete survey coverage for barn owls, the assessment has been based on a reasonable precautionary approach (considering existing knowledge of barn owl and applying professional judgement). Recent biological records, publicly available aerial imagery, survey results from adjacent areas, and the suitability of habitats present within the surrounding area have also been used, where appropriate, to inform the ecological baseline for barn owl.

2.8.23 Where available, anecdotal data from residents and landowners was tentatively used to supplement the survey data and help fill knowledge gaps imposed by the above limitations.

2.8.24 This approach is considered appropriate in obtaining an ecological baseline for barn owl across the EZoI of the Scheme and therefore, the current survey effort is considered sufficient in order to inform the impact assessment and mitigation design for barn owl.

2.9 Otter

Desk Study

2.9.1 The results of the past assessment in 2017 and the extended Phase 1 habitat survey (undertaken in October 2019), alongside a review of OS mapping and publicly available aerial imagery were used to identify the extent of habitats considered potentially suitable to support otter.

2.9.2 Watercourses have been screened in for otter field survey where the feature is within 200 m of the DCO boundary. Watercourses/ water bodies have been screened out where they are isolated from other areas of suitable habitat for otter, such as an isolated water body or otherwise suitable terrestrial site separate and remote from any wider watercourse network. Further details are provided within Appendix I.

2.9.3 Where suitable otter terrestrial habitat of an area over 1 ha was identified within 100 m of a suitable watercourse, and within 100 m of the DCO Boundary, was screened in. Suitable terrestrial habitats include woodlands, large reedbeds and large areas of dense scrub[61].

Field Survey

Habitat suitability survey

2.9.4 Where watercourses or water bodies were screened in as requiring assessment, an on-site suitability assessment was undertaken by a suitably experienced ecologist assessed as at least capable in line with the CIEEM competency framework for otter[62] and the Atkins internal competency framework for otter. The suitability assessment considered the habitat present against the preferences for otter, specifically:

- Water depth and permanence
- Food supply
- Level of disturbance
- Connectivity to other areas of suitable habitat
- Pollution
- Suitable resting site opportunities

[61] Liles, G. (2003) *Otter Breeding Sites. Conservation and Management.* Conserving Natura 2000 Rivers conservation Techniques Series No. 5. English Nature, Peterborough.
[62] CIEEM (2013) Competencies for species survey: Eurasian otter.

Field sign survey

2.9.5 Where habitats were deemed suitable to support otter a detailed search for field signs was undertaken by a suitably experienced ecologist assessed as at least capable in line with the CIEEM competency framework for otter and Atkins' internal competency framework. This involved walking along the bank, and where possible, in the channel, of suitable habitat up to 175 m up and downstream of the DCO boundary, where access allowed (the otter survey area).

2.9.6 Otter surveys were undertaken in accordance with DMRB LD 118 and taking account of best practice guidance[63,64,65] , and CIEEM competencies for undertaking otter surveys[66].

2.9.7 The following evidence of otter activity was searched for and recorded during the surveys:

- Spraints (droppings)
- Potential resting site locations (including holts, hovers and laying up sites)
- Feeding remains
- Anal jelly
- Hairs around potential natal holts
- Paths and slides (defined otter paths on watercourse banks and mud slides evident of where the animal regularly enters the watercourse)
- Footprints.

Limitations

2.9.8 Due to health and safety concerns around the ability to perform a rescue while maintaining social distancing in channel access to deep watercourses (the River Etherow) was restricted. The survey was undertaken from the bankside for this watercourse and it is considered that if otter are present then evidence would have been identified either through the bankside survey or in areas of suitable habitat where water was shallow enough to allow in channel access.

2.9.9 Due to the coronavirus pandemic during March 2020 and concerns about unnecessary interactions with the general public, the gardens of residential properties were not accessed to undertake field surveys on water bodies during the 2020 surveys. It is considered that these water bodies (which are small residential ponds as outlined from the 2017 surveys (refer to Appendix J) are generally unsuitable for otter, and if they are used as a resource this is usually occasional and supplementary to feeding in more natural, riverine habitats. Therefore, it is considered that the lack of access to residential garden ponds does not pose a significant constraint to the assessment.

[63] Chanin and Smith (2003). *Monitoring the otter Lutra lutra.* Conserving Natura 2000 Rivers Monitoring Series No 10. Peterborough, English Nature.
[64] Liles G (2003). *Otter Breeding Sites. Conservation and Management*. Conserving Natura 2000 Rivers Conservation Techniques Series No. 5. English Nature, Peterborough.
[65] Chanin, P. (2005) *Otter surveillance in SACs: Testing the protocol.* English Nature, Peterborough.
[66] CIEEM (April, 2013) Competencies for Species Survey: Eurasian Otter.

2.9.10 Some areas of the watercourses within the otter survey area could not be accessed due to dense scrub or stands of invasive non-native plant species which could have resulted in field signs being missed. Over the reach of a watercourse these areas were isolated and only in discreet patches. Therefore, it is considered that although some field signs may have been obscured, if otter are present on a section of watercourse, field signs would have observed in accessible areas.

2.10 Water vole

Desk Study

2.10.1 The results of the past assessment in 2017 and the extended Phase 1 habitat survey (undertaken in October 2019), alongside a review of Ordinance Survey mapping and publicly available aerial imagery were used to identify the extent of habitats considered potentially suitable to support water vole/ otter.

2.10.2 Watercourses were screened for water vole field survey where they were considered suitable to support water vole and were within 50 m of the DCO boundary (the water vole survey area). Areas deemed less suitable were also screened for water vole field survey where they were within 50 m of the DCO Boundary and also within 50 m of a watercourse considered suitable to support water vole with suitable habitat connectivity between the two. Examples of barriers to water vole movement include areas of hardstanding and busy roads. Features have also been screened out where existing survey information (for example from the extended Phase 1 habitat survey or great crested newt HSI data) indicates it is unsuitable for water vole, such as where it dries regularly.

Field Survey

Habitat suitability survey

2.10.3 Where watercourses or water bodies were screened in as requiring assessment an on-site suitability assessment was undertaken by a suitably qualified ecologist assessed as at least capable in line with the CIEEM competency framework for water vole[67] and the Atkins internal competency framework for water vole. The suitability assessment considered the habitat present against the preferences for water vole, specifically:

- Dry areas above water level for nesting
- Herbaceous vegetation for food and cover
- Bank profile and substrate suitable for burrowing
- Water depth, permanence and likelihood of fluctuations.

[67] CIEEM (April, 2013) Competencies for Species Survey: Water Vole.

Field sign survey

2.10.4 Where habitats were deemed suitable to support water vole, two detailed field sign surveys were undertaken in different halves of the optimal survey season (mid-April to end of June and July to September 2020, inclusive). All surveys were undertaken by a suitably experienced ecologist assessed as at least capable in line with the CIEEM competency framework for water vole[68] and Atkins' internal competency framework for water vole.

2.10.5 These surveys were undertaken according to good practice guidance[69,70] and CIEEM competencies for undertaking water vole surveys[71].

2.10.6 This involved surveyors walking along the bank, and where possible in the channel, of suitable habitat up to 250 m up and downstream of the DCO boundary, where access allowed (the water vole survey area).

2.10.7 The following evidence of water vole activity was looked for during these surveys:

- Burrows and 'lawns' (area around burrow entrances where there is grazed vegetation, surrounded by taller vegetation)
- Faeces
- Latrines
- Feeding stations
- Runways and footprints
- Nests
- Sightings.

2.10.8 In addition to the above, evidence of mink presence was also looked for as this can have a detrimental effect on local water vole populations.

2.10.9 Only droppings or direct observation can be taken as confirming water vole presence on their own, but a combination of other field signs can be suggestive of water vole[70].

Population Estimates

2.10.10 It is not possible to make robust estimates of absolute numbers of water vole from latrine counts, however, latrines provide relative indices of activity and can be used to give an indication of the relative population size. This is outlined within Table 2-10.

[68] CIEEM (April, 2013) Competencies for Species Survey: Water Vole.
[69] Strachan, R. and Moorhouse, T. (2011). Water Vole Conservation Handbook (3rd edition). Wildlife Conservation Research Unit, University of Oxford.
[70] Dean, M. et al The Water Vole Mitigation Handbook (2016). Mammal Society.
[71] CIEEM (April, 2013) Competencies for Species Survey: Water Vole.

Table 2-10: Estimating water vole population density from latrines

Relative population density	Approximate number of latrines per 100 m of bankside habitat	
	First half of survey season	Second half of survey season
High	10 +	20+
Medium	3-9	6-19
Low	<3 (or none with other confirmatory field signs)	<6 (or none with other confirmatory field signs)

Table Source: Dean, M. et al The Water Vole Mitigation Handbook (2016). Mammal Society.

Limitations

2.10.11 Due to health and safety concerns around the ability to perform a rescue while maintaining social distancing in channel access to deep watercourses (the River Etherow) was restricted. The survey was undertaken from the bankside only for this watercourse and it is considered that if water vole are present on the watercourse then evidence would have been identified either through the bankside survey or in areas of suitable habitat where water was shallow enough to allow in channel access.

2.10.12 Due to the coronavirus pandemic during March 2020 and concerns about unnecessary interactions with the general public the gardens of residential properties were not accessed to undertake field survey on ponds during the 2020 surveys. It is considered that small residential ponds are generally unsuitable for water vole, and if they are used as a resource this is usually occasional and supplementary to feeding in more natural, riverine habitats. Therefore, it is considered that the presence of water vole on watercourses within the Scheme will be determined through the field surveys on watercourses and the lack of access to residential garden ponds does not pose a significant constraint to the assessment.

2.10.13 Some areas of watercourses could not be accessed due to dense scrub or stands of invasive non-native plant species could have resulted in field signs being missed. Over the reach of a watercourse these areas were isolated and only in discreet patches. Therefore, it is considered that although some field signs may have been obscured, if water vole are present on a section of watercourse, field signs would have been observed in accessible areas.

2.11 Reptiles

Previous Surveys

2.11.1 Reptile surveys were undertaken for the Scheme during 2017, the results of which were presented in a draft ES appendix (Biodiversity Baseline and Preliminary Assessment[72]) for the Scheme that was produced in 2019. The Scheme provides pockets of habitat with suitability for common reptile species (including adder, slow-worm, grass snake and common lizard) and the surveys focused on these species. The Scheme is located outside of areas known to support reptiles that are European Protected Species (such as sand lizard and smooth snake) and, therefore, no survey licence was required.

2.11.2 The scope of the reptile surveys was designed with the requirements of all relevant legislation and in reference to good practice guidance, including the Reptile Survey Guidance[73] the Herpetofauna Workers Manual[74] and the now superseded DMRB Volume, 10, Section 4, Part 7 (HA 116/05)[75].

2.11.3 All surveyors involved with screening and scoping for reptiles were experienced in the following:

- Field identification of all widespread reptile species and field signs (e.g. sloughs, burrows and eggs)
- Assessing the potential suitability of habitats for widespread reptile species
- Determining appropriate spatial scope for survey
- Identifying appropriate survey techniques to achieve a robust survey in a variety of habitat types.

Screening for survey and defining survey area

2.11.4 Prior to the 2017 reptile surveys in the field, aerial imagery, the results of the extended Phase 1 habitat survey, and a review of existing reptile records were analysed to identify and map the extent of key habitat areas within close proximity of the DCO Boundary that were considered potentially suitable to support reptiles.

2.11.5 The habitat assessment was based on consideration of the following characters:

- Location in relation to species range
- Vegetation structure
- Insolation (sun exposure)
- Aspect
- Topography
- Surface geology

[72] Highways England (2019) Trans-Pennine Upgrade (TR010034). 6.8.1 Appendix 8.1: Biodiversity Baseline and Preliminary Assessment
[73] Froglife (1999) Reptile survey; an introduction to planning, conducting and interpreting surveys for snake and lizard conservation. Froglife Advice Sheet 10. Froglife, Halesworth
[74] Gent T and Gibson S (2003) Herpetofauna Workers Manual. JNCC, Peterborough.
[75] Highways Agency (2005) Design Manual for Roads and Bridges Volume 10 Environmental Design and Management, Section 4 Nature Conservation, Part 7 Nature Conservation Advice in Relation to Reptiles and Roads. HA116/05.

- Connectivity to nearby good quality habitat
- Prey abundance
- Refuge opportunity
- Hibernation habitat potential
- Disturbance
- Egg-laying site potential (grass snake only).

2.11.6 The habitats within the DCO boundary were considered largely unsuitable for reptiles. Nevertheless, there were pockets of suitable habitat (e.g. rank grassland, areas of scrub, and along hedgerows and watercourses) and these were selected for survey, based on professional judgement. Reptile survey areas are shown on Figure 8.14 (TR010034/APP/6.4).

Presence/ likely absence survey

2.11.7 Artificial refugia (a combination of corrugated iron, coroline roofing material and roofing felt), measuring a minimum of 0.5 m x 1.0 m, were placed in areas identified as suitable reptile habitat. The default was a 1:3 ratio of corrugated (i.e. iron and coroline material) to roofing felt.

2.11.8 In non-linear habitats, refugia were placed at a density of 20 per hectare. In linear habitats of less than 10 m in width (e.g. hedgerows, road verges, etc.) refugia were placed at a frequency of at least 1 every 10 m of suitable habitat. The total number of refugia was marked and their approximate locations recorded on an aerial map.

2.11.9 Artificial refugia were left to settle for a minimum of 14 days prior to conducting the first check.

2.11.10 Each refugia check was conducted during the following conditions:

- Time: conducted between 07:00 and 18:00
- Air temperature: 9 – 18ºC
- Rain: No or light rain only at time of survey. Surveys between periods of heavy rain (when all other conditions are suitable) were considered acceptable.

2.11.11 Binoculars were used to check for reptiles between refugia, as well as careful checks by lifting each refugium. During each check, the surveyor recorded details of all reptiles encountered during the survey (and any incidental records of amphibians), including area, species, number, life stage (adult, sub adult, juvenile) and sex (if possible).

2.11.12 The locations of any reptiles or incidental records of other species (such as amphibians) were marked with GP-derived grid coordinates. Where topography and vegetation structure may have reduced the accuracy of records below an accuracy of <5 m, this information was noted.

2.11.13 To determine reptile presence or likely absence, seven visits were undertaken to each survey area between April and September 2017.

2.11.14 In line with good practice guidance[76], the first and last surveys were separated by a period of at least 30 days, with a minimum of two days between each visit.

2.11.15 The survey conditions for the survey are shown below (Table 2-11).

Table 2-11: Reptile survey details

Visit number	Date	Area (ha)	Start time	End time	Temp at start	Temp at end	Weather
1	18/05/2017	4-9	09:25	11:00	13	15	Cloudy with sunny spells
	25/05/2017	1-3	16:30	17:40	22	19	Clear and dry
2	18/07/2017	4, 5, 7	09:00	10:00	18	20	Clear, dry, slight drizzle at end of survey
	19/07/2017	3, 8, 9	09:00	17:55	17	19	Clear and dry
	20/07/2017	1, 2, 6	16:45	17:30	17	16	Cloudy with sunny spells, light drizzle
3	02/08/2017	1-3	09:00	17:10	15	17	Light showers at beginning then dry
	03/08/2017	4-9	09:40	17:10	16	18	Light shows, sunny warm spells
4	08/08/2017	3-6	14:25	15:50	16	17	Cloudy with sunny spells
	09/08/2017	1-2, 7-9	10:25	13:25	16	18	Cloudy with sunny spells
5	15/08/2017	All	09:10	13:00	15	18	Cloudy with sunny spells
6	01/09/2017	All	08:30	16:00	15	16	Cloudy with sunny spells
7	29/09/2017	All	12:00	15:30	12	12	Cloudy with sunny spells

Limitations

2.11.16 DBRC and GMBRC records are not exhaustive, and the absence of records does not demonstrate the absence of species.

2.11.17 The temperature during one of the surveys visits (Visit 1 of Areas 1 to 3), was slightly above the recommended maximum temperature of 20°C during the first part of the survey. However, it was ensured that the remaining weather/ timing factors were favourable for that survey visit and the six other survey visits were undertaken during optimal conditions. As such, it was not considered to significantly affect confidence in the survey findings.

[76] Froglife (1999) Reptile survey; an introduction to planning, conducting and interpreting surveys for snake and lizard conservation. Froglife Advice Sheet 10. Froglife, Halesworth

2.11.18 Approximately 15 refugia were removed from Area 5, and 10 refugia from Area 2 by a third party or were eaten/ trampled by livestock over the course of the seven visits. However, it was considered that this was unlikely to impact on the quality of the results as the initial refugia density was 20 per hectare and so significantly higher than 5-10 per hectare recommended in the survey guidance[77]. Additionally, replacement refugia were added to other areas no susceptible to disturbance.

2.11.19 Although the previous surveys were undertaken approximately three years prior to the production of this technical appendix, it is considered that the survey results are still valid as it is understood that there have been no significant changes to the habitats and other ecological conditions present within the Scheme in the intervening years that would significantly alter their suitability for reptiles. In addition to this, the updated data search returned no recent records of reptiles in the area. It was therefore decided that no further reptile surveys would be necessary.

2.12 Amphibians

Previous Surveys

2.12.1 Amphibian surveys were undertaken within 500 m of the DCO boundary during 2016 and 2017, the results of which were presented in a draft ES appendix (Biodiversity Baseline and Preliminary Assessment[78]) for the Scheme that was produced in 2019.

2.12.2 The Scheme is considered to provide pockets of habitat with suitability for widespread amphibian species (including GCN, smooth newt, palmate newt, common toad and common frog). The surveys were targeted on GCN, however, observations of other amphibian species were recorded and are detailed in this report. The Scheme is located outside of areas known to support the two rarer British amphibian species; natterjack toad and pool frog.

2.12.3 The scope of the amphibian surveys was designed with the requirements of all relevant legislation and in reference to good practice guidance[79] and the now superseded DMRB Volume, 10, Section 4, Part 6 (HA 98/01)[80]. The surveyors were experienced in conducting such surveys and able to confidently identify all relevant amphibian species. All surveys were led by a Natural England GCN licensed ecologist, which allows the licensed ecologist to take and disturb GCN for the purposes of science and conservation.

[77] Froglife (1999) Reptile survey; an introduction to planning, conducting and interpreting surveys for snake and lizard conservation. Froglife Advice Sheet 10. Froglife, Halesworth
[78] Highways England (2019) Trans-Pennine Upgrade (TR010034). 6.8.1 Appendix 8.1: Biodiversity Baseline and Preliminary Assessment
[79] English Nature (2001) Great Crested Newt Mitigation Guidelines. English Nature, Peterborough
[80] Highways Agency (2001) Design Manual for Roads and Bridges Volume 10 Environmental Design and Management, Section 4 Nature Conservation, Part 6 Nature Conservation Management Advice in Relation to Amphibians. HA98/01.

Screening for Survey and Defining Survey Area

2.12.4 Prior to the 2017 amphibian surveys, a desk-based scoping exercise was carried out in 2016 to identify those waterbodies requiring survey, and the likely appropriate survey effort. Ordnance survey maps and aerial photography were analysed and all identified inland water bodies and watercourses (including ponds, lakes, ditches, and canals) located within a 500 m radius of the DCO boundary were mapped (the amphibian survey area). Each water body and watercourse identified was then examined against aerial photographs and allocated to one of the following survey categories:

- Habitat Suitability Index (HSI) assessment/ walkover only; or
- HSI assessment and traditional presence/ likely absence surveys or eDNA presence/ likely absence surveys.

2.12.5 The 'HSI assessment/ walkover survey only' category was designed to be used as a survey prescription for those features where habitat was considered likely to have marginal potential to support GCN (e.g. canals) but for which field data was required to confirm this assessment.

2.12.6 For suitable water bodies located within the 500 m buffer, the initial basis for selecting waterbodies requiring survey was in line with current Natural England guidance[79][81]. However, because detailed construction information was not available at the time of survey, all suitable water bodies situated within 500 m of the Scheme boundary were surveyed. A water body location plan, illustrating the location of all suitable waterbodies associated with the Scheme, is provided in Figure 8.13 (TR010034/APP/6.4).

Habitat Suitability Index

2.12.7 HSI scores were calculated from data collected during an initial survey visit between mid-April to mid-May (initially in 2016 and updated in 2017).

2.12.8 The HSI is a quantitative measure of habitat quality for GCN[82] and enables an assessment of a waterbodies potential to be used by GCN. The HSI is a numerical index between 0 and 1, derived from an assessment of ten habitat variables known to influence the presence of newts such as geographic location, waterbody size and permanence, the presence of predatory fish and wildfowl, availability of suitable terrestrial habitat and proximity to other waterbodies, and scores each factor based on its level of suitability. A HSI score of 1 is optimal habitat (high probability of occurrence), while an HSI score of 0 is very poor habitat (minimal probability of occurrence). The HSI is calculated on a single pond basis but takes into account surrounding terrestrial habitat and local pond density. If a pond has a very low HSI score (<0.5) then there would typically be a minimal chance of GCN presence.

[81] Natural England (2017) *Great Crested Newt Method Statement Template WML_A14_2 Version November 2017* available at https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/66 4193/gcn-method-statement.xlsm [accessed 06/03/2017]

[82] Evaluating the suitability of habitat for the Great Crested Newt (*Triturus cristatus)* Herpetological Journal 10 (4), 143-155. (2000) Oldham R.S., Keeble J., Swan M.J.S. & Jeffcote M.). The great crested newt Habitat Suitability Index (HSI) is a quantitative measure of aquatic habitat quality for great crested newt. The HSI is a number between 0 and 1, derived from an assessment of ten habitat variables known to influence the presence of newts.

2.12.9 During subsequent surveys, notes were made of factors/ events that may have resulted in a significant change to the HSI score previously calculated and these were updated accordingly. Where a suitability score could not be allotted for any of the habitat variables, then a comment was recorded to explain this. In addition, a comment was recorded where the surveyor considered that the atypical nature of a water body may result in an unreliable HSI score.

2.12.10 HSI assessments were undertaken on all waterbodies within the amphibian survey area and the calculations are provided in Appendix K.

Traditional Presence/ Likely Absence Survey

2.12.11 Presence/ likely absence surveys comprised four visits in suitable weather conditions in line with good practice guidance[83]. Visits were conducted during the period mid-March to mid-June 2017, with at least two visits during the period mid-April to mid-May 2017.

2.12.12 Visits were well-spaced (aiming for no more than one per week and no more than four weeks apart) and survey visits to the same waterbody on consecutive nights were avoided.

2.12.13 During each survey visit, at least three survey methods were employed. In the first instance, this consisted of the following:

- Torchlight survey:
  - All torchlight surveys used torches of at least 1 million candle power
  - Torchlight survey did not commence until at least 1 hour after published local sunset time
  - Where areas of the waterbody were omitted (due to restricted accessibility or health and safety constraints), an estimate of the percentage of the waterbody margin omitted and a justification for this is included within the notes section of the recording form (Appendix J)
  - During each survey visit, the turbidity and vegetation cover of the waterbody was scored against the 5-point scales advocated by Natural England
  - Where a turbidity or vegetation cover score of 4 was allocated, torchlight surveys were still conducted but (due to potential unreliability) complemented by use of an additional survey method (e.g. netting)
  - Where a turbidity or vegetation cover score of 5 was allocated, torchlight surveys were replaced by an appropriate alternative method (e.g. netting).
- Bottle trapping:
  - All bottle traps used were created from clear plastic 2 litre round bottles and secured using a bamboo cane or similar
  - Where used, bottle traps were positioned at a frequency of one every 2 m in areas of suitable habitat; for large waterbodies where this was not practical, areas of trapping focused on targeted survey of sections of the margin which support the most suitable habitat

[83] English Nature (2001) *Great Crested Newt Mitigation Guidelines*. English Nature, Peterborough

- Where areas of the waterbody were omitted (due to restricted accessibility or health and safety constraints), an estimate of the percentage of the waterbody margin omitted and a justification for this is included within the notes section of the recording form (see Appendix J)
- Bottle trapping was only used on nights where the overnight temperature was forecast to be 5°C or above, when great crested newts and other amphibians are more likely to be active
- All bottle traps were set to include an air bubble and collected the following morning
- To avoid capture of water shrews; where they are known to occur, or were identified during survey, bottle trapping was replaced by an alternative survey method.

- Egg searching:
  - Egg searching was halted when searches confirmed presence of GCN eggs on any visit, and not undertaken during subsequent visits
  - The use of 'egg strips' was only considered where conventional egg searching was not appropriate and other constraints meant it was not possible to complete survey using three of the remaining available conventional survey methods (i.e. bottle trapping, torching, netting, refuge survey).

2.12.14 Where conditions at the waterbody or physical constraints to access (e.g. presence of dense scrub adjoining part of the waterbodies, or unstable margins) meant that it was not possible or appropriate to use these preferred methods, unsuitable methods were substituted according to the following:

2.12.15 Netting was used as the first alternative survey methodology;

- All netting was conducted at night; as netting causes widespread disturbance of the pond. Where used in combination with torchlight survey, it was only conducted following completion of torching
- Nets used had a mesh size of 2-4 mm.

2.12.16 Refuge searches were only used where two or more other survey methodologies were inappropriate.

- Where used as a survey methodology, refuge searches were conducted during each of the proposed 4/ 6 survey visits
- Survey incorporated checks of both natural refuges (such as logs, bark, rocks, debris) and, where possible, artificial refugia placed around the margins of the waterbody
- Where refuge searches were to be used as a survey methodology for subsequent visits, carpet tiles were placed face-down every 2 m around the waterbody margin and the refuges allowed to settle 7 days before the next survey visit.

2.12.17 In each case, where a deviation from the standard three survey methodologies (torchlight, egg searching and bottle trapping) was required, survey notes were produced that include a justification for this deviation.

Environmental DNA Presence/ Likely Absence Survey

2.12.18 Environmental DNA (eDNA) surveys were undertaken between 15 April and 30 June 2017 and required one survey visit to the sampled waterbody.

2.12.19 This method detects occupancy by great crested newts using traces of DNA shed into the waterbody environment and has been accepted by Natural England to run in conjunction with or replace traditional presence/ likely absence surveys. Where access restrictions dictated, water samples were collected for subsequent eDNA analysis in accordance with standard methodology[84].

2.12.20 In summary, field methodology was as follows:

- A total of 20 water samples were taken from the waterbody margin, without entering the water in order to prevent disturbance of sediment. Water samples were collected at intervals (from locations with safe access) around the edge of the waterbody
- Prior to each sample being taken, the waterbody water column was mixed without disturbing the sediment on the bed of the waterbody
- All 20 samples were combined into a “Whirl-Pak” bag, and then shaken for 10 seconds to mix any DNA present across the whole sample
- After combining and shaking the samples the sample bag was then be split in to six sterile conical sample tubes, with 15 ml of sample and 35 ml of ethanol preservative. Prior to each 15 ml sample being taken, the water in the “Whirl-Pak” bag was stirred. Each tube was also shaken to mix the sample and preservative.

2.12.21 The results provided by the laboratory fall into one of three categories: positive, negative, or inconclusive.

- A positive result means that great crested newts are present in the water or have been present in the water in the recent past (eDNA degrades over 7-21 days)
- A negative result means that great crested newt DNA was not detected in the samples collected
- An inconclusive result occurs where great crested newt DNA has not been detected but the controls have indicated that the sample has been degraded or the polymerase chain reaction (PCR) reaction (analytical step) was inhibited in some way. This can occur because of undefined components in the water chemistry or the presence of high levels of sediment or algae in the sample. A retest would require a fresh sample (noting that, if water chemistry was the cause of the indeterminate then a re-test would most likely also return an inconclusive result).

2.12.22 The results provided by the laboratory are presented in Appendix L. Evidence of decay (meaning that the degradation control was outside of accepted limits) or evidence of residual inhibition (meaning that the PCR reaction was inhibited) are also presented in this table.

[84] Biggs J, Ewald N, Valentini A, Gaboriaud C, Griffiths RA, Foster J, Wilkinson J, Arnett A, Williams P and Dunn F (2014). *Analytical and methodological development for improved surveillance of the Great Crested Newt*. Appendix 5. Technical Advice Note for field and laboratory sampling of great crested

Population Size Class Assessment

2.12.23 As a result of the findings of the traditional presence/ likely absence and the eDNA presence/ likely absence surveys (which found no evidence of GCN presence), population size class assessments were not required.

Survey Limitations

2.12.24 DBRC and GMBRC records are not exhaustive, and the absence of records does not demonstrate the absence of species.

2.12.25 Ecological surveys are limited by factors which affect the presence of plants and animals such as the time of year, migration patterns and behaviour and the absence of evidence of any particular species should not be taken as conclusive proof that the species is not present or that it will not be present in the future. The survey was undertaken during the optimum survey window maximising the likelihood of finding amphibians, if present.

2.12.26 Traditional presence/ likely absence surveys could not be undertaken at water bodies P18 and P30 due to access restrictions (the landowners did not permit access during night-time hours). Therefore, these ponds were subject to eDNA surveys. One pond (P31) was not surveyed because it was too shallow for eDNA analysis, dip netting or bottle traps and, due to the presence of dense vegetation and deep silt, torch light surveys were not undertaken.

2.12.27 Although the previous surveys were undertaken approximately three years prior to the production of this technical appendix, it is considered that the survey results are still valid as it is understood that there have been no significant changes to the habitats and other ecological conditions present in the survey area in the intervening years that would significantly increase their suitability for amphibians (including GCN). In addition to this, the recent updated data search returned no recent records of GCN in the area. Common toad records were returned but their presence within the survey area is already known. Therefore, it was decided that no further amphibian surveys would be necessary.

3. Results

3.1 Desk Study and Extended Phase 1 Habitat Survey

Statutory designated sites

3.1.1 No European sites were identified within 2 km and no SACs designated for bats were identified within 30 km of the Scheme.

3.1.2 The Scheme does not cross or lie adjacent to, upstream or downstream of, a watercourse which is designated in part or wholly as a European site, nor is it hydrologically or hydro-geologically linked to a European site with a groundwater dependent terrestrial ecosystem.

3.1.3 Two statutory designed sites (both Local Nature Reserves (LNR) of importance for nature conservation lie within 2 km of the Scheme. Details of these sites are provided within Table 3-1 with locations provided in Figure 8.1 (TR010034/APP/6.4).

Table 3-1: Statutory designated sites for nature conservation within 2 km of the Scheme.

Site name and designation	Description of habitats	Approximate distance and direction from scheme	Grid reference
Hurst Clough LNR	Woodland stretching into wildflower meadows where butterflies are common.	345 m south	SJ987943
Great Wood LNR	Most of the trees are oak, but in places there are birch, alder beech and willow that add to the variety. Dead and dying trees are as important as live ones and the dead wood provides food and shelter for spiders, millipedes, beetles and fungi.	1.3 km south	SJ984935

Non-statutory designated sites

3.1.4 31 non-statutory designated sites for nature conservation were identified within 2 km of the DCO boundary. These are outlined within Table 3-2 and locations shown on Figure 8.2 (TR010034/APP/6.4).

Table 3-2: Statutory and non-statutory designated sites within 2 km of the Scheme

Site name and designation	Description of habitats	Approximate distance and direction from Scheme	Grid reference
Melandra Castle and Railway LWS	Habitat mosaic	141 m south	SK007949
Hurtsclough SBI	Ancient Woodland	360 m south	SJ987941

Site name and designation	Description of habitats	Approximate distance and direction from Scheme	Grid reference
Clough at Hattersly SBI	Woodland	463 m south-west	SJ977947
Westwood Clough and Longlands Hall SBI	Woodland; Plantation woodland	427 m west	SJ972953
Roe Cross Quarry SBI	Upland heathland	475 m north	SJ988966
Dinting Nature Reserve LWS	Ancient semi-natural ash woodland	603 m south-east	SK015946
Dinting Lodge Grassland LWS	Unimproved neutral grassland	818 m south-east	SK018947
Hollingworth Hall Wood SBI	Ancient Woodland; Grassland	850 m north-east	SK007976
Robin Wood LWS	Ancient semi-natural woodland - mixed deciduous	859 m south	SK005943
Wild Bank Hill SBI	Heathland; Birds	886 m north	SJ984980
Dinting Vale Reservoirs and Brook LWS	Standing open water	877 m south-east	SK020944
Paradise Quarry pLWS	Habitat mosaic	888 m north-east	SK018963
Woodland and Grassland at Landslow Green SBI	Woodland; Grassland	924 m north-east	SK001971
Great Wood SBI	Ancient Woodland	937 m south	SJ983935
Hollingworth Reservoir & Swallowswood Nature Reserve LWS	Secondary broad-leaved woodland	973 m north-east	SK009975
Godley Hill SBI	Woodland; Heathland; Grassland	1,060 m west	SJ969950
Dinting Wood LWS	Ancient semi-natural oak woodland	1,073 m south-east	SK016943
Banks Wood LWS	Habitat mosaic	1,110 m east	SK023956
Clough at Madeley SBI	Ancient woodland; Grassland	1,115 m north-west	SJ973962
Gamesley Sidings LWS	Habitat mosaic	1,210 m south	SK013940
Dinting Junction Pond LWS	Standing open water	1,287 m south-east	SK022947

Site name and designation	Description of habitats	Approximate distance and direction from Scheme	Grid reference
Brookfold Wood SBI	Ancient woodland; Grassland; Ponds	1330 m south-west	SJ970944
Eastwood and Acre Clough SBI	Woodland	1,414 m north-west	SJ971974
Higher Gamesley Marsh pLWS	Unimproved neutral grassland	1,429 m south-east	SK014939
Back Wood SBI	Ancient Woodland	1,470 m south-west	SJ979930
Warrastfold Bridge Complex LWS	Unimproved acid grassland	1,539 m south	SJ991935
Ashes Farm Meadows pLWS	Unimproved neutral grassland	1,699 m south east	SK026946
Woodseats Wood LWS	Secondary broad-leaved woodland	1,840 m south	SJ989929
North Road Ponds LWS	Standing open water	1,924 m east	SK030952
Tom Wood LWS	Ancient semi-natural woodland - mixed deciduous	1,966 m south	SJ997931
Pond at Oaklands Hall SBI	Ponds; Amphibians	1,970 m west	SJ962948

Ancient woodland and ancient, veteran, and notable trees

3.1.5 No Ancient Woodland was identified using the Ancient Tree Inventory[85][86] within 500 m of the Scheme[87]. However, 15 separate parcels were present within 2 km of the Scheme as outlined within Table 3-3 with locations provided on Figure 8.2 (TR010034/APP/6.4).

3.1.6 One common sycamore classified as a notable tree was identified approximately 125 m north of the DCO boundary just north of Coach Road. A notable beech and a veteran oak were also identified 1.2 km north-east of the DCO boundary associated with Hollingworth Hall Wood SBI.

Table 3-3: Ancient Woodland and ancient, veteran, and notable trees within 2 km

Site / Feature name	Designation	Approximate distance and

[85] https://data.gov.uk/dataset/9461f463-c363-4309-ae77-fdcd7e9df7d3/ancient-woodland-england
[86] https://ati.woodlandtrust.org.uk/
[87] Hurts Clough SBI (within 500 m of the Scheme) is designated due to containing ancient woodland, however, the ancient woodland area is located 902 m away from the Scheme at the closest point.

		direction from Scheme
Common Sycamore	Notable tree	125 m north
Westwood Clough	Ancient & Semi-Natural Woodland	516 m west
Dinting Vale Wood	Ancient & Semi-Natural Woodland	618 m south-east
Millbrook Bridge Wood (1)	Ancient & Semi-Natural Woodland	623 m north-east
Millbrook Bridge Wood (2)	Ancient & Semi-Natural Woodland	757 m north-east
Un-named Woodland	Ancient & Semi-Natural Woodland	829 m north-east
Un-named Woodland	Ancient & Semi-Natural Woodland	848 m north-east
Hurst Clough	Ancient & Semi-Natural Woodland	919 m south
Great Wood (2)	Ancient & Semi-Natural Woodland	956 m south-west
Robin Wood	Ancient & Semi-Natural Woodland	988 m south
Un-named Woodland	Ancient & Semi-Natural Woodland	1164 m north-west
Beech	Notable Tree	1.2 km north-east
Oak	Veteran Tree	1.2 km north-east
Hurst Clough	Ancient & Semi-Natural Woodland	1295 m south
Great Wood (1)	Ancient & Semi-Natural Woodland	1336 m south-west
Brookfold Wood	Ancient & Semi-Natural Woodland	1376 m west
Hollingworth Hall Wood	Ancient & Semi-Natural Woodland	1465 m north
Un-named Woodland	Ancient & Semi-Natural Woodland	1510 m north-west
Back Wood	Ancient & Semi-Natural Woodland	1579 m south-west

General Overview

3.1.7 Habitats within the DCO boundary are generally agricultural grassland used for grazing and silage. The Scheme can be broadly characterised into four areas showing different habitats. From the existing M67 roundabout through to Roe Cross Road is generally dominated by agricultural grasslands used for cattle grazing, much of which is inundated and dominated by rushes due to the presence of the Hurstclough Brook. Hedges in this area are typically hawthorn dominated with few other species present and are heavily defunct

3.1.8 Between Roe Cross Road and Old Hall Lane lies the urban area of Mottram-in-Longdendale which is suburban in nature and characterised by residential dwellings and gardens. Between Old Hall Lane and the Existing A57 Mottram Moor Road lies the Mottram Showground used for sheep grazing. This is separated with a belt of semi-natural broadleaved woodland and shows characteristics of once belonging to managed parkland, including mature, maiden trees. Land in this section of the Scheme also includes fields used for silage and as horse grazing. Hedges in this area tend to have a more diverse species composition and are usually intact.

3.1.9 Between the A57 Mottram Moor and the tie in of the Scheme east of the River Etherow land use is characterised by cattle grazed pasture with an area of coniferous plantation of woodland. Hedgerows in this area tend to be hawthorn dominated with few other species present and are usually intact.

Notable Habitats

3.1.10 The location of the habitats are provided within Figure 8.3 (TR010034/APP/6.4).

Traditional Orchard

3.1.11 Three areas of traditional orchard listed on the priority habitat inventory were identified within 500 m of the DCO boundary:

- One small area of traditional orchard (approximately 0.1 ha), a S41 priority habitat, is located immediately adjacent to the DCO boundary north of Mottram Moor Road (SJ996958). This area has been classified as priority habitat with low confidence on Magic Map. A walkover of the site in September 2020 found this area to contain no features to suggest this habitat is traditional orchard and appeared to contain traditional garden habitat with amenity grassland and shrub planting
- One area (0.11 ha) is located adjacent to a farm complex approximately 65 m north-east of the Scheme. This area has been classified as priority habitat with low confidence on Magic Map
- One area of traditional orchard (approximately 0.25 ha) is located approximately 235 m north of the DCO boundary at Water Lane, Hollingworth (SK009960). It is classified as medium confidence within the priority habitat inventory; however a review of historic aerial imagery shows the site having suffered heavy disturbance and clearance as recently as 2009.

3.1.12 It is considered all areas of traditional orchard listed on the priority habitat inventory within the study area have been classified in error or using aerial imagery only and do not conform to the priority habitat description for this habitat type.

Lowland Mixed Deciduous Woodland

3.1.13 There are 90 parcels of deciduous woodland as listed on the priority habitat inventory located within 500 m of the DCO boundary. Three woodland blocks listed on the priority habitats inventory fall at least partially within or for the boundary of the DCO boundary.

3.1.14 These include:

- An area of woodland south-east of the M67 Junction 4. This area of deciduous woodland is approximately 3 ha and borders the DCO boundary on its northern border
- An area of woodland east of Old Hall Lane and north of Lodge Court is present within the DCO boundary. The woodland forms a continuous block running parallel with the watercourse and bounding the Showground on its south-western border
- An area of woodland (approximately 0.02 ha) north of Old Hall lane north of the Showground is located within the DCO boundary.

3.1.15 The field survey confirmed all areas identified within the priority habitat inventory conformed to the lowland mixed deciduous priority habitat type. In addition, the field survey identified a further three areas of lowland mixed deciduous woodland conforming to the priority habitat definition. Two of these were small areas with

0.12 ha located within the Showground (SJ994960) and 0.06 ha east of Carrhouse Lane (SK003956). A larger area of lowland mixed deciduous woodland habitat was located immediately west of Carrhouse Lane (SK002955).

3.1.16 This area is an extension of woodland identified on the priority habitat inventory and measures an additional 0.95 ha, of which 0.19 ha is located within the DCO boundary. All semi natural broadleaved woodland located within the DCO boundary conformed to the lowland mixed deciduous priority habitat type.

Wet Woodland

3.1.17 The phase 1 habitat survey identified two small areas of wet woodland, both of which were located within the DCO boundary. One area was approximately 0.08 ha and was dominated by goat willow over a rush dominated ground layer and located west of Roe Cross Road (SJ988959). Grazing by sheep meant there was little in the way of understory cover.

3.1.18 The second area, located north-west of the cricket ground (SJ989959), was 0.02 ha and consisted of a small area of semi-mature ash and alder.

Lowland Dry Acid Grassland

3.1.19 Three distinct areas of lowland dry acid grassland that conform to the priority habitat description of this habitat type were identified within the DCO boundary.

3.1.20 One, located north of the cricket ground (SJ989959), was approximately 0.07 ha in size on an embankment. This patch was dominated by mat grass and sheep sorrel.

3.1.21 Another patch was located approximately 45 m north of the existing A57 Mottram Moor Road (SJ996959) and was approximately 0.012 ha in size. A larger patch was located approximately 80 m north of the existing A57 Mottram Moor Road (SJ997958). Acid indicator species in these two areas included common bent, tormentil, heath bedstraw, hard-fern, bilberry, mat-grass and sheep's sorrel, with betony also present. These areas of acid grassland had a good fit with NVC type U4 *Festuca ovina-Agrostis capillaris-Galium saxatile* grassland. All semi-improved acid grassland located within the DCO boundary conformed to this habitat type.

Flood Plain Mire

3.1.22 An un-named tributary WC_210 (classified as an Ordinary Watercourse) of the River Etherow drains the hill slopes north of the A57 Mottram Moor. The riparian zone comprises marginal vegetation with varying mixtures of water-cress, brooklime, water forget-me-not, gypsywort, meadowsweet, creeping buttercup, common nettle and broad-leaved dock. Throughout the vegetation Himalayan balsam is overwhelmingly dominant. Beyond the marginal vegetation, the riparian zone comprises a narrow flood-plain supporting alluvial wetland habitat with a tall-herb fen community dominated by meadowsweet with wild angelica, soft-rush, common marsh-bedstraw, meadow vetchling, devil's-bit scabious, lesser spearwort, greater bird's-foot-trefoil and marsh thistle.

This vegetation community has a good fit to the NVC type M27 *Filipendula ulmaria-Angelica Sylvestris* mire which is a key vegetation type of the alluvial wetland component of flood-plain fen.

3.1.23 The narrow flood-plain is underlain by wet mineral soils and is not a peatland fen system. Therefore, despite the presence of flood-plain fen vegetation, the vegetation does not conform to the JNCC UK BAP priority habitat description of lowland fen, which states that lowland fens are peatlands, and therefore it would not be considered to be a priority habitat published in accordance with Section 41 of the NERC Act 2006 nor an irreplaceable habitat as listed in the NPPF 2019.

Other Habitats

Amenity Grassland

3.1.24 0.41 ha of amenity grassland is present within the DCO boundary all of which is present on land surrounding the existing M67 Junction4 at the western end of the Scheme. This grassland was characterised by a regular cutting regime, dominated by perennial rye grass and generally with a low diversity of herb species.

Bare ground

3.1.25 Areas of bare ground were present marking farm access tracks in the east of the Scheme. These areas totalled approximately 0.17 ha

Bracken

3.1.26 An area dominated by dense bracken, measuring approximately 0.01 ha, was present along a field boundary west of Carr House Lane.

Broadleaved woodland plantation

3.1.27 Approximately 0.58 ha of semi-mature broadleaved plantation woodland also present within the central areas of the M67 Junction 4. This included a variety of mostly broadleaved species typical of highways planting, including sycamore, oak and silver birch. This area of woodland had an edge of shrub species including buddleia, goat willow, guelder rose and was bordered by an area of rank, neutral grassland.

Coniferous woodland plantation

3.1.28 Approximately 0.48 ha of semi-mature coniferous plantation woodland was present to the east of Carrhouse Lane. The woodland comprised densely planted firs and spruce. The woodland was bordered to the north by a defunct, predominately hawthorn, hedgerow and by broad-leaved tree lines to the south and west. The woodland understory was generally absent, although there were patches of dense bramble scrub in places.

Urban habitats (including buildings, gardens and hardstanding

3.1.29 Mottram-in-Longdendale is situated within a rural area and the study area comprised mixed-age residential dwellings and farmhouse buildings. The residential dwellings to the north of A57 at Mottram Moor comprised a row of brick-built terraced and semi-detached houses over two floors with slate roofs. The area around Old Road was more variable and modern, with a mix of commercial development and a variety of building types, such as bungalows and semi-detached residential properties.

There were also several farm complexes comprising a variety of buildings and a small circular structure near to the M67 Terminal Roundabout.

3.1.30 Approximately 2.54 ha of suburban area comprising houses, minor roads and gardens lies within the DCO boundary. In addition, 8ha of hardstanding, mostly comprised of the existing A57 road due to be de-trunked also lies within the DCO boundary.

Dense scrub

3.1.31 Dense scrub was widespread across the Scheme including along the embankments of the M67 and in small patches throughout the Scheme, with the largest area (approximately 0.67 ha) situated immediately south of Mottram Moor. Dense scrub habitat within the DCO boundary totalled 1.22 ha (excluding an area of willow categorised as wet woodland and addressed in the notable habitats section above) and was largely dominated by mature bramble but also included hawthorn and gorse.

Improved grassland

3.1.32 Improved grassland was common and widespread throughout the study area, totalling approximately 29.98 ha. Improved grassland was particularly common to the east between the A6106 (Roe Cross Road) and the A57 at Mottram Moor. It occupied intensively grazed pastoral fields and silage plots with a sward dominated by perennial rye-grass. Where herb species were present these typically had little diversity and were made up of mostly white clover and creeping buttercup, both species indicative of heavy nutrient enrichment.

Marshy Grassland

3.1.33 Marshy grassland was common in the west of the scheme in fields nearby to the Hurstclough Brook. Areas of marshy grassland were generally located in hollows where the ground is frequently wet and had a high cover of rush species. In many places the marshy grassland habitat showed signs of nutrient enrichment resulting from cattle grazing and possible runoff from nearby fields, including the presence of thistle and nettle. As well a high cover of rushes, other species frequently found in this habitat included common bent and Yorkshire fog. None of the areas of marshy grassland conform to the description of the S41 priority habitat purple moor grass and rush pasture.

Neutral semi-improved grassland

3.1.34 Patches of semi-improved neutral grassland totalling 1.47 ha were present within the study area mainly within an un-grazed field adjacent to A6018 Roe Cross Road to the south. These areas displayed a much wider diversity of grass and herb species including Yorkshire fog, timothy, cock's-foot, false oat grass, reed canary grass, red clover and a number of common vetch species.

Poor semi-improved grassland

3.1.35 Poor semi-improved grassland was the most common of these habitats totalling approximately 4.32 ha. Poor semi-improved grassland covers a large proportion of the fields between the M67 junction and Roe Cross Road, and those to the south-east of the A57 at Mottram Moor. Perennial ryegrass, white clover and creeping buttercup were typically abundant with varying prevalence and

sometimes localised dominance of other grasses including: Yorkshire-fog, rough Meadow-grass, meadow foxtail, crested dog's-tail and, cock's-foot. Forb diversity was low and generally sparse but red clover, broad-leaved dock, common sorrel, ribwort plantain and dandelion were typically occasional to frequent.

Scattered scrub

3.1.36 A small area (approximately 0.05 ha) of scattered scrub was present north of the Scheme and bordering to the west of the A6018 Roe Cross Road. The scrub was dominated by bramble with occasional hawthorn, rowan, and Himalayan balsam.

Tall ruderal

3.1.37 Areas of tall ruderal vegetation, totalling approximately 0.52 ha were present bordering the north boundary of the M67 roundabout and Tall ruderal vegetation also bordering A57 Woolley Lane to the south. These were generally located in wet areas that have been left unmanaged. Areas of tall ruderal vegetation were dominated by rosebay willow-herb, common nettle, great willowherb, and wild angelica with Himalayan balsam also occasionally present.

Parkland and scattered trees

3.1.38 An area of intensively grazed pasture, measuring approximately 0.90 ha, showed characteristics of parkland a scattered trees habitat, including open grown mature trees, made up mostly of sycamore and oak. The ground flora was generally dominated by rye grass with areas of thistle and nettle indicative of localised nutrient enrichment as a result of sheep grazing. An Ordnance Survey map of Cheshire, published in 1882, showed that this area was parkland of at least 19th century origin[88].

3.1.39 None of the open grown trees displayed veteran tree features, and it is therefore considered that the habitat does not conform to the description of the S41 priority habitat wood-pasture and parkland[89].

3.2 Hedgerows

3.2.1 Hedgerows were frequent throughout the Survey Area, predominantly marking field boundaries. Although these hedgerows were mostly gappy, species-poor (predominantly hawthorn), and heavily managed, they all met the criteria for S41 priority habitat hedgerow[90].

3.2.2 Of the hedgerows surveyed, two met the criteria to be considered 'important' under the Hedgerow Regulations 1997. These were Hedgerow 18 (H18) which is located approximately 100 m east of the DCO boundary and qualified due to containing at least seven woody species. H24, located partially within the DCO boundary, qualified due to containing six woody species and having at least three associated features. Both are located within the Showground area with locations provided on Figure 8.4 (TR010034/APP/6.4) and further details provided within 0.

[88] https://maps.nls.uk/view/102340957
[89] http://data.jncc.gov.uk/data/2829ce47-1ca5-41e7-bc1a-871c1cc0b3ae/UKBAP-BAPHabitats-65-WoodPastureParkland-2011.pdf
[90] http://data.jncc.gov.uk/data/ca179c55-3e9d-4e95-abd9-4edb2347c3b6/UKBAP-BAPHabitats-17-Hedgerows.pdf

3.2.3 During the surveys, 48 distinct hedgerows were recorded within the Survey Area. Thirty-six of these, with a total combined length of 3,312 m, are located within the DCO boundary. These comprise:

- approximately 779 m of defunct species-poor hedgerow
- approximately 271 m of intact species-rich hedgerow
- approximately 1,132 m of intact species-poor hedgerow
- approximately 37 m of species rich hedgerow with trees
- approximately 499 m of species poor hedgerow with trees
- approximately 594 m of lines of trees.

3.2.4 The remaining hedgerows were generally dominated by hawthorn and elder and where trees were present, these were usually ash or oak.

3.2.5 Full results are presented in 0 and locations are provided on Figure 8.4 (TR010034/APP/6.4).

3.3 NVC Survey

3.3.1 Four quadrats of woodland located between Old Hall Lane and the Mottram Showground were selected for NVC surveys. Locations are provided on Figure 8.4 (TR010034/APP/6.4).

3.3.2 The results of the NVC surveys showed that the areas surveyed comprised broadleaved woodland. The canopy was dominated by sycamore within quadrats 1, 2 and 3 and by oak and whitebeam within quadrat 4. Ash, beech and wych elm were also present within the quadrats. The understory was broadly similar in quadrats 1,2 and 3 including holly, privet, hawthorn, and samplings of various species. The understory in quadrat 4 was composed of hawthorn and oak saplings. All quadrats had a similar ground flora which included bramble, dead nettles, ivy, common nettle and willowherb species. The invasive species Himalayan balsam was present in all quadrats and a number of non-native garden shrubs were present in quadrats 2, 3 and 4. A description of all quadrats is presented in Table 3-4. Further quadrat descriptions are provided within Appendix B.

Table 3-4: Summary of TABLEFIT results for each quadrat

Quadrat	EUNIS code	NVC code	Goodness- of-fit	NVC community	NVC Subcommunity
Q1	G1.632	W12a	49	*Fagus sylvatica - Mercurialis perennis* woodland	*Mercurialis perennis*
	G1.A2	W8e	41	*Fraxinus excelsior - Acer campestre - Mercurialis perennis*	*Geranium robertianum*
	G1.632	W12	38	*Fagus sylvatica - Mercurialis perennis* woodland	

Quadrat	EUNIS code	NVC code	Goodness- of-fit	NVC community	NVC Subcommunity
Q2	G1.A2	W8e	39	*Fraxinus excelsior - Acer campestre - Mercurialis perennis*	*Geranium robertianum*
	G1.21	W7c	35	*Alnus glutinosa - Fraxinus excelsior - Lysimachia nemorum*	*Deschampia cespitosa*
	G1.A2	W9a	34	*Fraxinus excelsior – Sorbus aucuparia - Mercurialis perennis*	Typical
Q3	G1.A2	W8e	40	*Fraxinus excelsior - Acer campestre - Mercurialis perennis*	*Geranium robertianum*
	G1.A2	W9a	32	*Fraxinus excelsior – Sorbus aucuparia - Mercurialis perennis*	Typical
	G1.A11	W10e	31	*Quercus robur - Pteridium aquilinum - Rubus fruticosus*	*Acer pseudoplatanus -Oxalis acetosella*
Q4	G1.A11	W10e	50	*Quercus robur - Pteridium aquilinum - Rubus fruticosus*	*Acer pseudoplatanus -Oxalis acetosella*
	F3.11212	W21b	36	*Crataegus monogyna - Hedera* scrub	*Mercurialis perennis*
	G1.A11	W10a	35	*Quercus robur - Pteridium aquilinum - Rubus fruticosus*	Typical
Q 1-4 Combined	G1.A2	W8e	35	*Fraxinus excelsior - Acer campestre - Mercurialis perennis*	*Geranium robertianum*
	G1.A11	W10	32	*Quercus robur- Pteridium aquilinum - Rubus fruticosus*	
	G1.A11	W10e	31	*Quercus robur - Pteridium aquilinum - Rubus fruticosus*	*Acer pseudoplatanus -Oxalis acetosella*

3.3.3 TABLEFIT results suggest that the best diagnosis for the woodland community present in quadrat 1 would be W12a *Fagus sylvatica - Mercurialis perennis* woodland *Mercurialis perennis* subcommunity with a very poor goodness-of-fit of 49. However, this description is not considered to be appropriate as beech is dominant in W12 communities, whereas this species only had a dominance score of 5 in quadrat 1. W8e is also not considered to be representative in quadrat 1 due to the dominance of sycamore over ash

3.3.4 TABLEFIT results suggest that the best diagnosis for the woodland community present in quadrat 2 would be W8e *Fraxinus excelsior - Acer campestre -*

Mercurialis perennis woodland *Geranium robertianum* subcommunity with a very poor goodness-of-fit of 39. As detailed earlier for quadrat 1, this community is not considered to be a good fit for quadrat 2, due to the absence of ash within the canopy (only found in the understory). W7c and W9a are also not considered to be satisfactory community descriptions due to the low frequency of ash and the absence of alder.

3.3.5 TABLEFIT results suggest that the best diagnosis for the woodland community present in quadrat 3 would also be W8e *Fraxinus excelsior - Acer campestre - Mercurialis perennis* woodland *Geranium robertianum* subcommunity with a very poor goodness-of-fit of 40. For the same reasons as in quadrat 2, W8e or W9a are not considered to be a good fit. W10e is also not considered to be representative due to the absence of oak in this quadrat.

3.3.6 TABLEFIT results suggest that the best diagnosis for the woodland community present in quadrat 4 would be W10e *Quercus robur - Pteridium aquilinum - Rubus fruticosus* woodland *Acer pseudoplatanus - Oxalis acetosella* subcommunity with a poor goodness-of-fit of 50. In typical W10e woodlands, oak is present, with ash, sycamore and some wych elm, in a (usually) high forest structure; silver birch is quite sparse. Hazel is the most abundant shrub, often with hawthorn or holly. The ground flora can be quite rich, and wood sorrel, common dog-violet and a good bryophyte cover are the most distinctive features. lady-fern, broad buckler-fern and creeping soft-grass are more common than in the rest of the W10 community. The canopy present in quadrat 4 is similar to that described for the W10e subcommunity. The shrub layer, however, lacks hazel and holly and the ground flora is not as rich due to the dominance of Himalayan balsam.

3.3.7 TABLEFIT results suggest that the best diagnosis for the overall woodland community, using TABLEFIT alone, would be W8e with a very poor goodness-of-fit of 35, followed by W10 and W10e. Based on the low goodness-of-fit results obtained from TABLEFIT and the reasons already mentioned in previous paragraphs (e.g. low frequency of ash and oak), the habitat present within the woodland at Old Hall Showground, does not fit well with any NVC community

3.4 Biodiversity Metric Calculation

Area units

3.4.1 The biodiversity baseline of the Scheme for area units within the DCO boundary totals 199.69 units over 62.07 ha. A total of 18.2 units will be retained, resulting in a loss of 181.49 units prior to any habitat creation post construction.

3.4.2 Habitat creation as a result of the scheme will result in 203.00 biodiversity units, with a post intervention total of 221.20 units. This is a net unit gain of +21.51 units, or a net gain of 10.77%. Full results are provided within Appendix C.

3.4.3 The biodiversity metric has been used to supplement the reporting of the significance of environmental effects, by providing a way of calculating biodiversity gains and losses. It is possible that the results of the metric may change as the Scheme evolves, particularly during the detailed design. Whilst minor changes may occur, it is not anticipated that the results of the biodiversity metric would change fundamentally from what is reported within this appendix.

Trading Summary

3.4.4 To avoid trading down, it is recommended that habitats of a high distinctiveness are replaced like-for-like with the same habitat, and that habitats of medium distinctiveness are replaced with the same broad habitat type or one of a higher distinctiveness (e.g. other neutral grassland can be replaced with any other grassland habitat type). Habitats of low distinctiveness should be replaced with habitats of the same or higher distinctiveness. No compensatory habitat is required for habits of very low distinctiveness. Very high distinctiveness habitats are subject to bespoke compensation and removed from the metric calculator. A summary of the unit and area changes by habitat type is outlined in Table 3-5 and Table 3-6.

High Distinctiveness Habitat Trading

3.4.5 The scheme results in trading down of -3.28 units of flood plain mare (recorded as coastal flood grazing marsh within the metric) and -7.16 biodiversity units of lowland mixed deciduous woodland habitat and -11.88 units of wood pasture and parkland habitat. The decrease in lowland mixed deciduous is attributed to created habitats being input other broadleaved woodland (i.e. plantation), and not an overall decrease of broadleaved woodland.

3.4.6 All other high distinctiveness habitats resulted in positive trading outcomes.

Medium Distinctiveness Habitat Trading

3.4.7 For medium distinctiveness habitats, all broad habitat types resulted in an overall unit and area gain, and therefore, there is no trading down in this distinctiveness group.

Low Distinctiveness Habitat Trading

3.4.8 There is a unit loss of –56.12 units in low distinctiveness habitats, however, there is a surplus of 96.62 units in higher distinctiveness habitat types to account for this, resulting in no overall trading down for low distinctiveness habitats.

Table 3-5: Summary of unit and area change for each habitat type

Distinctiveness	Habitat	Units Lost	Units created	Unit difference	Baseline area (ha)	Created area (ha)	Area difference ha)
High	Lakes - Ponds (Non- Priority Habitat)	2.508	9.34	6.832	0.14	0.93	0.79
	Coastal flood grazing marsh[91]	3.3	0.02	-3.28	0.25	0.01	-0.24
	Heathland and shrub - Lowland Heathland	0	0.83	0.83	0	0.39	0.39

[91] Recorded as flood plain mire within the phase 1 habitat survey

Distinctiveness	Habitat	Units Lost	Units created	Unit difference	Baseline area (ha)	Created area (ha)	Area difference ha)
	Sparsely vegetated land - Inland rock outcrop and scree habitats	0	1.97	1.97	0	0.92	0.92
	Woodland and forest - Lowland mixed deciduous woodland	7.26	0.1	-7.16	0.5	0.07	-0.43
	Woodland and forest - Wet woodland	1.188	2.28	1.092	0.09	0.63	0.54
	Woodland and forest – Wood pasture and parkland	11.88	0	-11.88	0.9	0	-0.9
Medium	Grassland - Bracken	0.04	0	-0.04	0.01	0	-0.01
	Grassland - Other neutral grassland	73.44	109.54	36.1	9.69	19.61	9.92
	Heathland and shrub - Blackthorn scrub	0.16	0	-0.16	0.02	0	-0.02
	Heathland and shrub - Bramble scrub	2.84	0.34	-2.5	0.64	0.06	-0.58
	Heathland and shrub - Hawthorn scrub	0.2	0	-0.2	0.03	0	-0.03
	Heathland and shrub - Mixed scrub	2.48	33.79	31.31	0.31	4.7	4.39
	Woodland and forest - Other woodland; broadleaved	1.08	4.38	3.3	0.27	2.43	2.16
	Grassland - Other lowland acid grassland	0	7.45	7.45	0	1.33	1.33
	Lakes - Ditches	0	13.92	13.92	0	2.08	2.08
Low	Grassland - Modified grassland	69.16	15.42	-53.74	34.33	7.88	-26.45
	Urban - Amenity grassland	0.6	1.25	0.65	0.3	0.65	0.35
	Urban - Suburban/ mosaic of developed/ natural surface	4.48	2.03	-2.45	2.24	1.05	-1.19
	Urban - Vegetated garden	0.14	0	-0.14	0.07	0	-0.07
	Urban - Introduced shrub	0	0.23	0.23	0	0.12	0.12
	Woodland and forest - Other coniferous woodland	0.74	0.07	-0.67	0.37	0.06	-0.31

Table 3-6: Summary of unit and area change by broad habitat type

Broad habitat	Units lost	Units created	Unit change	Area lost (ha)	Area created (ha)	Area difference (ha)
Lakes	2.508	0	-2.508	0.14	0	-0.14
Grassland	145.94	132.46	-13.48	44.28	28.84	-15.44
Heathland and shrub	5.68	34.96	29.28	1	5.15	4.15
Sparsely vegetated land	0	1.97	1.97	0	0.92	0.92
Urban	5.22	3.74	-1.48	10.36	16.91	6.55
Woodland and forest	22.148	6.83	-15.318	2.13	3.19	1.06

Linear units

3.4.9 The biodiversity baseline for linear units within the DCO boundary totals 23.96 units over a total length of 3.64 km. Of these, 5.42 units will be retained, resulting in a loss of 18.54 units prior to any habitat creation post construction.

3.4.10 Habitat creation as a result of the Scheme will result in 30.72 linear units, with a post intervention total of 36.14 units. This is a net unit gain of 12.18 units, or a net gain of 50.85% for linear units. Full results are provided within Appendix C.

River units

3.4.11 The biodiversity baseline for rivers within the DCO boundary totals 18.16 River Biodiversity Units (RBU) over a total length of 1.33 km. A total of 11.22 RBU will be retained and 1.8 units to be enhanced, resulting in a loss of 5.14 RBU prior to any habitat enhancement or creation.

3.4.12 Habitat creation as a result of the scheme (from river realignment and the creation of a new interceptor channel) results in the delivery of 4.84 RBU. Enhancements to a retained section of the Hurstclough Brook (WC_300) which will form backwater habitat will result in 2.47 RBU. This gives a post intervention total of 18.54 RBU, or a net change of 2.09%. These results are also provided within Table 3-7.

3.4.13 These calculations are based on a number of assumptions principally related to the ascribed distinctiveness and condition of the river baseline, creation and enhancement. This approach has been necessary to overcome limitations with the current Defra metric which is available only as a beta test version at the time of writing.

Table 3-7: Biodiversity Metric Calculation Results

Unit type	Baseline units	Retained units	Units lost	Units created	Units enhanced	Post work units	Units change (%)
Area	199.69	18.20	181.50	203.23	0	221.43	+21.74 (10.88%)
Linear	23.96	5.42	18.54	30.72	0	36.14	12.18 (50.85%)
River	18.16	11.22	5.14	4.85	2.47*	18.54	+0.38 (2.09%)

** RBU delivered through enhancements (post works).*

3.5 Bats

Desk Study

3.5.1 GMBRC returned 181 recent[92] records of bat sightings within 5 km of the DCO boundary. Species included soprano pipistrelle (twenty-four records), common pipistrelle (eighty-eight records), Brandt's bat (one record), myotis species (three records), pipistrelle species (21 records), noctule bat (eight records), natterer's bat (one record), *Nyctalus* species (two records), Daubenton's bat (six records), brown long-eared bat (four records), whiskered bat (two records) and unidentified bat species (twenty-one records). The closest of these records are from within the DCO boundary, one soprano pipistrelle are recorded foraging near the Roe Cross Road and Old Road junction.

3.5.2 GMBRC returned fifty-two recent records of bat roosts within 5 km of the DCO boundary. Species included common pipistrelle (twenty records), soprano pipistrelle (four records), pipistrelle species (five records), myotis species (five records), unidentified bat species (fourteen records), brown long-eared bat (four records). Four of the recorded common pipistrelle roosts are within the DCO boundary, in houses on Old Hall Lane. All of these roosts are classified as day roosts. A further four common pipistrelle roosts were identified within 50 m of the DCO boundary, three of these roosts were identified as day roosts, one was not characterised further.
All of these roosts were in residential properties, two on the A57 near Woolley Lane, one on Carrhouse Lane and one on Lodge Crescent.

3.5.3 DBG returned thirty-eight recent records of bat sightings within 5 km of the DCO boundary. Species included common pipistrelle (fourteen records), soprano pipistrelle (seven records), myotis species (eight records), Noctule bat (three records), brown long-eared bat (two records) and unidentified bat species (four records). The closest record was 765 m to the south of the DCO boundary, a common pipistrelle and soprano pipistrelle recorded foraging.

3.5.4 DBG returned nine recent records of roosts within 5 km of the DCO boundary. Species included common pipistrelle (five records), pipistrelle species (three records) and brown long-eared bat (one record). The closest roost is of pipistrelle

[92] Recent is considered to be in the last 10 years.

species, located 1.4 km to the south of the DCO boundary, in woodland near Glossop Road.

3.5.5 DBRC returned twenty recent records of bat sightings within 2 km of the DCO boundary. Species included common pipistrelle (seven records), myotis species (three records), soprano pipistrelle (five records), noctule (three records), brown long-eared bat (one record) and unidentified bat species (one record). The closest records were approximately 940 m southeast of the DCO boundary, eleven bats had the same grid reference (four common pipistrelle, three myotis species, two Noctule and two Soprano Pipistrelle). No further details about the records was given.

3.5.6 DBRC returned seven recent roost records within 2 km of the DCO boundary. Species included brown long-eared bat (two records), common pipistrelle (three records) and unidentified pipistrelle species (two records). The closest roost record was of a pipistrelle species roost 1.4 km away from the DCO boundary. No further details about these roosts was given.

3.5.7 The desk-based habitat suitability assessment of land within and up to 500 m from the DCO boundary used aerial imagery and the previous Phase 1 habitat survey to determine the connectivity of the habitats between the Scheme and wider area. The assessment identified that the majority of the habitats within the DCO boundary and wider surrounding area are improved grassland and poor semi-improved grassland, particularly to the east of A6106 Roe Cross Road and to the south east of the Scheme. There are few intact hedgerows across the Scheme and in the wider surrounding area, several field boundaries comprise of lines of trees. Woodland is mainly found in small patches and clumps throughout the study area, there are no large areas of woodland across the study area or with connectivity to the study area. A number of rivers are streams are present across the Scheme and the surrounding area, providing suitable foraging and commuting habitat for a number of bats.

3.5.8 The MAGIC search for EPS licences within 2 km of the DCO boundary returned four records of granted EPS licences. The following licences were returned:

- EPSM2013-6462, licence to allow the destruction of a common pipistrelle resting place. 0.95 km to the east of the DCO boundary
- EPSM2012-5014, species on the licence are common pipistrelle and Soprano Pipistrelle. Allows for the destruction of a resting place. 0.55 km to the south of the DCO boundary
- EPSM2012-4826, species on this licence are brown-long eared bat and Common Pipistrelle bat. Allows for the destruction of a resting place. 1.25 km from the DCO boundary
- 2015-17859-EPS-MIT, species on the licence are Brandt's bat, common pipistrelle and whiskered bat. 1.5 km from the DCO boundary.

Field Survey

Habitat Assessment

3.5.9 The bat survey area was assessed as being of moderate suitability to support foraging and commuting bats, as outlined in Table 2-3: Habitat suitability for foraging and commuting bats. Table 2-3. This was due to the presence of

significant linear features within the bat survey area (including hedgerows and watercourses), patches of woodland edge habitat, and good links to the wider landscape. However, the site lacked continuous, high quality-habitat with many hedgerows being in species-poor with large gaps and the majority of the Scheme consisting of heavily grazed pastoral land.

Ground Level Tree Assessments and Tree Climbing Surveys

3.5.10 Ninety-two trees within the study area were initially identified as having potential bat roosting suitability during the GLTAs in 2020. These trees were subsequently subject to further climbing surveys to determine presence/ likely absence and provide an updated bat roosting suitability[93]. Overall, 45 trees were assessed as having bat roosting suitability (one high, 13 moderate and 31 low suitability); the remaining trees were scoped out due to having negligible bat roosting suitability. Thirty of these trees are located within the DCO boundary with the remainder being located within 50 m.

3.5.11 Surveys of these trees did not record any bat roosting evidence and bat roosts within trees are considered to be likely absent at the time of survey.

3.5.12 Full results, including survey dates, are provided within Appendix D.

Hibernation Surveys

3.5.13 Fourteen trees within the bat survey area were assessed as having suitability to support hibernating bats.

3.5.14 Hibernation surveys of these trees did not record any bat roosting evidence and bat roosts within trees are considered to be likely absent at the time of survey.

3.5.15 Full results, including survey dates, are provided within Appendix D.

Walked Transect Activity Surveys

3.5.16 Four taxa were identified during the walked transect surveys:

- Myotis species
- Noctule
- common pipistrelle
- Soprano pipistrelle

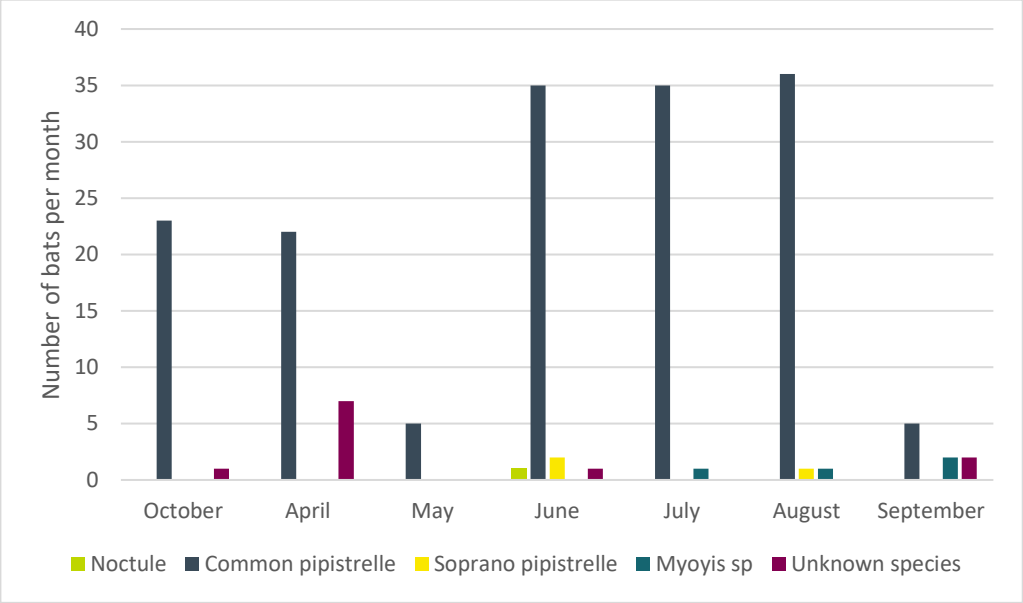
3.5.17 Some bats of unknown species were recorded as they were seen but not recorded on the detector.

3.5.18 The vast majority of bats identified were Common Pipistrelle (90.4%). 6.2% of species recorded were unknown (seen not heard). The remaining taxa identified in the surveys were recorded much less frequently, and include 1.7% of soprano pipistrelle, 1.1% were myotis species, and 0.6% of noctule. Bat activity was highest in October, April, June, July and August with much lower levels of activity in September and May.

3.5.19 Relative abundances per taxon is provided within Chart 1, below.

[93] In line with Collins (2016).

Chart 1 - Relative Abundance per Taxon per Month during Transect Activity Surveys



3.5.20 The distribution of commuting and foraging bats across the bat survey area, as illustrated in Figure 8.10 (TR010034/APP/6.4), to some extent reflects the routes that were followed by the surveyors on the transects. However, information on the favoured foraging areas of bats can be gained by observing the relative densities of bats plotted on the figures.

3.5.21 Bat activity was dispersed throughout the survey area, however a much larger proportion (70.7%) of bat activity was recorded along Transect 1, which covers the area to the north of Mottram Moor A6018 and Hyde Road, encompassing The Mottram Showground and Hurstclough Brook (route shown in Figure 8.9 (TR010034/APP/6.4)).

3.5.22 Commuting bats were found in areas where significant linear features were present, providing good connectivity between adjacent habitats including intact hedgerows, woodland edges, lines of trees and watercourses. A large proportion of commuting activity was recorded at:

- The River Etherow
- Hedgerow and lines of trees to the southwest of Tara Brook Farm
- Hedgerows to the southwest of Coach Road and along Coach Road
- Old Hall Lane
- Hurstclough Brook.

3.5.23 Foraging activity was recorded across the bat survey area, in particular this activity was recorded along watercourses, intact hedgerows and wooded areas. A large proportion of foraging bats were recorded at:

- Hurstclough Brook, particularly to the west of the Cricket Ground
- Old Hall Land and Old Road
- Along wooded areas and hedgerows to the southeast of Coach Road
- Carrhouse Lane and the woodland to the east

- The River Etherow.

3.5.24 Further results are provided in Appendix E.

Automated Detector Surveys

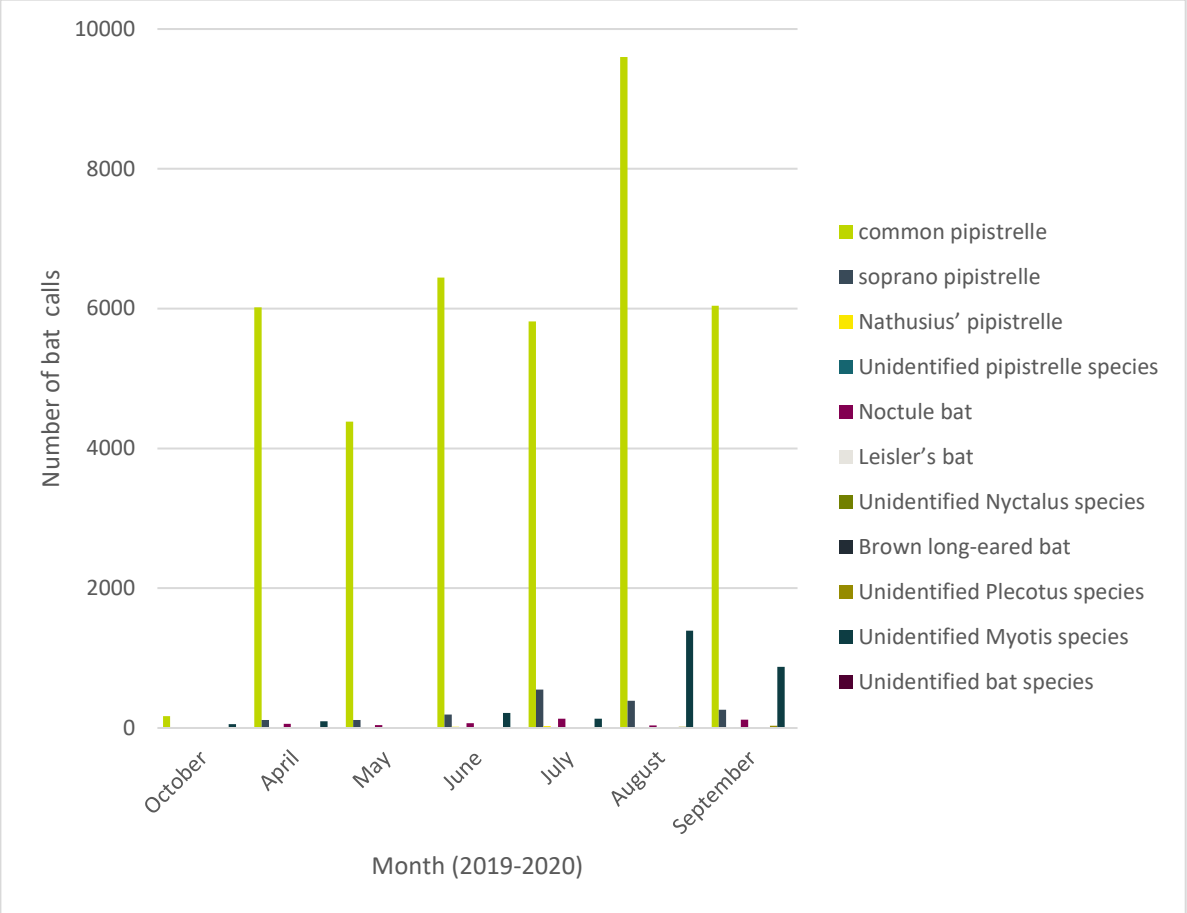
3.5.25 The following eleven taxa were recorded during the static/automated detector surveys:

- Common pipistrelle
- Sopranos pipistrelle
- Nathusius' pipistrelle
- Unidentified pipistrelle species
- Noctule
- Leisler's
- Unidentified Nyctalus species
- Brown long-eared
- Unidentified Plecotus species
- Unidentified Myotis species
- Unidentified bat species

3.5.26 The majority of recorded activity was identified as common pipistrelle (approximately 88%), with the second most abundant being unidentified Myotis species (approximately 7%) followed by soprano pipistrelle (approximately 4%). The remaining taxa was found in very low numbers.

3.5.27 Each static was deployed for five nights each month during October 2019 and between April – September 2020 in six different locations (Locations provided in Figure 8.9 (TR010034/APP/6.4)). The relative abundance of each taxa per month is shown in Chart 2.

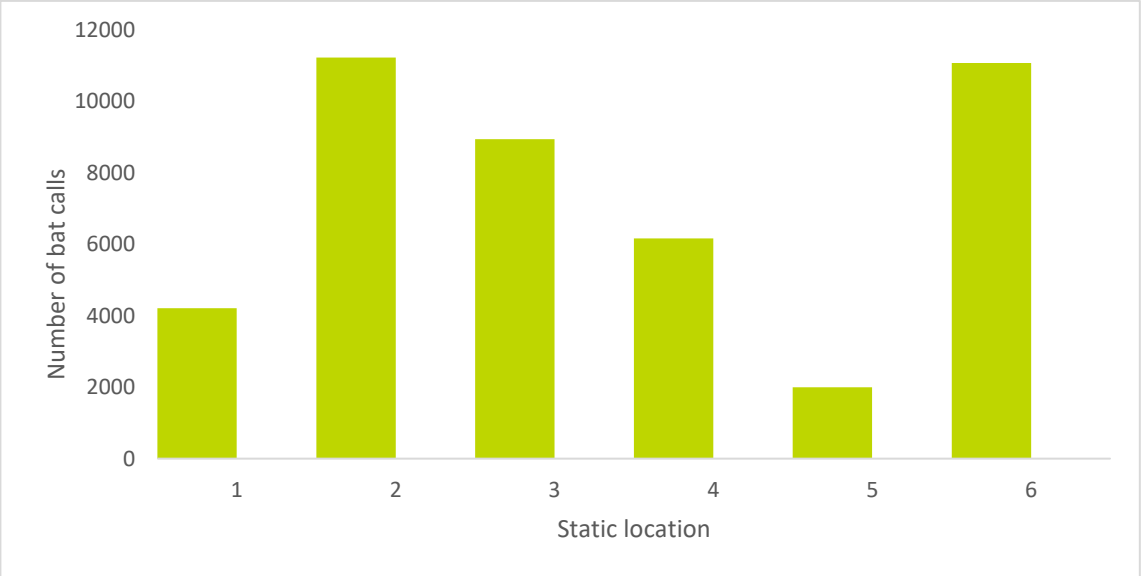
Chart 2 - Bat species abundance per taxa per month during static activity surveys



3.5.28 The highest number of bat calls was recorded in August (approximately 26%) and the lowest was in October (approximately 0.5%). Common pipistrelle was consistently the most abundant species recorded each month. Soprano pipistrelle, unidentified Myotis species and noctule bat were also consistently recorded every month, albeit in much lower numbers. The remaining taxa were infrequently recorded in low numbers.

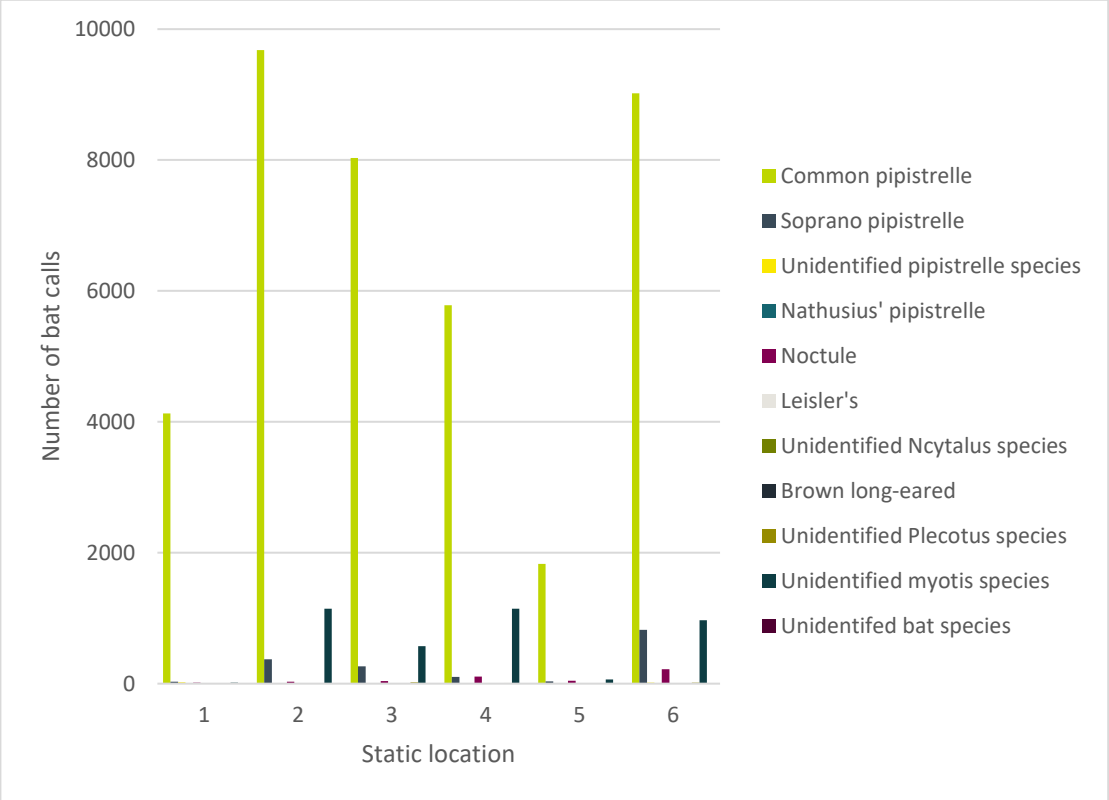
3.5.29 The number of bat calls recorded by each static location is provided in Chart 3 with locations provided in Figure 8.9 (TR010034/APP/6.4). The highest number of bat calls was recorded at location 2 (east of Old Hall Lane), closely followed by location 6 (adjacent to the River Etherow). The lowest number of calls was at location 5 (east of Carrhouse Lane).

Chart 3 - Number of bat calls by static detector location



3.5.30 The breakdown of taxa at each static location is provided in Chart 4. Common pipistrelle was recorded in significantly higher numbers at each static detector location. Unidentified Myotis species were noticeably higher in locations 2, 4 and 6, accounting for approximately 83% of the total calls recorded. Location 6 also accounted for approximately 51% of all soprano pipistrelle and 49% of all noctule bat calls.

Chart 4 - Number of bat calls by taxa at each static detector location



Previous Surveys

Bat Roost Assessment – Structures

3.5.31 The bat roost inspection survey (2017/ 2018) identified 42 structures within the survey area that had suitability to support roosting bats in the survey area. Table 3-8 summarises the results of the 2017 and 2018 bat roost assessments. Further details of the results of these assessments are listed in Appendix F with locations provided in Figure 8.8 (TR010034/APP/6.4).

Table 3-8: Summary of structures with suitability to support roosting bats

Suitability	Structure ID
Negligible	S1, S6, S15, S40
Low	S2, S3, S4, S5, S12, S13, S14, S21, S25, S26, S27, S28, S29, S32, S33, S38, S41
Moderate	S9, S22, S30, S31, S35, S36, S37, S39, S42
High	S7, S8, S11, S16, S17, S18, S19, S20, S34
Confirmed roost	S10, S23
Unknown[94]	S24

3.5.32 Any structures that were assessed to have negligible suitability to support roosting bats were not surveyed further. S6 was identified as a potential roost by Hyder (2007c), however the updated inspection of the property carried out in 2017 found no features suitable for roosting bats or evidence of roosting bats.

3.5.33 S10 and S23 were considered confirmed roosts, as evidence of bats was identified during the inspection. Seventeen structures were considered to have low suitability to support roosting bats, nine moderate and nine high.

3.5.34 Table 3-9 summarises the confirmed and potential roosts previously found by Hyder (2007c).

Table 3-9: Summary of confirmed and potential roosts (Hyder, 2007c)

Location	Structure ID	Details	Conclusion
17 Old Road	S6	No signs of bat occupation found following an internal and external inspection. The house occupier had seen what looked like a bat emerging at around dusk from the back (east facing) of the house.	Potential bat roost
19 Old Road	S7	Scattered bat droppings found on the drive, car and dustbin. One of the house occupiers thought she saw a bat coming out from under the eaves on the east side of the house, although it is thought that it may have been a bird. There were gaps between the wall and soffit board, but no droppings were recorded.	Potential bat roost

[94] This structure could not be surveyed due to lack of landowner permission to access the property. Emergence/re-entry surveys were also not possible due to lack of landowner permission.

Location	Structure ID	Details	Conclusion
2A Old Hall Lane	S10	Eight fresh bat droppings found on the porch roof below a suitable access point between the chimney and eave structure on the south face of the house. Two dead juvenile/ sub-adult bats found in the attic space. The occupier reported seeing bats exiting in 2005.	Pipistrelle maternity roost
2B Old Hall Lane	S11	The roost here had been counted as part of the National Bat Monitoring Programme and was present in 2005. A number of bat droppings on the chimney ledge found below a suitable exit hole, on the north face of the building. The occupiers had counted over 40 bats in 2005.	Pipistrelle maternity roost
5 Tollemache Close	S16	Adult and juvenile bat droppings found on the ground at the gable end, and in the attic space.	Pipistrelle maternity roost
6 Tollemache Close	S17	Four bat droppings found in the attic space, probably attributable to a single individual.	Transitional bat roost.
7 Tollemache Close	S18	A number of bat droppings found in the loft (none outside). The access points on the gable end had been sealed with expanding foam in summer 2004 (according to both the occupier and neighbours).	Sealed bat roost
9 Tollemache Close	S20	Old and fresh juvenile and adult droppings found in the loft and the garage roof below and exit hole at the gable end.	Pipistrelle maternity roost

Emergence/ Re-entry Surveys

3.5.35 Roosts were found in twelve buildings within the bat survey area during the emergence/ re-entry surveys conducted in 2017, these are summarised below in Table 3-10. Further details including dates and weather conditions are provided within Appendix F.

Table 3-10: Summary of bat roosts found during emergence/ re-entry surveys

Structure ID	Location of structure	Location of roost	Maximum number of bats	Species
S8	21 Old Road	Ridge tile	1	Common pipistrelle
S10	2A Old Hall Lane	Fascia board on western aspect of shed located to the north of the building	1	Common pipistrelle
		Fascia board on western aspect of the building	1	Common pipistrelle

Structure ID	Location of structure	Location of roost	Maximum number of bats	Species
S11	2B Old Hall Lane	Chimney on northern aspect of the building	1	Common pipistrelle
S16	5 Tollemache Close	Alarm box on northern aspect of the building	1	Common pipistrelle
S20	9 Tollemache Close	9 Tollemache Close	3	Common pipistrelle
S23	8 Carrhouse Lane	Gable end on south-west aspect of the building	1	Common pipistrelle
S30	56 Mottram Moor	Fascia board on southern aspect of the building	1	Common pipistrelle
S31	60 Mottram Moor	Alarm box on southern aspect of the building	1	Common pipistrelle
S32	1-7 and 13-15 Mottram Moor	Southern aspect of dormer window on the roof of no. 13	3	Common pipistrelle
		Southern aspect of dormer window on the roof of No. 13	1	Soprano pipistrelle
S33	9-11 Mottram Moor	Fascia board on southern aspect of the building	1	Common pipistrelle
S35	Units H ,J ,K,L Roe Cross Industrial Estate	Gable end on eastern aspect of the building	1	Common pipistrelle
S42	11-15 Old Hall Lane	Under separate slates on eastern section of the roof	3	Common pipistrelle

3.6 Birds

Previous Surveys

3.6.1 Previously, breeding bird surveys have been undertaken for the Scheme in 2017. Three survey visits were carried out and observed 15 species of nature conservation importance. The species of nature conservation importance were defined as:

- Species that receive protection under Schedule 1 of the Wildlife and Countryside Act 1981 (as amended);

- Species of Principal Importance listed under S41 of the Natural Environment and Rural Communities (NERC) Act 2006[95]; and,
- Birds that are on the Red or Amber lists of Birds of Conservation Concern (BoCC) in the UK[96].

3.6.2 The species identified were mallard, lapwing, black-headed gull, skylark, house martin, willow warbler, grasshopper warbler, starling, song thrush, mistle thrush, dunnock, house sparrow, meadow pipit, linnet and reed bunting. Of these 13 were considered likely to be breeding within the Survey Area and the other two species were considered likely to be breeding elsewhere and to be using the Survey Area as a foraging resource.

3.6.3 The assessment concluded that the majority of birds recorded during the surveys were of species associated with nesting within woodland/ hedgerows and scrub. The assessment found that the built-up areas generally supported a less diverse breeding bird assemblage. It was also concluded that the habitats within the Survey Area were assessed to be of low value for the breeding bird assemblage given the relatively small numbers of birds recorded[97].

Desk Study

3.6.4 All birds were categorised as "priority" if they are:

- listed in Schedule 1 of the Wildlife and Countryside Act;
- listed in Annex I of the Birds Directive of the European Commission;
- listed in the UK Biodiversity Action Plan (UKBAP) list of Priority Bird Species (2007):
- listed in Section 41 of the Natural Environment and Rural Communities Act 2006;
- listed on Red and Amber lists of Birds of Conservation Concern (BoCC);
- considered as a 'Rare or Scarce Breeder' or 'Colonial Breeder' in the GMEU's report 'Sites of Biological Importance Selection Guidelines'[98]; or,
- listed in the Greater Manchester Local Biodiversity Action Plan (LBAP)[99] or the Peak District LBAP[100].

3.6.5 GMEU provided 1442 recent[101] records of birds within 2 km of the Scheme for all priority species excepting Schedule 1 species for whom the search was extended to 5 km. This included:

- Fourteen species listed on the Wildlife and Countryside Act 1981 (as amended) Schedule 1 (298 records in total);

[95] Section 41 of the Natural Environment and Rural Communities (NERC) Act 2006 requires the Secretary of State to publish a list of species of flora and fauna and habitats considered to be of principal importance for the purpose of conserving biodiversity; this is known as England Biodiversity List. Forty-nine bird Species of Principal Importance (SPI) are included on the England Biodiversity List.
[96] Eaton MA, Aebischer NJ, Brown AF, Hearn RD, Lock L, Musgrove AJ, Noble DG, Stroud DA and Gregory RD (2015) Birds of Conservation Concern 4: the population status of birds in the United Kingdom, Channel Islands and Isle of Man. British Birds 108, 708–746.
[97] Arcadis, 2019, Trans-Pennine Upgrade; Appendix 8.1: Biodiversity Baseline and Preliminary Assessment.
[98] Greater Manchester Sites of Biological Importance Selection Guidelines Version 2.0 (2016), (accessed 12/10/2020)
[99] Greater Manchester Local Biodiversity Action Plan (2009) https://www.gmwildlife.org.uk/resources/downloads/gm_bap/introduction_gm_biodiversity_action_plan_2009.pdf (accessed 12/10/2020)
[100] Peak District Local Biodiversity Action Plan (2001) Peak District National Park Authority https://www.peakdistrict.gov.uk/looking-after/biodiversity/biodiversity-action-plan (accessed 12/10/2020)
[101] Taken to be within the last 10 years from the time of records request.

- Five species listed on the Annex I of the Birds Directive of the European Commission (55 records in total);
- Nineteen species listed on the UK BAP (536 records in total);
- Twenty-two species listed under Section 41 of the Natural Environment and Rural Communities (NERC) Act 2006 (627 records in total);
- Twenty-one species listed on the Birds of Conservation Concern Red List (450 records in total);
- Twenty-one species listed on the Birds of Conservation Concern Amber List (572 records in total);
- Fourteen bird species included in Great Manchester Sites of Biological Importance (SBI) selection guidelines (232 records in total);
- Nine species listed under the Greater Manchester LBAP (173 records in total); and,
- Twelve species listed under the Peak District LBAP (331 records in total).

3.6.6 DBRC were only able to provide records for Schedule 1 and UKBAP species. They provided 23 recent records of birds within 2 km of the Scheme. Of these:

- One species) was listed on the Wildlife and Countryside Act 1981 (as amended) Schedule 1 (2 records in total); and,
- Fifteen species were listed on the UK BAP (21 records in total).

3.6.7 The only IBA within a 5 km radius of the Scheme is the Peak District Moors, located approximately 2.3 km to the east. The Peak District Moors IBA is described as an upland area supporting a nationally significant, high density of breeding waders and other upland species"[102]. These species include merlin, golden plover, dunlin, curlew, ring ousel, twite and snipe.

3.6.8 This IBA is comprised of sites with multiple other designations. The Peak District Moors are designated as a SSSI (Dark Peak Moors), South Pennine Moors SAC and the South Pennine Moors SPA.

3.6.9 A Habitat Regulations Assessment (HRA) Report (TR010034/APP/5.3) has been produced alongside this report and has assessed the impact of the Scheme on the European designated sites (South Pennine Moors SAC and SPA). As such, this report contains no assessment in relation to these sites or species for the qualifying species for these sites (merlin, golden plover and short-eared owl) as this will be covered by the HRA.

3.6.10 The Dark Peak SSSI, also located approximately 2.3 km to the east of the Scheme, comprises moorland which supports a breeding bird assemblage is of national importance. It includes internationally important populations of golden plover and dunlin; species listed in the European Commission Birds Directive as requiring special conservation measures. The site also supports meadow pipit which also breed in significant numbers there.

[102] Important Bird Areas of the United Kingdom (1992) Joint Nature Conservation Committee (JNCC)/Royal Society for the Protection of Birds (RSPB), https://data.jncc.gov.uk/data/377c0fc8-d8f2-49bc-ae7a-f37deb290b76/important-bird-areas-web.pdf (accessed 12/10/2020)

Curlew, peregrine, red grouse, merlin, short-eared owl, twite, ring ouzel, wheatear, whinchat, tree pipit, redstart, green woodpecker, wood warbler and pied flycatcher breed within the SSSI. Dipper, grey wagtail and common sandpiper also use water courses within the SSSI for breeding.

Breeding Bird Surveys

3.6.11 A list of all species recorded during the survey visits is provided in Appendix G with a likely breeding status and associated breeding evidence category according to the BTO[103].

3.6.12 A list of all priority bird species recorded during the survey visits is provided in Table 3-11 below.

3.6.13 Territory mapping was not undertaken for species that, despite their priority status, either remain common and relatively widespread at a county level or have shown recent population increases at the national and county level[104], e.g. mallard.

3.6.14 The approximate distributions of the confirmed breeding territories of priority bird species are indicated on Figure 8.6 (TR010034/APP/6.4).

3.6.15 The species with confirmed territories are highlighted in bold in Table 3-11.

3.6.16 The breeding status of all species according to the Greater Manchester Bird Atlas 2011[105] and the Derbyshire Bird Report[106] are also displayed in Table 3-11 below. A list of all priority bird species recorded during the survey visits was made and the number of confirmed territories recorded during territory analysis were calculated as percentages of the estimated number of pairs breeding in Great Britain per year taken from Avian Population Estimates Panel (APEP) 4 Population estimates of birds in Great Britain and the United Kingdom"[107]. These are provided in Table 3-11 below.

3.6.17 This analysis was undertaken in order to identify key priority species, defined as a species where the number of confirmed territories identified during surveys was found to be that of 0.5% or higher of the estimated number of pairs breeding in Great Britain per year. This threshold was taken from the Greater Manchester Sites of Biological Importance Selection Guidelines as the indicator of the presence of a Significant Breeding Population at the site[108]. No species were found to have a number of confirmed territories higher than this threshold.

3.6.18 Only a very small part of the Survey Area (approximately 1.4 ha) falls within the area covered by the Peak District LBAP[109] and therefore the species which are included as target species within the Peak District LBAP are detailed below in Table 4-1 but will be assessed as to whether these species will be take forward for further assessment in the ES on a case by case basis dependent of whether

[103]Assessment was made using the "Breeding Evidence" categories webpage from the British Trust for Ornithology, https://www.bto.org/our-science/projects/birdatlas/methods/breeding-evidence (accessed 12/10/2020)
[104] Birds of Conservation Concern 4: the population status of birds in the UK, Channel Islands and Isle of Man (2015) https://www.bto.org/our-science/publications/psob (accessed 12/10/2020)
[105] Birds in Greater Manchester County Report (2011) Introduction to the Systematic List, http://www.manchesterbirding.com/uploads/9/7/5/1/97513866/birds_in_greater_manchester_2011_complete.pdf (accessed 12/10/2020)
[106] Derbyshire Bird Report (2018) Derbyshire Ornithological Society
[107] APEP 4 - Population estimates of birds in Great Britain and the United Kingdom (2020) https://www.bto.org/sites/default/files/publications/apep4-population-estimates-birds-great-britain-uk-2020.pdf (accessed 12/10/2020)
[108] Greater Manchester Sites of Biological Importance Selection Guidelines Version 2.0 (2016), (accessed 12/10/2020)
[109] https://www.peakdistrict.gov.uk/looking-after/biodiversity/biodiversity-action-plan (accessed 12/10/2020)

that species was recorded in the part of the Survey Area covered by the Peak District LBAP during 2020 surveys.

3.6.19 The Greater Manchester LBAP listed 'Farmland Birds' as included in the suite of biodiversity action plans for the report. However, the action plans are currently unavailable and therefore could not be included in this assessment[110].

Table 3-11: Species recorded during the Breeding Bird Surveys

Species	Status	Breeding Category (within the Survey Area)	Species breeding status as per Derbyshire Bird Report 2018	Species breeding status as per Birds in Greater Manchester Report 2011	% of GB breeding population (APEP 4)
Bullfinch	Amber List BoCC[111], SPI[112], UKBAP[113]	3 probable territories 2 possible territories	Fairly common resident	Fairly common resident	0.001%
Black-headed Gull	Amber List BoCC	No registrations of breeding territories	Fairly common breeder	Uncommon breeder	N/A
Curlew	Red List BoCC[114], SPI, UKBAP, Cited as 'Scarce Breeder' in the Greater Manchester SBI Selection Guidelines, Peak District LBAP	No registrations of breeding territories	Fairly common breeder in uplands, uncommon breeder in lowlands	Uncommon breeder	N/A
Dunnock	Amber List BoCC, SPI, UKBAP	10 confirmed territories 18 probable territories 6 possible territories	Abundant resident	Abundant resident	<0.005%
Dipper	Amber List BoCC	1 possible territory	Fairly common resident	Fairly common resident	N/A

[110] https://www.gmwildlife.org.uk/projects/gm_bap/ (accessed 14/12/2020)
[111] Eaton MA, Aebischer NJ, Brown AF, Hearn RD, Lock L, Musgrove AJ, Noble DG, Stroud DA and Gregory RD (2015) Birds of Conservation Concern 4: the population status of birds in the United Kingdom, Channel Islands and Isle of Man. British Birds 108, 708–746.
[112] Section 41 of the Natural Environment and Rural Communities (NERC) Act 2006 requires the Secretary of State to publish a list of species of flora and fauna and habitats considered to be of principal importance for the purpose of conserving biodiversity; this is known as England Biodiversity List. Forty-nine bird Species of Principal Importance (SPI) are included on the England Biodiversity List.
[113] UK Biodiversity Action Plan, List of UK BAP Priority Bird Species (2007) https://hub.jncc.gov.uk/assets/98fb6dab-13ae-470d-884b-7816afce42d4 (accessed 12/10/2020)
[114] Eaton MA, Aebischer NJ, Brown AF, Hearn RD, Lock L, Musgrove AJ, Noble DG, Stroud DA and Gregory RD (2015) Birds of Conservation Concern 4: the population status of birds in the United Kingdom, Channel Islands and Isle of Man. *British Birds* 108, pp708–746.

Species	Status	Breeding Category (within the Survey Area)	Species breeding status as per Derbyshire Bird Report 2018	Species breeding status as per Birds in Greater Manchester Report 2011	% of GB breeding population (APEP 4)
Goosander	Cited as 'Rare Breeder' in SBI Selection Guidelines	No registrations of breeding territories	Uncommon breeder	Rare breeder	N/A
Grasshopper Warbler	Red List BoCC, SPI, UKBAP, Cited as 'Scarce Breeder' in the Greater Manchester SBI Selection Guidelines	1 confirmed territory 1 probable territory	Uncommon summer visitor	Uncommon summer visitor	0.010%
Grey Heron	Cited as 'Colonial Breeder' in the Greater Manchester SBI Selection Guidelines	No registrations of breeding territories	Fairly common resident	Fairly common resident	N/A
Grey Wagtail	Red List BoCC	1 possible territory	Fairly common resident	Fairly common resident	N/A
House Martin	Amber List BoCC, Cited as 'Colonial Breeder' in the Greater Manchester SBI Selection Guidelines	1 possible territory	Common summer visitor	Common summer visitor	N/A
House Sparrow	Red List BoCC, SPI, UKBAP	3 confirmed territories (combined = ≤6 pairs) 2 probable territories (combined = ≤4 pairs) 1 possible territory (combined = ≤2 pairs)	Common but decreasing resident	Abundant resident	<0.005%
Kestrel	Amber List BoCC	No registrations of breeding territories	Fairly common resident	Abundant resident	N/A

Species	Status	Breeding Category (within the Survey Area)	Species breeding status as per Derbyshire Bird Report 2018	Species breeding status as per Birds in Greater Manchester Report 2011	% of GB breeding population (APEP 4)
Lapwing	Red List BoCC, SPI, UKBAP, Cited as 'Scarce Breeder' in the Greater Manchester SBI Selection Guidelines, Peak District LBAP	No registrations of breeding territories	Common resident	Common but declining resident	N/A
Lesser Black-backed Gull	Amber List BoCC	No registrations of breeding territories	Common summer visitor	Common passage and winter visitor, uncommon resident	N/A
Linnet	Red List BoCC, SPI, Peak District LBAP	1 possible territory	Common resident	Common resident	N/A
Mistle Thrush	Red List BoCC	4 probable territories	Fairly common or common resident	Common resident	N/A
Reed Bunting	Amber List BoCC, SPI, Peak District LBAP	1 confirmed territory 1 possible territory	Fairly common resident	Fairly common resident	<0.005%
Stock Dove	Amber List BoCC	1 possible territory	Fairly common resident	Fairly common resident	N/A
Sand Martin	Cited as 'Colonial Breeder' in the Greater Manchester SBI Selection Guidelines	No registrations of breeding territories	Fairly common summer visitor	Fairly common summer visitor	N/A
Starling	Red List BoCC, SPI	3 confirmed territories (combined = ≤8 pairs) 6 probable territories (combined = ≤20 pairs)	Abundant resident	Abundant resident	0.001%

Species	Status	Breeding Category (within the Survey Area)	Species breeding status as per Derbyshire Bird Report 2018	Species breeding status as per Birds in Greater Manchester Report 2011	% of GB breeding population (APEP 4)
		9 possible territories (combined = ≤16 pairs)			
Swift	Amber List BoCC	1 possible territory	Common summer visitor	Common summer visitor: declining	N/A
Snipe	Amber List BoCC, Cited as 'Scarce Breeder' in the Greater Manchester SBI Selection Guidelines, Peak District LBAP	1 possible territory	Scarce breeding visitor in the lowlands	Uncommon breeder	N/A
Song Thrush	Red List BoCC, SPI, UKBAP, Peak District LBAP	6 confirmed territories 2 probable territories 3 possible territories	Common resident	Common resident	0.001%
Tawny Owl	Amber List BoCC	No registrations of breeding territories registered using the CBC method but a possible 'home range' identified[115]	Fairly common resident	Fairly common resident	0.002%
Willow Warbler	Amber List BoCC	1 confirmed territory 5 probable territories	Common summer visitor	Abundant summer visitor	<0.05%

[115] A pair of tawny owls were recorded roosting together in an area of woodland in the central part of the Survey Area. A territory can be considered 'confirmed' by the presence of a calling male during two visits, as described in the method within 'Raptors: A field Guide for Surveys and Monitoring (2013) Scottish Natural Heritage'. By combining this method and the CBC method used throughout this report it is considered that the presence of a pair tawny owls roosting together can be considered evidence of the presence of a 'possible' home range.

Kingfisher Habitat Assessment

3.6.20 Suitable nesting habitat for kingfishers, involving stone-free sandy soil suitable for excavating a nest burrow in riverbanks was recorded within the Survey Area along the banks of the River Etherow in the eastern part of the Scheme. This suitable nesting habitat was mapped and is provided in the Kingfisher Habitat Plan in Figure 8.6 (TR010034/APP/6.4). No kingfishers were recorded, or nests found during the course of the surveys.

3.7 Barn Owl

Previous Surveys

3.7.1 Barn owl surveys have previously been undertaken for the Scheme in 2017 and 2018. Three survey visits were carried out in June 2017 and February and June 2018. Seven buildings/ groups of buildings were surveyed[116].

3.7.2 During the June 2017 breeding bird surveys, splash marks and fresh barn owl pellets were found on a post in a field near Grange Farm at the far western end of the Scheme.

3.7.3 Additionally, during the 2017 and 2018 barn owl surveys a barn owl was seen inside one of the barns at Carr House Farm perching on a narrow wooden tie beam at the entrance of the building before it flew out. However, no signs indicating regular use (such as splash marks, pellets or nesting debris) were found within accessible areas, and due to access restrictions, the presence/ absence of breeding barn owl within the farm buildings could not be confirmed.

3.7.4 No trees suitable for nesting barn owl were identified within the Survey Area.

3.7.5 No other signs, or sightings or evidence of barn owl were recorded during the barn owl or breeding bird surveys. The assessment following these surveys concluded that it is likely that the Survey Area could include the home-range of at least one pair of barn owl.

Desk Study

3.7.6 DBRC returned no recent records of barn owls within 5 km of the Scheme.

3.7.7 GMEU provided two recent records of barn owls within 5 km of the Scheme (specific nature of records not disclosed). The closest record to the Scheme boundary was seen hunting over grassland used for agricultural purposes at Harrop Edge, approximately 1.14 km north of the Scheme boundary. The second result was of a barn owl hunting over land used for agricultural purposes near Park Road, 1.72 km east of the Scheme.

3.7.8 The desk study and Pennine Edge Barn Owl Group record locations have been included in the survey results plans in Figure 8.7 (TR010034/APP/6.4).

Incidental Records

3.7.9 During 2020 Atkins led bat activity surveys recorded a barn owl flying from west to east, over the fields by Carr House Lane (intersected by the Scheme) and crossing the lane itself.

[116] Arcadis, 2019, Trans-Pennine Upgrade; Appendix 8.1: Biodiversity Baseline and Preliminary Assessment.

Field Survey

3.7.10 The surveys recorded patches of potential barn owl foraging habitat (Type 1 and Type 2) spread throughout the Survey Area (refer to plans in Appendix H). Most of this habitat was present in linear patches, for example unmanaged field boundaries and hedgerows. Large, continuous areas of Type 1 and Type 2 habitats were relatively rare within the Survey Area, with the vast majority of the Survey Area occupied by Type 3 or 'Other habitats' habitats.

3.7.11 Of the area assessed for the presence of suitable habitat (500 m from the Scheme boundary), Type 1 habitat occupied approximately 1.6% of the Survey Area (approximately 9.4 ha) and Type 2 approximately 2.5% (approximately 14.8 ha), with Type 3 and 'Other habitats' making up the remainder (approximately 95.9%; 554 ha).

3.7.12 Forty-three features (buildings, trees and nest boxes) were surveyed for their suitability for, and evidence of, barn owl. The surveys recorded the following:

- one Occupied Breeding Sites
- thirteen Potential Nest Sites
- ten Potential Roost Sites
- five sites which appeared to have barn owl potential but could not be surveyed due to access restrictions (classified as "unknown")
- Thirteen sites with negligible barn owl potential.

3.7.13 The Pennine Edge Barn Owl Group confirmed that they have installed two barn owl boxes within Mottram in Longdendale, at Grange Farm and on land at Edge Lane. Both boxes are monitored on a regular basis and only the box at Grange Farm has been used by barn owl. The Edge Lane box is believed to have been used by tawny owl during the 2017 breeding season.

3.7.14 Barn Owl Survey Results Plans are provided in Figure 8.7 (TR010034/APP/6.4) (feature number labels have been omitted from the 'Overview' plan for ease of interpretation but are included on the subsequent plans which are presented at a larger scale). Detailed results for investigative field surveys and nest site verification surveys can be found in Appendix H.

3.8 Otter

Desk Study

3.8.1 DBRC returned one recent record of otter within 2 km of the Scheme. This record was located approximately 1550 m north east of the Scheme, further upstream along the River Etherow. GMBRC returned no recent records of otter.

3.8.2 Previous field survey data gathered in 2017 identified four watercourses within the otter survey area with suitability to support this species, including two with confirmed otter presence (as outlined with Table 3-12, below). No otter resting sites were identified during the previous surveys in 2017 and it was assessed that otter are likely using the water courses within the Scheme for foraging and commuting only.

Table 3-12: Results of previous surveys for otter undertaken in 2017

Watercourse ID	Field Sign(s)	Distance and direction from the Scheme	Observations
WC_100 (River Etherow)	Spraint	25 m north	Spraint located approximately 7 m from a culvert on the east bank of the River Etherow.
WC_400 (Glossop Brook)	Spraint	140 m south	Dried, intact spraint located on a ledge south of a bridge on the Glossop Brook, approximately 40 m upstream of its confluence with the River Etherow.

Field Survey

Habitat Assessment

Watercourses

3.8.3 Of the 15 watercourses screened in for survey two were assessed as high suitability for otter, six as low suitability, and seven were unsuitable for use by otter.

Water bodies

3.8.4 Of the 15 water bodies screened in for survey three were assessed as having low suitability for otter and seven assessed as unsuitable for use by otter. A further five water bodies could not be accessed for survey.

3.8.5 The watercourses and water bodies identified as having high and low suitability were subject to a detailed search for field signs while any watercourses or water bodies identified as being unsuitable for use by otter were scoped out of any further assessment. Further details are provided within Appendix I with locations provided Figure 8.12 of the ES (TR010034/APP/6.4).

Field Sign Search

3.8.6 During the detailed search for field signs, only Glossop Brook (WC_400) had confirmed presence of otter. Two sprainting locations (with total of five individual spraints) were identified on this watercourse, one of which had two recent spraints and the other which had two recent spraints and one old spraint.

3.8.7 Anecdotal evidence of otter using the River Etherow (WC_100) was provided by a local resident who lives adjacent to the river. This supports current and previous field survey data suggesting otter are present in the area and use the River Etherow, and surrounding tributaries, for foraging and commuting. A summary of the results is provided in Table 3-13 with full details provided within Appendix I.

Table 3-13: Summary of otter survey results

Watercourse/ pond ID (watercourse name)	Otter		
	Screening	Habitat assessment suitability	Field sign survey
WC_010	Out	-	-
WC_020	Out	-	-
WC_030	Out	-	-
WC_040	Out	-	-
WC_050	Out	-	-
WC_100 (River Etherow)	In	High	None
WC_110	Out	-	-
WC_120	Out	-	-
WC_130	In	None	-
WC_140	In	Low	None
WC_150	Out	-	-
WC_160	Out	-	-
WC_170	Out	-	-
WC_200 (Tara Brook)	In	Low	None
WC_210	In	Low	None
WC_211	In	Low	None
WC_212	In	None	-
WC_213	In	None	-
WC_214	In	None	-
WC_215	Out	-	-
WC_220	Out	-	-
WC_300 (Hurstclough Brook)	In	Low	None
WC_310	Out	-	-
WC_320	In	None	-
WC_330	In	None	-
WC_340	In	None	-
WC_350	In	Low	None
WC_360	Out	-	-
WC_370	Out	-	-

Watercourse/ pond ID (watercourse name)	Otter		
	Screening	Habitat assessment suitability	Field sign survey
WC_400 (Glossop Brook)	In	High	Two sprainting locations (total 5 spraints)
WC_410	Out	-	-
WC_420	Out	-	-
WC_430	Out	-	-
WC_500 (Hollingworth Brook)	Out	-	-
P1	In	None	-
P2	In	Low	None
P3	In	None	-
P4	In	None	-
P5	In	Low	None
P6	Assessed as part of WC_300		
P7	Out	-	-
P16	In	Low	None
P17	In	None	-
P18	Out	-	-
P19	Out	-	-
P20	Out	-	-
P21	Out	-	-
P22	In	Not accessed	-
P23	In	Not accessed	-
P24	In	Not accessed	-
P25	Assessed as part of WC_200		
P26	In	Not accessed	-
P27	In	None	-
P28	In	None	-
P29	Out	-	-
P30	In	None	-
P31	In	Not accessed	-

3.9 Water Vole

Desk Study

3.9.1 No recent records of water vole were returned by either DBRC or GMBRC.

3.9.2 Previous field survey data gathered in 2017 identified eight watercourses within the water vole survey area with suitability to support this species, including three with confirmed water vole presence due to the presence of latrines, feeding stations, burrows and runs as outlined within Table 3-14. Two of the watercourses (WC_100 and WC_210) had a low population of water vole, while one (WC_200) had a medium population during the first survey and a low population during the second survey.

Table 3-14: Results of previous surveys for water vole undertaken in 2017

Watercourse ID	Field Sign(s)	Relative population density	Distance from the Scheme	Observations
WC_100	Latrines, burrows	Low	Within DCO Boundary	-
WC_200	Latrines, feeding station, burrow and potential burrow	Medium/ Low[117]	Within DCO boundary	Where evidence of water vole was found this was outside of the DCO boundary
WC_210	Burrows, potential burrows, feeding stations and runs	Low	45 m south of DCO boundary	-

Field Survey

Habitat Assessment

Watercourses

3.9.3 Of the 13 watercourses screened in for survey two were assessed as high suitability to support water vole, five as low suitability to support water vole and six assessed as being unsuitable for water vole.

Water bodies

3.9.4 Of the 14 water bodies screened in for survey three were assessed as low suitability for water vole and six as unsuitable for water vole. Five water bodies could not be accessed for survey.

[117] Medium population density during first half of survey season and low during second half.

3.9.5 The watercourses and water bodies identified as having high and low suitability were subject to a detailed search for field signs while any watercourses or water bodies identified as being unsuitable for use by water vole were scoped out of any further assessment.

Field Sign Search

3.9.6 Burrows were found at three locations along Tara Brook (WC_200), however, no accompanying evidence was found to confirm that these relate to water vole. One of these burrows had footprints nearby that were considered likely to be brown rat, however, the prints were not clear and species identification could not be confirmed.

3.9.7 No conclusive evidence of water vole was found on any of the watercourses or water bodies subject to a detailed field sign survey. A summary of the results is provided in Table 3-15.

Table 3-15: Summary of otter and water vole survey results

Watercourse/ pond ID (Watercourse name)	Water Vole		
	Screening	Habitat assessment suitability	Field sign survey
WC_010	Out	-	-
WC_020	Out	-	-
WC_030	Out	-	-
WC_040	Out	-	-
WC_050	Out	-	-
WC_100 (River Etherow)	In	Low	None
WC_110	Out	-	-
WC_120	Out	-	-
WC_130	In	Low	None
WC_140	In	Low	None
WC_150	Out	-	-
WC_160	Out	-	-
WC_170	Out	-	-
WC_200 (Tara Brook)	In	High	No evidence of water vole. Burrows and prints found considered likely to be brown rat.
WC_210	In	Low	None
WC_211	In	Low	None
WC_212	In	None	-
WC_213	In	None	-
WC_214	In	None	-

Watercourse/ pond ID (Watercourse name)	Water Vole		
	Screening	Habitat assessment suitability	Field sign survey
WC_215	Out	-	-
WC_220	Out	-	-
WC_300 (Hurstclough Brook)	In	High	None
WC_310	Out	-	-
WC_320	In	None	-
WC_330	In	None	-
WC_340	In	None	-
WC_350	Out	-	-
WC_360	Out	-	-
WC_370	Out	-	-
WC_400 (Glossop Brook)	Out	-	-
WC_410	Out	-	-
WC_420	Out	-	-
WC_430	Out	-	-
WC_500 (Hollingworth Brook)	Out	-	-
P1	In	None	-
P2	In	Low	None
P3	In	None	-
P4	In	None	-
P5	In	Low	None
P6	Assessed as part of WC_300		
P7	Out	-	-
P16	In	Low	None
P17	In	None	-
P18	Out	-	-
P19	Out	-	-
P20	Out	-	-
P21	Out	-	-
P22	In	Not accessed	-
P23	In	Not accessed	-

Watercourse/ pond ID (Watercourse name)	Water Vole		
	Screening	Habitat assessment suitability	Field sign survey
P24	In	Not accessed	-
P25	Assessed as part of WC_200		
P26	In	Not accessed	-
P27	In	None	-
P28	In	None	-
P29	Out	-	-
P30	Out	-	-
P31	In	Not accessed	-

3.10 Reptiles

Desk Study

3.10.1 DBRC and GMEU returned no recent records of reptile species within 2 km of the Scheme during the October 2019 data search.

Previous Surveys

3.10.2 No reptiles were recorded within the study area during the 2017 surveys, although there were incidental records of common frog and common toad using the artificial refugia.

3.10.3 Over the seven survey visits, there were 37 records of common toad and four records of common frog.

3.10.4 Further details of the surveys are provided in Table 3-16. below.

Table 3-16: Reptile survey results (including incidental amphibian sightings)

Visit number	Date	Survey area	Results
1	18/05/2017	N/A	No reptile or amphibians recorded
	25/05/2017	N/A	No reptile or amphibians recorded
2	18/07/2017	5	5 common toad
	19/07/2017	7	1 common frog, 5 common toad
3	02/08/2017	2	1 common frog
		3	4 juvenile common toad
	03/08/2017	7	2 juvenile common toad
		4	1 common toad
		5	1 common toad
4	08/08/2017	3	1 common toad

Visit number	Date	Survey area	Results
	09/08/2017	2	1 common frog, 1 common toad
5	15/08/2017	3	1 juvenile common toad
6	01/09/2017	2	1 juvenile common frog
		7	1 juvenile common toad
7	29/09/2017	N/A	No reptile or amphibians recorded

Incidental Sightings

3.10.5 There have been no incidental sightings of reptiles made during surveys carried out by Atkins for other protected/ priority species (including badger, breeding birds, bats, otter and water vole) and habitats in 2019 and 2020, to inform the ES for the Scheme. These surveys have involved regular survey visits to the Scheme area throughout the seasons and have included survey effort in areas of habitat considered suitable for common reptile species. It is also understood that there were no incidental sightings made during further surveys carried out between 2016 and 2018, which included habitat and botanical surveys, river corridor surveys, amphibian surveys, bird surveys, bat surveys and otter and water vole surveys.

3.11 Amphibians

Desk Study

3.11.1 DBRC and GMEU returned no recent records of GCN within 2 km of the Scheme during the 2019 data search.

3.11.2 There were 11 records of common toad (10 dating from 2015 and one with the date unspecified) provided by DBRC. Records were from three locations to the east of the Scheme, with the closest approximately 900 m away. There were no further records of amphibians provided by DBRC.

3.11.3 GMEU returned two common toad records. One dating from 2012 and one from 2013. These records were both from locations south of Scheme with the closest located approximately 1.4 km away. There were no further records of amphibians provided by GMEU.

Previous Surveys

Habitat Suitability Assessment

3.11.4 Refer to Appendix J for waterbody photographs and HSI scores. A summary of all the HSI results for each water body is provided in Table 3-17.

Table 3-17: HSI results

HSI Grade	Date
Total waterbodies assessed	21*
Poor	P16, P17, P19, P20, P23, P24, P26, P27, P28, P29, P30 and P31

HSI Grade	Date
Below average	P2, P3, P5 and P22
Average	P1, P7 and P18
Good	P25
Excellent	P21
** Pond references followed Hyder (2007c)[118] for consistency; P8 to P15 do not fall within the current study area. P4 and P6 were defunct in 2017 and were therefore not surveyed*	

Survey Results

3.11.5 No GCN were recorded during any of the surveys at any of the surveyed waterbodies. Population size class assessments were, therefore, not required.

3.11.6 The GCN presence/ likely absence surveys (following good practice guidance[119]) were undertaken at a total of 18 waterbodies. Access restrictions (the landowners did not permit access during night-time hours) prevented this method at P18 and P30 and as a result these waterbodies were subject to eDNA surveys; the remaining pond (P31) was too shallow to survey.

3.11.7 The following amphibian species were identified during the survey visits:

- Smooth newt: one waterbody (P21)
- Palmate newt: 10 waterbodies (P1, P2, P3, P7, P16, P20, P21, P23, P28 and P29)
- Common frog: 13 waterbodies (P1, P2, P3, P5, P7, P16, P19, P20, P21, P23, P26, P27 and P29)
- Common toad: nine waterbodies (P1, P3, P7, P16, P19, P20, P21, P26 and P29).

3.11.8 Further descriptions and photographs are provided within Appendix J. Full survey results are provided within Appendix K.

3.11.9 The results of eDNA sampling at P18 and P30 were both negative (refer to Appendix L for results).

Incidental Sightings

3.11.10 There have been no incidental sightings of GCN during surveys for other priority and protected species and habitats in 2019 and 2020 and no incidental records were made during the reptile surveys carried out in 2017, although both common toad and common frog were recorded in terrestrial habitats during these reptile surveys, where they were recorded beneath artificial refugia.

3.11.11 Further details of these surveys are provided in Table 3-18.

[118] Hyder (2007c). A57/A628 Mottram – Tintwistle Bypass and A628/A616 Route Restraint Measures Environmental Impact Assessment - Extended Study Area Ecology. Report no: 1469-NH50845-NHR-04; 27 February 2007.
[119] English Nature (2001) Great Crested Newt Mitigation Guidelines. English Nature, Peterborough

Table 3-18: Reptile survey results (including incidental amphibian sightings)

Visit number	Date	Survey area	Results
1	18/05/2017	N/A	No reptile or amphibians recorded
	25/05/2017	N/A	No reptile or amphibians recorded
2	18/07/2017	5	5 common toad
	19/07/2017	7	1 common frog, 5 common toad
3	02/08/2017	2	1 common frog
		3	4 juvenile common toad
	03/08/2017	7	2 juvenile common toad
		4	1 common toad
		5	1 common toad
4	08/08/2017	3	1 common toad
	09/08/2017	2	1 common frog, 1 common toad
5	15/08/2017	3	1 juvenile common toad
6	01/09/2017	2	1 juvenile common frog
		7	1 juvenile common toad
7	29/09/2017	N/A	No reptile or amphibians recorded

3.12 Other Mammals

Hazel Dormice

3.12.1 GMLRC and DBRC provided no recent records of hazel dormice within 2 km of the Scheme.

3.12.2 Hazel dormice are considered to be largely absent from Greater Manchester and Derbyshire[120], although there were two reintroductions in Derbyshire in 2003 and 2005[121]. Due to the distance between the reintroduction sites and the Scheme, with the closest reintroduction site being 30 km south, and the lack of obvious of connecting habitat between them (with upland heathland appearing to dominate the area between them), it is considered likely that hazel dormice are absent from the Scheme area.

3.12.3 As no suitable habitat for dormice has been recorded within the study area, this species is not discussed further within this report as it is not considered to pose a constraint to the Scheme.

Hedgehog

3.12.4 GMLRC and DBRC provided one recent record of hedgehog within 2 km of the Scheme. This is a record of a live hedgehog recorded 1.5 km north west of the Scheme in 2014.

[120] Wembridge, D., Al-Fulaji, N., Langton S. (2016). The State of Britain's Dormice 2016. Peoples Trust for Endangered Species
[121] https://ptes.org/wp-content/uploads/2019/07/20190717_Dormouse-Reintroduction-sites-2019-Appendices.docx.pdf

3.12.5 Hedgehog make use of a wide range of habitats including but not limited to; hedgerows, woodland, verges, parks and gardens. No sightings of hedgehog have been recorded during the various surveys, however, hedgehogs are considered likely to be present within the DCO boundary due to the good terrestrial connectivity to the wider landscape and suitable habitat within the survey area.

Brown Hare

3.12.6 GMLRC and DBRC provided no recent records of hare within 2 km of the Scheme.

3.12.7 Brown hare are most common in grassland habitats and at woodland edges, favouring a mosaic of arable fields, grasses and hedgerows. The habitats within the survey area are broadly suitable for this species and one incidental sighting of brown hare was recorded during the extended Phase 1 habitat survey in 2019.

3.13 Priority Invertebrates

Terrestrial invertebrates

3.13.1 GMLRC provided four recent records of invertebrate species within 2 km of the Scheme, three records of the cinnabar moth and one record of the knot grass moth. The closest record was a record of a cinnabar moth from 1,200 m south of the Scheme, which was recorded in 2014. DBRC provided no recent records of invertebrate species within 1 km of the Scheme.

3.13.2 Derbyshire and Nottinghamshire Entomological Society provided 431 records of 162 species of terrestrial invertebrates within the search area. Of these, 15 notable species (all moths) were identified and the species, status and distance from the DCO boundary is presented in Table 3-19. All notable records were returned from the same monitoring location 510 m south-east of the DCO boundary.

Table 3-19: Notable invertebrate data results within 1 km

Species	Conservation Status	Distance from DCO boundary
Knot grass *Acronicta rumicis*	Priority species	510 m south-east
Mouse moth *Amphipyra Tragopoginis*	Priority species	510 m south-east
Small phoenix *Ecliptopera silaceata*	Priority species	510 m south-east
Ghost moth *Hepialus humuli*	Priority species	510 m south-east
Rustic *Hoplodrina blanda*	Priority species	510 m south-east
Rosy minor *Mesoligia literosa*	Priority species	510 m south-east
Dot moth *Melanchra persicariae*	Priority species	510 m south-east
Shaded broad-bar *Scotopteryx chenopodiata*	Priority species	510 m south-east
Buff ermine *Spilosoma luteum*	Priority species	510 m south-east
Scarce silver *Syngrapha interrogationis*	Nationally scarce	510 m south-east
Juniper carpet *Thera juniperata*	Nationally scarce	510 m south-east

Species	Conservation Status	Distance from DCO boundary
Cinnabar *Tyria jacobaeae*	Priority species	510 m south-east

3.13.3 Hyder (2007) reported the results of detailed surveys conducted in 2001 for the A57/ A628 Mottram - Tintwistle Bypass scheme where a total of 137 target group taxa of Lepidoptera were recorded within the 'main study area', comprising 22 species of butterflies and 115 species of moths. At the time, one 'Nationally Scarce (Notable) B' species; the micro-moth *Phyllonorycter platanoidella*, was reported; however, the current status of this species is 'common'[122]. No other protected or notable species were reported within proximity of the Scheme. Grizzled skipper Pyrgus malvae, a species classified as Vulnerable was recorded at Hollingworth Hall Wood SBI, situated approximately 1.3 km north from the DCO boundary. Hyder (2007) stated that the SBI was by far the most species-rich area and the Lepidopteran quality of the 'main study area' appeared to be concentrated to a large extent within this site.

3.13.4 The overall conclusions drawn from the survey data by Hyder (2007) were that the surveyed areas within the DCO boundary were of low interest as far as their Lepidopteran fauna was concerned. Considering this and based on the results of the 2019 extended Phase 1 habitat survey, it is considered that the likelihood of a significant Lepidoptera assemblage existing within the DCO boundary or wider study area is negligible. The study area is therefore assessed to be of negligible value for Lepidoptera.

3.13.5 No records of other notable terrestrial invertebrates were reported by Hyder. Hyder (2007) reported the results of detailed terrestrial invertebrate surveys conducted in 2000 for the A57/ A628 Mottram - Tintwistle Bypass scheme where four of the survey areas were of relevance to the Scheme study area as follows:

- Site 1: Hurstclough Brook Corridor (SJ 9867 9572). A total of 197 target group taxa recorded, 28 of which had a restricted (Local) national distribution
- Site 2: Grassland southeast of Mottram Moor link (SJ 9969 9604). A total of 170 target group taxa recorded, three of which were Nationally Scarce (Notable) B species and 15 had a restricted (Local) national distribution
- Site 3: Woodland north of Coach Road (SJ 9968 9638). A total of 99 target group taxa recorded, four of which had a restricted (Local) national distribution
- Site 4: Thorncliffe Wood SBI and environs (SK 0018 9716). A total of 225 target group taxa recorded, four of which were Nationally Scarce (Notable) B species of Diptera and 29 had a restricted (Local) national distribution.

[122] Davis A.M. (2012). *A Review of the Status of Microlepidoptera in Britain*. Butterfly Conservation, Wareham. (Butterfly Conservation Report No. S12-02).

3.13.6 The study area contained a number of mature woodland and corridors in the form of (albeit species-poor) hedgerows, streams and ditches that are likely to support a range of terrestrial invertebrates. No notable terrestrial invertebrates were recorded during the targeted surveys in 2001[123], and suitable habitats within the survey area are of limited extent, likely only to support an invertebrate assemblage typical of the region. The habitats on site haven't changed significantly since the original assessment and are, therefore, scoped out of this assessment.

White clawed crayfish

3.13.7 No records of white-clawed crayfish were provided by GMLRC or DBRC during the desk study exercise. Hyder (2007)[123] reported that a river corridor survey of all watercourses crossed by the A57/ A628 Mottram - Tintwistle Bypass scheme, undertaken in 2000, indicated the potential for white-clawed crayfish in seven streams or river corridors. Subsequent surveys were carried out at each of these locations in June 2003. No white-clawed crayfish were found during these surveys. Furthermore, there have been no records of this species in the main study area for the last 20 years, the nearest record being 5 km to the north. It is therefore considered unlikely that white-clawed crayfish would colonise the streams surveyed in the foreseeable future.

3.13.8 White-clawed crayfish are classified as 'Endangered' in the IUCN Red List of Endangered Species[124] and their populations are declining throughout much of their range with predictions that the species will face extinction in much of their former range within the next few decades. Due to the difference in extent of the Scheme and the A57/ A628 Mottram - Tintwistle Bypass scheme, the 2003 presence/ likely absence survey did not include the section of River Etherow that now lies to the east of the Scheme. However, the Environment Agency commissioned a crayfish survey of the Weaver, Dane, Goyt and Etherow catchments in 1998[125]. No crayfish (native or non-native) were found during the survey of the River Etherow and they attributed this to poor quality habitat on account of unsuitable water quality. With regards to the section of the Etherow within the study area (and heading upstream), the 1998 survey noted that the pH decreased from 6.5 to 5.5 and this increased acidity, which is a result of peat run off, would exclude crayfish.

3.13.9 Signal crayfish have been recorded as being present within the River Etherow (during water vole and otter surveys undertaken in 2020); The Environment Agency also provided a number of records at Woolley Bridge. Evidence has shown that where signal crayfish move into an area occupied by white-clawed crayfish, there may be initial co-existence, but there is gradual replacement of the white-clawed crayfish population by signal crayfish in rivers and in lakes[126].

[123] Hyder (2007a). A57/A628 Mottram – Tintwistle Bypass and A628/A616 Route Restraint Measures Environmental Statement. Volume 2A. Report no: 7551- NH50845-NHR-01; 9 February 2007.
[124] Website accessed at: https://www.iucnredlist.org/species/2430/9438817 [accessed 10/03/2021]
[125] David Rogers Associates (1998). Crayfish survey of the Weaver, Dane, Goyt and Etherow catchments. Prepared for: Environment Agency, Carrington Lane, Manchester, M33 5NL
[126] Holdich, D. M. & Domaniewski, J. C. J., (1995); Studies on a mixed population of the crayfish Austropotamobius pallipes and Pacifastacus leniusculus in England. Freshwater Crayfish 10, 37-45.

3.13.10 Overall, due to the lack of records within the study area and the presence of signal crayfish, it is considered highly unlikely that white-clawed crayfish are present within the Scheme. Furthermore, the use of a clear span bridge over the River Etherow removes the need to modify the existing river habitat through in-channel works. Therefore, white-clawed crayfish have been scoped out of this assessment.

4. Evaluation

4.1 Habitats

Lowland mixed deciduous woodland

4.1.1 Lowland mixed deciduous woodland is widespread within Greater Manchester, gradually becoming sparser towards the Peak District National Park. Lowland mixed deciduous woodland is a priority habitat within the UK and in line with DMRB LA 108, is classed as being of national value. This habitat is common and widespread within the county, and the examples within the Scheme are small in extent, fragmented, and not part of any habitat designations or Ancient Woodland. Taking this into consideration, the assemblage of lowland mixed deciduous woodland within the DCO boundary is considered to be of local value.

Wet woodland

4.1.2 In line with DMRB LA 108, wet woodland is classed as being of national value as it is a priority habitat. Wet woodland is rare in Greater Manchester, however, due to the small extent (0.1 ha) and fragmented area found within the Scheme, the wet woodland is considered to be of local value.

Lowland dry acid grassland

4.1.3 In line with DMRB LA 108, lowland dry acid grassland is classed as being of national value as it is a priority habitat. However, due to the limited and fragmented areas found within the Scheme, lowland dry acid grassland is considered to be of county value.

Flood plain maire

4.1.4 The narrow flood-plain is underlain by wet mineral soils and is not a peatland fen system. Therefore, despite the presence of flood-plain fen vegetation, the vegetation does not conform to the JNCC UK BAP priority habitat description of lowland fen[127], which states that lowland fens are peatlands, and therefore it would not be considered to be a priority habitat nor an irreplaceable habitat as listed in the National Planning Policy Framework (NPPF) 2019. Whilst not conforming to S41 priority habitat 'lowland fen', it enriches the habitat resource within the local context and is, therefore, considered to be of local value.

Other Habitats

4.1.5 Other habitats within the Survey Area, including scrub, hardstanding, buildings, gardens, were all typical of the relevant habitat type and are all common and widespread both within the local area and the UK as a whole. Therefore, the remaining habitats within the Scheme area are considered to be of less than local value (that is of value within the Scheme area only).

[127] https://data.jncc.gov.uk/data/6fe22f18-fff7-4974-b333-03b0ad819b88/UKBAP-BAPHabitats-27-LowlandFens.pdf

4.2 Hedgerows

4.2.1 Hedgerows were frequent throughout the study area, predominantly marking field boundaries. Although these hedgerows were mostly gappy, species-poor (predominantly hawthorn), and heavily managed, they all meet the criteria for S41 priority habitat hedgerow[128]. In addition to qualifying as S41 priority habitats, hedgerow 18 and Hedgerow 24 met the criteria for an important hedgerow under the Hedgerow Regulations (1997).

4.2.2 In line with DMRB LA 108 hedgerows are classed as being of national value as they are a priority habitat. As the hedgerows within the Scheme are predominantly heavily managed, species-poor and gappy, it is considered that the hedgerows are of local value.

4.3 Bats

4.3.1 Common pipistrelles are common in the area, as indicated by the local records and history of records within the Scheme, however, all bats are considered to be of conservation importance within Greater Manchester and are included as local BAP species. As updated roost surveys (structures) were not able to be undertaken during 2020 (due to Covid-19 restrictions), a precautionary approach has been determined, taking into consideration the previous survey data and local record data and basing the impact assessment on a likely worst-case scenario. This consists of the presence of four common pipistrelle maternity roosts and nine day and/ or satellite roosts. Due to the potential presence of four maternity colonies for common pipistrelle and the importance of these roosts, roosting bats within the Scheme are considered to be of county value, using the precautionary principle.

4.3.2 The habitats within the Scheme are generally considered to be sub-optimal consisting of gappy and flailed hedgerows and grazed pastoral land. However, taking a combination of the 2020 and 2017 bat activity results, 11 key commuting and foraging areas were identified across the Scheme where bats were regularly recorded utilising these habitats. Taking this into consideration and in line with the criteria provided in Wray *et al.,* (2010)[129], the commuting and foraging areas within the Scheme are considered to be of local value.

4.3.3 Taking into consideration the highest ecological receptor, the assemblage of bats using the Scheme is considered to be of county value.

4.4 Birds

4.4.1 The habitats present within the Survey Area are unsuitable for use for breeding by upland species associated with the Dark Peak SSSI such as dunlin, red grouse, twite and ring ouzel. The Survey Area is at too low an altitude and comprises mostly pasture with little vegetation or grassland of a suitable type for these species.

[128] http://data.jncc.gov.uk/data/ca179c55-3e9d-4e95-abd9-4edb2347c3b6/UKBAP-BAPHabitats-17-Hedgerows.pdf
[129] Wray *et al.,* Valuing Bats in Ecological Impact Assessment (provided within CIEEM (2010) In Practice Number 70)

4.4.2 Habitats present within the Survey Area are also mostly unsuitable for use for breeding by other species associated with the Dark Peak SSSI such as tree pipit, redstart, green woodpecker, wood warbler, pied flycatcher, peregrine falcon, meadow pipit, wheatear and whinchat. Suitable habitat for these species does exist in the vicinity of the Survey Area but only in very small areas that are over 50 m from the Survey Area. No evidence of these species was recorded during surveys.

4.4.3 Suitable breeding and foraging habitat for riverine species associated with the Dark Peak SSSI including dipper, grey wagtail and common sandpiper, exists within the Survey Area along the River Etherow. Dipper and grey wagtail were both recorded within the Survey Area, but common sandpiper was not. These species are water birds and rarely use habitats other than river habitats so are unlikely to exist away from the River Etherow itself and its banks.

4.4.4 The breeding bird surveys undertaken in 2020 have identified the following priority species that have been confirmed as breeding within the Survey Area:

- dunnock
- grasshopper warbler
- house sparrow
- reed bunting
- starling
- song thrush
- willow warbler.

4.4.5 The breeding bird surveys undertaken in 2020 have identified the following priority species as probable breeders within the Survey Area:

- bullfinch
- mistle thrush.

4.4.6 The breeding bird surveys undertaken in 2020 have identified the following priority species as possible breeders within the Survey Area:

- dipper
- grey wagtail
- house martin
- linnet
- stock dove
- swift
- snipe.

4.4.7 The species maps in Figure 8.6 (TR010034/APP/6.4) show that the species listed above are using a wide range of habitats throughout the Survey Area.

4.4.8 Considering the above, the key priority features within this assessment in relation to the Scheme have been drawn out and valued following the guidance within Table 3.9 of DMRB LA 108[130].

4.4.9 These are detailed below in Table 4-1 along with the evaluation of features of Biodiversity Resource Importance as per the LA108 guidance.

Table 4-1: Key priority features and their biodiversity resource importance valuation

Priority feature	Biodiversity resource importance valuation	Justification for biodiversity resource importance valuation as per the LA108 Guidance[131]
Lowland scrub/ lowland damp grassland species Including priority species: grasshopper warbler and willow warbler, reed bunting and curlew (non-breeding).	County importance	These species are identified in county or equivalent authority area plans or strategies. These species are listed in either the SBI Selection Guidelines, the Greater Manchester LBAP or the Peak District LBAP.
General bird assemblage Including all other priority species recorded as having confirmed territories during 2020 surveys: dunnock, house sparrow, starling and song thrush.	Local importance	These species include populations/ communities of species considered to appreciably enrich the habitat resource within the local context including features of importance for migration, dispersal or genetic exchange.

4.4.10 Curlew have been identified as a species which uses the Survey Area as a pre-breeding resource. The curlew recorded during the 2020 surveys were not using the habitats with the Scheme to breed but were recorded foraging in large groups during April surveys before moving on. Curlew are cited as a 'Scarce Breeder' in the Greater Manchester SBI Selection Guidelines and therefore require an importance valuation of county importance due to the species being listed in county or equivalent authority area plans or strategies as per the guidance within Table 3.9 of DMRB LA 108[132]. Consequently, curlew have been included as part of the 'lowland scrub/ lowland damp grassland' species assemblage in Table 4-1 and assigned county importance despite their non-breeding status within the Survey Area.

[130] Highways England et al (2020). Design Manual for Roads and Bridges: LA108. Biodiversity.
[131] Highways England et al (2020). Design Manual for Roads and Bridges: LA108. Biodiversity.
[132] Highways England et al (2020). Design Manual for Roads and Bridges: LA108. Biodiversity.

4.4.11 Song thrush is included as a target species in the Peak District LBAP and therefore falls into the category requiring an importance valuation of 'county importance' as it is listed in county or equivalent authority area plans or strategies as per the guidance within Table 3.9 of DMRB LA 108. However, only a very small part of the Survey Area (approximately 1.4 ha) falls within the area covered by the Peak District LBAP and no song thrushes were recorded in this area during the 2020 surveys. Therefore, song thrush has not been assigned county importance value but has instead been included in the 'general bird assemblage' assigned local importance value (see Table 4-1).

4.4.12 It is important to note that other non-priority species which have not been highlighted as priority features requiring mitigation or compensation still require consideration to address the possibility of their nests being taken, damaged or destroyed whilst breeding during the construction phases of the Scheme e.g. during vegetation clearance phases, which is a legal offence.

4.5 Barn Owl

4.5.1 Approximately 95.9% (554 ha) of the Survey Area consisted of habitat which is unsuitable for barn owl foraging. Optimal Type 1 grassland habitat and sub-optimal habitat including Type 2 grassland habitat was widespread but limited in extent. In several locations these habitat patches are located close to the footprint of the Scheme and such that barn owl may occasionally commute across these roads to access foraging sites and/ or forage in close proximity to these roads.

4.5.2 Given the presence of the Occupied Breeding Site within the Survey Area at Grange Farm, the survey results indicate the presence of one to two breeding pairs of barn owl within the predicted EZoI of the Scheme for barn owl. One at Grange Farm and another likely present at Carr House Farm based on previous sightings of a roosting individual there during the 2017 surveys and an incidental sighting of a commuting barn owl over Carr House Lane during the surveys in 2020.

4.5.3 Additionally, one record from 2018 details a barn owl hunting near to Park Road and 'Top O' Th Hill Farm at SK02749578, just over 1.5 km away from the Scheme to the south east. As adult barn owls typically range no further than 1.5 km from their breeding sites, this suggests that this might be an individual from a third territory within the EZoI of the Scheme. It could also be an individual that is part of the territory associated with Carr House Farm. However, this seems unlikely due to the substantial area of residential and industrial land between Carr House Farm and the area near to Park Road and the lack of connectivity between them via suitable barn owl foraging and/ or commuting habitat. This individual could also be a dispersing juvenile fledged from nests within the EZoI or an adult barn owl which breeds outside of the EZoI but occasionally roosts within it.

4.5.4 Considering the above, barn owls can be considered a key notable feature within this assessment that requires further impact assessment and mitigation in relation to the Scheme. The valuation for the local barn owl population in the geographical context following the guidance within Table 3.9 of DMRB LA 108[133] is determined to be of local importance because the local population of barn owls is considered to appreciably enrich the habitat resource within the local context including features of importance for migration, dispersal or genetic exchange.

4.6 Otter

4.6.1 Suitable habitat to support foraging and/ or commuting otter has been identified on eight watercourses and three water bodies within the otter survey area. In addition, five residential water bodies could not be accessed to undertake a detailed field sign survey. However, these water bodies were visited in 2017 during amphibian surveys and are not considered suitable for use by otter. Further details (including photographs) are provided within Appendix I and Appendix J with locations provided within Figure 8.12 (TR010034/APP/6.4).

4.6.2 Surveys undertaken in 2020 identified spraints on Glossop Brook (WC_400) which is a tributary of the River Etherow (WC_100). It is considered likely that otter utilise both these watercourses for foraging and commuting. No evidence of otter resting sites was found across the Scheme. In addition, it is likely that otter occasionally utilise the suitable habitat along Tara Brook (WC_200) for foraging and commuting, although due to the absence of any field signs this is considered likely to be infrequent.

4.6.3 Otter have suffered historic declines but are now expanding in range and numbers both at a nationwide level and within the north-west of England and Derbyshire[134] and can now be considered ubiquitous, occupying sites in urban areas and in highly disturbed waterways. Otter are not listed on the Greater Manchester LBAP[135], but are named as a 'species for which we are taking action' in the Peak District LBAP[136]. The Peak District LBAP includes otter as a Section 41 species and does not list any actions or projects specifically targeting this species.

4.6.4 Otters have not been recorded breeding within the otter survey area, however, they are using the River Etherow (and surrounding tributaries) for both foraging and commuting. Given this, the otter population using the River Etherow and surrounding tributaries is considered to be of local value.

4.7 Water Vole

4.7.1 Suitable habitat to support water vole has been identified on seven watercourses and three water bodies within the water vole survey area. In addition, five residential water bodies could not be accessed to undertake a detailed field sign survey. Water vole presence has been confirmed previously during surveys undertaken in 2017.

[133] Highways England et al (2020). Design Manual for Roads and Bridges: LA108. Biodiversity.
[134] Crawford, A. 2010. Fifth Otter Survey of England 2009 – 2010. Technical Report. Bristol: Environment Agency.
[135] Greater Manchester Local Record Centre. 2020. Accessed 5/11/2020. https://www.gmwildlife.org.uk/projects/gm_bap/
[136] Peak District Biodiversity Partnership. 2020. Accessed 5/11/2020. https://www.peakdistrict.gov.uk/looking-after/biodiversity/biodiversity-action-plan

The results in 2017 indicated low populations on the River Etherow (WC_100) and WC_210 and a low/ medium population on Tara Brook (WC_200). Further details (including photographs) are provided within Appendix I and Appendix J with locations provided within Figure 8.12 (TR010034/APP/6.4).

4.7.2 Surveys undertaken in 2020 found no evidence of water vole in either survey visit, and it is, therefore, considered that water vole population has become likely locally extinct and are likely absent from the water vole survey area.

4.7.3 Previous populations recorded in 2017 were of low numbers and the watercourses where water vole have previously been found offered little connectivity to the wider landscape due to the lack of crossing points under Mottram Moor. Due to this, it is considered that the water vole population was vulnerable to local extinction, and susceptible to adverse weather conditions and risings water levels. Anecdotal evidence of mink[137] has also been reported within the study area which also may be a cause for the local extinction.

4.7.4 It is, therefore, considered that this populations was vulnerable to predation or other natural adverse impacts with limited opportunity for re-colonisation and due to this, have become locally extinct.

4.8 Reptiles

4.8.1 During the surveys undertaken in 2017, no reptiles or other conclusive evidence of reptiles (such as grass snake eggs or shed skins) were recorded in the survey area. Therefore, it was concluded that reptiles are likely absent from the study area[138].

4.8.2 In addition to the above, there have been no incidental sightings of reptiles recorded during surveys for other protected or priority species and habitats undertaken for the Scheme, including surveys undertaken in 2019 and 2020, and there were no recent records of reptile species returned by GMEU or DBRC within 2 km of the Scheme during the 2019 desk study.

4.8.3 Although the Scheme provides some small pockets of suitable reptile habitat (such as rough grassland, scrub and hedgerow), the habitats within the Scheme predominantly comprise intensively grazed agricultural fields, which are largely unsuitable for reptile species.

4.8.4 Based on the results of previous surveys (and lack of incidental records during surveys undertaken for other species), the lack of recent reptile records in the area, and the limited suitability of the habitats for reptile species, it is considered unlikely that significant reptile populations are present within the Scheme. However, it is considered possible that low numbers of grass snake may occasionally use the habitats within the Scheme for commuting due to their tendency to use wider areas for foraging and commuting.

4.8.5 Despite the previous surveys being undertaken approximately three years prior to the production of this technical appendix, there have been no significant changes to the habitats and other ecological conditions present within the DCO boundary in the intervening years that would significantly alter their suitability for reptiles. Therefore, it is considered that the existing baseline is valid.

[137] Personal communication with local farmer.
[138] Highways England (2019) Trans-Pennine Upgrade (TR010034). 6.8.1 Appendix 8.1: Biodiversity Baseline and Preliminary Assessment

4.9 Amphibians

4.9.1 During the surveys undertaken in 2017, no evidence of GCN presence was identified within 500 m of the Scheme, although smooth newts, palmate newts, common toad and common frog appeared to be widespread throughout the waterbodies in the survey area (as identified through targeted amphibian surveys and incidental observations made during reptile presence/ likely absence surveys).

4.9.2 It was assessed that the likelihood of GCN being presence within 500 m of the DCO boundary was negligible and the species was ruled out of further assessment[139]. It was noted that P31 was not surveyed; however, an assessment of negligible likelihood of GCN presence was made for this waterbody due to the previous presence of fish (now silted up), the 'poor' HSI score, and the absence of GCN within any of the other ponds within the survey area.

4.9.3 In addition to the above, there have been no incidental sightings of GCN recorded during surveys for other protected and priority species and habitats undertaken for the Scheme (including surveys undertaken in 2019 and 2020), and there were no records of GCN within 2 km of the Scheme returned by GMBRC or DBRC during the 2019 desk study, although there were records of common toad.

4.9.4 Eight ponds (P2, P3, P5, P7, P16, P28, P30) are situated within the DCO boundary. P4 and P6 are also included within the DCO boundary, but these ponds were defunct in 2017 and 2019. The 2017 surveys found that some these ponds supported populations of smooth and/ or palmate newts, common toad and common frog.

4.9.5 Smooth and/ or palmate newt and common frog are nationally common and widespread and appear to be locally common and widespread. However, the common toad is a priority species in the UK and has declined continuously since the 1980s[140]. Nine water bodies were recorded as having common toad presence recorded during the 2017 GCN surveys, including three ponds where evidence of breeding was recorded through the presence of toad tadpoles. The habitats within the study area are also suitable for foraging, commuting and refuge as they included combinations of broadleaved woodland, improved grassland, and several watercourses. The common toad population within the Scheme is considered to be of local value.

4.9.6 Although the amphibian surveys carried out in 2017 were undertaken approximately three years prior to the production of this technical appendix, it is considered that the survey results are still valid as it is understood that there have been no significant changes to the habitats and other ecological conditions present within the DCO boundary in the intervening years that would significantly alter their suitability for GCN and other amphibians. No new ponds have been constructed or existing ponds changed significantly since these surveys and no new records have been identified during the desk study.

[139] Highways England (2019) Trans-Pennine Upgrade (TR010034). 6.8.1 Appendix 8.1: Biodiversity Baseline and Preliminary Assessment
[140] Petrovan. S., Schmidt, B. R., (2016) Volunteer Conservation Action Data Reveals Large-Scale and Long-Term Negative Population Trends of a Widespread Amphibian, the Common Toad *(Bufo bufo)*. Plos One.

Appendices

Appendix A. Hedgerow Survey Results

Hedgerow number (Grid Reference)	Hedgerow dimensions Height (h) and width (w)	Number of woody species per 30 m	Features								PROW adjacent	Woody species present	Notes
			Bank or Wall present?	<10% Gappy	>1 Standard Tree per 50 m	3 Woodland Species per	Ditch?	Connections > 4 Points	Parallel Hedge?	Total Number of Features			
H1 (SJ 98529544)	H = 3 m W = 3 m	2	N	N	N	N	Y	N	N	1	N	Ia Ms	Himalayan balsam present
H2 (SJ 98629540)	H = 2.5 m W = 2.5 m	1	Y	Y	N	N	N	N	N	2	N	Cm	
H3 (SJ 98579549)	H = 2.5 m W = 2.5 m	1	N	N	N	N	Y	N	N	1	N	Cm	
H4 (SJ 98569564)	H = 3.5 m W = 2.5 m	2	Y	N	N	N	Y	N	N	2	N	Cm Ia	
H5 (SJ 98639570)	H = 2.5 m W = 2.5 m	2	N	N	N	N	Y	N	N	1	N	Cm Ia	
H6 (SJ 99829602)	H = 3 m W = 2.5 m	2	N	N	N	N	N	N	N	0	Y	Cm Sn	
H7 (SJ 99689579)	H = 3 m W = 3 m	1	Y	Y	N	N	N	N	N	2	N	Cm	
H8 (SJ 99519608)	H = 4 m W = 5 m	2	N	N	Y	Y	N	Y	N	3	N	Cm Qr	

Hedgerow number (Grid Reference)	Hedgerow dimensions Height (h) and width (w)	Number of woody species per 30 m	Features								PROW adjacent	Woody species present	Notes
			Bank or Wall present?	<10% Gappy	>1 Standard Tree per 50 m	3 Woodland Species per	Ditch?	Connections > 4 Points	Parallel Hedge?	Total Number of Features			
H9 (SJ 99569602)	H = 12 m W = 6 m	5	N	Y	Y	N	Y	N	N	3	N	Cm Sn Ros Ia Qr	Bluebells present
H10 (SJ 99549610)	H = 3.5 m W = 3.5 m	1	N	N	Y	N	Y	Y	N	3	N	Cm	
H11 (SJ 99669605)	H = 3.5 m W = 3.5 m	2	Y	N	N	N	N	N	N	1	N	Cm Sn	Himalayan balsam present
H12 (SJ 99809593)	H = 3.5 m W = 3.5 m	4	Y	N	N	N	N	N	N	1	N	Cm Sn Ros Ia	
H13 (SJ 99739583)	H = 5 m W = 5 m	2	Y	Y	N	N	N	N	N	2	N	Cm Sn	
H14 (SJ 99839583)	H = 4 m W = 3 m	4	Y	Y	Y	N	N	N	N	3	N	Cm Fe Ros Pa	
H15 (SJ 99589613)	H = 3.5 m W = 2.5 m	1	Y	N	N	N	N	N	N	1	N	Cm	
H16 (SJ 99569617)	H = 10 m W = 3 m	5	Y	N	Y	N	N	N	N	2	N	Cm Qp Qr Um Sn	
H17 (SJ 99689617)	H = 2 m W = 2.5 m	2	Y	Y	N	N	N	N	N	2	N	Cm Sn	

Hedgerow number (Grid Reference)	Hedgerow dimensions Height (h) and width (w)	Number of woody species per 30 m	Features								PROW adjacent	Woody species present	Notes
			Bank or Wall present?	<10% Gappy	>1 Standard Tree per 50 m	3 Woodland Species per	Ditch?	Connections > 4 Points	Parallel Hedge?	Total Number of Features			
H18 (SJ 99759622)	H = 10 m W = 5 m	6	Y	N	Y	N	Y	N	N	3	N	Qr Ia Ca Sn Qp Um Fe Bpe Sac Ros	**Qualifies as Important**
H19 (SJ 99739608)	H = 4.5 m W = 4.5 m	5	Y	N	N	N	N	N	N	1	N	Cm Qr Ms Vop Sn	
H20 (SJ 99679626	H = 3 m W = 2 m	1	N	Y	N	N	N	N	N	1	Y	Cm	
H21 (SJ 99609632)	H = 2.5 m W = 2.5 m	3	Y	N	N	N	N	Y	N	2	N	Cm Sn Ia	
H22 (SJ 99679626)	H = 3 m W = 2 m	1	N	Y	N	N	N	N	N	1	Y	Cm	
H23 (SJ 99689626)	H = 12 m W = 3.5 m	4	N	N	Y	N	N	N	N	1	Y	Qr Cm Sn Qp	
H24 (SJ 99729601)	H = 10 m W = 5 m	8	N	Y	Y	N	Y	N	N	3	N	Ia Cm Ca Ros Qr Ac Sn Sac	**Qualifies as Important** Himalayan balsam present.
H25 (SK 00089588)	H = 1.5 m W = 1.5 m	3	N	Y	Y	N	N	N	N	2	N	Cm Sn	
H26 (SK 00289551)	H = 1.5 m W = 1.5 m	1	N	Y	N	N	N	N	Y	2	N	Cm	

Hedgerow number (Grid Reference)	Hedgerow dimensions Height (h) and width (w)	Number of woody species per 30 m	Features								PROW adjacent	Woody species present	Notes
			Bank or Wall present?	<10% Gappy	>1 Standard Tree per 50 m	3 Woodland Species per	Ditch?	Connections > 4 Points	Parallel Hedge?	Total Number of Features			
H27 (SK 00329552)	H = 2 m W = 2 m	1	N	Y	N	N	N	N	Y	2	N	Cm	
H28 (SK 00529560)	H = 2 m W = 2 m	2	N	N	N	N	Y	N	N	1	N	Cm Sn	Non-native *Cornus* species present
H29 (SK 00459566)	H = 2 m W = 2 m	3	N	Y	Y	N	N	Y	N	3	N?	Cm Sn Fe	
H30 (SK 00529573)	H = 2 m W = 2 m	5	N	Y	Y	N	N	N	N	2	N	Cm Sn Fe Ps Ia	
H31 (SK 01059554)	H = 2 m W = 2 m	3	N	Y	N	N	N	N	N	2	N	Cm Sn Fe	
H32 (SK 00299565)	H = 3 m W = 3 m	2	Y	Y	N	N	N	N	N	2	N	Cm Qr Fe Ia	Himalayan balsam present
H33 (SK 00789552)	H = 2 m W = 2 m	2	N	N	N	N	N	N	N	0	N	Cm Sn	
H34 (SK 00849541)	H = 2 m W = 2 m	2	N	N	N	N	Y	N	N	1	N	Cm Sn	
H35 (SJ 98949571)	H = 2 m W = 2 m	1	N	Y	N	N	N	N	N	1	N	Cm	
H36	H = 3	3	N	N	N	N	Y	N	N	1	N	Cm Ia Sn	

Hedgerow number (Grid Reference)	Hedgerow dimensions Height (h) and width (w)	Number of woody species per 30 m	Features								PROW adjacent	Woody species present	Notes
			Bank or Wall present?	<10% Gappy	>1 Standard Tree per 50 m	3 Woodland Species per	Ditch?	Connections > 4 Points	Parallel Hedge?	Total Number of Features			
(SJ 99999559)	W = 3												
H37 (SJ 99939559)	H = 2.5 m W = 2 m	2	N	Y	N	N	N	N	N	1	N	Cm Fe	
H38 (SK00889537)	H = 4 m W = 2 m	1	N	Y	N	N	N	N	N	1	N	Cm	
H39 (SK 00169571)	H = 2.5 m W = 2 m	2	N	N	N	N	N	N	N	0	N	Cm Qr	
H40 (SK 00779538)	H = 5 m W = 4 m	5	N	N	Y	Y	Y	N	N	3	N	Cm Qr Bpu Ps Ros	
H41 (SK 00969535)	H = 4 m W = 2 m	1	N	Y	N	N	N	N	N	1	N	Cm	
H42 (SK 00889559)	H = 2 m W = 2 m	2	N	Y	N	N	N	N	N	1	N	Cm Ia	Himalayan balsam present
H43 (SJ 98939589)	H = 10 m W = 4 m	5	Y	Y	N	Y	N	N	N	3	N	Cm Bpu Ag Fe Liv	Scot's pine present
H44 (SJ 99029574)	H = 8 m W = 3 m	2	N	N	Y	N	N	N	N	1	N	Cm Bpu	
H45 (SJ98869586)	H = 5 m W = 3 m	2	N	N	N	N	Y	N	N	1	N	Sx Qr	

Hedgerow number (Grid Reference)	Hedgerow dimensions Height (h) and width (w)	Number of woody species per 30 m	Features								PROW adjacent	Woody species present	Notes
			Bank or Wall present?	<10% Gappy	>1 Standard Tree per 50 m	3 Woodland Species per	Ditch?	Connections > 4 Points	Parallel Hedge?	Total Number of Features			
H46 (SJ 98499542)	H = 10 m W = 5 m	4	N	Y	Y	Y	N	N	N	3	N	Fe Qr Cm Pa	
H47 (SK 00379559)	H = 4 m W = 3 m	4	N	Y	Y	N	Y	N	N	3	Y	Cm Sn Qr Ia Fe Sx Ag	
H48 (SK 00909555)	H = 1 m W = 1 M	1	N	Y	N	N	N	N	N	1	N	Cm	

A.1 Accompanying Notes for Hedgerows Regulations 1997 Record Sheet

A.1.1 These Regulations only apply to hedgerows adjacent to land in agricultural/ horticultural use. A hedgerow may be classified as 'important' for archaeological/ historical reasons, or according to Wildlife and Landscape criteria. To be classified as 'important' under the Wildlife and Landscape criteria, the hedgerow must be over 30 years old and should comprise one of the following:

- *at least 7 woody species/ 30 m
- *at least 6 woody species/ 30 m and at least 3 features
- *at least 6 woody spp/ 30 m including any one of Pn/Sot/Tic/Tip (see below)
- *at least 5 woody species and at least 4 features
- or if adjacent to a bridleway/ footpath, at least 4 woody species and at least 2 features.

*If the hedgerow is situated wholly or partly in one of the counties listed in Criteria 7 sub- paragraph (2) of the Regulations, the number of woody species should be reduced by one.

A.1.2 (N.B. A hedgerow may also be classified as 'important' due to the presence/ recorded presence of particular animal and plant species (see Criteria 6 sub-paragraphs (1)-(4) of the Regulations for details).)

A.1.3 The woody species 'recognised' by the Hedgerows Regulations are listed below in Table B-1, along with the species codes to be used on the record sheet.

Table A-1: Woody species with regard to the Hedgerows Regulations 1997.

Spp code	Latin name	English name	Spp code	Latin name	English name
Ac	*Acer campestre*	Field maple	**Pp**	*Prunus padus*	Bird cherry
Ag	*Alnus glutinosa*	Alder	**Ps**	*Prunus spinosa*	Blackthorn
Bpe	*Betula pendula*	Silver birch	**Pyc**	*Pyrus communis*	Pear
Bpu	*Betula pubescens*	Downy birch	**Qp**	*Quercus petraea*	Sessile oak
Bxs	*Buxus sempervirens*	Box	**Qr**	*Quercus robur*	Pedunculate oak
Cb	*Carpinus betulus*	Hornbeam	**Rc**	*Rhamnus catharticus*	Buckthorn
Cos	*Cornus sanguinea*	Dogwood	**Ruv**	*Ribes uva-crispa*	Gooseberry
Ca	*Corylus avellana*	Hazel	**Ros**	*Rosa* sp(p)	Rose
Cla	*Crataegus laevigata*	Midland hawthorn	**Rac**	*Ruscus aculeatus*	Butcher's-broom
Cm	*Crataegus monogyna*	Hawthorn	**Sx**	*Salix* sp(p)	Willow

Spp code	Latin name	English name	Spp code	Latin name	English name
Cys	*Cytisus scoparius*	Broom	**Sxca**	*Salix caprea*	Goat willow
Dl	*Daphne laureola*	Spurge-laurel	**Sxf**	*Salix fragilis*	Crack-willow
Ee	*Euonymus europaeus*	Spindle	**Sxv**	*Salix viminalis*	Osier
Fs	*Fagus sylvatica*	Beech	**Sn**	*Sambucus nigra*	Elder
Fa	*Frangula alnus*	Alder buckthorn	**Sac**	*Sorbus aucuparia*	Rowan
Fe	*Fraxinus excelsior*	Ash	**Sor**	*Sorbus* sp(p)	Whitebeam
Hr	*Hippophae rhamnoides*	Sea-buckthorn	**Sot**	*Sorbus torminalis*	Wild Service-tree
Ia	*Ilex aquilfolium*	Holly	**Tb**	*Taxus baccata*	Yew
Jr	*Juglans regia*	Walnut	**Tic**	*Tilia cordata*	Small-leaved lime
Jc	*Juniperus communis*	Common juniper	**Tip**	*Tilia platyphyllos*	Large-leaved lime
Liv	*Ligustrum vulgare*	Wild privet	**Ue**	*Ulex europaeus*	Gorse
Ms	*Malus sylvestris*	Crab apple	**Ug**	*Ulex gallii*	Western gorse
Pal	*Populus alba*	White poplar	**Umi**	*Ulex minor*	Dwarf gorse
Pn	*Populus nigra sub-species betulifolia*	Black poplar	**Um**	*Ulmus* sp(p)	Elm
Pot	*Populus tremula*	Aspen	**Vl**	*Viburnum lantana*	Wayfaring tree
Pcan	*Populus x canescens*	Grey poplar	**Vop**	*Viburnum opulus*	Guelder rose
Pa	*Prunus avium*	Wild cherry			

A.1.4 The presence of a number of features along a hedgerow influences the classification under the Regulations. The terms used on the record sheet are explained below, and their presence is indicated by a '**Y**':

- Bank/ wall: The hedgerow is supported along at least half of its length by a bank/ wall.
- Intact: The hedgerow contains less than 10% gaps along its length.
- Trees: The hedgerow supports at least 1 standard tree per 50 m length of hedgerow (standard trees are defined as those which when measured at 1.3 m above ground level have a diameter of at least 20cm, or 15cm for multi-stemmed trees).

- 3 flora spp: The hedgerow supports at least 3 of the valuable ground flora species defined by the Regulations. The hedgerow is considered to support a plant if it is rooted within 1 m (in any direction) of the hedgerow.
- Ditch: There is a ditch along at least half of the length of the hedgerow.
- Connections ≥4 points: A hedgerow must score 4 or more 'connections points', where connections with an adjoining hedgerow(s) score 1 point each, and a connection with a pond or woodland (in which the majority of the trees are broad-leaved) scores 2 points each. A hedgerow is considered to be connected if it meets the feature, or if it has a point within 10 m of it and would meet it if the line of the hedgerow continued.
- Parallel hedge: A parallel hedgerow is present within 15 m.
- An explanation of additional terms used on the Hedgerows Regulation Record Sheet follows:
- Hedge No.: Hedgerow number (within survey area/ site)
- Important: Would the hedgerow be classified as 'important' under the Hedgerows Regulations?
- Bridleway/ path: The hedgerow runs parallel to a designated bridleway/ footpath.
- Pn/Sot/Tic/Tip: The presence of these trees within the hedgerow influences the classification. An explanation of the species codes is shown above.
- Woody species: A list of the woody species found along the hedgerow (this is likely to list more species than are present along 30 m length(s)).
- Ground flora spp.: A list of any dominant/ notable ground flora species recorded along the hedgerow.

Table A-2: Valuable Ground Flora Species with regard to the Hedgerows Regulations 1997.

Latin name	English name	Latin name	English code
Adoxa mochatellina	Moschatel	*Lamiastrum galeobdolon*	Yellow archangel
Ajuga reptans	Bugle	*Lathraea squamaria*	Toothwort
Allium ursinum	Ramsons	*Luzula sylvatica*	Greater wood- rush
Anemone nemorosa	Wood anemone	*Lysimachia nemorum*	Yellow pimpernel
Arum maculatum	Lord's-and-ladies	*Melampyrum pratense*	Common Cow- wheat
Athyrium filix-femina	Lady fern	*Melampyrum sylvaticum*	Small cow-wheat
Blechnum spicant	Hard fern	*Melica uniflora*	Wood Melick
Brachypodium sylvaticum	False-brome	*Mercurialis perennis*	Dog's Mercury
Bromus ramosa	Hairy Brome	*Milium effusum*	Wood Millet
Campanula latifolia	Great Bell-flower	*Orchis mascula*	Early –purple Orchid

Latin name	English name	Latin name	English code
Campanula trachelium	Nettle-leaved Bellflower	*Oxalis acetosella*	Wood Sorrel
Carex sylvatica	Wood Sedge	*Paris quadrifolia*	Herb Paris
Circaea lutetiana	Enchanter's Nightshade	*Phyllitis scolopendrium*	Hart's-tongue
Common Polypody	Polypodium vulgare	*Poa nemoralis*	Wood Meadow- grass
Conopodium majus	Pignut	*Polystichum aculeatum*	Hard Shield-fern
Dryopteris affinis	Scaly Male-fern	*Polystichum setiferum*	Soft Shield-fern
Dryopteris carthusiana	Narrow Buckler-fern	*Potentilla erecta*	Tormentil
Dryopteris filix-mas	Male-fern	*Potentilla sterilis*	Barren Strawberry
Epipactis helleborine	Broad-leaved Helleborine	*Primula elatior*	Oxlip
Equisetum sylvaticum	Wo Horsetail	*Primula vulgaris*	Primrose
Euphorbia amygdaloides	Wood Spurge	*Ranunculus auricomus*	Goldilocks Buttercup
Festuca gigantea	Giant Fescue	*Sanicula europaea*	Sanicle
Fragaria vesca	Wild Strawberry	*Teucrium scorodonia*	Wood Sage
Galium odoratum	Woodruff	*Veronica montana*	Wood Speedwell
Galium saxatile	Heath Bedstraw	*Viola odorata*	Sweet Violet
Geranium robertianum	Herb-Robert	*Viola reichenbachiana*	Early Dog-violet
Geum urbanum	Wood Avens	*Viola riviniana*	Common Dog- violet
Hyacinthoides non-scripta	Bluebell		

Appendix B. NVC Quadrat Description

B.1 Phase 2 NVC Quadrat Descriptions

Quadrat	Description
Quadrat 1 – Broad-leaved woodland embankment	Quadrat 1 comprised a steep embankment along a dry stream bed. The embankment supported broad-leaved woodland and dropped into a wet stream corridor to the south. Sycamore dominated the canopy of the woodland. The understorey was more natural and supported hazel, sycamore, and beech. The ground flora was sparse comprising bare ground, ivy, variegated yellow archangel.
Quadrat 2 – Broad-leaved wooded stream corridor	Quadrat 2 comprised a steep-sided broad-leaved wooded stream corridor. The canopy was dominated by sycamore. The understorey was dense and dominated by scrub species including bramble and ivy. The banks of the stream supported variegated yellow archangel and abundant Himalayan balsam.
Quadrat 3 – Broad-leaved wooded stream corridor	Quadrat 3 comprised a steep-sided broad-leaved wooded stream corridor. The canopy was open but dominated by sycamore. The understorey was sparser that quadrat 2, but also dominated by scrub species including bramble and ivy. The banks of the stream supported variegated yellow archangel and abundant Himalayan balsam.
Quadrat 4 – Broad-leaved wooded stream corridor	Quadrat 4 comprised a broad-leaved wooded stream corridor. The woodland was much younger than the other three quadrats (plantation secondary woodland). The only large sycamore trees were located at the top of the bank adjacent to the field. The canopy was low and comprised oak, rowan, whitebeam, and silver birch. The ground flora was made up of grasses, bramble, bluebell and Himalayan balsam.
Surrounding woodland	To the east of quadrat 4, the woodland reverts back to similar woodland as quadrats 2 and 3. The canopy was dominated by mature sycamore with scattered ash. The understorey comprised hazel, hawthorn and holly. The ground flora appeared more diverse than quadrats 1 to 4. There was abundant Himalayan balsam. To the north of quadrat 1, the woodland was very similar, but with more mature horse-chestnut.

B.2 Phase 2 NVC Survey Results (Domin Scale, see below)

Species	Quadrat	Quadrat 2	Quadrat 3	Quadrat 4	Frequency
Acer pseudoplatanus (c)	8	10	10	3	V

Species	Quadrat	Quadrat 2	Quadrat 3	Quadrat 4	Frequency
Betula pendula (c)	-	-	1	4	III
Fagus sylvatica (c)	5	-	-	-	II
Fraxinus excelsior (c)	4	-	-	2	III
Quercus robur (c)	-	-	-	7	II
Sorbus aria (c)	-	-	-	6	II
Ulmus glabra (c)	2	2	2	2	V
Acer pseudoplatanus (s)	3	2	3	-	IV
Acer platanoides (s)	-	2	-	-	II
Aesculus hippocastanum (s)	3	2	1	-	IV
Betula pendula (s)	2	-	-	-	II
Corylus avellana (s)	3	1	3	-	IV
Cotoneaster sp. (s)	-	-	1	-	II
Crataegus monogyna (s)	2	2	3	2	V
Ilex aquifolium (s)	4	8	5	-	IV
Fargesia sp. (s)	-	2	-	-	II
Ligustrum sp. (s)	2	2	-	-	III
Prunus laurocerasus (s	2	-	-	-	II
Quercus robur (s)	-	-	-	4	II
Sorbus aucuparia (s)	3	2	3	-	IV
Ulmus minor (s)	2	-	-	-	II
Aesculus hippocastanum (u)	2	2	-	-	III
Alliaria petiolata (u)	3	2	1	-	IV

Species	Quadrat	Quadrat 2	Quadrat 3	Quadrat 4	Frequency
Allium ursinum (u)	1	2	-	-	III
Asplenium scolopendrium (u)	-	2	-	-	II
Blechnum spicant (u)	-	-	1	-	II
Carex pendula (u)	1	2	-	-	III
Cardamine flexuosa (u)	2	2	-	-	III
Chrysosplenium oppositifolium (u)	-	3	-	-	II
Crocosmia sp. (u)	1	2	-	-	III
Deschampsia cespitosa (u)	-	3	-	3	III
Dryopteris dilatata (u)	2	2	2	2	V
Epilobium sp. (u)	-	3	-	-	II
Equisetum sp. (u)	-	-	1	1	III
Fraxinus excelsior (u)	2	2	-	2	IV
Galium aparine (u)	-	-	-	3	II
Geum urbanum (u)	1	1	-	-	III
Geranium robertianum (u)	-	2	1	-	III
Hedera helix (u)	7	4	3	2	V
Heuchera sp. (u)	3	2	-	3	IV
Holcus mollis (u)	-	-	-	5	II
Hyacinthoides non-scripta (u)	-	2	3	4	IV
Impatiens glandulifera (u)	3	6	5	5	V
Lamiastrum galeobdolon (u)	4	4	-	-	III
Lonicera periclymenum (u)	-	1	-	-	II

Species	Quadrat	Quadrat 2	Quadrat 3	Quadrat 4	Frequency
Poa trivialis (u)	2	3	1	3	V
Rubus fruticosus agg. (u)	3	3	2	5	V
Sorbus aucuparia (u)	2	-	3	-	III
Urtica dioica (u)	-	2	2	2	IV
Ulmus procera (u)	2	-	-	-	II
Lower plants					
Mnium hornum	-	3	-	-	I
Pelia sp. (u)	-	3	-	-	II
Thuidium tamariscinum (u)	-	3	3	3	IV
Bare ground	7	7	7	5	V
Introduced garden shrubs	-	3	2	3	IV

Domin scale

Within each quadrat all species were recorded with an estimate of percentage cover/ abundance using the Domin scale:

1 = few individuals
2 = some individuals
3 = many individuals
4 = 4% - 10%
5 = 11% - 25%
6 = 26% - 33%
7 = 34% - 50%
8 = 51% - 75%
9 = 76% - 90%
10 = 91% - 100%

Appendix C. Biodiversity Metric Calculations

C.1 Baseline Habitat Units

Habitat type	Area (hectares)	Distinctiveness (score)	Condition (score)	Connectivity (Score)	Strategic significance (score)	Baseline Habitat Biodiversity Units	Area retained	Area enhanced	Area succession	Baseline units retained	Baseline units enhanced	Baseline units succession	Area lost	Units lost
Urban - Amenity grassland	0.32	Low (2)	Poor (1)	Low (1)	Low (1)	0.64	0.02	0	0	0.04	0	0	0.3	0.6
Urban - Artificial unvegetated, unsealed surface	0.18	V. Low (0)	N/A - Other (0)	Low (1)	Low (1)	0	0.02	0	0	0	0	0	0.16	0
Heathland and shrub - Blackthorn scrub	0.02	Medium (4)	Moderate (2)	Low (1)	Low (1)	0.16	0	0	0	0	0	0	0.02	0.16
Grassland - Bracken	0.01	Medium (4)	Poor (1)	Low (1)	Low (1)	0.04	0	0	0	0	0	0	0.01	0.04
Heathland and shrub - Bramble scrub	0.16	Medium (4)	Moderate (2)	Low (1)	Low (1)	1.28	0.09	0	0	0.72	0	0	0.07	0.56

Habitat type	Area (hectares)	Distinctiveness (score)	Condition (score)	Connectivity (Score)	Strategic significance (score)	Baseline Habitat Biodiversity Units	Area retained	Area enhanced	Area succession	Baseline units retained	Baseline units enhanced	Baseline units succession	Area lost	Units lost
Heathland and shrub - Bramble scrub	0.58	Medium (4)	Poor (1)	Low (1)	Low (1)	2.32	0.01	0	0	0.04	0	0	0.57	2.28
Urban - Developed land; sealed surface	8.23	V.Low (0)	N/A - Other (0)	Low (1)	Low (1)	0	0.64	0	0	0	0	0	7.59	0
Heathland and shrub - Hawthorn scrub	0.02	Medium (4)	Moderate (2)	Low (1)	Low (1)	0.16	0	0	0	0	0	0	0.02	0.16
Heathland and shrub - Hawthorn scrub	0.01	Medium (4)	Poor (1)	Low (1)	Low (1)	0.04	0	0	0	0	0	0	0.01	0.04
Grassland - Lowland dry acid grassland	0.24	V.High (8)	Good (3)	Medium (1.1)	Low (1)	0.26	0.01	0	0	0.264	0	0	Unacceptable loss	Alternative compensation
Grassland - Lowland dry acid grassland	0.08	V.High (8)	Moderate (2)	Medium (1.1)	Low (1)	0	0	0	0	0	0	0	Unacceptable loss	Alternative compensation

Habitat type	Area (hectares)	Distinctiveness (score)	Condition (score)	Connectivity (Score)	Strategic significance (score)	Baseline Habitat Biodiversity Units	Area retained	Area enhanced	Area succession	Baseline units retained	Baseline units enhanced	Baseline units succession	Area lost	Units lost
Grassland - Floodplain Wetland Mosaic (CFGM)	0.3	High (6)	Moderate (2)	Medium (1.1)	Low (1)	3.96	0.05	0	0	0.66	0	0	0.25	3.3
Woodland and forest - Lowland mixed deciduous woodland	0.12	High (6)	Good (3)	Medium (1.1)	Low (1)	2.38	0	0	0	0	0	0	0.12	2.376
Woodland and forest - Lowland mixed deciduous woodland	0.73	High (6)	Moderate (2)	Medium (1.1)	Low (1)	9.64	0.37	0	0	4.884	0	0	0.36	4.752
Woodland and forest - Lowland mixed deciduous woodland	0.06	High (6)	Poor (1)	Medium (1.1)	Low (1)	0.4	0.04	0	0	0.264	0	0	0.02	0.132
Heathland and shrub - Mixed scrub	0.53	Medium (4)	Moderate (2)	Low (1)	Low (1)	4.24	0.22	0	0	1.76	0	0	0.31	2.48
Grassland - Modified grassland	0.25	Low (2)	Moderate (2)	Low (1)	Low (1)	1	0	0	0	0	0	0	0.25	1

Habitat type	Area (hectares)	Distinctiveness (score)	Condition (score)	Connectivity (Score)	Strategic significance (score)	Baseline Habitat Biodiversity Units	Area retained	Area enhanced	Area succession	Baseline units retained	Baseline units enhanced	Baseline units succession	Area lost	Units lost
Grassland - Modified grassland	34.59	Low (2)	Poor (1)	Low (1)	Low (1)	69.18	0.51	0	0	1.02	0	0	34.08	68.16
Woodland and forest - Other coniferous woodland	1.04	Low (2)	Poor (1)	Low (1)	Low (1)	2.08	0.67	0	0	1.34	0	0	0.37	0.74
Grassland - Other neutral grassland	9.32	Medium (4)	Moderate (2)	Low (1)	Low (1)	74.56	0.65	0	0	5.2	0	0	8.67	69.36
Grassland - Other neutral grassland	1.05	Medium (4)	Poor (1)	Low (1)	Low (1)	4.2	0.03	0	0	0.12	0	0	1.02	4.08
Woodland and forest - Other woodland; broadleaved	0.58	Medium (4)	Poor (1)	Low (1)	Low (1)	2.32	0.31	0	0	1.24	0	0	0.27	1.08
Lakes - Ponds (Non-Priority Habitat)	0.1	High (6)	Good (3)	Medium (1.1)	Low (1)	1.98	0	0	0	0	0	0	0.1	1.98

Habitat type	Area (hectares)	Distinctiveness (score)	Condition (score)	Connectivity (Score)	Strategic significance (score)	Baseline Habitat Biodiversity Units	Area retained	Area enhanced	Area succession	Baseline units retained	Baseline units enhanced	Baseline units succession	Area lost	Units lost
Lakes - Ponds (Non-Priority Habitat)	0.04	High (6)	Moderate (2)	Medium (1.1)	Low (1)	0.53	0	0	0	0	0	0	0.04	0.528
Urban - Suburban/ mosaic of developed/ natural surface	2.42	Low (2)	Poor (1)	Low (1)	Low (1)	4.84	0.18	0	0	0.36	0	0	2.24	4.48
Urban - Vegetated garden	0.08	Low (2)	Poor (1)	Low (1)	Low (1)	0.16	0.01	0	0	0.02	0	0	0.07	0.14
Woodland and forest - Wet woodland	0.11	High (6)	Moderate (2)	Medium (1.1)	Low (1)	1.45	0.02	0	0	0.264	0	0	0.09	1.188
Woodland and forest - Wood-pasture and parkland	0.9	High (6)	Moderate (2)	Medium (1.1)	Low (1)	11.88	0	0	0	0	0	0	0.9	11.88

C.2 Habitat creation units

Habitat Type	Landscape habitat(s)	Area (ha)	Distinctiveness (score)	Condition (score)	Connectivity (score)	Strategic significance (score)	Time to target condition (score)	Difficulty (score)	Biodiversity units
Heathland and shrub - Mixed scrub	ARC_Ex-Scrub Hatch	0.68	Medium (4)	Moderate (2)	Low (1)	Low (1)	3 (0.9)	Low (1)	4.89
Urban - Amenity grassland	ARC_LE1.1-Amenity Grassland Hatch A	0.38	Low (2)	Poor (1)	Low (1)	Low (1)	1 (0.97)	Low (1)	0.73
Grassland - Modified grassland	ARC_LE1.2-Grassland with Bulbs Hatch A	0.68	Low (2)	Poor (1)	Low (1)	Low (1)	1 (0.97)	Low (1)	1.31
Grassland - Other neutral grassland	ARC_LE1.3-Species Rich Grassland Hatch A	11.96	Medium (4)	Moderate (2)	Low (1)	Low (1)	10 (0.7)	Low (1)	67
Sparsely vegetated land - Inland rock outcrop and scree habitats	ARC_LE1.4-Rock and Scree Hatch	0.92	High (6)	Moderate (2)	Medium (1.1)	Low (1)	20 (0.49)	High (0.33)	1.97
Grassland - Other neutral grassland	ARC_LE1.6-Open Grassland Hatch A	1.13	Medium (4)	Moderate (2)	Low (1)	Low (1)	10 (0.7)	Low (1)	6.33
Grassland - Other lowland acid grassland	ARC_LE1.X-Acid Grassland Hatch A (1.64 ha - 0.31ha for 1:1 replacement of Lowland Dry Acid)	1.33	Medium (4)	Moderate (2)	Low (1)	Low (1)	10 (0.7)	Low (1)	7.45

Habitat Type	Landscape habitat(s)	Area (ha)	Distinctiveness (score)	Condition (score)	Connectivity (score)	Strategic significance (score)	Time to target condition (score)	Difficulty (score)	Biodiversity units
Woodland and forest - Other woodland; broadleaved	ARC_LE2.1-Woodland Hatch	2.25	Medium (4)	Moderate (2)	Low (1)	Low (1)	30 (0.34)	Medium (0.67)	4.14
Heathland and shrub - Mixed scrub	ARC_LE2.2-Woodland Edge Hatch	3.02	Medium (4)	Moderate (2)	Low (1)	Low (1)	3 (0.9)	Low (1)	21.71
Woodland and forest - Wet woodland	ARC_LE2.3-Woodland Wet Hatch A	0.61	High (6)	Moderate (2)	Medium (1.1)	Low (1)	25 (0.41)	Medium (0.67)	2.21
Heathland and shrub - Mixed scrub	ARC_LE2.4-Linear Belt of Shrubs and Trees Hatch A	0.17	Medium (4)	Moderate (2)	Low (1)	Low (1)	3 (0.9)	Low (1)	1.22
Heathland and shrub - Mixed scrub	ARC_LE2.5-Shrubs with intermittent trees hatch A	0.57	Medium (4)	Moderate (2)	Low (1)	Low (1)	3 (0.9)	Low (1)	4.1
Heathland and shrub - Lowland Heathland	ARC_LE2.6-Heather Hatch A	0.39	High (6)	Moderate (2)	Medium (1.1)	Low (1)	20 (0.49)	High (0.33)	0.83
Heathland and shrub - Mixed scrub	ARC_LE2.6-Shrubs Hatch A	0.12	Medium (4)	Moderate (2)	Low (1)	Low (1)	3 (0.9)	Low (1)	0.86
Urban - Introduced shrub	ARC_LE3.2-Ornamental Shrubs hatch	0.12	Low (2)	Poor (1)	Low (1)	Low (1)	1 (0.97)	Low (1)	0.23
Lakes - Ponds (Non-Priority Habitat)	ARC_LE6.1-Water Bodies and Associated Plants	0.54	High (6)	Moderate (2)	Medium (1.1)	Low (1)	3 (0.9)	Low (1)	6.41

Habitat Type	Landscape habitat(s)	Area (ha)	Distinctiveness (score)	Condition (score)	Connectivity (score)	Strategic significance (score)	Time to target condition (score)	Difficulty (score)	Biodiversity units
Lakes - Ditches	ARC_LE6.2-Bank and Ditches Hatch	2.08	Medium (4)	Moderate (2)	Low (1)	Low (1)	5 (0.84)	Low (1)	13.92
Lakes - Ponds (Priority Habitat)	ARC_LE6.3-Reed Beds	0.38	High (6)	Moderate (2)	Medium (1.1)	Low (1)	5 (0.84)	Medium (0.67)	2.81
Grassland - Other neutral grassland	ARC_LE6.4-Marsh and Wet Grassland Hatch	1.14	Medium (4)	Moderate (2)	Low (1)	Low (1)	10 (0.7)	Low (1)	6.39
Urban - Developed land; sealed surface	New highway, central reservation, footpath etc	10.84	V. Low (0)	N/A - Other (0)	Low (1)	Low (1)	0 (1)	Low (1)	0
Urban - Amenity grassland	Assumed return to baseline	0.27	Low (2)	Poor (1)	Low (1)	Low (1)	1 (0.97)	Low (1)	0.52
Urban - Artificial unvegetated, unsealed surface	Assumed return to baseline	0.07	V. Low (0)	N/A - Other (0)	Low (1)	Low (1)	0 (1)	Low (1)	0
Heathland and shrub - Bramble scrub	Assumed return to baseline	0.03	Medium (4)	Moderate (2)	Low (1)	Low (1)	3 (0.9)	Low (1)	0.22
Heathland and shrub - Bramble scrub	Assumed return to baseline	0.03	Medium (4)	Poor (1)	Low (1)	Low (1)	1 (0.97)	Low (1)	0.12
Urban - Developed land; sealed surface	Assumed return to baseline	4.18	V. Low (0)	N/A - Other (0)	Low (1)	Low (1)	0 (1)	Low (1)	0

Habitat Type	Landscape habitat(s)	Area (ha)	Distinctiveness (score)	Condition (score)	Connectivity (score)	Strategic significance (score)	Time to target condition (score)	Difficulty (score)	Biodiversity units
Grassland - Lowland dry acid grassland	Assumed return to baseline	0.01	V. High (8)	Good (3)	Medium (1.1)	Low (1)	30 (0.34)	High (0.33)	0.03
Grassland - Floodplain Wetland Mosaic (CFGM)	Assumed return to baseline	0.01	High (6)	Moderate (2)	Medium (1.1)	Low (1)	20 (0.49)	High (0.33)	0.02
Woodland and forest - Lowland mixed deciduous woodland	Assumed return to baseline	0.07	High (6)	Moderate (2)	Medium (1.1)	Low (1)	32+ (0.32)	High (0.33)	0.1
Heathland and shrub - Mixed scrub	Assumed return to baseline	0.14	Medium (4)	Moderate (2)	Low (1)	Low (1)	3 (0.9)	Low (1)	1.01
Grassland - Modified grassland	Assumed return to baseline	0.25	Low (2)	Moderate (2)	Low (1)	Low (1)	10 (0.7)	Low (1)	0.7
Grassland - Modified grassland	Assumed return to baseline	6.95	Low (2)	Poor (1)	Low (1)	Low (1)	1 (0.97)	Low (1)	13.41
Woodland and forest - Other coniferous woodland	Assumed return to baseline	0.06	Low (2)	Poor (1)	Low (1)	Low (1)	15 (0.59)	Low (1)	0.07
Grassland - Other neutral grassland	Assumed return to baseline	5.2	Medium (4)	Moderate (2)	Low (1)	Low (1)	10 (0.7)	Low (1)	29.13

Habitat Type	Landscape habitat(s)	Area (ha)	Distinctiveness (score)	Condition (score)	Connectivity (score)	Strategic significance (score)	Time to target condition (score)	Difficulty (score)	Biodiversity units
Grassland - Other neutral grassland	Assumed return to baseline	0.18	Medium (4)	Poor (1)	Low (1)	Low (1)	1 (0.97)	Low (1)	0.69
Woodland and forest - Other woodland; broadleaved	Assumed return to baseline	0.18	Medium (4)	Poor (1)	Low (1)	Low (1)	20 (0.49)	Medium (0.67)	0.24
Lakes - Ponds (Non-Priority Habitat)	Assumed return to baseline	0.01	High (6)	Moderate (2)	Medium (1.1)	Low (1)	3 (0.9)	Low (1)	0.12
Urban - Suburban/ mosaic of developed/ natural surface	Assumed return to baseline	1.05	Low (2)	Poor (1)	Low (1)	Low (1)	1 (0.97)	Low (1)	2.03
Woodland and forest - Wet woodland	Assumed return to baseline	0.02	High (6)	Moderate (2)	Medium (1.1)	Low (1)	25 (0.41)	Medium (0.67)	0.07

C.3 Baseline linear units

Hedgerow type	Length (km)	Distinctiveness (score)	Condition (score)	Connectivity (Score)	Strategic significance (score)	Baseline Hedgerow Biodiversity Units	Length retained	length enhanced	Units retained	Units enhanced	Length lost	Units lost
Line of Trees	0.12	Low (2)	Good (3)	Low (1)	Low (1)	0.72	0	0	0	0	0.12	0.72
Line of Trees (Ecologically Valuable)	0.48	Medium (4)	Good (3)	Low (1)	Low (1)	5.76	0.25	0	3	0	0.23	2.76
Native Hedgerow with trees	0.27	Low (2)	Good (3)	Low (1)	Low (1)	1.62	0.01	0	0.06	0	0.26	1.56
Native Hedgerow with trees	0.21	Low (2)	Moderate (2)	Low (1)	Low (1)	0.84	0.06	0	0.24	0	0.15	0.6
Native Hedgerow	0.19	Low (2)	Good (3)	Low (1)	Low (1)	1.14	0.07	0	0.42	0	0.12	0.72
Native Hedgerow	1.01	Low (2)	Moderate (2)	Low (1)	Low (1)	4.04	0.05	0	0.2	0	0.96	3.84
Native Hedgerow	0.26	Low (2)	Poor (1)	Low (1)	Low (1)	0.52	0.07	0	0.14	0	0.19	0.38
Native Hedgerow - Associated with bank or ditch	0.31	Medium (4)	Good (3)	Low (1)	Low (1)	3.72	0.03	0	0.36	0	0.28	3.36
Native Hedgerow - Associated with bank or ditch	0.41	Medium (4)	Moderate (2)	Low (1)	Low (1)	3.28	0.07	0	0.56	0	0.34	2.72
Native Hedgerow - Associated with bank or ditch	0.23	Medium (4)	Poor (1)	Low (1)	Low (1)	0.92	0	0	0	0	0.23	0.92
Native Hedgerow with trees	0.02	Low (2)	Moderate (2)	Low (1)	Low (1)	0.08	0	0	0	0	0.02	0.08

Hedgerow type	Length (km)	Distinctiveness (score)	Condition (score)	Connectivity (Score)	Strategic significance (score)	Baseline Hedgerow Biodiversity Units	Length retained	length enhanced	Units retained	Units enhanced	Length lost	Units lost
Native Hedgerow with trees - Associated with bank or ditch	0.07	Medium (4)	Good (3)	Low (1)	Low (1)	0.84	0.03	0	0.36	0	0.04	0.48
Native Hedgerow with trees - Associated with bank or ditch	0.06	Medium (4)	Moderate (2)	Low (1)	Low (1)	0.48	0.01	0	0.08	0	0.05	0.4

C.4 Hedgerow Creation

Habitat Type	Landscape habitat(s)	Area (ha)	Distinctiveness (score)	Condition (score)	Connectivity (score)	Strategic significance (score)	Time to target condition (score)	Difficulty (score)	Biodiversity units
Hedge Ornamental Non Native	ARC_LE4.1-Ornamental Species Hedges	0.31	V.Low (0)	Poor (1)	Low (1)	Low (1)	1 (0.97)	Low (1)	0
Native Species Rich Hedgerow	ARC_LE4.2-Native Species Hedges (trimmed)	1.34	Medium (4)	Moderate (2)	Low (1)	Low (1)	5 (0.84)	Medium (0.67)	6.01

Habitat Type	Landscape habitat(s)	Area (ha)	Distinctiveness (score)	Condition (score)	Connectivity (score)	Strategic significance (score)	Time to target condition (score)	Difficulty (score)	Biodiversity units
Native Species Rich Hedgerow - Associated with bank or ditch	ARC_LE4.2-Native Species Hedges (trimmed)	0.09	High (6)	Moderate (2)	Low (1)	Low (1)	5 (0.84)	Medium (0.67)	0.61
Native Species Rich Hedgerow	ARC_LE4.3-Native Species Hedgerow (untrimmed)	1.4	Medium (4)	Moderate (2)	Low (1)	Low (1)	5 (0.84)	Medium (0.67)	6.28
Native Species Rich Hedgerow - Associated with bank or ditch	ARC_LE4.3-Native Species Hedgerow (untrimmed)	1.88	High (6)	Moderate (2)	Low (1)	Low (1)	5 (0.84)	Medium (0.67)	12.65
Native Species Rich Hedgerow with trees	ARC_LE4.4-Native Hedgerow with Trees	1.08	Medium (4)	Moderate (2)	Low (1)	Low (1)	10 (0.7)	Medium (0.67)	4.05
Native Species Rich Hedgerow with trees - Associated with bank or ditch	ARC_LE4.4-Native Hedgerow with Trees	0.2	High (6)	Moderate (2)	Low (1)	Low (1)	10 (0.7)	Medium (0.67)	1.13

Appendix D. Bat Tree Climbing Results

Tree ID	Species	Roosting suitability	Aerial assessment notes	First aerial	Second aerial	Third aerial	Hibernation suitability	First hibernation aerial	Second hibernation aerial
T1	Beech	Moderate	Good feature on lower trunk - possibly more suited to hibernation	31/07/20	09/09/20	N/A	Yes	21/01/2021	16/02/21
T9	Willow	Low	Willow tree with several superficial features - one low potential feature	05/08/20	N/A	N/A	-	-	-
T10	Wych elm	Moderate	Dead tree with good feature present	03/08/20	09/09/20	N/A	-	-	-
T12	Oak	Moderate	Good feature present - cluttered entrance, more suitable for hibernation	04/08/20	14/09/20	N/A	Yes	21/01/21	16/02/21
T15	Sycamore	Low	Exposed and superficial features	03/08/20	N/A	N/A	-	-	-
T16	Oak	Moderate	Good feature present	29/07/20	01/09/20	N/A	Yes	18/01/21	16/02/21
T26	Elder	Low	Lifted bark creating small, sheltered crevice	10/09/20	N/A	N/A	-	-	-
T29	Oak	Low	Lifted bark creating small, sheltered crevice	10/09/20	N/A	N/A	-	-	-
T30	Ash	Low	Semi-mature Ivy cover - no other significant features	04/08/20	N/A	N/A	-	-	-
T32	Oak	Low	Small, exposed features	07/09/20	N/A	N/A	-	-	-

Tree ID	Species	Roosting suitability	Aerial assessment notes	First aerial	Second aerial	Third aerial	Hibernation suitability	First hibernation aerial	Second hibernation aerial
T33	Sycamore	Low	Lifted bark with small crevices	07/09/20	N/A	N/A	-	-	-
T36	Oak	Moderate	Suitable features present but with minor water flows	22/07/20	07/09/20	N/A	-	-	-
T37	Oak	Low	Low potential callus roll	01/09/20	N/A	N/A	-	-	-
T40	Oak	Moderate	Good features but competition present	21/07/20	02/09/20	N/A	Yes	18/01/21	16/02/21
T41	Oak	Moderate	Good features present - low hibernation potential	29/07/20	02/09/20	N/A	Yes	18/01/21	16/02/21
T43	Sycamore	Low	Only small, low pot cavity/crevice present	29/07/20	N/A	N/A	-	-	-
T46	Sycamore	Moderate	Good features present	29/07/20	02/09/20	N/A	Yes	18/01/21	15/02/21
T48	Hawthorn	Low	Only small, low potential cavity	02/09/20	N/A	N/A	Yes	18/02/21	15/02/21
T49	Sycamore	Low	Only small, low potential cavity/crevice present	29/07/20	N/A	N/A	-	-	-
T50	Oak	Low	Suitable cavity but with minor water flows	02/09/20	N/A	N/A	-	-	-
T52	Oak	Moderate	Good features present but with competition	22/07/20	02/09/20	N/A	Yes	18/02/21	16/02/21
T57	Sycamore	Low	Suitable feature but cluttered entrance	03/09/20	N/A	N/A	-	-	-

Tree ID	Species	Roosting suitability	Aerial assessment notes	First aerial	Second aerial	Third aerial	Hibernation suitability	First hibernation aerial	Second hibernation aerial
T59	Oak	Low	Low cavity at base of tree - suitable but exposed	03/09/20	N/A	N/A	-	-	-
T62	Oak	Moderate	Good features present - low hibernation potential	29/07/20	02/09/20	N/A	Yes	18/02/21	17/02/21
T63	Oak	Low	Small, exposed features	07/09/20	N/A	N/A	-	-	-
T66	Hawthorn	Low	Low suitable feature - low hibernation potential	01/09/20	N/A	N/A	Yes	18/02/21	17/02/21
T67	Sycamore	Low	Assessed from ground level - all features low/negligible	24/07/20	N/A	N/A	-	-	-
T76	Sycamore	Low	Open, exposed features	31/07/20	N/A	N/A	-	-	-
T77	Ash	Moderate	Good features present - very suitable in absence of competitors	31/07/20	07/09/20	N/A	Yes	21/02/21	16/02/21
T78	not identified	Low	Small crack/crevice present but highly exposed	09/09/20	N/A	N/A	-	-	-
T81	Ash	Low	Open and exposed features in canopy - butt rot cavity low potential due to environment	06/08/20	N/A	N/A	-	-	-
T83	Ash	Low	Open and exposed features in canopy - butt rot cavity low potential due to environment	06/08/20	N/A	N/A	-	-	-

Tree ID	Species	Roosting suitability	Aerial assessment notes	First aerial	Second aerial	Third aerial	Hibernation suitability	First hibernation aerial	Second hibernation aerial
T84	Sycamore	Low	Lifted bark creating small, sheltered crevice	16/09/20	N/A	N/A	-	-	-
T86	Ash	Low	Features small and exposed or filled with debris - low potential only	05/08/20	N/A	N/A	-	-	-
T88	Willow	Low	Good crevice present but exposed	05/08/20	N/A	N/A	-	-	-
T89	Willow	Low	Small crevices in snapped branch - highly exposed however	16/09/20	N/A	N/A	-	-	-
T90	Ash	Low	Fissures in hanging branch create some small suitable crevices - exposed however	16/09/20	N/A	N/A	-	-	-
T92	not identified	Low	Sheltered cavity present but close to river level - would likely become periodically flooded	16/09/20	N/A	N/A	-	-	-
T93	Ash	High	Very suitable roosting features present	21/07/20	05/08/20	14/09/20	Yes	21/02/21	16/02/21
T95	Ash	Moderate	Very good features present but in isolated pasture - lower features suitable for hibernation	05/08/20	15/09/20	N/A	Yes	21/02/21	16/02/21
T96	Ash	Low	Suitable feature present but highly cluttered entrance	14/09/20	N/A	N/A	-	-	-
T99	Oak	Moderate	Good feature present	04/08/20	11/09/20	N/A	Yes	21/02/21	16/02/21

Tree ID	Species	Roosting suitability	Aerial assessment notes	First aerial	Second aerial	Third aerial	Hibernation suitability	First hibernation aerial	Second hibernation aerial
T101	not identified	Low	Ash tree - lower features superficial and exposed - loose bark in dead branches not safe to climb but assessed as low	04/08/20	N/A	N/A	-	-	-
T108	Willow	Low	Small, sheltered feature, but highly cluttered entrance	15/09/20	N/A	N/A	-	-	-
T115	Oak	Low	Damp cavity with some shelter	04/08/20	N/A	N/A	-	-	-

Appendix E. Bat Activity Survey Methodology

E.1 Bat Activity Results 2019/ 2020

Transect no.	Date	Survey type	Start/ End time	Temp (°C)	Humidity (%)	Wind speed (Beaufort)	Precipitation	Cloud cover (0-8)	Observations
1	23/10/2019	Dusk	Start: 18:00 End: 20:35	Start: 9 End: 7	Start: 52 End: 61	Start: 1 End: 1	Start: Dry End: Dry	Start: 2 End: 2	None
2	23/10/2019	Dusk	Start: 17:55 End: 19:45	Start: 9 End: 7	Start: 52 End : 61	Start: 1 End: 1	Start: Dry End: Dry	Start: 2 End: 2	Cold, but bats still active in early part of the survey
1	14/04/2020	Dusk	Start: 20:11 End: 22:33	Start: 7 End: 4	Start: 40 End: 40	Start:1 End:1	Start: Dry End: Dry	Start: 8 End: 8	None
2	14/04/2020	Dusk	Start: 20:00 End: 22:11	Start: 7 End: 3	Start: 40 End: 40	Start: 1 End: 1	Start: Dry End: Dry	Start: 8 End: 8	None
1	12/05/2020	Dusk	Start: 20:58 End: 22:55	Start: 10 End: 10	Start: 57 End: 80	Start: 1 End: 1	Start: Dry End: Dry	Start: 4 End: 8	None
2	12/05/2020	Dusk	Start: 20:43 End: 22:30	Start: 10 End: 10	Start: 54 End: 80	Start: 1 End: 1	Start: Dry End: Dry	Start: 4 End: 4	None
1	09/06/2020	Dusk	Start: 21:34 End: 00:14	Start: 11 End: 9	Start: 70 End: 85	Start: 1 End: 0	Start: Dry End: Dry	Start: 8 End: 8	None
2	09/06/2020	Dusk	Start: 21:34 End: 00:14	Start: 11 End: 9	Start: 70 End: 85	Start: 1 End: 1	Start: Dry End: Dry	Start: 4 End: 4	None
1	22/07/2020	Pre-dawn	Start: 03:10 End: 05:09	Start: 12 End: 12	Start: 91 End: 78	Start: 2 End: 2	Start: Dry End: Dry	Start: 8 End: 8	None

Transect no.	Date	Survey type	Start/ End time	Temp (°C)	Humidity (%)	Wind speed (Beaufort)	Precipitation	Cloud cover (0-8)	Observations
2	22/07/2020	Pre-dawn	Start: 03:07 End: 04:48	Start: 12 End: 14	Start: 91 End: 78	Start: 0 End: 0	Start: Dry End: Dry	Start: 8 End: 8	None
1	20/08/2020	Dusk	Start: 20:24 End: 22:35	Start: 18 End: 17	Start: 56 End: 63	Start: 2 End: 3	Start: Dry End: Dry	Start: 5 End: 5	None
2	20/08/2020	Dusk	Start: 20:24 End: 22:30	Start: 19 End: 17	Start: 56 End: 63	Start: 2 End: 3	Start: Dry End: Dry	Start: 4 End: 5	None
1	09/09/2020	Dusk	Start: 19:40 End: 21:54	Start: 13 End: 11	Start: 79 End: Not recorded	Start: 2 End: 1	Start: Dry End: Dry	Start: 8 End: 8	None
1	10/09/2020	Pre-dawn	Start: 04:30 End: 06:35	Start: 8 End: 10	Start: Not recorded End: Not recorded	Start: 1 End: 1	Start: Dry End: Dry	Start: 0 End: 0	None
2	09/09/2020	Dusk	Start: 19:37 End: 21:40	Start: 13 End: 11	Start: 79 End: Not recorded	Start: 2 End: 1	Start: Dry End: Dry	Start: 8 End: 8	None
2	10/09/2020	Pre-dawn	Start: 04:30 End: 06:30	Start: 8 End: 10	Start: Not recorded End: Not recorded	Start: 1 End: 1	Start: Dry End: Dry	Start: 0 End: 0	A fault with the detector meant the time was 20 minutes behind.

E.2 Summary of Transect One Results

Date	Number of each species					Total number of bats per survey
	Noctule	Common pipistrelle	Soprano pipistrelle	Myotis species	Species unknown	
23/10/2019	0	15	0	0	1	16
14/04/2020	0	18	0	0	7	25
12/05/2020	0	3	0	0	0	3
09/06/2020	0	27	0	0	1	28
22/07/2020	0	21	0	0	0	21
20/08/2020	0	27	1	1	0	29
09/09/2020	0	3	0	0	1	4
10/09/2020	0	0	0	0	0	0
Total number recorded across all surveys	**0**	**114**	**1**	**1**	**10**	**126**

E.3 Summary of Transect Two Results

Date	Number of each species					Total number of bats per survey
	Noctule	Common Pipistrelle	Soprano Pipistrelle	Myotis sp	Species unknown	
23/10/2019	0	8	0	0	0	8
14/04/2020	0	4	0	0	0	4
12/05/2020	0	2	0	0	0	2

Date	Number of each species					Total number of bats per survey
	Noctule	Common Pipistrelle	Soprano Pipistrelle	Myotis sp	Species unknown	
09/06/2020	1	8	2	0	0	11
22/07/2020	0	14	0	1	0	15
20/08/2020	0	9	0	0	0	9
09/09/2020	0	2	0	0	1	3
10/09/2020	0	0	0	0	0	0
Total number recorded across all surveys	**1**	**47**	**2**	**1**	**1**	**52**

Appendix F. Bat Roost Survey Results

F.1 External and internal inspections undertaken in 2017/ 2018

Structure ID	Location	Known roost (Hyder, 2005)	Internal inspection undertaken 2017	Brief description	Overall roosting suitability assessment
S1	Access shaft	No	No, no internal space	Small United Utilities Water Plc stone-built access shaft situated within a grazed field. The external wall was in very good condition and did not provide any suitable bat roosting features. The top of the structure comprised a domed mesh with a flat concrete roof. No suitable roosting features or entry/ exit points were identified. No bats or signs of bats identified.	Negligible
S2	Wall west of Roe Cross Road	No	No, no internal space	Stone wall located west of Roe Cross Road and nearby stables. The wall contained multiple crevices which could be used by individual bats opportunistically. The stables had a small number of crevices behind wooden boarding. No bats or signs of bats identified.	Low
S3	8A Old Road	No	No	One storey residential building with detached garage. Rendered walls and gable roof with concrete tiles. Hanging tiles on both gable ends	Low
S4	8B Old Road	No	No	One storey residential building with detached garage. Rendered walls and gable roof with concrete tiles. Hanging tiles on both gable ends. Two hanging tiles were missing. No bats or signs of bats identified.	Low
S5	8C Old Road	No	Yes	One storey residential building with detached garage. Rendered walls and gable roof with concrete tiles. Small number of gaps within soffit boxes, wooden cladding and ridge tiles. No bats or signs of bats identified.	Low
S6	17 Old Road	Potential	Yes	One storey residential building with detached garage. Brick cavity wall and gable roof with concrete tiles. The building has recently been re-roofed (2016) no suitable roosting features or entry/ exit points were identified. No bats or signs of bats identified.	Negligible

Structure ID	Location	Known roost (Hyder, 2005)	Internal inspection undertaken 2017	Brief description	Overall roosting suitability assessment
S7	19 Old Road	Potential	Yes	Two storey residential building with detached garage. Brick cavity wall and hip/ gable and valley roof with concrete tiles. Gaps present along soffits, on western gable end and within roof tiles. No bats or signs of bats identified.	High
S8	21 Old Road	No	Yes	Two storey residential building with detached garage. Brick solid wall and hipped roof with concrete tiles. Gaps present along eaves, fascias, and hanging tiles. No bats or signs of bats identified.	High
S9	21A Old Road	No	Yes	Two storey residential building with detached garage. Brick cavity wall and gable roof with concrete tiles. Gaps present under roof tiles, missing mortar on chimney and behind fascia. No bats or signs of bats identified	Moderate
S10	2A Old Hall Lane	Yes	Yes	Two storey residential building with adjoining flat-roofed garage and shed. Brick cavity wall and gable and flat roofs with concrete tiles. Gaps in missing mortar, under lead flashing and roofing felt, behind alarm box and soffit boxes. One pipistrelle bat was found roosting under roofing felt on the westfacing aspect of the shed located to the north of the building. A small number of fresh bat droppings (c. 10) were present below the roosting area. No bats or signs of bats found within the loft.	High
S11	2B Old Hall Lane	Yes	Yes	Two storey residential building. Brick cavity wall and gable, flat and lean-to roofs with concrete tiles. Gaps under lead flashing and in missing mortar on both gable ends and, on the chimney, located on the northern aspect. No bats or signs of bats identified. The occupier reported seeing c. 40 bats emerging from the chimney in 2005. Since then, the chimney had been capped. In summer 2017, a bat was found by the occupiers within the living room, next to the chimney.	High
S12	4A Old Hall Lane (The Chestnuts)	No	No	Two storey residential building with detached garage, adjoining 4 Old Hall Lane. Solid stone wall and gable roof with concrete tiles. No obvious suitable roosting features or entry/ exit points were identified from an external	Low

Structure ID	Location	Known roost (Hyder, 2005)	Internal inspection undertaken 2017	Brief description	Overall roosting suitability assessment
				inspection, but low roosting suitability was assumed as worst-case scenario. No bats or signs of bats identified.	
S13	4 Old Hall Lane	No	No	Two storey residential building with detached garage, adjoining 4A Old Hall Lane. Solid stone wall and gable roof with concrete tiles. No obvious suitable roosting features or entry/ exit points were identified from an external inspection, but low roosting suitability was assumed as worst-case scenario. No bats or signs of bats identified.	Low
S14	6 Old Hall Lane	No	Yes	Two storey residential building with adjoining flat-roofed garage. Rendered brick cavity and gable roof with concrete tiles. Gap along gable ends, ridge tiles and behind roofing felt. No bats or signs of bats identified.	Low
S15	Garages of 3-4 Tollemache Close	No	No	One storey garages comprised of brick cavity wall and a flat-roof covered with roofing felt. No suitable roosting features or entry/ exit points were identified. No bats or signs of bats identified.	Negligible
S16	5 Tollemache Close	Yes	Yes	Two storey semi-detached house, adjoining 6 Tollemache Close. Brick cavity wall and gable roof with concrete tiles. Gap along gable end provided access into the loft space. No bats or signs of bats identified. High roosting suitability was assumed as worst-case scenario due to the historical presence of a bat roost.	High
S17	6 Tollemache Close	Yes	No	Two storey semi-detached house, adjoining 5 Tollemache Close. Brick cavity wall and gable roof with concrete tiles. No obvious suitable roosting features or entry/ exit points were identified from an external inspection, but high roosting suitability was assumed as worst-case scenario due to the historical presence of a bat roost. No bats or signs of bats identified	High
S18	7 Tollemache Close	Yes	Yes	Two storey end-of-terrace house, adjoining 8 Tollemache Close. Brick cavity wall and gable roof with concrete tiles. Gap between soffit box and wall. No	High

Structure ID	Location	Known roost (Hyder, 2005)	Internal inspection undertaken 2017	Brief description	Overall roosting suitability assessment
				bats or signs of bats identified. High roosting suitability was assumed as worst-case scenario due to the historical presence of a bat roost.	
S19	8 Tollemache Close	No	Yes	Two storey mid-terrace house, adjoining 7 and 9 Tollemache Close. Brick cavity wall and gable roof with concrete tiles. Gap between soffit box and wall. No bats or signs of bats identified. High roosting suitability was assumed as worst-case scenario due to the historical presence of a bat roost within adjoining properties.	High
S20	9 Tollemache Clse	Yes	No	Two storey end-of-terrace house, adjoining 8 Tollemache Close. Brick cavity wall and gable roof with concrete tiles. Gap along gable end provided access into the loft space. No bats or signs of bats identified. High roosting suitability was assumed as worst-case scenario due to the historical presence of a bat roost.	High
S21	Stable Block at 103 Mottram Moor	No	Yes	One storey stable block. Solid stone walls and gable roof with slate tiles. Circular open windows and gaps along the eaves provided access for bats into the building. No bats or signs of bats identified.	Low
S22	Mottram Moor Farm	No	No	Two two storey detached residential buildings (named 'The Barn' and 'The Farmhouse') with detached garages. All buildings had solid stone walls and gable roofs with concrete tiles. No suitable roosting features or entry/ exit points were identified on 'The Barn'. On 'The Farmhouse', gaps were present on soffit boxes of the house and along the gable ends of the garage. No bats or signs of bats identified.	Moderate
S23	8 Carrhouse Lane	No	Yes	Two storey residential building with adjoining garage. Solid stone walls and gable and valley roof with slate tiles. Gaps along security lighting cabling, along eaves, under lead flashing and between wall and soffit. A small number of bat droppings (c. 10) were present within the garage loft space (on the west side of the house). One bat dropping was present within the loft space located to the south east	Confirmed Roost

Structure ID	Location	Known roost (Hyder, 2005)	Internal inspection undertaken 2017	Brief description	Overall roosting suitability assessment
S24	Nettle Hall Farm	No	No	The landowner denied access for either an external or internal survey to be undertaken. As such, the bat roosting suitability of this building is unknown.	Unknown
S25	Nettle Hall Barn	No	No	Two storey residential building with detached garage. Solid stone walls and gable and valley roof with concrete tiles. Gaps under roof tiles. No bats or signs of bats identified.	Low
S26	177-189 Mottram Moor	No	No	Row of two storey terraced houses. Solid stone walls and gable roof with slate tiles. Gaps under roof tiles and missing mortar along the eastern gable end. No bats or signs of bats identified.	Low
S27	Used car dealer north of Mottram Moor	No	No	One storey commercial unit. Solid stone walls and gable roof with concrete tiles. No suitable roosting features or entry/ exit points were identified from an external inspection, but low roosting suitability was assumed as worst-case scenario. No bats or signs of bats identified	Low
S28	36-50 Mottram Moor	No	No	Row of two storey terraced houses. Solid stone walls and gable roof with slate tiles. Gaps under roof tiles. No bats or signs of bats identified.	Low
S29	52-54 Mottram Moor	No	Yes	Two semi-detached two storey houses. Solid stone walls and gable roof with slate tiles. Gaps under roof tiles, No bats or signs of bats identified.	Low
S30	56 Mottram Moor	No	No	Detached two storey residential building. Solid stone walls and gable roof with slate tiles. Gaps under roof tiles and behind fascia board on southern elevation. No bats or signs of bats identified	Moderate
S31	60 Mottram Moor	No	No	Detached two storey residential building. Solid stone walls and gable and valley roof with slate tiles. Gaps under roof tiles, under lead flashing, in missing mortar and gable end and behind alarm box. No bats or signs of bats identified	Moderate

Structure ID	Location	Known roost (Hyder, 2005)	Internal inspection undertaken 2017	Brief description	Overall roosting suitability assessment
S32	1-7 and 13-15 Mottram Moor	No	Yes*	* Internal inspection undertaken of No. 1, 3, 5 and 13 Mottram Moor only. Row of two storey terraced houses. Solid stone walls and gable roof with slate tiles. Gaps under roof tiles and behind hanging tiles on dormer windows. No bats or signs of bats identified.	Low
S33	9-11 Mottram Moor	No	No	Detached two storey residential building. Solid stone walls and gable roof with slate tiles. Gaps under roof tiles and behind fascia board on southern elevation. No bats or signs of bats identified	Low
S34	21-23 Woolley Bridge (Home Farm)	No	No	Detached two storey residential building. Solid stone walls and gable roof with slate tiles. Gaps under roof tiles, behind fascia board on eastern and western elevation, under lead flashing on four chimneys and in missing mortar on northern and southern gable ends. No access to loft space (considered unsafe and the hatch is screwed in). Undisturbed loft space with loft insulation, but the occupier said it is wet (and potentially cold/ draughty due to the lack of underfelt). No bats or signs of bats identified.	High
S35	Units J,H,K and L, Roe Cross	No	No**	**The occupiers of the business units do not use the buildings regularly and it was therefore not possible to undertake the survey while they were available to provide internal access. This was not considered to be a constraint. Single-storey industrial/ commercial building divided internally into four units. Brick cavity wall and gable roof with concrete tiles. Multiple gaps on the soffit box and between the soffit and the wall on all aspects of the building provide suitable roosting opportunities. Round openings (to the north and south) and vents (to the south) on the brick wall provide access into the cavity wall. Gaps on top of roller shutters to the north provide access into the interior of the building.	Moderate

Structure ID	Location	Known roost (Hyder, 2005)	Internal inspection undertaken 2017	Brief description	Overall roosting suitability assessment
S36	36 Four Lanes	No	Yes	Detached one storey residential building. Cavity brick walls. L-shaped floor plan. Gable roofs with concrete tiles. Adjoining garage to the front (south east facing) with flat felt-covered roof. One loft space, with underfelt and insulation. There were many objects stored in the loft, covering the majority of the space and the joists were hidden under insulation. As such, it was not considered safe to inspect the loft. No bats or signs of bats were identified from the hatch. There were gaps in the soffit box, along eaves, under lead flashing, along gable ends and behind the alarm box. These features allow access into the loft space, cavity wall and between tiles and underfelt, and provide roosting opportunities. No bats or signs of bats identified externally.	Moderate
S37	38 Four Lanes	No	Yes	Detached one storey residential building. Cavity brick walls. L-shaped floor plan. Gable roofs with concrete tiles. Adjoining garage to the front (south east facing) with flat felt-covered roof. Detached metal shed to south east. One loft space, with underfelt and insulation. No bats or signs of bats identified. Part of the loft space was not accessed as there was no boarding or wooden joists. Multiple gaps in soffit box, along eaves, under lead flashing and along gable ends. These features provide access into the loft space and/ or roosting opportunities. No bats or signs of bats identified.	Moderate
S38	40 Four Lanes	No	Yes	Detached one storey residential building. Cavity brick walls. Chimney to the east. Hipped roofs with concrete tiles. Adjoining brick garage to north west. Garage loft boarded, uninsulated and with underfelt. No bats or signs of bats identified. House loft not boarded, insulated and with underfelt. Underfelt broken in two places. No bats or signs of bats identified. Gaps in soffit box (3) and under ridge tiles (1). These features provide access into the loft space and/ or roosting opportunities. No bats or signs of bats identified.	Low

Structure ID	Location	Known roost (Hyder, 2005)	Internal inspection undertaken 2017	Brief description	Overall roosting suitability assessment
S39	25 Four Lanes	No	Yes	Detached one storey residential building. Cavity brick walls insulated with mineral wool. L-shaped floor plan. Gable and hipped roofs with concrete tiles. Adjoining garage to the front (north west facing) and extension to the back (south west facing) with flat felt-covered roof. One loft space, with underfelt and insulation. The underfelt was damaged in some areas. No bats or signs of bats identified. Multiple gaps in soffit boxes, along eaves, under lead flashing, missing mortar between tiles at gable ends, between displaced tiles and behind roofing felt on flat roofs. These features provide access into the loft space and/ or roosting opportunities. No bats or signs of bats identified	Moderate
S40	Outbuildings at Robin Hood Farm	No	No, no internal space	Two disused polytunnel frames with no covering. No suitable roosting features or entry/ exit points were identified. No bats or signs of bats identified.	Negligible
S41	Outbuildings at Tara Brook Farm	No	Yes	Group of outbuildings and sheds located to the south and south east of the farmhouse. Brick storage outbuilding: Single-storey building with solid brick wall and gable roof with slates. Two bird boxes to west. No loft space. Roof lined internally with wooden boards. Lifted fascia board (to west), lifted roof slates and gaps behind the boards lining the roof provide suitable roosting features. Vents to the north and south provide access into the building. Low suitability. Dog kennels: Open-fronted metal shed with lean-to roof adjacent south to brick storage outbuilding. Potential access by bats as it is open-fronted, but no suitable roosting features were identified. No bats or signs of bats identified. Negligible suitability.	Low (Brick storage building only)

Structure ID	Location	Known roost (Hyder, 2005)	Internal inspection undertaken 2017	Brief description	Overall roosting suitability assessment
				Large wooden sheds: Two large wooden sheds adjacent to south of dog kennels. Both in good condition and with gable roofs. No suitable roosting features or entry/ exit points were identified. No bats or signs of bats identified. Negligible suitability. Small wooden sheds: Two small wooden sheds with gable roofs. Both had small gaps, but they were damp inside. No suitable roosting features were identified. No bats or signs of bats identified. Negligible suitability. Glasshouse: Small glass house with gable roof. No suitable roosting features or entry/ exit points were identified. No bats or signs of bats identified. Negligible suitability	
S42	11-15 Old Hall Lane	No	No	Row of two storey terraced houses with an outbuilding. Solid stone walls and gable roof with slate tiles. Gaps under roof tiles and along fascia boards to the east and west of the building. No bats or signs of bats identified.	Moderate

F.2 Emergence/ Re-entry Survey Results 2017 – Structures

Structure ID	Location	Date	Visit No.	Dusk/ dawn	Start/ end	Sunset/ sunrise	Temperature (°C)	Precipitation	Cloud cover (1/8-8/8)	Wind Speed (Beaufort)	Emergence / Re-entry recorded?
S2	Wall west of Roe Cross Road	19/06/2017	1 of 1 (S)	Dusk	21:40 / 23:11	21:41	Start: 24 End: 2	Start: 0 End: 0	Start: 3 End: 3	Start: 0 End: 0	No
		20/06/2017	1 of 1 (N)	Dusk	21:40 / 23:11	21:41	Start: 24 End: 2	Start: 0 End: 0	Start: 3 End: 3	Start: 0 End: 0	No
S3	8A Old Road	17/07/2017	1 of 1	Dusk	21:20/ 22:55	21:27	Start: 19 End: 19	Start: 0 End: 0	Start: 3 End: 3	Start: 1 End: 1	No
S4	8B Old Road	03/07/2017	1 of 1	Dusk	21:25/ 23:00	21:39	Start: 15 End: 14	Start: 0 End: 0	Start: 1 End: 1	Start: 0 End: 0	No
S5	8C Old Road	31/07/2017	1 of 1	Dusk	20:52/ 22:36	21:05	Start: 18 End: 15	Start: 2 End: 0-2	Start: 5 End: 8	Start: 1 End: 1	No
S7	19 Old Road	17/07/2017	1 of 3	Dusk	21:20/ 22:55	21:27	Start: 19 End: 19	Start: 0 End: 0	Start: 3 End: 3	Start: 1 End: 1	No
		15/08/2017	2 of 3	Dawn	03:48/ 05:47	05:48	Start: 13 End: 13	Start: 0 End: 0	Start: 8 End: 8	Start: 0 End: 1	No
		26/09/2017	3 of 3	Dusk	18:42/ 20:12	18:58	Start: 16 End: 15	Start: 0 End: 0	Start: 1 End: 8	Start: 0 End: 0	No
S8	21 Old Road	01/08/2017	1 of 3	Dusk	20:56/ 22:32	21:04	Start: 16 End: 16	Start: 0 End: 0	Start: 8 End: 8	Start: 2 End: 2	No

Structure ID	Location	Date	Visit No.	Dusk/ dawn	Start/ end	Sunset/ sunrise	Temperature (°C)	Precipitation	Cloud cover (1/8-8/8)	Wind Speed (Beaufort)	Emergence / Re-entry recorded?
		16/08/2017	2 of 3	Dawn	03:50 / 05:50	05:50	Start: 9 End: 9	Start: 0 End: 0	Start: 3 End: 2	Start: 0 End: 0	Yes Common pipistrelle: 1 from ridge tile.
		30/08/2017	3 of 3	Dusk	19:45/ 21:33	20:03	Start: 14.3 End: 12.5	Start: 0 End: 0	Start: 0 End: 0	Start: 1 End: 1	Yes Common pipistrelle: 1 from ridge tile.
S9	21A Old Hall Road	09/08/2017	1 of 2	Dusk	20:35/ 22:35	20:50	Start: 14.4 End: 12.5	Start: 0 End: 0	Start: 0 End: 0	Start: 3 End: 3	No
		24/08/2017	2 of 2	Dawn	04:03/ 06:05	06:03	Start: 12 End: 12	Start: 0 End: 0	Start: 4 End: 4	Start: 1 End: 1	No
S10	2A Old Hall Lane	01/08/2017	1 of 3	Dusk	20:50/ 22:20	21:05	Start: 14 End: 13	Start: 0 End: 0	Start: 7 End: 7	Start: 1 End: 1	Yes Common pipistrelle: 1 from fascia board on western aspect of shed located to the north of the building.

Structure ID	Location	Date	Visit No.	Dusk/ dawn	Start/ end	Sunset/ sunrise	Temperature (°C)	Precipitation	Cloud cover (1/8-8/8)	Wind Speed (Beaufort)	Emergence / Re-entry recorded?
		17/08/2017	2 of 3	Dusk	20:02/ 22:01	20:32	Start: 19 End: 17	Start: 0 End: 0-1	Start: 6 End: 4	Start: 1 End: 1	Yes Common pipistrelle: 2 (1 from fascia board on western aspect of shed located to the north of the building; 1 from fascia board on western aspect of the building).
		01/09/2017	3 of 3	Dawn	04:45/ 06:16	06:16	Start: 7.8 End: 7.9	Start: 0 End: 0	Start: 0 End: 8	Start: 1 End: 1	No
S11	2B Old Hall Lane	12/07/2017	1 of 3	Dusk	21:20/ 23:10	21:38	Start: 20 End: 20	Start: 0 End: 0	Start: 6 End: 6	Start: 0 End: 0	Yes Common pipistrelle: 1 from chimney on northern

Structure ID	Location	Date	Visit No.	Dusk/ dawn	Start/ end	Sunset/ sunrise	Temperature (°C)	Precipitation	Cloud cover (1/8-8/8)	Wind Speed (Beaufort)	Emergence / Re-entry recorded?
											aspect of the building
		03/08/2017	2 of 3	Dusk	20:44/ 22:25	21:01	Start: 16 End: 14	Start: 0 End: 0	Start: 4 End: 8	Start: 2 End: 2	Yes Common pipistrelle: 1 from chimney on northern aspect of the building.
		06/09/2017	3 of 3	Dawn	04:56/ 06:25	06:25	Start: 11 End: 11	Start: 0 End: 0	Start:7 End: 6	Start: 0 End: 0	No
S12	A2 Old Hall Lane (The Chestnuts)	11/072017	1 of 1	Dusk	21:20/ 23:10	21:37	Start: 12 End: 12	Start: 0 End: 0	Start: 6 End: 6	Start: 2 End: 2	No
S13	4 Old Hall Lane	11/07/2017	1 of 1	Dusk	21:20/ 23:10	21:37	Start: 12 End: 12	Start: 0 End: 0	Start: 6 End: 6	Start: 2 End: 2	No
S14	6 Old Hall Lane	04/09/2017	1 of 1	Dusk	19:37/ 21:11	19:52	Start: 20 End: 17	Start: 0 End: 4	Start: 8 End: 8	Start: 1 End: 1	No
S16	5 Tollemache Close	10/07/2017	1 of 3	Dusk	21:20/ 23:10	21:38	Start: 16.5 End: 16.5	Start:0 End: 0	Start: 8 End: 5	Start: 1 End: 1	No

Structure ID	Location	Date	Visit No.	Dusk/ dawn	Start/ end	Sunset/ sunrise	Temperature (°C)	Precipitation	Cloud cover (1/8-8/8)	Wind Speed (Beaufort)	Emergence / Re-entry recorded?
		27/07/2017	2 of 3	Dusk	21:00/ 22:45	21:13	Start: 15 End: 13	Start:2 End: 0	Start: 5 End: 8	Start: 1 End: 3	Yes Common pipistrelle: 1 from behind alarm box on northern aspect of building
		07/09/2017	3 of 3	Dawn	04:55/ 06:27	06:27	Start: 11 End: 10	Start:0 End: 0	Start: 2 End: 2	Start: 3 End: 0	No
S17	6 Tollemache Close	07/08/2017	1 of 3	Dusk	20:40/ 22:40	20:54	Start: 15.3 End: 14.1	Start: 0 End: 0	Start: 2 End: 8	Start: 2 End: 2	No
		23/08/2017	2 of 3	Dusk	20:05/ 21:50	20:20	Start: 17 End: 15	Start: 0 End: 0	Start: 2 End: 0	Start: 1 End: 1	No
		12/09/2017	3 of 3	Dawn	04:37/ 06:37	06:37	Start: 10 End: 10	Start: 0 End: 0	Start: 3 End: 3	Start:3 End: 3	No
S18	7 Tollemache Close	29/06/2017	1 of 3	Dusk	21:25/ 23:10	21:40	Start: 14 End: 13	Start: 2 End: 2	Start: 8 End: 8	Start: 1 End: 1	No
		18/07/2017	2 of 3	Dusk	20:55/ 22:55	21:25	Start: 21 End: 21	Start: 0 End: 0	Start: 3 End: 3	Start: 4 End: 4	No

Structure ID	Location	Date	Visit No.	Dusk/ dawn	Start/ end	Sunset/ sunrise	Temperature (°C)	Precipitation	Cloud cover (1/8-8/8)	Wind Speed (Beaufort)	Emergence / Re-entry recorded?
		15/09/2017	3 of 3	Dawn	05:15/ 06:31	06:31	Start: 8 End: 8	Start: 1 End: 1	Start: 8 End: 8	Start: 3 End: 3	No
S19	8 Tollemache Close	10/07/2017	1 of 3	Dusk	21:20/ 23:10	21:38	Start: 16.5 End: 16.5	Start: 0 End: 0	Start: 5 End: 5	Start: 1 End: 1	No
		19/07 2017	2 of 3	Dawn	03:04/ 05:04	05:04	Start: 15 End: 15	Start: 0 End: 0	Start: 8 End: 8	Start: 6 End: 6	No
		31/08/2017	3 of 3	Dusk	29:40/ 21:31	20:01	Start: 16.3 End: 14.3	Start: 0 End: 0	Start: 2 End: 0	Start: 1 End: 1	No
S20	9 Tollemache Close	03/08/2017	1 of 3	Dusk	20:45/ 22:30	21:00	Start: 16 End: 14	Start: 0 End: 0	Start: 4 End: 2	Start: 1 End: 0	Yes Unknown (no echolocation): 3 from western gable end of the building.
			2 of 3	Dusk	20:04/ 21:52	20:22	Start: 19 End: 19	Start: 0 End: 0	Start: 8 End: 8	Start: 1 End: 1	Yes Common pipistrelle: 1 from western gable end of the building.
			3 of 3	Dusk	19:32/ 21:17	19:47	Start: 14 End: 12	Start: 0 End: 0	Start: 8 End: 8	Start: 2 End: 0	Yes Common pipistrelle: 1

Structure ID	Location	Date	Visit No.	Dusk/ dawn	Start/ end	Sunset/ sunrise	Temperature (°C)	Precipitation	Cloud cover (1/8-8/8)	Wind Speed (Beaufort)	Emergence / Re-entry recorded?
											from western gable end of the building.
S21	Stable block at 103 Mottram Moor	27/06/2017	1 of 1	Dusk	21:25/ 23:15	21:41	Start: 15 End: 13	Start: 0-1 End: 0	Start: 8 End: 8	Start: 1 End: 1	No
S22	Mottram Moor Farm	20/07/2017	1 of 2	Dusk	21:10/ 22:53	21:23	Start:14 End: 12	Start: 0 End: 0	Start: 8 End: 8	Start: 2 End: 2	No
		18/08/2017	2 of 2	Dawn	03:50/ 05:52	05:52	Start: 13 End: 13	Start: 0-2 End: 0-2	Start: 8 End: 8	Start: 1 End: 1	No
S23	8 Carrhouse Lane	30/06/2017	1 of 3	Dawn	03:18/ 04:48	04:48	Start: 11 End: 12	Start: 0 End: 0	Start: 8 End: 8	Start: 0 End: 0	Yes Unknown (no echolocation): 1 into gable end on south-west aspect of building
		24/07/2017	2 of 3	Dusk	21:05/ 22:50	21:19	Start: 19 End: 19	Start: 0 End: 0	Start: 2 End: 2	Start: 0 End: 0	Yes Common pipistrelle: 1 from gable end on south-west aspect of building

Structure ID	Location	Date	Visit No.	Dusk/ dawn	Start/ end	Sunset/ sunrise	Temperature (°C)	Precipitation	Cloud cover (1/8-8/8)	Wind Speed (Beaufort)	Emergence / Re-entry recorded?
		29/08/2017	3 of 3	Dusk	19:50/ 21:40	20:06	Start:15.5 End: 12.7	Start: 0 End: 0	Start: 6 End: 6	Start: 1 End: 1	No
S25	Nettle Hall Barn	21/08/2017	1 of 1	Dusk	20:00/ 21:49	20:25	Start: 17 End: 16	Start: 0 End: 0	Start: 8 End: 8	Start: 1 End: 0	No
S26	177-189 Mottram Moor	06/07/2017	1 of 1	Dusk	21:20 / 23:10	21:37	Start: 19 End: 19	Start: 0 End: 0	Start: 6 End: 6	Start: 1 End: 1	No
S27	Used car dealer north of Mottram Moor	04/07/2017	1 of 1	Dusk	21:25/ 23:08	21:39	Start: 17 End: 16	Start: 0 End: 0	Start: 3 End: 3	Start: 8 End: 8	No
S28	36-50 Mottram Moor	13/07/2017	1 of 1	Dusk	21:15/ 22:50	21:32	Start: 17 End: 15	Start: 0 End: 0	Start: 6 End: 6	Start: 1 End: 1	No
S29	52-54 Mottram Moor	27/07/2017	1 of 3	Dusk	21:00 22:40	21:18	Start: 16 End: 16	Start: 2 End: 0	Start: 5 End: 5	Start: 2 End: 2	No
		10/08/2017	2 of 3	Dusk	20:30 22:07	20:47	Start: 14.3 End: 12.8	Start: 0 End: 0	Start: 4 End: 4	Start: 2 End: 3	No
		31/08/2017	3 of 3	Dawn	04:48 06:15	06:15	Start: 8 End: 6.5	Start: 0 End: 0	Start: 7 End: 2	Start: 1 End: 1	No
S30	56 Mottram Moor	27/07/2017	1 of 3	Dusk	21:00/ 22:40	21:18	Start: 16 End: 16	Start: 2 End: 0	Start: 5 End: 5	Start: 2 End: 2	Yes Common pipistrelle: 1

Structure ID	Location	Date	Visit No.	Dusk/ dawn	Start/ end	Sunset/ sunrise	Temperature (°C)	Precipitation	Cloud cover (1/8-8/8)	Wind Speed (Beaufort)	Emergence / Re-entry recorded?
											from behind fascia board on southern aspect of building.
		10/08/2017	2 of 3	Dusk	20:30/ 22:07	20:47	Start: 14.3 End: 12.8	Start: 0 End: 0	Start: 4 End: 4	Start: 2 End: 3	Yes Common pipistrelle: 1 from behind fascia board on southern aspect of building.
		31/08/2017	3 of 3	Dawn	04:48/ 06:15	06:15	Start: 8 End: 6.5	Start: 0 End: 0	Start: 7 End: 2	Start: 1 End: 1	No
S31	60 Mottram Moor	25/07/2017	1 of 3	Dusk	21:00/ 22:42	21:16	Start: 20 End: 18	Start: 0 End: 0	Start: 5 End: 5	Start: 1 End: 1	Yes Common pipistrelle: 1 from behind alarm box on southern aspect of building.
		09/08/2017	2 of 3	Dawn	04:07/ 05:45	05:37	Start: 12.4 End: 13	Start: 0-2 End: 0 -2	Start: 8 End: 8	Start: 2 End: 3	No

Structure ID	Location	Date	Visit No.	Dusk/ dawn	Start/ end	Sunset/ sunrise	Temperature (°C)	Precipitation	Cloud cover (1/8-8/8)	Wind Speed (Beaufort)	Emergence / Re-entry recorded?
		30/08/2017	3 of 3	Dusk	19:52/ 21:36	20:03	Start: 14 End: 13	Start: 0 End: 0	Start: 0 End: 0	Start: 2 End: 2	No
S32	1 – 7 and 13-15 Mottram Moor	08/08/2017	1 of 1	Dusk	20:35/ 22:00	20:51	Start: 12.8 End: 12.8	Start: 1 End: 4	Start: 8 End: 8	Start: 2 End: 3	Yes Common pipistrelle: 2 from hanging tiles on southern aspect of dormer window on the roof of no. 13.
		22/08.2017	2 of 3	Dawn	04:07/ 06:01	05:59	Start: 16 End: 16	Start: 0 End: 0	Start: 8 End: 8	Start: 8 End: 0	Yes Common pipistrelle: 1 into hanging tiles on southern aspect of dormer window on the roof of no. 13
		05/09.2017	3 of 3	Dusk	19:34/ 21:23	29:49	Start: 15 End: 13	Start: 0 End: 0	Start: 7 End: 1	Start: 1 End: 0	Yes Common pipistrelle: 3 (2 from behind fascia

Structure ID	Location	Date	Visit No.	Dusk/ dawn	Start/ end	Sunset/ sunrise	Temperature (°C)	Precipitation	Cloud cover (1/8-8/8)	Wind Speed (Beaufort)	Emergence / Re-entry recorded?
											board on south-western aspect of dormer window on the roof of no. 13; 1 from under roof tile to the south-east of dormer window on the roof of no. 13). Soprano pipistrelle: 1 from behind fascia board on south-western aspect of dormer window on the roof of no. 13.
S33	9-11 Mottram Moor	08/08/2017	1 of 3	Dusk	20:35/ 22:00	20:51	Start: 12.8 End: 12.8	Start: 1 End: 4	Start: 8 End: 8	Start: 2 End: 3	No
		22/08/2017	2 of 3	Dawn	04:07/ 06:01	05:59	Start: 16 End: 16	Start: 0 End: 0	Start: 8 End: 8	Start: 0 End: 0	No

Structure ID	Location	Date	Visit No.	Dusk/ dawn	Start/ end	Sunset/ sunrise	Temperature (°C)	Precipitation	Cloud cover (1/8-8/8)	Wind Speed (Beaufort)	Emergence / Re-entry recorded?
		05/09/2017	3 of 3	Dusk	19:34/ 21:23	19:49	Start:15 End: 13	Start: 0 End: 0	Start: 7 End: 1	Start: 1 End: 0	Yes Common pipistrelle: 1 from behind fascia board on southern aspect of building.
S35	Units J, H, K and L, Roe Cross Industrial Estate	08/05/2018	1 of 3	Dusk	20:20/ 22:22	20:50	Start: 12 End: 10	Start: 0 End: 0	Start: 6 End: 6	Start: 1 End: 1	Yes Common pipistrelle: 1 from gable end on eastern aspect of building
		05/06/2018	2 of 3	Dawn	03:05/ 04:43	04:43	Start: 10 End: 10	Start: 0 End: 0	Start: 8 End: 8	Start: 2/4 End: 2/4	Yes Common pipistrelle: 1 returning to gable end on eastern aspect of building.
		18/06/2018	3 of 3	Dusk	21:25/ 22:45	21:40	Start: 16 End: 15	Start: 1 End: 2	Start: 8 End: 8	Start: 5 End: 5	No

Structure ID	Location	Date	Visit No.	Dusk/ dawn	Start/ end	Sunset/ sunrise	Temperature (°C)	Precipitation	Cloud cover (1/8-8/8)	Wind Speed (Beaufort)	Emergence / Re-entry recorded?
S36	36 Four Lanes	03/05/2018	1 of 2	Dusk	20:20/ 22:10	20:41	Start: 11 End: 10	Start: 0 End: 0	Start: 8 End: 8	Start: 0 End: 1	No
		30/05/2018	2 of 2	Dawn	03:10/ 04:48	04:48	Start: 12 End: 11	Start: 0 End: 0	Start: 7 End: 7	Start: 1 End: 1	No
S37	38 Four Lanes	17/05/2018	1 of 2	Dusk	20:37/ 22:22	21:05	Start: 12 End: 10	Start: 0 End: 0	Start: 0 End: 0	Start: 1 End: 1	No
		07/06/2018	2 of 2	Dawn	03:05/ 04:44	04:42	Start: 9 End: 9	Start: 0 End: 0	Start: 0 End: 0	Start: 1 End: 1	No
S38	40 Four Lanes	16/05/2018	1 of 1	Dusk	20:35/22: 15	21:03	Start: 10 End: 7	Start: 0 End: 0	Start: 0 End: 0	Start: 1 End: 1	No
S39	25 Four Lanes	02/05/2018	1 of 2	Dusk	20:21/22: 19	20:39	Start: 9 End: 8	Start: 0 End: 0	Start: 4 End: 1/2	Start: 4 End: 1/2	No
		22/05/2018	2 of 2	Dawn	03:25/04: 59	04:59	Start: 10 End: 10	Start: 0 End: 0	Start: 3 End: 2	Start: 2 End: 2	No
S41	Outbuilding at Tara Brook Farm	22/05/2018	1 of 1	Dusk	20:40/22: 42	21:12	Start: 14 End: 9	Start: 0 End: 0	Start:0 End: 0	Start: 3 End: 3	No
S42	11-15 Old Hall Lane	30/07/2018	1 of 3	Dusk	20:45/ 22:30	21:05	Start: 18 End: 16	Start: 0 End: 0	Start:6 End: 6	Start: 3 End: 3	Yes Common pipistrelle: 3 (2 from under separate

Structure ID	Location	Date	Visit No.	Dusk/ dawn	Start/ end	Sunset/ sunrise	Temperature (°C)	Precipitation	Cloud cover (1/8-8/8)	Wind Speed (Beaufort)	Emergence / Re-entry recorded?
											slates to the south-east of the building, 1 from under slate of extension to north-east of building).
		07/08/2018	2 of 3	Dusk	20:30/ 22:20	20:52	Start:17 End: 15	Start: 0 End: 0	Start: 8 End: 8	Start: 3 End: 3	Yes Common pipistrelle: 2 from under separate slates to the south-east of building.
		19/08/2018	3 of 3	Dawn	04:05/ 05:50	05:50	Start:12 End: 12	Start: 0 End: 0	Start: 5 End: 5	Start: 1 End: 1	Yes Common pipistrelle: 1 re- entered chimney to south- east of building.

Appendix G. Breeding Bird Species List

BTO Code	Species Common Name	Likely Breeding Status[141]	Justification and Breeding Evidence
B.	Blackbird	Probable	One or more pairs observed in suitable nesting habitat in breeding season
BC	Blackcap	Possible	Species observed in breeding season in suitable nesting habitat
BF	Bullfinch	See Table 3-11 for survey results and territory analysis.	N/A
BH	Black-headed Gull	See Table 3-11 for survey results and territory analysis.	N/A
BT	Blue Tit	Probable	One or more pairs observed in suitable nesting habitat in breeding season
BZ	Buzzard	Possible	Species observed in breeding season in suitable nesting habitat
C.	Carrion Crow	Probable	One or more pairs observed in suitable nesting habitat in breeding season
CA	Cormorant	Non-breeding	Species was recorded flying over on one or more occasions
CC	Chiffchaff	Possible	Species observed in breeding season in suitable nesting habitat
CD	Collared Dove	Probable	One or more pairs observed in suitable nesting habitat in breeding season
CG	Canada Goose	Probable	One or more pairs observed in suitable nesting habitat in breeding season
CH	Chaffinch	Probable	One or more pairs observed in suitable nesting habitat in breeding season
CO	Coot	Possible	Species observed in breeding season in suitable nesting habitat
CT	Coal Tit	Probable	One or more pairs observed in suitable nesting habitat in breeding season

[141]Assessment was made using the "Breeding Evidence" categories webpage from the British Trust for Ornithology, https://www.bto.org/our-science/projects/birdatlas/methods/breeding-evidence (accessed 12/10/2020)

BTO Code	Species Common Name	Likely Breeding Status[141]	Justification and Breeding Evidence
CU	Curlew	See Table 3-11 for survey results and territory analysis.	N/A
D.	Dunnock	See Table 3-11 for survey results and territory analysis.	N/A
DI	Dipper	See Table 3-11 for survey results and territory analysis.	N/A
FP	Feral Pigeon	Possible	Species observed in breeding season in suitable nesting habitat
GC	Goldcrest	Confirmed breeding	Recently fledged young were recorded during surveys
GD	Goosander	See Table 3-11 for survey results and territory analysis.	N/A
GH	Grasshopper Warbler	See Table 3-11 for survey results and territory analysis.	N/A
GL	Grey Wagtail	See Table 3-11 for survey results and territory analysis.	N/A
GO	Goldfinch	Probable	One or more pairs observed in suitable nesting habitat in breeding season
GR	Greenfinch	Possible	Species observed in breeding season in suitable nesting habitat
GS	Goosander	Possible	Species observed in breeding season in suitable nesting habitat
GT	Great Tit	Probable	One or more pairs observed in suitable nesting habitat in breeding season
H.	Grey Heron	See Table 3-11 for survey results and territory analysis.	N/A
HM	House Martin	See Table 3-11 for survey results and territory analysis.	N/A
HS	House Sparrow	See Table 3-11 for survey results and territory analysis.	N/A

BTO Code	Species Common Name	Likely Breeding Status[141]	Justification and Breeding Evidence
J.	Jay	Probable	One or more pairs observed in suitable nesting habitat in breeding season
JD	Jackdaw	Probable	One or more pairs observed in suitable nesting habitat in breeding season
K.	Kestrel	See Table 3-11 for survey results and territory analysis.	N/A
L.	Lapwing	See Table 3-11 for survey results and territory analysis.	N/A
LB	Lesser Black-backed Gull	See Table 3-11 for survey results and territory analysis.	N/A
LI	Linnet	See Table 3-11 for survey results and territory analysis.	N/A
LT	Long-tailed Tit	Probable	One or more pairs observed in suitable nesting habitat in breeding season
M.	Mistle Thrush	See Table 3-11 for survey results and territory analysis.	N/A
MA	Mallard	Probable	One or more pairs observed in suitable nesting habitat in breeding season
MG	Magpie	Probable	One or more pairs observed in suitable nesting habitat in breeding season
MH	Moorhen	Possible	Species observed in breeding season in suitable nesting habitat
MN	Mandarin Duck	Probable	One or more pairs observed in suitable nesting habitat in breeding season
NH	Nuthatch	Possible	Species observed in breeding season in suitable nesting habitat
PH	Pheasant	Probable	One or more pairs observed in suitable nesting habitat in breeding season
PW	Pied Wagtail	Possible	Species observed in breeding season in suitable nesting habitat
R.	Robin	Possible	Species observed in breeding season in suitable nesting habitat
RB	Reed Bunting	See Table 3-11 for survey results and territory analysis.	N/A

BTO Code	Species Common Name	Likely Breeding Status[141]	Justification and Breeding Evidence
RO	Rook	Probable	One or more pairs observed in suitable nesting habitat in breeding season
SD	Stock Dove	See Table 3-11 for survey results and territory analysis.	N/A
SG	Starling	See Table 3-11 for survey results and territory analysis.	N/A
SH	Sparrowhawk	Possible	Species observed in breeding season in suitable nesting habitat
SI	Swift	See Table 3-11 for survey results and territory analysis.	N/A
SL	Swallow	Possible	Species observed in breeding season in suitable nesting habitat
SM	Sand Martin	See Table 3-11 for survey results and territory analysis.	N/A
SN	Snipe	See Table 3-11 for survey results and territory analysis.	N/A
ST	Song Thrush	See Table 3-11 for survey results and territory analysis.	N/A
SW	Sedge Warbler	Possible	Species observed in breeding season in suitable nesting habitat
TC	Treecreeper	Possible	Species observed in breeding season in suitable nesting habitat
TO	Tawny Owl	See Table 3-11 for survey results and territory analysis.	N/A
WH	Whitethroat	Possible	Species observed in breeding season in suitable nesting habitat
WP	Wood Pigeon	Probable	One or more pairs observed in suitable nesting habitat in breeding season
WR	Wren	Possible	Species observed in breeding season in suitable nesting habitat

BTO Code	Species Common Name	Likely Breeding Status[141]	Justification and Breeding Evidence
WW	Willow Warbler	See Table 3-11 for survey results and territory analysis.	N/A

Appendix H. Barn Owl Results of Investigative Field Surveys & Nest Site Verification Surveys

Feature number	Feature name	Field survey notes	Barn owl evidence found	Classification	Distance from the Scheme boundary (m)
1	Old Mill Farm Outbuildings	A barn looking out over a field. Good access for barn owls was possible via a hole in the gable end wall. The building had some suitability for nesting.	None	PNS	188.56
2		A cow shed used regularly by cows but with a few perching opportunities present.	None found, however, heavy trampling by cows may have resulted in possible evidence being difficult to locate.	PRS	166.43
3		A cow shed with a few perching opportunities present. The building is heavily used by cows.	None found, however, heavy trampling by cows may have resulted in possible evidence being difficult to locate.	PRS	180.96
4		A grain storage shed. No nesting or roosting suitability.	None	Negligible	193.16
5		A grain storage shed. No nesting or roosting suitability.	None	Negligible	201.33
6	Grange Farm Outbuildings - Hay Loft	A hay storage barn with many hay bales. The bales are moved regularly. One stock dove eggshell was found. The eggshell was situated around dispersed white, downy feathers all of which had quills and	None	PNS	19.11

Feature number	Feature name	Field survey notes	Barn owl evidence found	Classification	Distance from the Scheme boundary (m)
		interspersed with grey dove feathers. Fresh looking rats' droppings dispersed around it.			
7	Grange Farm Barn Owl Box	A box situated on tree at the back of the property overlooking fields.	No evidence was found but this site was confirmed as barn owl breeding site in 2020 by the local Pennine Edge Barn Owl Group.	OBS	39.75
8	Grange Farm Outbuildings	An animal shed with some perching opportunities but no nesting suitability.	None	PRS	58.33
9		A wooden outbuilding with some perching opportunities, however, the building is shut up at night making it unsuitable for roosting and had no nesting suitability. High levels of animal movement within the building and human disturbance.	None	Negligible	34.93
10	Building at Former Cricket Club	A derelict and shut up building with some access points through a window board being vandalised and knocked in. Access for surveyors was possible. The building held no suitability for nesting but some roosting suitability within the building. However, the entrance and access points were small and therefore this is unlikely to be used as a roosting site.	None	Negligible	108.67
11	Carr House Farm Outbuildings	A vehicle shed which is kept constantly closed and had no suitable nesting spaces and no clear entrance points or perching opportunities.	None	Negligible	138.08

Feature number	Feature name	Field survey notes	Barn owl evidence found	Classification	Distance from the Scheme boundary (m)
12		An outbuilding with limited roosting potential with open sides and no nesting suitability.	None	Negligible	145.96
13		A cow shed with high levels of human disturbance. The building is kept open all times. The building had no nesting potential but some roosting opportunities.	None	PRS	140.76
14		A machinery shed contained within a building complex in different parts but all adjoined. One section had a mezzanine floor at the same level as the upper storey of a hay loft (Building 32) which has multiple possible barn owl access points. Many possible perching opportunities were available including large wooden beams. Cats were seen using the building with access to all areas of the barn including the mezzanine and the hay loft.	None	PNS	171.27
15		A stable block used for housing animals. The building provides many perching places and access points. A hayloft is present above (Building 31).	None	PNS	152.21
16		A hay shed used for storing large hay bales. The building is open sided and very light with many sky lights. It provides limited perching opportunities on metal beams. However, there were potential nesting opportunities on the higher hay bales. The hay bales are likely to be moved often resulting in high levels of	None	PNS	149.18

Feature number	Feature name	Field survey notes	Barn owl evidence found	Classification	Distance from the Scheme boundary (m)
		disturbance and the areas at the top of the hay bale stack are quite exposed.			
17		A wood shack where the cutting of logs occurs daily using machinery. Noises from sawing was loud and likely to result in high levels of disturbance. Perching opportunities exist but the building is so open, exposed and frequently used that roosting is unlikely. The building provides no suitable places for nesting.	None	N/A	117.69
31		An old hay loft now used for storage with very low levels of disturbance on the first storey and several possible entry point for barn owl. However, the ground floor and the surrounding courtyard are likely subject to high levels of human disturbance. Hay bales in the corners of the first storey provide suitable opportunities for nesting and roosting.	None	PNS	145.21
32		A hay loft above a complex of rooms (Building 14). A dead cat was present showing that cats had access to this space but that levels of human disturbance are low. A thin layer of hay was present on the floor and the space was being used as storage. The space provided definite nesting and roosting opportunities; however, the presence of cats is likely to deter and breeding attempts.	None	PNS	168.84

Feature number	Feature name	Field survey notes	Barn owl evidence found	Classification	Distance from the Scheme boundary (m)
18	Home Farm Outbuildings	An oil tank with no access points or access to the roof. The structure provided no roosting or nesting opportunities for barn owl.	None	Negligible	14.13
19		A brick horse shed with no roosting or nesting opportunities for barn owl.	None	Negligible	16.57
20		An open-sided asbestos roof cattle shed with some minimal roosting opportunities but no nesting opportunities for barn owl.	None	PRS	15.70
21		An outbuilding with a broken floor with no nesting opportunities for barn owl but some limited roosting opportunities.	None	PRS	8.68
22		A hay storage shed containing hay bales providing some nesting opportunities. There appears to be a high turnover of bales resulting is high levels of disturbance There were numerous access points present and some perching opportunities also.	None	PNS	19.33
23		A regularly used open-sided cow shed with regular hay movement. The building provided no roosting or nesting opportunities for barn owl.	None	Negligible	23.09
24		A tractor shed with no roosting or nesting opportunities for barn owl.	None	Negligible	23.86
25	Beamont Farm	A horse stable with horses present. The building provided suitable perching but no suitable nesting opportunities.	None	PRS	27.59

Feature number	Feature name	Field survey notes	Barn owl evidence found	Classification	Distance from the Scheme boundary (m)
26	Closes Farm	A “lean-to” structure and adjacent building which could provide possible suitable roosting and/ or nesting opportunities. Access was not granted to these buildings so surveyors could not confirm or rule out nesting suitability for the building.	No access	Unknown	854.77
27	Oak Farm Outbuildings	An open fronted horse shed with some very limited perching spaces. The space is very open and exposed with horses present and likely high levels of human disturbance. It is therefore unlikely to be used as a roost.	None	Negligible	1166.16
28		An open horse shed with some very limited perching opportunities. The space is very open and exposed with horses present and likely high levels of human disturbance. It is therefore unlikely to be used as a roost.	None	Negligible	1164.27
29		A metal open-fronted Dutch barn with some suitable perching opportunities but no suitable nesting places. The building is used as a wood and vehicle store. The building appears to be left open and is located on the edge of a hamlet with access out on to fields.	None	PRS	1149.42
30		A cow shed providing some suitable perching opportunities. The building is likely to be regularly closed up, however, It is also likely to be heavily disturbed as it is used for vehicle storage and is well lit and therefore unlikely to be used a roost site.	None	Negligible	1152.39

Feature number	Feature name	Field survey notes	Barn owl evidence found	Classification	Distance from the Scheme boundary (m)
33	Oak tree near Carr House Farm	A mature oak surrounded by pasture with a tear out/ missing limb with substantial hole and shallow cavity. The feature is suitable as a barn owl nest site, although it is on the small side. No evidence of usage of the feature by barn owl was found on the ground.	None	PNS	361.29
34	Box in garden on Melandra Road	A small cube shaped box up in tree on the edge of a garden. The box is relatively small but big enough to act as at least a roost or possibly a nest site. The entrance faces into the garden but is on the periphery of the garden and adjacent to open fields.	None	PNS	605.48
35	Farm on Hague Road	Several old barns to the side of a farmyard with some perching and possible nesting suitability. There was a barn owl box in one of the barns but it appeared to be unused. There was no scratching on ledge leading in or splashing or pellets visible under the box or around the base. The larger barns provided some areas suitable for perching. The possible nesting suitability for these buildings is associated with hay bales piled up in the corner of the larger barns. Access was limited so the buildings were not able to be assessed fully for nesting suitability.	No access	Unknown	883.71
36	Oak tree with tear out	Mature oak tree with a tear out forming a shallow cavity that could provide shelter for a barn owl as a roost site.	None	PRS	1060.99

Feature number	Feature name	Field survey notes	Barn owl evidence found	Classification	Distance from the Scheme boundary (m)
37	Beech tree with potential cavity	A mature beech with potential cavity. Access was not granted to the land surrounding the tree, so surveyors were unable to inspect it further. This tree would require a tree climb to complete a full inspection.	No access	Unknown	1142.97
38	Thornecliffe Farm Outbuildings	An outbuilding with some with perching opportunities. One barn was open at back opening out on to fields. Access was limited so the buildings were not able to be assessed fully for nesting suitability. However, the building's suitability as a PRS can be confirmed.	No access	PRS	797.07
39		Several open barns with a large number of hay bales stored within. These provide roosting and nesting opportunities on top of the hay bales and also within the rafters of the barns.	None	PNS	713.55
40	"A Frame" Box in gardens at Wood Street	An "A frame" box ideal in size for roosting and nesting barn owls affixed to a tree at the end of gardens. However, the surrounding area is cluttered by vegetation and the area is slightly wooded making access less ideal habitat for barn owls.	None	PNS	245.55
41	Beech trees at Dewsnap Lane	Two mature beech trees with apparent large cavities when surveyed from the ground. A kestrel was seen flying into one of them, possibly into a cavity. Access was not granted for the land surrounding the trees so surveyors could not confirm or rule out	None	PNS	378.39

Feature number	Feature name	Field survey notes	Barn owl evidence found	Classification	Distance from the Scheme boundary (m)
		nesting suitability in these trees. One of the trees had a broken trunk and was likely to have cavities suitable for barn owl nesting and perching. From a distance, no evidence could be seen at the bases of the trees. These trees would require a climb to investigate further.			
42	Derelict shed near Lumb Farm	An old derelict shed with some roof intact that could provide good shelter for a roosting barn owl. Access was not granted for the land around the building so surveyors could not check for evidence and the building was surveyed from a distance.	No access	Unknown	468.42
43	Hard Times Farm	Multiple barns with entrance points and possible roosting and nesting opportunity. Access was not granted for the land around the building so surveyors could not survey the buildings fully.	No access	Unknown	753.22

Any buildings with feature numbers not appearing in the table below were opportunistically scoped-out of detailed surveys during earlier surveys for other species, due to having no suitable entry points for barn owl or having been demolished. The classifications of structures and trees are as follows:

PNS - Potential Nest Site;

PRS - Potential Roost Site;

OBS - Occupied Breeding Site

Negligible – Negligible Roosting and Nesting Potential

Unknown - not surveyed due to access restrictions.

Appendix I. Watercourse and Water body Photographs and Descriptions

Watercourse/ water body ID (watercourse name)	Watercourse description	Photograph
WC_100 (River Etherow)	Major river which fluctuates in depth due to being fed by reservoir. Depth often around 0.5 m and width approximately 9 m. Steep earth banks present tree lined in placed and dominated by grasses.	
WC_130	Field drain mostly dry and very shallow where water is present. Likely dries over summer months. Flat earth banks dominated by grasses with abundant herb species.	

Watercourse/ water body ID (watercourse name)	Watercourse description	Photograph
WC_140	Upper Section Shallow and narrow, slow flowing stream with shallow earth banks. Bankside vegetation dominated by bramble with frequent grasses, herbs and trees.	
	Lower section Slow flowing, shallow ditch. Steep earth banks often dominated by bramble with occasional grasses and trees. Heavily shaded.	

Watercourse/ water body ID (watercourse name)	Watercourse description	Photograph
WC_200 (Tara Brook)	Upper Section (west of Carrhouse Lane) Narrow and shallow ditch bordered by intensive pasture and horse paddock. Shallow earth banks dominated by grasses with patches of frequent scrub.	
	Lower Section (east of Carrhouse Lane to Etherow Confluence) Slow flowing and narrow stream with steep earth banks bordered by pasture. Banks generally dominated by grasses with frequent herb and scrub in places.	

Watercourse/ water body ID (watercourse name)	Watercourse description	Photograph
WC_210	Upper Section (north of existing A57) Shallow and narrow stream flowing with flat earth banks. Bankside vegetation dominated by grasses and herbs. Land use is horse paddock.	
	Lower Section (south of existing A57) Shallow stream with occasional pools. Approximately 1 m wide. Gravel bed with earth banks. Bankside vegetation mostly herb dominant with some scrub, trees and grasses	

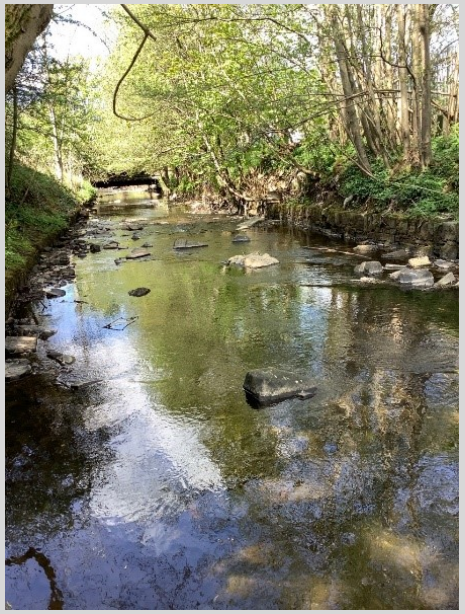
Watercourse/ water body ID (watercourse name)	Watercourse description	Photograph
WC_211	Shallow (0.2 m) stream approx. 1 m wide flowing through woodland strip. Bank is earthy with boulders and stony bed. Bankside vegetation dominated by trees with frequent grasses and herbs.	
WC_212	Shallow ditch with steep earth banks. Bankside vegetation dominated by grasses with frequent trees and scrub.	

Watercourse/ water body ID (watercourse name)	Watercourse description	Photograph
WC_213	Shallow wet ditch with earth banks. Probably dry often in summer. Bankside vegetation dominated by rushes and Himalayan balsam.	

Watercourse/ water body ID (watercourse name)	Watercourse description	Photograph
WC_214	Shallow and narrow stream through small strip of woodland. Steep banks dominated by trees with frequent scrub.	
WC_300 (Hurstclough Brook)	<u>Upper Section</u> Narrow and shallow watercourse with moderate flows. Shallow earth banks dominated by grasses and rushes. Upper part of this section has some wooded areas. Surrounding habitat is sheep pasture.	

Watercourse/ water body ID (watercourse name)	Watercourse description	Photograph
	Middle section Narrow and shallow watercourse with slow to moderate flows. Bankside vegetation varies between grass dominated areas and scrub/ tree dominated areas. Surrounding habitat is marshy grassland grazed by sheep and cattle.	
	Lower section (south of existing A57 road) Narrow and shallow watercourse with moderate flows within area of woodland with open canopy. Shallow earth banks with bankside vegetation dominated by grasses and frequent herbs.	
WC_320	Not present	*[Not available]*

Watercourse/ water body ID (watercourse name)	Watercourse description	Photograph
WC_330	Small muddy ditch at edge of horse paddock, almost dry at time of survey and likely dries completely over summer months. Heavily disturbed by horses with no substantial vegetation.	
WC_340	Not present	*[Not available]*

Watercourse/ water body ID (watercourse name)	Watercourse description	Photograph
WC_400 (Glossop Brook)	Wide but shallow watercourse with manmade stone banks. Above banks is earth dominated by trees.	
P1	Pond that dries regularly and is surrounded by intensively grazed land. Earth bank with grass dominated vegetation	

Watercourse/ water body ID (watercourse name)	Watercourse description	Photograph
P2	Shallow pond with earth banks which are steep on the western edge. Vegetation is rush dominated with abundant grasses. Pond likely dries during summer months and is surrounded by intensively grazed land.	
P3	Shallow pond likely to dry regularly. Banks are flat and dominated by grasses.	

Watercourse/ water body ID (watercourse name)	Watercourse description	Photograph
P4	Dry ditch with no water surrounded by intensively grazed land.	
P5	Pond with shallow banks. Banks have lots of bare earth due to disturbance from cattle. Rushes dominant with abundant grasses.	

Watercourse/ water body ID (watercourse name)	Watercourse description	Photograph
P6	Part of WC_300. Slow flowing, shallow and narrow water course with shallow banks. Bankside vegetation dominated by rushes with abundant grasses.	 

Watercourse/ water body ID (watercourse name)	Watercourse description	Photograph
P7	Large pond in middle of small woodland block. Shallow banks dominated by trees with frequent grasses and herbs. Fenced off from any disturbance by livestock.	
P16	Large pond with flat earth banks. Bankside vegetation abundant grasses, nettle and bare earth. Rushes frequent. Heavily disturbed by cattle.	
P17	Water body not present during 2020 otter and water vole surveys.	

Watercourse/ water body ID (watercourse name)	Watercourse description	Photograph
P18	Large garden pond not surveyed during 2020 otter and water vole surveys.	
P19	Not surveyed during 2020 otter and water vole surveys.	
P20	Not surveyed during 2020 otter and water vole surveys.	

Watercourse/ water body ID (watercourse name)	Watercourse description	Photograph
P21	Not surveyed during 2020 otter and water vole surveys.	
P22	Garden pond not surveyed during 2020 otter and water vole surveys.	
P23	Garden pond not surveyed during 2020 otter and water vole surveys.	

Watercourse/ water body ID (watercourse name)	Watercourse description	Photograph
P24	Garden pond not surveyed during 2020 otter and water vole surveys.	
P25	Surveyed as part of WC_200.	
P26	Garden pond not surveyed during 2020 otter and water vole surveys.	

Watercourse/ water body ID (watercourse name)	Watercourse description	Photograph
P27	Water body not present during 2020 otter and water vole surveys.	
P28	Small pond used for drinking water for horses. Shallow banks with bare earth.	
P29	Garden pond not surveyed during 2020 otter and water vole surveys	

Watercourse/ water body ID (watercourse name)	Watercourse description	Photograph
P30	Shallow water body with shallow earth banks. Likely dries during summer. Dominated by grasses with frequent shrub and herbs.	
P31	Garden pond not surveyed during 2020 otter and water vole surveys.	

Appendix J. Waterbody Description and Amphibian Survey Results

Waterbody reference	HSI score	Pond Description and Results	Photograph
P1	0.62 (average)	Pond 1 (SJ 9848 9556) – situated approximately 50 m west of the Scheme. Small cattle pond (c. 9 m x 4 m) with organic matter/ sludge restricting open water to a smaller central pool. No macrophytes were recorded but the pond margins comprised a mixture of floating sweet-grass and species typically associated with semi-improved grassland and occasional Himalayan) Balsam. Palmate newts, common frog and common toad were recorded during the 2017 surveys. The pond had almost completely dried out in mid-May.	

Waterbody reference	HSI score	Pond Description and Results	Photograph
P2	0.55 (below average)	Pond 2 (SJ 9864 9555) – situated within the Scheme. Approximately 15 m x 15 m hollow dominated by soft rush and water horsetail, with a small, ephemeral pool (approximately 2 m x 2 m) covered in floating sweet-grass. Breeding palmate newts and common frog were present during the 2017 surveys. The pond had almost completely dried out from early April to mid-May.	
P3	0.50 (below average)	Pond 3 (SJ 9865 9545) – situated within the Scheme. Ephemeral pond situated within a shallow depression dominated with soft rush with a small section of floating sweet-grass. Palmate newts and common toad were recorded within the pond during the 2017 surveys. Common frog eggs (but no adults) were also identified. The pond had almost completely dried out in mid-May.	

Waterbody reference	HSI score	Pond Description and Results	Photograph
P4	N/A (defunct)	Pond 4 (SJ 9874 9581) – situated within the Scheme. Small hollow with patch of soft rush. The 'pond' showed no signs of holding water during the 2017 surveys; assumed defunct.	
P5	0.57 (below average)	Pond 5 (SJ 9891 9594) – situated within the Scheme. A shallow, highly ephemeral hollow with dense soft rush. One adult common frog and eggs were recorded during the 2017 surveys; however, the pond was dry in early May.	

Waterbody reference	HSI score	Pond Description and Results	Photograph
P6	N/A (defunct)	Pond 6 (SJ 9898 9610) – situated 45 m north of the Scheme. A strip of rush pasture extended along the foot of the Roe Cross Road embankment. The 'pond' showed no signs of holding water during the 2017 surveys and was recorded as defunct.	
P7	0.09 (average)	Pond 7 (SJ 9950 9608) – situated within the Scheme. Situated within a fenced-off steep sided hollow with mature trees and scrub scattered around the banks. There was good habitat structure with submerged and emergent vegetation present together with marginal floating mats that provided excellent terrestrial and aquatic amphibian habitat. The pond measured approximately 8 m x 12 m. The pond was generally shallow with a water depth of up to c.40 cm. Breeding palmate newts and adult common toad and common frog eggs were recorded within the pond in 2017.	

Waterbody reference	HSI score	Pond Description and Results	Photograph
P16	0.47 (poor)	Pond 16 (SJ 9882 9599) – situated 8 m north of the Scheme. Heavily poached cattle pond. Pond substrate comprised bricks/ rubble and refuse that appeared to have relatively recently been tipped. Shallow margins with very little aquatic flora; potentially poor water quality. Palmate newts, common frog and common toad were recorded within the pond in 2017.	
P17	0.35 (poor)	Pond 17 (SJ 9902 9599) – situated within the Scheme. Small, ephemeral pond in shallow hollow shaded by mature willow and elder scrub. Surrounded by marshy grassland and sheep pasture. It is unclear how readily water persists in this area and the pond appears likely to be prone to regular drying out. No amphibians were recorded during the 2017 surveys. The pond was dry in early May.	

Waterbody reference	HSI score	Pond Description and Results	Photograph
P18	0.66 (average)	Pond 18 (SJ 9933 9637) – situated approximately 65 m north of the Scheme. Large garden pond located within Mottram Old Hall. The pond had a rocky substrate and occasional emergent bulrush. The surrounding terrestrial habitat comprised amenity grassland and ornamental shrubs. It was stocked with large koi carp. Great crested newt eDNA survey was undertaken in 2017 as the landowner did not permit access during night-time hours; the result was negative. Common toad spawn was recorded in the pond during this visit.	
P19	0.43 (poor)	Pond 19 (SK 0008 9612) – situated approximately 150 m east of the Scheme. Large reservoir. Fed by stream and very silted. Partially shaded by trees and with occasional emergent yellow iris. Himalayan balsam was present on the banks. Common frog and common toad were recorded during the 2017 surveys. Landowner informed surveyors that it is stocked with fish (trout, tench and perch) and that smooth newts have been seen in previous years.	

Waterbody reference	HSI score	Pond Description and Results	Photograph
P20	0.47 (poor)	Pond 20 (SJ 9994 9596) – situated approximately 75 m east of the Scheme. Small pond situated within a horse-grazed field to the south of Nettle Hall Farm. The banks were denuded of vegetation. Palmate newts, common frog and common toad were recorded within the pond during the 2017 surveys.	
P21	0.80 (excellent)	Pond 21 (SJ 9950 9563) – situated approximately 150 m south west of the Scheme. Large pond situated within a field to the south of allotment gardens. The pond had shallow margins with abundant New Zealand pygmyweed and floating sweetgrass. A patch of bulrush was present on the southern margin. Smooth newt, palmate newt, common frog and common toad were recorded within the pond during the 2017 surveys.	

Waterbody reference	HSI score	Pond Description and Results	Photograph
P22	0.53 (below average)	Pond 22 (SJ 9998 9585) – situated approximately 30 m south of the Scheme. Small lined garden pond covered with duckweed and mare's-tail. Situated within Mottram Moor Farm. No amphibians were recorded within the pond during the 2017 surveys.	
P23	0.47 (poor)	Pond 23 (SK 0004 9585) – situated approximately 25 m west of the Scheme. Small lined garden pond situated to the west of Carrhouse Lane. Macrophytes limited to broad-leaved pondweed and koi carp were present within the pond. Palmate newt and common frog were recorded within the pond during the 2017 surveys.	

Waterbody reference	HSI score	Pond Description and Results	Photograph
P24	0.31 (poor)	Pond 24 (SK 0010 9578) – situated approximately 17 m west of the Scheme. Small garden pond situated to the west of Carrhouse Lane. Lacked macrophytes and stocked with koi carp. No amphibians were recorded within the pond during the 2017 surveys.	

Waterbody reference	HSI score	Pond Description and Results	Photograph
P25	0.70 (good)	Pond 25 (SK 0018 9581) – situated approximately 60 m north of the Scheme. Situated to the east of the Carrhouse Lane. The waterbody comprised an area of shallow standing water fed by a stream. Aquatic vegetation comprised yellow iris, water-cress and great willowherb. No amphibians were recorded within the pond during the 2017 surveys.	
P26	0.31 (poor)	Pond 26 (SK 0022 9551) – situated approximately 50 m south of the Scheme. Small garden pond within Carr House Farm. Stocked with koi carp and covered with netting. Common frog and common toad were recorded within the pond during the 2017 surveys.	

Waterbody reference	HSI score	Pond Description and Results	Photograph
P27	0.44 (poor)	Pond 27 (SJ 9901 9595) – situated within the Scheme. Small hollow (9 x 4 m) with New Zealand pygmyweed and floating sweet-grass. Completely dry by early April. Common frog eggs were recorded during the 2017 surveys.	
P28	0.43 (poor)	Pond 28 (SJ 9966 9604) – situated within the Scheme. Small hollow with water-cress and great willowherb; located within a horse-grazed field in Nettle Hall Farm. Palmate newts were recorded within the pond during the 2017 surveys.	

Waterbody reference	HSI score	Pond Description and Results	Photograph
P29	0.41 (poor)	Pond 29 (SJ 9991 9609) – situated c. 215 m east of the Scheme. Small pond located within a horse-grazed field in Nettle Hall Farm. The margins were denuded of vegetation and fish were present. Palmate newt, common toad and common frog (eggs only) were recorded within the pond during the 2017 surveys.	
P30	0.46 (poor)	Pond 30 (SK 0042 9564) – situated within the Scheme. Small turbid pond located within a field margin in Carr House Farm. The pond margins were denuded of vegetation. Great crested newt eDNA survey was undertaken as the landowner did not permit access during night-time hours; result was negative. Common toad was recorded under a reptile artificial cover object (placed for ongoing reptile surveys) adjacent to the pond.	

Waterbody reference	HSI score	Pond Description and Results	Photograph
P31	0.47 (poor)	Pond 31 (SJ 9976 9586) – situated approximately 5 m east of the Scheme. Small, shallow garden pond within a residential property north of Mottram Moor. The landowner confirmed that the waterbody had been previously used as a fish pond, but it had silted up over the last few years. The surface of the pond was covered with yellow iris. Too shallow for survey during 2017.	

Appendix K. Amphibian Survey Results

Trans-Pennine Upgrade
Mottram Moor Link Road and A57(T) to A57 Link Road
Great Crested Newt Survey Results

Surveyor(s) name(s): A Cordon, H Gunning, D Orchard
Assistant(s) name(s): J Dunning, R, P Thompson, A George

Pond reference - enter in box below:				Method / species:	*Triturus cristatus* Torch			*Triturus cristatus* Bottle-trap			Eggs	Larvae	*Lissotriton vulgaris* Torch			*Lissotriton vulgaris* Bottle-trap			*Lissotriton helveticus* Torch			*Lissotriton helveticus* Bottle-trap			Small newt eggs	Small newt larvae	*Bufo bufo* total	*Bufo bufo* eggs / larvae	*Rana temporaria* total	*Rana temporaria* eggs / larvae
P1					Torch power:			No. of traps used in pond:																							
No. of survey visits to this pond:		4			1million candle power			10																							
				Sex/life stage:	Male	Female	Imm.	Male	Female	Imm.			Male	Female	Imm.	Male	Female	Imm.	Male	Female	Imm.	Male	Female	Imm.							
(1) Date:	Air temp	Veg cover	Turbidity		0	0	0	0	0	0	No	No	0	0	0	0	0	0	0	1	0	2	3	0	No	No		No		Yes
27/03/2017	9	4	1	Adult totals:	0			0					0			0			1			5				29		0		
(2) Date:	Air temp	Veg cover	Turbidity		0	0	0	0	0	0	No	No	0	0	0	0	0	0	23	20	0	0	0	0	No	No		No		No
03/04/2017	12	4	0	Adult totals:	0			0					0			0			43			0				17		0		
(3) Date:	Air temp	Veg cover	Turbidity		0	0	0	0	0	0	No	No	0	0	0	0	0	0	0	0	0	0	0	0	No	No		No		No
08/05/2017	5	5	2	Adult totals:	0			0					0			0			0			0				0		0		
(4) Date:	Air temp	Veg cover	Turbidity		0	0	0	0	0	0	No	No	0	0	0	0	0	0	2	3	0	0	0	0	No	No		No		Yes
17/05/2017	11	4	2	Adult totals:	0			0					0			0			5			0				10		11		
Peak adult count for this pond in any one visit (by torch, trap or net):					0								0									43				29		11		

Comments and constraints: New Zealand pigmyweed present.
Pond beginning to dry out during second visit; shallower water exposed deep sediment that restricted bottle trap installation and dip netting thereafter. Almost completely dry during the third and fourth visit.

Habitat Suitability Index: Indices	SI1 Location	SI2 Pond area	SI3 Pond drying	SI4 Water quality	SI5 Shade	SI6 Fowl	SI7 Fish	SI8 Ponds	SI9 Terr'l habitat	SI10 Macrophytes	Score	Suitability
P1	0.5	0.3	0.5	0.67	1	0.67	1	0.9	0.33	0.9	0.62	Average

Pond reference - enter in box below:				Method / species:	*Triturus cristatus* Torch			*Triturus cristatus* Bottle-trap			Eggs	Larvae	*Lissotriton vulgaris* Torch			*Lissotriton vulgaris* Bottle-trap			*Lissotriton helveticus* Torch			*Lissotriton helveticus* Bottle-trap			Small newt eggs	Small newt larvae	*Bufo bufo* total	*Bufo bufo* eggs / larvae	*Rana temporaria* total	*Rana temporaria* eggs / larvae
P2					Torch power:			No. of traps used in pond:																							
No. of survey visits to this pond:		4			1million candle power			0																							
				Sex/life stage:	Male	Female	Imm.	Male	Female	Imm.			Male	Female	Imm.	Male	Female	Imm.	Male	Female	Imm.	Male	Female	Imm.							
(1) Date:	Air temp	Veg cover	Turbidity		0	0	0	0	0	0	No	No	0	0	0	0	0	0	0	1	0	0	0	0	No	No		No		Yes
27/03/2017	9	4	3	Adult totals:	0			0					0			0			1			0				0		1		
(2) Date:	Air temp	Veg cover	Turbidity		0	0	0	0	0	0	No	No	0	0	0	0	0	0	0	0	0	0	0	0	No	No		No		Yes
03/04/2017	10	4	3	Adult totals:	0			0					0			0			0			0				0		0		
(3) Date:	Air temp	Veg cover	Turbidity		0	0	0	0	0	0	No	No	0	0	0	0	0	0	0	0	0	0	0	0	No	No		No		No
08/05/2017	5	4	4	Adult totals:	0			0					0			0			0			0				0		0		
(4) Date:	Air temp	Veg cover	Turbidity		0	0	0	0	0	0	No	No	0	0	0	0	0	0	0	2	0	0	0	0	Yes	No		No		Yes
15/05/2017	15	4	2	Adult totals:	0			0					0			0			2			0				0		0		
Peak adult count for this pond in any one visit (by torch, trap or net):					0								0									2				0		1		

Comments and constraints: Very deep margins with dense vegetation. Not possible / safe to set traps or dip net; torch only.
Pond almost dry during second visit and reduced to a small pool for the third and fourth visit.

Habitat Suitability Index: Indices	SI1 Location	SI2 Pond area	SI3 Pond drying	SI4 Water quality	SI5 Shade	SI6 Fowl	SI7 Fish	SI8 Ponds	SI9 Terr'l habitat	SI10 Macrophytes	Score	Suitability
P2	0.5	0.5	0.1	0.33	1	1	1	0.9	0.33	1	0.55	Below Average

Trans-Pennine Upgrade
Mottram Moor Link Road and A57(T) to A57 Link Road
Great Crested Newt Survey Results

Surveyor(s) name(s): A Cordon, H Gunning, D Orchard
Assistant(s) name(s): J Dunning, R, P Thompson, A George

Pond reference - enter in box below:				Method / species:	*Triturus cristatus* Torch			*Triturus cristatus* Bottle-trap			Eggs	Larvae	*Lissotriton vulgaris* Torch			*Lissotriton vulgaris* Bottle-trap			*Lissotriton helveticus* Torch			*Lissotriton helveticus* Bottle-trap			Small newt eggs	Small newt larvae	*Bufo bufo* total	*Bufo bufo* eggs / larvae	*Rana temporaria* total	*Rana temporaria* eggs / larvae
P3					Torch power:			No. of traps used in pond:																							
No. of survey visits to this pond:			4		1million candle power			0																							
				Sex/life stage:	Male	Female	Imm.	Male	Female	Imm.			Male	Female	Imm.	Male	Female	Imm.	Male	Female	Imm.	Male	Female	Imm.							
(1) Date:	Air temp	Veg cover	Turbidity		0	0	0	0	0	0	No	No	0	0	0	0	0	0	0	0	0	0	0	0	No	No		No		Yes
27/03/2017	9	4	2	Adult totals:	0			0					0			0			0			0					12		0	
(2) Date:	Air temp	Veg cover	Turbidity		0	0	0	0	0	0	No	No	0	0	0	0	0	0	0	0	0	0	0	0	No	No		No		No
03/04/2017	10	5	3	Adult totals:	0			0					0			0			0			0					0		0	
(3) Date:	Air temp	Veg cover	Turbidity																											
08/05/2017	5	5	5	Adult totals:	0			0					0			0			0			0								
(4) Date:	Air temp	Veg cover	Turbidity		0	0	0	0	0	0	No	No	0	0	0	0	0	0	1	0	0	0	0	0	No	No		No		Yes
15/05/2017	15	5	4	Adult totals:	0			0					0			0			1			0					2		0	
Peak adult count for this pond in any one visit (by torch, trap or net):					0											0						1					12		0	

Comments and constraints: New Zealand pygmyweed present. Too shallow to bottle trap. Very shallow on second and fourth visit; dry on third visit.

Habitat Suitability Index: Indices	SI1 Location	SI2 Pond area	SI3 Pond drying	SI4 Water quality	SI5 Shade	SI6 Fowl	SI7 Fish	SI8 Ponds	SI9 Terr'l habitat	SI10 Macrophytes	Score	Suitability
P3	0.5	0.2	0.1	0.33	1	1	1	1	0.33	0.9	0.50	Below Average

Pond reference - enter in box below:				Method / species:	*Triturus cristatus* Torch			*Triturus cristatus* Bottle-trap			Eggs	Larvae	*Lissotriton vulgaris* Torch			*Lissotriton vulgaris* Bottle-trap			*Lissotriton helveticus* Torch			*Lissotriton helveticus* Bottle-trap			Small newt eggs	Small newt larvae	*Bufo bufo* total	*Bufo bufo* eggs / larvae	*Rana temporaria* total	*Rana temporaria* eggs / larvae
P4					Torch power:			No. of traps used in pond:																							
No. of survey visits to this pond:			0																											
				Sex/life stage:	Male	Female	Imm.	Male	Female	Imm.			Male	Female	Imm.	Male	Female	Imm.	Male	Female	Imm.	Male	Female	Imm.							
Peak adult count for this pond in any one visit (by torch, trap or net):					0											0						0					0		0	

Comments and constraints: Pond completely defunct - not surveyed.

Habitat Suitability Index: Indices	SI1 Location	SI2 Pond area	SI3 Pond drying	SI4 Water quality	SI5 Shade	SI6 Fowl	SI7 Fish	SI8 Ponds	SI9 Terr'l habitat	SI10 Macrophytes	Score	Suitability
P4												

Trans-Pennine Upgrade
Mottram Moor Link Road and A57(T) to A57 Link Road
Great Crested Newt Survey Results

Surveyor(s) name(s): A Cordon, H Gunning, D Orchard
Assistant(s) name(s): J Dunning, R, P Thompson, A George

Pond reference - enter in box below:				Method / species:	*Triturus cristatus* Torch			*Triturus cristatus* Bottle-trap			Eggs	Larvae	*Lissotriton vulgaris* Torch			*Lissotriton vulgaris* Bottle-trap			*Lissotriton helveticus* Torch			*Lissotriton helveticus* Bottle-trap			Small newt eggs	Small newt larvae	*Bufo bufo* total	*Bufo bufo* eggs / larvae	*Rana temporaria* total	*Rana temporaria* eggs / larvae
P5					Torch power:			No. of traps used in pond:																							
No. of survey visits to this pond:	2				1million candle power			5																							
				Sex/life stage:	Male	Female	Imm.	Male	Female	Imm.			Male	Female	Imm.	Male	Female	Imm.	Male	Female	Imm.	Male	Female	Imm.							
(1) Date:	Air temp	Veg cover	Turbidity		0	0	0	0	0	0	No	No	0	0	0	0	0	0	0	0	0	0	0	0	No	No		No		Yes
27/03/2017	9	4	1	Adult totals:	0			0					0			0			0			0					0		0	
(2) Date:	Air temp	Veg cover	Turbidity		0	0	0	0	0	0	No	No	0	0	0	0	0	0	0	0	0	0	0	0	No	No		No		Yes
03/04/2017	10	4	1	Adult totals:	0			0					0			0			0			0					0		1	
Peak adult count for this pond in any one visit (by torch, trap or net):					0											0						0					0		1	

Comments and constraints: Completely dry on third and fourth visit.

Habitat Suitability Index: Indices	SI1 Location	SI2 Pond area	SI3 Pond drying	SI4 Water quality	SI5 Shade	SI6 Fowl	SI7 Fish	SI8 Ponds	SI9 Terr'l habitat	SI10 Macrophytes	Score	Suitability
P5	0.5	0.2	0.1	0.67	1	1	1	0.95	0.67	0.9	0.57	Below Average

Pond reference - enter in box below:				Method / species:	*Triturus cristatus* Torch			*Triturus cristatus* Bottle-trap			Eggs	Larvae	*Lissotriton vulgaris* Torch			*Lissotriton vulgaris* Bottle-trap			*Lissotriton helveticus* Torch			*Lissotriton helveticus* Bottle-trap			Small newt eggs	Small newt larvae	*Bufo bufo* total	*Bufo bufo* eggs / larvae	*Rana temporaria* total	*Rana temporaria* eggs / larvae
P6					Torch power:			No. of traps used in pond:																							
No. of survey visits to this pond:	0																													
				Sex/life stage:	Male	Female	Imm.	Male	Female	Imm.			Male	Female	Imm.	Male	Female	Imm.	Male	Female	Imm.	Male	Female	Imm.							
Peak adult count for this pond in any one visit (by torch, trap or net):					0											0						0					0		0	

Comments and constraints: Pond completely defunct - not surveyed.

Habitat Suitability Index: Indices	SI1 Location	SI2 Pond area	SI3 Pond drying	SI4 Water quality	SI5 Shade	SI6 Fowl	SI7 Fish	SI8 Ponds	SI9 Terr'l habitat	SI10 Macrophytes	Score	Suitability
P6												

Trans-Pennine Upgrade
Mottram Moor Link Road and A57(T) to A57 Link Road
Great Crested Newt Survey Results

Surveyor(s) name(s): *A Cordon, H Gunning, D Orchard*
Assistant(s) name(s): *J Dunning, R, P Thompson, A George*

Pond reference - enter in box below:				Method / species:	*Triturus cristatus* Torch			*Triturus cristatus* Bottle-trap			Eggs	Larvae	*Lissotriton vulgaris* Torch			*Lissotriton vulgaris* Bottle-trap			*Lissotriton helveticus* Torch			*Lissotriton helveticus* Bottle-trap			Small newt eggs	Small newt larvae	*Bufo bufo* total	*Bufo bufo* eggs / larvae	*Rana temporaria* total	*Rana temporaria* eggs / larvae
P7					Torch power:			No. of traps used in pond:																							
No. of survey visits to this pond:			4		1million candle power			10																							
				Sex/life stage:	Male	Female	Imm.	Male	Female	Imm.			Male	Female	Imm.	Male	Female	Imm.	Male	Female	Imm.	Male	Female	Imm.							
(1) Date:	Air temp	Veg cover	Turbidity		0	0	0	0	0	0	No	No	0	0	0	0	0	0	1	0	0	3	0	0	No	No		No		No
28/03/2017	11	2	2	Adult totals:	0			0					0			0			1			3					33		0	
(2) Date:	Air temp	Veg cover	Turbidity		0	0	0	0	0	0	No	No	0	0	0	0	0	0	2	2	0	0	0	1	No	No		No		Yes
03/04/2017	13	2	2	Adult totals:	0			0					0			0			4			0					0		0	
(3) Date:	Air temp	Veg cover	Turbidity		0	0	0	0	0	0	No	No	0	0	0	0	0	0	7	3	0	10	2	0	Yes	No		No		No
03/05/2017	7	3	2	Adult totals:	0			0					0			0			10			12					0		0	
(4) Date:	Air temp	Veg cover	Turbidity		0	0	0	0	0	0	No	No	0	0	0	0	0	0	3	2	0	9	3	0	Yes	No		No		No
16/05/2017	13	2	3	Adult totals:	0			0					0			0			5			12					1		0	
Peak adult count for this pond in any one visit (by torch, trap or net):					0											0						12					33		0	

Comments and constraints: Deep substrate along c. 50% of the pond margin; not safe to bottle trap.

Habitat Suitability Index: Indices	SI1 Location	SI2 Pond area	SI3 Pond drying	SI4 Water quality	SI5 Shade	SI6 Fowl	SI7 Fish	SI8 Ponds	SI9 Terr'l habitat	SI10 Macrophytes	Score	Suitability
P7	0.5	0.4	0.5	0.67	0.8	1	1	1	0.67	0.7	0.69	Average

Pond reference - enter in box below:				Method / species:	*Triturus cristatus* Torch			*Triturus cristatus* Bottle-trap			Eggs	Larvae	*Lissotriton vulgaris* Torch			*Lissotriton vulgaris* Bottle-trap			*Lissotriton helveticus* Torch			*Lissotriton helveticus* Bottle-trap			Small newt eggs	Small newt larvae	*Bufo bufo* total	*Bufo bufo* eggs / larvae	*Rana temporaria* total	*Rana temporaria* eggs / larvae
P16					Torch power:			No. of traps used in pond:																							
No. of survey visits to this pond:			4		1million candle power			15																							
				Sex/life stage:	Male	Female	Imm.	Male	Female	Imm.			Male	Female	Imm.	Male	Female	Imm.	Male	Female	Imm.	Male	Female	Imm.							
(1) Date:	Air temp	Veg cover	Turbidity		0	0	0	0	0	0	No	No	0	0	0	0	0	0	0	0	0	0	0	0	No	No		No		No
27/03/2017	9	0	4	Adult totals:	0			0					0			0			0			0					5		0	
(2) Date:	Air temp	Veg cover	Turbidity		0	0	0	0	0	0	No	No	0	0	0	0	0	0	0	0	0	0	0	0	No	No		Yes		No
03/04/2017	10	0	4	Adult totals:	0			0					0			0			0			0					0		0	
(3) Date:	Air temp	Veg cover	Turbidity		0	0	0	0	0	0	No	No	0	0	0	0	0	0	0	0	0	2	0	0	No	No		No		No
08/05/2017	5	0	5	Adult totals:	0			0					0			0			0			2					0		0	
(4) Date:	Air temp	Veg cover	Turbidity		0	0	0	0	0	0	No	No	0	0	0	0	0	0	0	0	0	4	0	0	No	No		Yes		Yes
15/05/2017	15	0	5	Adult totals:	0			0					0			0			0			4					2		1	
Peak adult count for this pond in any one visit (by torch, trap or net):					0											0						4					5		1	

Comments and constraints:

Habitat Suitability Index: Indices	SI1 Location	SI2 Pond area	SI3 Pond drying	SI4 Water quality	SI5 Shade	SI6 Fowl	SI7 Fish	SI8 Ponds	SI9 Terr'l habitat	SI10 Macrophytes	Score	Suitability
P16	0.5	0.9	1	0.01	1	1	1	1	0.33	0.35	0.47	Poor

Trans-Pennine Upgrade
Mottram Moor Link Road and A57(T) to A57 Link Road
Great Crested Newt Survey Results

Surveyor(s) name(s): A Cordon, H Gunning, D Orchard
Assistant(s) name(s): J Dunning, R, P Thompson, A George

Pond reference - enter in box below:				Method / species:	*Triturus cristatus* Torch			*Triturus cristatus* Bottle-trap			Eggs	Larvae	*Lissotriton vulgaris* Torch			*Lissotriton vulgaris* Bottle-trap			*Lissotriton helveticus* Torch			*Lissotriton helveticus* Bottle-trap			Small newt eggs	Small newt larvae	*Bufo bufo* total	*Bufo bufo* eggs / larvae	*Rana temporaria* total	*Rana temporaria* eggs / larvae
P17					Torch power:			No. of traps used in pond:																							
No. of survey visits to this pond:	2				1million candle power			5																							
				Sex/life stage:	Male	Female	Imm.	Male	Female	Imm.			Male	Female	Imm.	Male	Female	Imm.	Male	Female	Imm.	Male	Female	Imm.							
(1) Date:	Air temp	Veg cover	Turbidity		0	0	0	0	0	0	No	No	0	0	0	0	0	0	0	0	0	0	0	0	No	No		No		No
27/03/2017	9	1	1	Adult totals:	0			0					0			0			0			0					0		0	
(2) Date:	Air temp	Veg cover	Turbidity		0	0	0	0	0	0	No	No	0	0	0	0	0	0	0	0	0	0	0	0	No	No		No		No
03/04/2017	10	1	1	Adult totals:	0			0					0			0			0			0					0		0	
Peak adult count for this pond in any one visit (by torch, trap or net):					0											0						0					0		0	

Comments and constraints: Completely dry during third and fourth visit.

Habitat Suitability Index: Indices	SI1 Location	SI2 Pond area	SI3 Pond drying	SI4 Water quality	SI5 Shade	SI6 Fowl	SI7 Fish	SI8 Ponds	SI9 Terr'l habitat	SI10 Macrophytes	Score	Suitability
P17	0.5	0.05	0.1	0.33	0.3	1	1	0.95	0.33	0.4	0.35	Poor

Pond reference - enter in box below:				Method / species:	*Triturus cristatus* Torch			*Triturus cristatus* Bottle-trap			Eggs	Larvae	*Lissotriton vulgaris* Torch			*Lissotriton vulgaris* Bottle-trap			*Lissotriton helveticus* Torch			*Lissotriton helveticus* Bottle-trap			Small newt eggs	Small newt larvae	*Bufo bufo* total	*Bufo bufo* eggs / larvae	*Rana temporaria* total	*Rana temporaria* eggs / larvae
P18					Torch power:			No. of traps used in pond:																							
No. of survey visits to this pond:	0				1million candle power																										
				Sex/life stage:	Male	Female	Imm.	Male	Female	Imm.			Male	Female	Imm.	Male	Female	Imm.	Male	Female	Imm.	Male	Female	Imm.							
Peak adult count for this pond in any one visit (by torch, trap or net):					0											0						0					0		0	

Comments and constraints: Access permitted for HSI and eDNA survey only.

Habitat Suitability Index: Indices	SI1 Location	SI2 Pond area	SI3 Pond drying	SI4 Water quality	SI5 Shade	SI6 Fowl	SI7 Fish	SI8 Ponds	SI9 Terr'l habitat	SI10 Macrophytes	Score	Suitability
P18	0.5	1	0.9	0.67	1	0.67	0.33	1	0.67	0.35	0.66	Average

Trans-Pennine Upgrade
Mottram Moor Link Road and A57(T) to A57 Link Road
Great Crested Newt Survey Results

Surveyor(s) name(s): A Cordon, H Gunning, D Orchard
Assistant(s) name(s): J Dunning, R, P Thompson, A George

Pond reference - enter in box below:				Method / species:	*Triturus cristatus* Torch			*Triturus cristatus* Bottle-trap			Eggs	Larvae	*Lissotriton vulgaris* Torch			*Lissotriton vulgaris* Bottle-trap			*Lissotriton helveticus* Torch			*Lissotriton helveticus* Bottle-trap			Small newt eggs	Small newt larvae	*Bufo bufo* total	*Bufo bufo* eggs / larvae	*Rana temporaria* total	*Rana temporaria* eggs / larvae
P19					Torch power:			No. of traps used in pond:																							
No. of survey visits to this pond:			4		1million candle power			15																							
			Sex/life stage:		Male	Female	Imm.	Male	Female	Imm.			Male	Female	Imm.	Male	Female	Imm.	Male	Female	Imm.	Male	Female	Imm.							
(1) Date:	Air temp	Veg cover	Turbidity		0	0	0	0	0	0	No	No	0	0	0	0	0	0	0	0	0	0	0	0	No	No		No		No
06/04/2017	12	1	3	Adult totals:	0			0					0			0			0			0					1		1	
(2) Date:	Air temp	Veg cover	Turbidity		0	0	0	0	0	0	No	No	0	0	0	0	0	0	0	0	0	0	0	0	No	No		No		No
02/05/2017	7	1	2	Adult totals:	0			0					0			0			0			0					1		0	
(3) Date:	Air temp	Veg cover	Turbidity		0	0	0	0	0	0	No	No	0	0	0	0	0	0	0	0	0	0	0	0	No	No		No		No
05/08/2017	5	1	3	Adult totals:	0			0					0			0			0			0					0		0	
(4) Date:	Air temp	Veg cover	Turbidity		0	0	0	0	0	0	No	No	0	0	0	0	0	0	0	0	0	0	0	0	No	No		No		No
16/05/2017	13	1	3	Adult totals:	0			0					0			0			0			0					0		0	
Peak adult count for this pond in any one visit (by torch, trap or net):					0											0						0					1		1	

Comments and constraints: Deep substrate along c. 50% of the pond margin; not safe to bottle trap.

Habitat Suitability Index: Indices	SI1 Location	SI2 Pond area	SI3 Pond drying	SI4 Water quality	SI5 Shade	SI6 Fowl	SI7 Fish	SI8 Ponds	SI9 Terr'l habitat	SI10 Macrophytes	Score	Suitability
P19	0.5	0.9	0.9	0.67	1	0.67	0.01	1	0.33	0.35	0.43	Poor

Pond reference - enter in box below:				Method / species:	*Triturus cristatus* Torch			*Triturus cristatus* Bottle-trap			Eggs	Larvae	*Lissotriton vulgaris* Torch			*Lissotriton vulgaris* Bottle-trap			*Lissotriton helveticus* Torch			*Lissotriton helveticus* Bottle-trap			Small newt eggs	Small newt larvae	*Bufo bufo* total	*Bufo bufo* eggs / larvae	*Rana temporaria* total	*Rana temporaria* eggs / larvae
P20					Torch power:			No. of traps used in pond:																							
No. of survey visits to this pond:			4		1million candle power			10																							
			Sex/life stage:		Male	Female	Imm.	Male	Female	Imm.			Male	Female	Imm.	Male	Female	Imm.	Male	Female	Imm.	Male	Female	Imm.							
(1) Date:	Air temp	Veg cover	Turbidity		0	0	0	0	0	0	No	No	0	0	0	0	0	0	0	2	0	4	1	0	No	No		No		Yes
28/03/2017	11	1	3	Adult totals:	0			0					0			0			2			5					42		0	
(2) Date:	Air temp	Veg cover	Turbidity		0	0	0	0	0	0	No	No	0	0	0	0	0	0	0	0	0	1	0	0	No	No		No		Yes
03/04/2017	13	1	4	Adult totals:	0			0					0			0			0			1					4		0	
(3) Date:	Air temp	Veg cover	Turbidity		0	0	0	0	0	0	No	No	0	0	0	0	0	0	2	5	0	0	0	0	No	No		No		No
03/05/2017	7	1	3	Adult totals:	0			0					0			0			7			0					0		2	
(4) Date:	Air temp	Veg cover	Turbidity		0	0	0	0	0	0	No	No	0	0	0	0	0	0	0	0	0	0	1	0	No	No		No		No
16/05/2017	13	1	3	Adult totals:	0			0					0			0			0			1					5		0	
Peak adult count for this pond in any one visit (by torch, trap or net):					0											0						7					42		2	

Comments and constraints:

Habitat Suitability Index: Indices	SI1 Location	SI2 Pond area	SI3 Pond drying	SI4 Water quality	SI5 Shade	SI6 Fowl	SI7 Fish	SI8 Ponds	SI9 Terr'l habitat	SI10 Macrophytes	Score	Suitability
P20	0.5	0.05	0.5	0.33	1	1	1	1	0.33	0.4	0.47	Poor

Trans-Pennine Upgrade
Mottram Moor Link Road and A57(T) to A57 Link Road
Great Crested Newt Survey Results

Surveyor(s) name(s): A Cordon, H Gunning, D Orchard
Assistant(s) name(s): J Dunning, R, P Thompson, A George

Pond reference - enter in box below:				Method / species:	*Triturus cristatus* Torch			*Triturus cristatus* Bottle-trap			Eggs	Larvae	*Lissotriton vulgaris* Torch			*Lissotriton vulgaris* Bottle-trap			*Lissotriton helveticus* Torch			*Lissotriton helveticus* Bottle-trap			Small newt eggs	Small newt larvae	*Bufo bufo* total	*Bufo bufo* eggs / larvae	*Rana temporaria* total	*Rana temporaria* eggs / larvae
P21					Torch power:			No. of traps used in pond:																							
No. of survey visits to this pond:			4		1million candle power			25																							
				Sex/life stage:	Male	Female	Imm.	Male	Female	Imm.			Male	Female	Imm.	Male	Female	Imm.	Male	Female	Imm.	Male	Female	Imm.							
(1) Date:	Air temp	Veg cover	Turbidity		0	0	0	0	0	0	No	No	0	0	0	1	0	0	5	2	0	15	7	0	No	No		Yes		Yes
28/03/2017	11	3	2	Adult totals:	0			0					0			1			7			22					138		0	
(2) Date:	Air temp	Veg cover	Turbidity		0	0	0	0	0	0	No	No	0	0	0	1	0	0	5	4	0	3	4	0	No	No		Yes		Yes
03/04/2017	13	3	3	Adult totals:	0			0					0			1			9			7					38		1	
(3) Date:	Air temp	Veg cover	Turbidity		0	0	0	0	0	0	No	No	0	0	0	0	0	0	0	0	0	0	0	0	No	No		No		No
03/05/2017	7	4	2	Adult totals:	0			0					0			0			0			0					0		0	
(4) Date:	Air temp	Veg cover	Turbidity		0	0	0	0	0	0	No	No	7	5	0	0	0	0	23	23	0	4	0	0	No	No		Yes		Yes
17/05/2017	11	3	1	Adult totals:	0			0					12			0			46			4					7		0	
Peak adult count for this pond in any one visit (by torch, trap or net):					0											12						46					138		1	

Comments and constraints: Pond area significantly reduced during third and fourth visit due to lower water level; only 7 bottle traps set.

Habitat Suitability Index: Indices	SI1 Location	SI2 Pond area	SI3 Pond drying	SI4 Water quality	SI5 Shade	SI6 Fowl	SI7 Fish	SI8 Ponds	SI9 Terr'l habitat	SI10 Macrophytes	Score	Suitability
P21	0.5	1	1	0.67	1	1	1	1	0.67	0.5	0.80	Excellent

Pond reference - enter in box below:				Method / species:	*Triturus cristatus* Torch			*Triturus cristatus* Bottle-trap			Eggs	Larvae	*Lissotriton vulgaris* Torch			*Lissotriton vulgaris* Bottle-trap			*Lissotriton helveticus* Torch			*Lissotriton helveticus* Bottle-trap			Small newt eggs	Small newt larvae	*Bufo bufo* total	*Bufo bufo* eggs / larvae	*Rana temporaria* total	*Rana temporaria* eggs / larvae
P22					Torch power:			No. of traps used in pond:																							
No. of survey visits to this pond:			4		1million candle power			0																							
				Sex/life stage:	Male	Female	Imm.	Male	Female	Imm.			Male	Female	Imm.	Male	Female	Imm.	Male	Female	Imm.	Male	Female	Imm.							
(1) Date:	Air temp	Veg cover	Turbidity		0	0	0	0	0	0	No	No	0	0	0	0	0	0	0	0	0	0	0	0	No	No		No		No
06/04/2017	12	4	1	Adult totals:	0			0					0			0			0			0					0		0	
(2) Date:	Air temp	Veg cover	Turbidity		0	0	0	0	0	0	No	No	0	0	0	0	0	0	0	0	0	0	0	0	No	No		No		No
02/05/2017	7	5	1	Adult totals:	0			0					0			0			0			0					0		0	
(3) Date:	Air temp	Veg cover	Turbidity		0	0	0	0	0	0	No	No	0	0	0	0	0	0	0	0	0	0	0	0	No	No		No		No
08/05/2017	5	5	1	Adult totals:	0			0					0			0			0			0					0		0	
(4) Date:	Air temp	Veg cover	Turbidity		0	0	0	0	0	0	No	No	0	0	0	0	0	0	0	0	0	0	0	0	No	No		No		No
17/05/2017	11	5	1	Adult totals:	0			0					0			0			0			0					0		0	
Peak adult count for this pond in any one visit (by torch, trap or net):					0											0						0					0		0	

Comments and constraints: Lined so not bottle trapped. Dip netted, but no adult amphibians captured.

Habitat Suitability Index: Indices	SI1 Location	SI2 Pond area	SI3 Pond drying	SI4 Water quality	SI5 Shade	SI6 Fowl	SI7 Fish	SI8 Ponds	SI9 Terr'l habitat	SI10 Macrophytes	Score	Suitability
P22	0.5	0.05	0.9	0.67	1	1	1	1	0.33	0.35	0.53	Below Average

Trans-Pennine Upgrade
Mottram Moor Link Road and A57(T) to A57 Link Road
Great Crested Newt Survey Results

Surveyor(s) name(s): A Cordon, H Gunning, D Orchard
Assistant(s) name(s): J Dunning, R, P Thompson, A George

Pond reference - enter in box below:				Method / species:	*Triturus cristatus* Torch			*Triturus cristatus* Bottle-trap			Eggs	Larvae	*Lissotriton vulgaris* Torch			*Lissotriton vulgaris* Bottle-trap			*Lissotriton helveticus* Torch			*Lissotriton helveticus* Bottle-trap			Small newt eggs	Small newt larvae	*Bufo bufo* total	*Bufo bufo* eggs / larvae	*Rana temporaria* total	*Rana temporaria* eggs / larvae
P23					Torch power:			No. of traps used in pond:																							
No. of survey visits to this pond:		4			1million candle power			0																							
				Sex/life stage:	Male	Female	Imm.	Male	Female	Imm.			Male	Female	Imm.	Male	Female	Imm.	Male	Female	Imm.	Male	Female	Imm.							
(1) Date:	Air temp	Veg cover	Turbidity		0	0	0	0	0	0	No	No	0	0	0	0	0	0	3	2	0	0	0	0	No	No		No		Yes
06/04/2017	12	1	3	Adult totals:	0			0					0			0			5			0					0		0	
(2) Date:	Air temp	Veg cover	Turbidity		0	0	0	0	0	0	No	No	0	0	0	0	0	0	0	0	0	0	0	0	No	No		No		No
02/05/2017	7	1	3	Adult totals:	0			0					0			0			0			0					0		0	
(3) Date:	Air temp	Veg cover	Turbidity		0	0	0	0	0	0	No	No	0	0	0	0	0	0	9	0	0	0	0	0	No	No		No		No
05/08/2017	5	1	4	Adult totals:	0			0					0			0			9			0					0		0	
(4) Date:	Air temp	Veg cover	Turbidity		0	0	0	0	0	0	No	No	0	0	0	0	0	0	0	1	0	0	0	0	No	No		No		Yes
17/05/2017	11	1	5	Adult totals:	0			0					0			0			1			0					0		1	
Peak adult count for this pond in any one visit (by torch, trap or net):					0											0						9					0		1	

Comments and constraints: Lined so not bottle trapped. Dip netted, but no adult amphibians captured.

Habitat Suitability Index: Indices	SI1 Location	SI2 Pond area	SI3 Pond drying	SI4 Water quality	SI5 Shade	SI6 Fowl	SI7 Fish	SI8 Ponds	SI9 Terr'l habitat	SI10 Macrophytes	Score	Suitability
P23	0.5	0.05	0.9	0.67	1	1	0.33	1	0.33	0.35	0.47	Poor

Pond reference - enter in box below:				Method / species:	*Triturus cristatus* Torch			*Triturus cristatus* Bottle-trap			Eggs	Larvae	*Lissotriton vulgaris* Torch			*Lissotriton vulgaris* Bottle-trap			*Lissotriton helveticus* Torch			*Lissotriton helveticus* Bottle-trap			Small newt eggs	Small newt larvae	*Bufo bufo* total	*Bufo bufo* eggs / larvae	*Rana temporaria* total	*Rana temporaria* eggs / larvae
P24					Torch power:			No. of traps used in pond:																							
No. of survey visits to this pond:		4			1million candle power			0																							
				Sex/life stage:	Male	Female	Imm.	Male	Female	Imm.			Male	Female	Imm.	Male	Female	Imm.	Male	Female	Imm.	Male	Female	Imm.							
(1) Date:	Air temp	Veg cover	Turbidity		0	0	0	0	0	0	No	No	0	0	0	0	0	0	0	0	0	0	0	0	No	No		No		No
28/03/2017	11	0	3	Adult totals:	0			0					0			0			0			0					0		0	
(2) Date:	Air temp	Veg cover	Turbidity		0	0	0	0	0	0	No	No	0	0	0	0	0	0	0	0	0	0	0	0	No	No		No		No
03/04/2017	13	0	3	Adult totals:	0			0					0			0			0			0					0		0	
(3) Date:	Air temp	Veg cover	Turbidity		0	0	0	0	0	0	No	No	0	0	0	0	0	0	0	0	0	0	0	0	No	No		No		No
02/05/2017	7	0	3	Adult totals:	0			0					0			0			0			0					0		0	
(4) Date:	Air temp	Veg cover	Turbidity		0	0	0	0	0	0	No	No	0	0	0	0	0	0	0	0	0	0	0	0	No	No		No		No
17/05/2017	11	0	4	Adult totals:	0			0					0			0			0			0					0		0	
Peak adult count for this pond in any one visit (by torch, trap or net):					0											0						0					0		0	

Comments and constraints: Small garden pond stocked with koi carp and covered with netting. Concrete substrate, so not bottle trapped. Dip netted, but no amphibians captured.

Habitat Suitability Index: Indices	SI1 Location	SI2 Pond area	SI3 Pond drying	SI4 Water quality	SI5 Shade	SI6 Fowl	SI7 Fish	SI8 Ponds	SI9 Terr'l habitat	SI10 Macrophytes	Score	Suitability
P24	0.5	0.05	0.9	0.33	1	1	0.01	1	0.33	0.3	0.31	Poor

Trans-Pennine Upgrade
Mottram Moor Link Road and A57(T) to A57 Link Road
Great Crested Newt Survey Results

Surveyor(s) name(s): A Cordon, H Gunning, D Orchard
Assistant(s) name(s): J Dunning, R, P Thompson, A George

Pond reference - enter in box below:				Method / species:	*Triturus cristatus* Torch			*Triturus cristatus* Bottle-trap			Eggs	Larvae	*Lissotriton vulgaris* Torch			*Lissotriton vulgaris* Bottle-trap			*Lissotriton helveticus* Torch			*Lissotriton helveticus* Bottle-trap			Small newt eggs	Small newt larvae	*Bufo bufo* total	*Bufo bufo* eggs / larvae	*Rana temporaria* total	*Rana temporaria* eggs / larvae
P25					Torch power:			No. of traps used in pond:																							
No. of survey visits to this pond:			4		1million candle power			0																							
				Sex/life stage:	Male	Female	Imm.	Male	Female	Imm.			Male	Female	Imm.	Male	Female	Imm.	Male	Female	Imm.	Male	Female	Imm.							
(1) Date:	Air temp	Veg cover	Turbidity		0	0	0	0	0	0	No	No	0	0	0	0	0	0	0	0	0	0	0	0	No	No		No		No
03/04/2017	13	3	2	Adult totals:	0			0					0			0			0			0					0		0	
(2) Date:	Air temp	Veg cover	Turbidity		0	0	0	0	0	0	No	No	0	0	0	0	0	0	0	0	0	0	0	0	No	No		No		No
06/04/2017	12	3	2	Adult totals:	0			0					0			0			0			0					0		0	
(3) Date:	Air temp	Veg cover	Turbidity		0	0	0	0	0	0	No	No	0	0	0	0	0	0	0	0	0	0	0	0	No	No		No		No
03/05/2017	7	4	1	Adult totals:	0			0					0			0			0			0					0		0	
(4) Date:	Air temp	Veg cover	Turbidity		0	0	0	0	0	0	No	No	0	0	0	0	0	0	0	0	0	0	0	0	No	No		No		No
17/05/2017	11	4	1	Adult totals:	0			0					0			0			0			0					0		0	
Peak adult count for this pond in any one visit (by torch, trap or net):					0											0						0					0		0	

Comments and constraints: Unsafe to bottle trap or dip net due to deep sediment.

Habitat Suitability Index: Indices	SI1 Location	SI2 Pond area	SI3 Pond drying	SI4 Water quality	SI5 Shade	SI6 Fowl	SI7 Fish	SI8 Ponds	SI9 Terr'l habitat	SI10 Macrophytes	Score	Suitability
P25	0.5	0.2	1	0.67	1	1	0.67	1	0.67	0.9	0.70	Good

Pond reference - enter in box below:				Method / species:	*Triturus cristatus* Torch			*Triturus cristatus* Bottle-trap			Eggs	Larvae	*Lissotriton vulgaris* Torch			*Lissotriton vulgaris* Bottle-trap			*Lissotriton helveticus* Torch			*Lissotriton helveticus* Bottle-trap			Small newt eggs	Small newt larvae	*Bufo bufo* total	*Bufo bufo* eggs / larvae	*Rana temporaria* total	*Rana temporaria* eggs / larvae
P26					Torch power:			No. of traps used in pond:																							
No. of survey visits to this pond:			4		1million candle power			0																							
				Sex/life stage:	Male	Female	Imm.	Male	Female	Imm.			Male	Female	Imm.	Male	Female	Imm.	Male	Female	Imm.	Male	Female	Imm.							
(1) Date:	Air temp	Veg cover	Turbidity		0	0	0	0	0	0	No	No	0	0	0	0	0	0	0	0	0	0	0	0	No	No		No		Yes
28/03/2017	11	1	5	Adult totals:	0			0					0			0			0			0					1		0	
(2) Date:	Air temp	Veg cover	Turbidity		0	0	0	0	0	0	No	No	0	0	0	0	0	0	0	0	0	0	0	0	No	No		No		Yes
03/04/2017	13	1	5	Adult totals:	0			0					0			0			0			0					0		1	
(3) Date:	Air temp	Veg cover	Turbidity		0	0	0	0	0	0	No	No	0	0	0	0	0	0	0	0	0	0	0	0	No	No		No		No
03/05/2017	7	1	4	Adult totals:	0			0					0			0			0			0					0		2	
(4) Date:	Air temp	Veg cover	Turbidity		0	0	0	0	0	0	No	No	0	0	0	0	0	0	0	0	0	0	0	0	No	No		No		No
17/05/2017	11	1	1	Adult totals:	0			0					0			0			0			0					0		0	
Peak adult count for this pond in any one visit (by torch, trap or net):					0											0						0					1		2	

Comments and constraints: Small garden pond stocked with koi carp and covered with netting. Concrete substrate, so not bottle trapped. Dip netted, but no amphibians captured.

Habitat Suitability Index: Indices	SI1 Location	SI2 Pond area	SI3 Pond drying	SI4 Water quality	SI5 Shade	SI6 Fowl	SI7 Fish	SI8 Ponds	SI9 Terr'l habitat	SI10 Macrophytes	Score	Suitability
P26	0.5	0.05	0.9	0.33	1	1	0.01	1	0.33	0.3	0.31	Poor

Trans-Pennine Upgrade
Mottram Moor Link Road and A57(T) to A57 Link Road
Great Crested Newt Survey Results

Surveyor(s) name(s): A Cordon, H Gunning, D Orchard
Assistant(s) name(s): J Dunning, R, P Thompson, A George

Pond reference - enter in box below:				Method / species:	*Triturus cristatus* Torch			*Triturus cristatus* Bottle-trap			Eggs	Larvae	*Lissotriton vulgaris* Torch			*Lissotriton vulgaris* Bottle-trap			*Lissotriton helveticus* Torch			*Lissotriton helveticus* Bottle-trap			Small newt eggs	Small newt larvae	*Bufo bufo* total	*Bufo bufo* eggs / larvae	*Rana temporaria* total	*Rana temporaria* eggs / larvae
P27					Torch power:			No. of traps used in pond:																							
No. of survey visits to this pond:			1		1million candle power			5																							
				Sex/life stage:	Male	Female	Imm.	Male	Female	Imm.			Male	Female	Imm.	Male	Female	Imm.	Male	Female	Imm.	Male	Female	Imm.							
(1) Date:	Air temp	Veg cover	Turbidity		0	0	0	0	0	0	No	No	0	0	0	0	0	0	0	0	0	0	0	0	No	No		No		Yes
27/03/2017	9	4	1	Adult totals:	0			0					0			0			0			0					0		0		
Peak adult count for this pond in any one visit (by torch, trap or net):					0											0						0					0		0	

Comments and constraints: Small hollow with New Zealand Pygmyweed. Completely dry by second visit.

Habitat Suitability Index: Indices	SI1 Location	SI2 Pond area	SI3 Pond drying	SI4 Water quality	SI5 Shade	SI6 Fowl	SI7 Fish	SI8 Ponds	SI9 Terr'l habitat	SI10 Macrophytes	Score	Suitability
P27	0.5	0.05	0.1	0.33	1	1	1	0.95	0.33	1	0.44	Poor

Pond reference - enter in box below:				Method / species:	*Triturus cristatus* Torch			*Triturus cristatus* Bottle-trap			Eggs	Larvae	*Lissotriton vulgaris* Torch			*Lissotriton vulgaris* Bottle-trap			*Lissotriton helveticus* Torch			*Lissotriton helveticus* Bottle-trap			Small newt eggs	Small newt larvae	*Bufo bufo* total	*Bufo bufo* eggs / larvae	*Rana temporaria* total	*Rana temporaria* eggs / larvae
P28					Torch power:			No. of traps used in pond:																							
No. of survey visits to this pond:			4		1million candle power			5																							
				Sex/life stage:	Male	Female	Imm.	Male	Female	Imm.			Male	Female	Imm.	Male	Female	Imm.	Male	Female	Imm.	Male	Female	Imm.							
(1) Date:	Air temp	Veg cover	Turbidity		0	0	0	0	0	0	No	No	0	0	0	0	0	0	0	0	0	0	0	0	No	No		No		No
06/04/2017	12	3	1	Adult totals:	0			0					0			0			0			0					0		0		
(2) Date:	Air temp	Veg cover	Turbidity		0	0	0	0	0	0	No	No	0	0	0	0	0	0	1	0	0	1	0	0	No	No		No		No
02/05/2017	7	4	1	Adult totals:	0			0					0			0			1			1					0		0		
(3) Date:	Air temp	Veg cover	Turbidity		0	0	0	0	0	0	No	No	0	0	0	0	0	0	0	0	0	2	0	0	No	No		No		No
08/05/2017	5	4	3	Adult totals:	0			0					0			0			0			2					0		0		
(4) Date:	Air temp	Veg cover	Turbidity		0	0	0	0	0	0	No	No	0	0	0	0	0	0	0	0	0	0	0	0	No	No		No		No
16/05/2017	13	4	5	Adult totals:	0			0					0			0			0			0					0		0		
Peak adult count for this pond in any one visit (by torch, trap or net):					0											0						2					0		0	

Comments and constraints:

Habitat Suitability Index: Indices	SI1 Location	SI2 Pond area	SI3 Pond drying	SI4 Water quality	SI5 Shade	SI6 Fowl	SI7 Fish	SI8 Ponds	SI9 Terr'l habitat	SI10 Macrophytes	Score	Suitability
P28	0.5	0.05	0.1	0.33	1	1	1	1	0.33	0.85	0.43	Poor

Trans-Pennine Upgrade
Mottram Moor Link Road and A57(T) to A57 Link Road
Great Crested Newt Survey Results

Surveyor(s) name(s): A Cordon, H Gunning, D Orchard
Assistant(s) name(s): J Dunning, R, P Thompson, A George

Pond reference - enter in box below:				Method / species:	*Triturus cristatus* Torch			*Triturus cristatus* Bottle-trap			Eggs	Larvae	*Lissotriton vulgaris* Torch			*Lissotriton vulgaris* Bottle-trap			*Lissotriton helveticus* Torch			*Lissotriton helveticus* Bottle-trap			Small newt eggs	Small newt larvae	*Bufo bufo* total	*Bufo bufo* eggs / larvae	*Rana temporaria* total	*Rana temporaria* eggs / larvae
P29					Torch power:			No. of traps used in pond:																							
No. of survey visits to this pond:			4		1million candle power			10																							
				Sex/life stage:	Male	Female	Imm.	Male	Female	Imm.			Male	Female	Imm.	Male	Female	Imm.	Male	Female	Imm.	Male	Female	Imm.							
(1) Date:	Air temp	Veg cover	Turbidity		0	0	0	0	0	0	No	No	0	0	0	0	0	0	0	0	0	0	0	0	No	No		Yes		Yes
05/04/2017	12	1	3	Adult totals:	0			0					0			0			0			0					0		0	
(2) Date:	Air temp	Veg cover	Turbidity		0	0	0	0	0	0	No	No	0	0	0	0	0	0	0	0	0	1	0	0	No	No		Yes		Yes
02/05/2017	7	2	5	Adult totals:	0			0					0			0			0			1					0		0	
(3) Date:	Air temp	Veg cover	Turbidity		0	0	0	0	0	0	No	No	0	0	0	0	0	0	0	0	0	0	0	0	No	No		Yes		Yes
08/05/2017	5	2	5	Adult totals:	0			0					0			0			0			0					0		0	
(4) Date:	Air temp	Veg cover	Turbidity		0	0	0	0	0	0	No	No	0	0	0	0	0	0	0	0	0	0	1	0	No	No		Yes		Yes
16/05/2017	13	2	5	Adult totals:	0			0					0			0			0			1					1		0	
Peak adult count for this pond in any one visit (by torch, trap or net):					0								0									1					1		0	

Comments and constraints:

Habitat Suitability Index: Indices	SI1 Location	SI2 Pond area	SI3 Pond drying	SI4 Water quality	SI5 Shade	SI6 Fowl	SI7 Fish	SI8 Ponds	SI9 Terr'l habitat	SI10 Macrophytes	Score	Suitability
P29	0.5	0.05	0.5	0.33	1	1	0.33	1	0.33	0.3	0.41	Poor

Pond reference - enter in box below:				Method / species:	*Triturus cristatus* Torch			*Triturus cristatus* Bottle-trap			Eggs	Larvae	*Lissotriton vulgaris* Torch			*Lissotriton vulgaris* Bottle-trap			*Lissotriton helveticus* Torch			*Lissotriton helveticus* Bottle-trap			Small newt eggs	Small newt larvae	*Bufo bufo* total	*Bufo bufo* eggs / larvae	*Rana temporaria* total	*Rana temporaria* eggs / larvae
P30					Torch power:			No. of traps used in pond:																							
No. of survey visits to this pond:			0																											
				Sex/life stage:	Male	Female	Imm.	Male	Female	Imm.			Male	Female	Imm.	Male	Female	Imm.	Male	Female	Imm.	Male	Female	Imm.							
Peak adult count for this pond in any one visit (by torch, trap or net):					0								0									0					0		0	

Comments and constraints: Access permitted for HSI and eDNA survey only. Common toad recorded under nearby reptile artificial cover object.

Habitat Suitability Index: Indices	SI1 Location	SI2 Pond area	SI3 Pond drying	SI4 Water quality	SI5 Shade	SI6 Fowl	SI7 Fish	SI8 Ponds	SI9 Terr'l habitat	SI10 Macrophytes	Score	Suitability
P30	0.5	0.05	0.5	0.33	1	1	1	1	0.33	0.3	0.46	Poor

Trans-Pennine Upgrade
Mottram Moor Link Road and A57(T) to A57 Link Road
Great Crested Newt Survey Results

Surveyor(s) name(s): A Cordon, H Gunning, D Orchard
Assistant(s) name(s): J Dunning, R, P Thompson, A George

Pond reference - enter in box below:	Method / species:	*Triturus cristatus* Torch	*Triturus cristatus* Bottle-trap	Eggs	Larvae	*Lissotriton vulgaris* Torch	*Lissotriton vulgaris* Bottle-trap	*Lissotriton helveticus* Torch	*Lissotriton helveticus* Bottle-trap	Small newt eggs	Small newt larvae	*Bufo bufo* total	*Bufo bufo* eggs / larvae	*Rana temporaria* total	*Rana temporaria* eggs / larvae
P31		Torch power:	No. of traps used in pond:												
No. of survey visits to this pond: 0		1million candle power													
	Sex/life stage:	Male Female Imm.	Male Female Imm.			Male Female Imm.	Male Female Imm.	Male Female Imm.	Male Female Imm.						
Peak adult count for this pond in any one visit (by torch, trap or net):		0					0		0			0		0	

Comments and constraints: Too shallow to survey.

Habitat Suitability Index: Indices	SI1 Location	SI2 Pond area	SI3 Pond drying	SI4 Water quality	SI5 Shade	SI6 Fowl	SI7 Fish	SI8 Ponds	SI9 Terr'l habitat	SI10 Macrophytes	Score	Suitability
P31	0.5	0.05	0.1	0.33	1	1	1	1	0.67	1	0.47	Poor

Appendix L. Great Crested Newt eDNA Results

SureScreen Scientifics

Folio No: E0571
Report No: 1
Order No: PO0066862
Client: ARCADIS
Contact: [redacted]
Contact Details:
Date: 12/06/2017

TECHNICAL REPORT

ANALYSIS OF ENVIRONMENTAL DNA IN POND WATER FOR THE DETECTION OF GREAT CRESTED NEWTS

Date sample received at Laboratory: 08/05/2017
Date Reported: 12/06/2017
Matters Affecting Results: None

RESULTS

Lab Sample No.	Site Name	O/S Reference	SIC	DC	IC	Result	Positive Replicates
30616	Pond 30, Mottram	N/A	Pass	Pass	Pass	Negative	0
30632	Pond 18, Mottram	N/A	Pass	Pass	Pass	Negative	0

SUMMARY

When Great Crested Newts (GCN); Triturus cristatus inhabit a pond, they deposit traces of their DNA in the water as evidence of their presence. By sampling the water, we can analyse these small environmental DNA (eDNA) traces to confirm GCN habitation, or establish GCN absence.

The water samples detailed below were submitted for eDNA analysis to the protocol stated in DEFRA WC1067 (Latest Amendments). Details on the sample submission form were used as the unique sample identity.

Forensic Scientists and Consultant Engineers
SureScreen Scientifics Division Ltd, Morley Retreat, Church Lane, Morley, Derbyshire, DE7 6DE
UK Tel: +44 (0)1332 292003 Email: scientifics@surescreen.com
Company Registration No. 08950940

SureScreen Scientifics

RESULTS INTERPRETATION

Lab Sample No.- When a kit is made it is given a unique sample number. When the pond samples have been taken and the kit has been received back in to the laboratory, this sample number is tracked throughout the laboratory.

Site Name- Information on the pond.

O/S Reference – Location/co-ordinates of pond.

SIC- Sample Integrity Check. Refers to quality of packaging, absence of tube leakage, suitability of sample (not too much mud or weed etc.) and absence of any factors that could potentially lead to results errors. Inspection upon receipt of sample at the laboratory. To check if the Sample is of adequate integrity when received. Pass or Fail.

DC- Degradation Check. Analysis of the spiked DNA marker to see if there has been degradation of the kit since made in the laboratory to sampling to analysis. Pass or Fail.

IC- Inhibition Check- PCR inhibitors can cause false results. Inhibitors are analysed to check the quality of the result. Every effort is made to clean the sample pre-analysis however some inhibitors cannot be extracted. An unacceptable inhibition check will cause an indeterminate sample and must be sampled again.

Result- NEGATIVE means that GCN eDNA was not detected or is below the threshold detection level and the test result should be considered as no evidence of GCN presence. POSITIVE means that GCN eDNA was found at or above the threshold level and the presence of GCN at this location at the time of sampling or in the recent past is confirmed. Positive or Negative.

Positive Replicates- To generate the results all of the tubes from each pond are combined to produce one eDNA extract. Then twelve separate analyses are undertaken. If one or more of these analyses are positive the pond is declared positive for the presence of GCN. It may be assumed that small fractions of positive analyses suggest low level presence but this cannot currently be used for population studies. In accordance with Natural England protocol, even a score of 1/12 is declared positive.

METHODOLOGY

The laboratory testing adheres to strict guidelines laid down in WC1067 Analytical and Methodological Development for Improved Surveillance of The Great Crested Newt, Version 1.1

The analysis is conducted in two phases. The sample first goes through an extraction process where all six tubes are pooled together to acquire as much eDNA as possible. The pooled sample is then tested via real time PCR (also called q-PCR). This process amplifies select part of DNA allowing it to be detected and measured in 'real time' as the analytical process develops. qPCR combines PCR amplification and detection into a single step. This eliminates the need to detect products using gel electrophoresis. With qPCR, fluorescent dyes specific to the target sequence are used to label PCR products during thermal cycling. The accumulation of fluorescent signals during the exponential phase of the reaction is measured for fast and objective data analysis. The point at which amplification begins (the Ct value) is an indicator of the quality of the sample. True positive controls, negatives and blanks as well as spiked synthetic DNA are included in every analysis and these have to be correct before any result is declared so they act as additional quality control measures.

The primers used in this process are specific to a part of mitochondrial DNA only found in GCN ensuring no DNA from other species present in the water is amplified. The unique sequence appropriate for GCN analysis is quoted in DEFRA WC 1067 and means there should be no detection of closely related species. We have tested our system exhaustively to ensure this is the case in our laboratory. We can offer eDNA analysis for most other species including other newts.

Analysis of eDNA requires scrupulous attention to detail to prevent risk of contamination. Kits are manufactured by SureScreen

Forensic Scientists and Consultant Engineers
SureScreen Scientifics Division Ltd, Morley Retreat, Church Lane, Morley, Derbyshire, DE7 6DE
UK Tel: +44 (0)1332 292003 Email: scientifics@surescreen.com
Company Registration No. 08950940

SureScreen Scientifics

Scientifics to strict quality procedures in a separate building and with separate staff, adopting best practice from WC1067 and WC1067 Appendix 5. Kits contain a 'spiked' DNA marker used as a quality control tracer (SureScreen patent pending) to ensure any DNA contained in the sampled water has not deteriorated in transit. Stages of the DNA analysis are also conducted in different buildings at our premises for added

SureScreen Scientifics Ltd also participate in Natural England's proficiency testing scheme and we also carry out inter-laboratory checks on accuracy of results as part of our quality procedures.

Reported by: Troy Whyte **Approved by:** Harry Neal

End Of Report

Printed on paper from well-managed forests and other controlled sources.

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