North Somerset and Mendip Bats Special Area of Conservation (SAC) Guidance on Development

Supplementary Planning Document

Updated Version (2): Draft for Consultation June 2025



North Somerset Council

Purpose of the Document
This Supplementary Planning Document (SPD) is an update of an original version (1) which was was adopted by North Somerset Council in January 2018.

This update (Version 2) has been produced following further research, including telemetry studies and population modelling by the University of the West of England and Geckoella Limited. These studies have provided more information regarding the behaviour of bat populations at key SAC roosts within North Somerset. Version 2 also incorporates feedback regarding use of the approaches in the original document.

The original SPD was based on guidance jointly produced by North Somerset Council, Natural England and Somerset local authorities, and particularly from Larry Burrows MCIEEM formerly of Somerset County Council (author of Version 1) and Elliot Hails MCIEEM of Taw Marsh Ecology for HEP metric values.

The guidance was based on approaches used for all bat SACs within Somerset, currently available for other areas of Somerset at Habitat Regulations Assessment for Bats guidance (somerset.gov.uk). The guidance was converted into the formal original SPD for North Somerset to ensure use in planning decisions alongside policies in the Local Plan. The approach in the original SPD (Version 1) has been tested at planning appeal. This update (Version 2) has largely been done by Sarah Dale MCIEEM of Avondale Ecology. It has been subject to public consultation. It revises technicalities and detail of the original SPD approach rather than the fundamental principles.

The SPD contains guidance on development regarding impacts on the North Somerset and Mendip Bats Special Area of Conservation (SAC; referred to as the 'Bat SAC') **within North Somerset**. There are also opportunities to use this evidence base to inform the preparation of land use plans through the Local Plan and proactive work for species recovery. The Bat SAC was designated because of its international importance for **Greater and Lesser Horseshoe bats**. This document relates solely to these species. This document must not be used to inform likely distribution or abundance of other bat species. Requirements for Preliminary Roost Assessments, emergence/night-time walkover surveys or mitigation to inform planning submissions for other bat species must instead be in accordance with national best practice guidance such as *Bat Surveys for Professional Ecologists – Good Practice Guidelines* 4th Edition (Collins Editor, 2023), Natural England standing advice and local guidance/local list requirements. The survey approach detailed in this SPD applies to impacts on both foraging habitat and dispersal corridors for horseshoe bats. The Habitat Evaluation Procedure (HEP) metric relates specifically to **replacement foraging habitat for Horseshoe bat species.**

The advice in this SPD is aimed at applicants, agents, consultants, ecologists and planners involved in producing and assessing development proposals in the landscapes surrounding the Bat SAC. Within these areas, there is a legal requirement for survey information and mitigation for bats and their habitats in order to demonstrate that development proposals will not impact on the designated bat populations. The document serves to meet the requirements of Regulation 63 of the Conservation of Habitats and Species Regulations 2017 (as amended). A Habitats Regulations Assessment (HRA)/Appropriate Assessment (AA) is required for any plans or projects which pose a credible risk to the integrity of the Bat SAC. The SPD has been developed to enable a comparative and quantified analysis of impacts based on the best available scientific evidence. The mitigation strategy informed by this document should enable judgements to be made 'beyond reasonable scientific doubt' (as required by case law) to avoid significant negative impacts on the Bat SAC as a result of planning applications, development planning and other activities within North Somerset.

Although the approach uses a metric in a similar manner to Biodiversity Net Gain, the requirements of the HEP run parallel, **and in addition**, to Biodiversity Net Gain.

Cover Photo: Frank Greenaway. Courtesy Vincent Wildlife Trust (http://www.vwt.org.uk/)

BAT SPECIAL AREA OF CONSERVATION (SAC): GUIDANCE ON DEVELOPMENT

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PART A: Non-Technical Guidance

A1. Who is the Supplementary Planning Document Aimed at and Why?

A1.1 This advice is aimed at developers, consultants, and planners involved in assessing development proposals and strategic planning policy in the landscapes surrounding the North Somerset and Mendip Bats Special Area of Conservation (SAC).

A1.2 The overall aim is for a clearer and measurable approach to considering impacts of development on the Bat SAC. The guidance provides a consistent basis for understanding how rare horseshoe bats use the landscape and where there is likely to be greater risk or opportunity for development. This document is intended to inform strategic planning for the area's future housing needs, as well as evidence required in the decision-making process for smaller applications. The document brings together existing scientific and conservation information regarding the known and likely distribution and abundance of horseshoe bats in the North Somerset district, and presents an approach to inform mitigation and conservation outcomes. GIS mapping layers showing Greater Horseshoe and Lesser Horseshoe Bat Consultation Zones are available on North Somerset Council's Planning Constraints Map.

A1.3 The guidance comprises a component of the development management process, to be considered in line with relevant policies, such as policy DM8 (Nature Conservation) of the adopted Development Management Policies of the North Somerset Local Plan, and relevant sections of the National Planning Policy Framework (NPPF).

A1.4 At project level, the guidance will help identify key issues at pre-application stage that can inform the location and sensitive design of development proposals to minimise delays and uncertainty. Within the areas identified, there are clear requirements for survey information and a strong emphasis on retaining and enhancing key habitat for bats to provide effective mitigation. The approach can be used to demonstrate that development proposals will avoid harm to the designated bat populations, and support them where possible. Development must be sited and designed to minimise harm to these internationally-important bat populations and to maximise opportunities through conservation. The approach can also be used in consideration of suitable locations for off-site habitat creation to benefit species conservation and restoration, such as the proposed North Somerset Nature Parks. The document does not replace the need for case-by-case considerations based on site-specific survey information.

A1.5 The guidance explains how development activities can impact on the Bat SAC and the steps required to avoid or mitigate impacts, primarily in relation to loss of **functionally-linked horseshoe bat foraging habitat and dispersal corridors**. Other best practice guidance, local knowledge, environmental context and professional expertise are key for impact assessment and mitigation/compensation decisions relating to bat roosts. The guidance will be applied by the local planning authority (North Somerset Council) to proposals (primarily planning applications) which are likely to impact on functionally-linked habitat to SAC bat roosts and the populations they support; hence requiring screening for Habitats Regulations Assessment (HRA) or Appropriate Assessments to be completed. More details of the HRA process, including when this may be required, are detailed in Annex 7.

A1.6 The guidance does not apply to minor developments which would not pose any credible risk of significant adverse impacts on a SAC from loss of functionally-linked habitat. This requires a judgement to be made based on location, scale and type of proposals, details such as lighting or habitat removal requirements, impacts and best available scientific knowledge of bat populations. Decisions on whether the guidance applies need to be informed by an ecological assessment, and potentially further surveys, involving guidance from qualified ecologists, the

Council's Ecologists and Natural England. Sufficient evidence to demonstrate that there is no credible risk of significant adverse impacts on functionally-linked habitat to the SAC will be required with applications if the SPD approach has not been followed. Further guidance on exemptions and schemes likely to have minor impacts is detailed in Section A7 below. Applications will be refused if there is insufficient evidence and information to inform a Habitats Regulations Assessment as required by Regulation 63 of the Conservation of Habitats and Species Regulations 2017 (as amended) and to meet national and local planning policy. There may still be risks to the SAC as a result of impacts on individual Horseshoe bat roosts even for minor developments. Impacts as a result of roost loss, disturbance or modification must be informed by standard survey approaches; for example, as set out in *Bat Surveys for Professional Ecologists* 4th Edition (Collins *et al*, 2023).

A1.7 This guidance brings together best practice and learning from the original SPD and similar approaches, such as Somerset Council and South Hams, and the best scientific information available at the time of writing. It will be periodically reviewed by North Somerset Council and their partners and is endorsed by Natural England. The planning guidance is part of a wider approach that is being pursued by partner organisations to safeguard and improve habitat for rare bats that includes farm management. The guidance is also consistent with Natural England's Site Improvement Plan for the Bat SAC.

A2. What is a Bat SAC?

A2.1 Special Areas of Conservation (SAC) are sites of international importance for wildlife, which are protected under UK law, and devolved from international agreements including the Rio Convention 1992. The North Somerset and Mendip Bat SAC is important for two bat species, Greater and Lesser Horseshoe bats. The SAC comprises component Sites of Special Scientific Interest (SSSI) which within North Somerset include the two Greater Horseshoe bat maternity roosts at Brockley Hall Stables SSSI and King's Wood and Urchin Wood SSSI, and two hibernation roosts at Banwell Caves SSSI and Banwell Ochres Caves SSSI. There are also hibernation roosts within King's Wood and Urchin Wood SSSI. The SAC also includes the maternity and hibernation roosts in the Cheddar Complex SSSI and the hibernation roosts at Wookey Hole SSSI in Somerset and Compton Martin Ochre Mine SSSI in Bath and North East Somerset.

A2.2 The boundary of the SSSI unit designations relates only to roosts. Landscapes around SAC bat roost sites are important in providing foraging and commuting habitat needed to maintain the Favourable Conservation Status of bat populations. Associated habitat outside of the SAC designation boundary is termed 'functionally-linked' habitat. This guidance sets out requirements for consultation, surveys and appropriate mitigation, to demonstrate that development proposals will not adversely impact on the designated SAC bat populations due to loss of or significant disturbance to functionally-linked habitat.

A2.3 It is important to remember that statutory designations apply to key roost sites which were designated 20+ years ago. Bats use roosts dynamically, with seasonal and annual variations, and have been found to travel up to 50 kilometres (km) between seasonal roosts. Both horseshoe bat species are recovering from the brink of local extinction. Taking a precautionary approach, as required by the law, all horseshoe bat roosts within the Consultation Zones are considered to be functionally-linked to the SAC. Therefore, they require consideration within a Habitats Regulations Assessment/Appropriate Assessment to maintain the Favourable Conservation Status of local horseshoe bat populations.

Figure A1 Location of North Somerset and Mendip Bats SAC

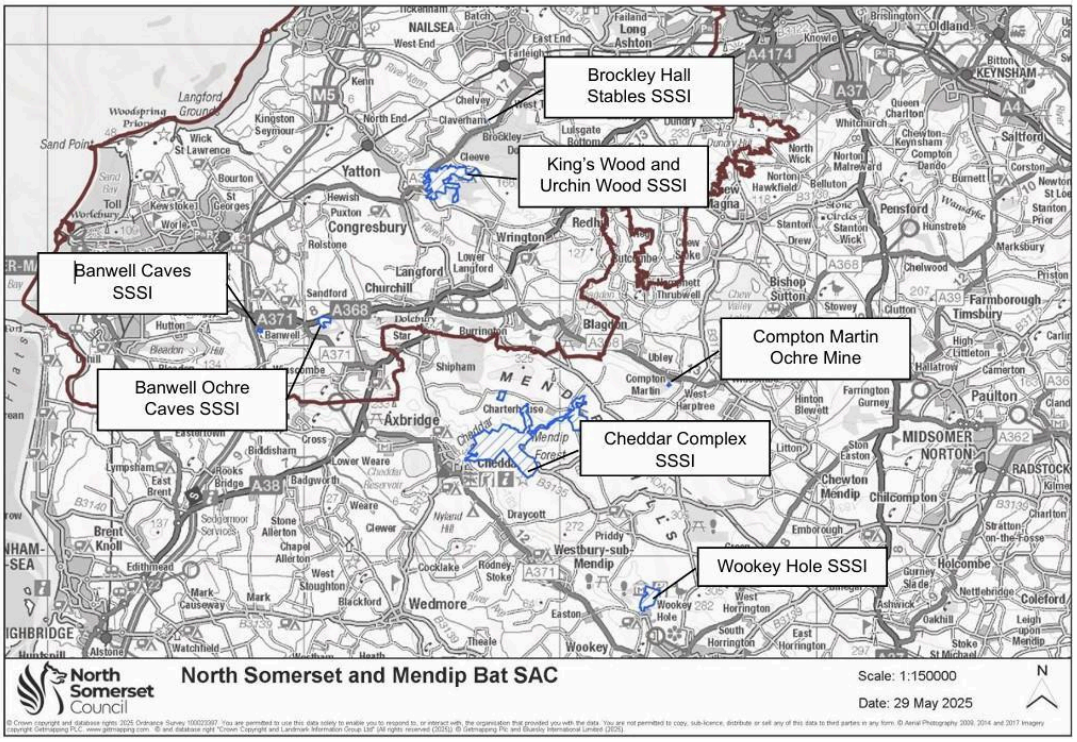
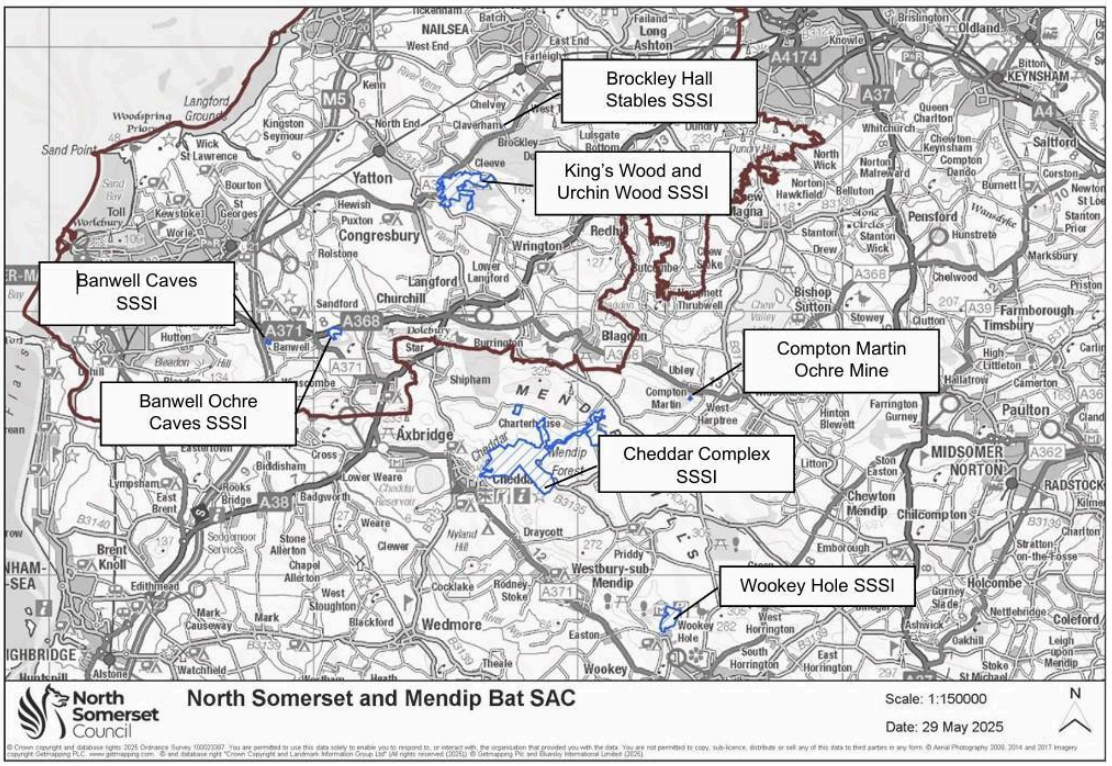


Figure A2 Location of North Somerset and Mendip Bats SAC showing Maternity Roosts



A3. Bat Consultation Zones

A3.1 This guidance identifies Greater Horseshoe Bat Consultation Zones and Lesser Horseshoe Bat Consultation Zones where SAC bats are most likely to be found. The Consultation Zones are divided into Bands A, B and C, reflecting the likely importance of the habitat for and proximity to known maternity and other roosts for **horseshoe bats** (but not other bat species).

A3.2 Within the Consultation Zones, development is likely to be subject to particular requirements, depending on the sensitivity of the site. This document is based on best available scientific evidence of horseshoe bat populations and is not a substitute for site-specific ecological assessment. A detailed ecological survey may identify that sites within different Bands are of increased or decreased value for horseshoe bats.

A4. Juvenile Sustenance Zones

A4.1 This guidance identifies the likely Juvenile Sustenance Zones (JSZs) around the maternity roosts. These zones contain vital habitat that supports juvenile bats in their first days of flight. Without a well-functioning JSZ, the size of local bat populations is likely to decline as fewer juveniles find enough food to survive to adulthood.

A4.2 New build development on greenfield sites in the Juvenile Sustenance Zones will require particularly careful scrutiny and stringent safeguards to prevent harm in view of the sensitivity and importance of the JSZs as suitable habitat as foraging areas for young bats. Such development will only be permitted where the Council is satisfied that mitigation to the highest level will be provided, with particular emphasis on the welfare of juvenile bats. The radius of the JSZ from maternity roosts has been expanded in this updated SPD based on new scientific evidence, and is now 5km. The same radius also now applies to Band A, so Band A and the JSZ are the same.

A5. Need for Early Consultation

A5.1 Section B3 emphasizes the need for pre-application consultation for development proposals. This is recommended within Bands A or B of the Consultation Zone, where proposals have the potential to affect features important to horseshoe bats (Section B3.4). As sufficient mitigation and compensation for development within the Juvenile Sustenance Zone (Band A) may not be easily achieved, and may impact on site feasibility and viability, pre-application consultations for any developments within this area are encouraged at the earliest possible opportunity. This particularly applies to, for example, greenfield sites affecting pasture within 5 km of Greater Horseshoe Bat maternity roosts and woodland, mature hedgerows or pasture within 600 m of Lesser Horseshoe Bat maternity roosts. Any developments which may cause significant impacts on horseshoe bat populations within Band C or outside of Consultation Zones would also benefit from pre-application consultation with the Council.

A6. Survey Requirements

A6.1 Section B3 and Annex 3 of the guidance sets out the survey requirements to assess impacts on **functionally-linked habitat** (including foraging habitat and dispersal corridors) for horseshoe bats in order to inform Habitats Regulations Assessments. The surveys may also record important information for other bat species and meet general requirements under best practice guidance for impact assessment for all bat species. Survey effort for impacts on bat roosts must be assessed following best practice guidance including *Bat Surveys for Professional Ecologists – Good Practice Guidelines* 4th Edition (Collins Ed., 2023). The survey requirements in this document are intended to complement rather than to replace national guidance.

A6.2 For proposals within the Greater Horseshoe and Lesser Horseshoe Bat Consultation Zones, developers must employ an experienced consultant ecologist at an early stage to identify and

assess any impacts. This document is not a substitute for a case-by-case, site specific assessment.

A6.3 For proposals within Bands A and B of the Greater and Lesser Horseshoe Bat Consultation Zones, full season surveys will be needed to identify likely importance for foraging and dispersing horseshoe bats (unless minor or insignificant impacts can be demonstrated – see Section A7). This must include automated bat detector surveys. Survey results are crucial for understanding how bats use the site, informing how impacts on horseshoe bats can be avoided, minimised or mitigated. Where mitigation is needed for loss of horseshoe bat foraging habitat, the survey results will inform the metric for calculating the amount of replacement habitat needed (see Annex 5).

A6.4 For proposals within Band C, survey effort required depends on the suitability of impacted and adjacent habitat to support prey species hunted by horseshoe bats. Whether there will be impacts on important dispersal/commuting corridors for horseshoe bats will also need to be considered; for example, fragmentation impacts as a result of light spill.

A6.5 Outside of the mapped Greater and Lesser Horseshoe Bat Consultation Zones, development proposals may still have impacts on horseshoe and other bat species across the entire Local Authority area. Developers should have regard to best practice guidelines, such as the Bat Conservation Trust's survey guidelines and Natural England's Standing Advice for Bats. North Somerset Council's guidance on surveys should also be followed as set out in Preliminary bat roost assessment and Ecological impact assessment.

A7. Proposed Developments with Minor Impacts on Foraging Habitat

A7.1 In some circumstances, a developer may be able to clearly demonstrate, based on a site assessment and report from a qualified ecologist, that the impacts of a proposed development on Horseshoe bat habitat are proven to be minor and can be avoided or mitigated. In these instances, a full season's survey is not needed. This must be demonstrated in a suitably robust and evidenced statement submitted as part of the development proposals.

A7.2 Examples of such developments may include (but are not limited to):

- Developments impacting on habitats which score zero in the Habitat Evaluation Procedure (HEP) metric such as brownfield developed land comprising sealed surfaces;
- Small sites less than 0.2 hectare (ha) in size unless these are in very close proximity to important known or newly identified horseshoe bat roosts associated with the North Somerset and Mendip Bat SAC. This will include most householder and permitted development applications. Professional judgement and sufficient survey information is likely to be required to determine this; and
- Sites where development has been designed to fully retain important functionally-linked habitat and where any impacts on retained habitat (such as light spill) have been demonstrated to be fully avoided.

A7.3 Impacts need to be assessed in a site context and must fully consider the impact of light spill, disturbance, fragmentation and displacement from nearby habitats as well as impacts within the site itself. Impacts must be assessed and qualified in accordance with best practice guidance including Guidelines for Ecological Impact Assessment (EcIA) (CIEEM, 2018) and Guidance Note 8 Bats and Artificial Lighting at Night (ILP, 2023), and any subsequent updates. All impacts of a scheme must be considered during both the construction and operational phases.

A7.4 Additional evidence to demonstrate that there is no credible risk of significant adverse impacts on functionally-linked habitat to the Bat SAC may still be requested for sites where the survey protocol does not apply. For example, horizontal and vertical lux contour plans for proposed lighting may be required to demonstrate that light spill onto suitable surrounding habitat will be

below 0.4 lux on the vertical plane and 0.2 lux on the horizontal plane even where no foraging or functionally-linked habitat will be lost on site. Further requirements are detailed in Sections B4.14 to B4.23.

A8. Need for Mitigation, Including Replacement Habitat

A8.1 Appropriate avoidance and mitigation measures will be required within all bands of the Greater and Lesser Horseshoe Bat Consultation Zones, where SAC bat populations could be adversely affected by development.

A8.2 Development proposals must seek to retain and enhance existing habitats and/or features of value and accessible to bats such as those listed in B3.4 in this guidance. The ecological mitigation hierarchy must be strictly followed, with avoidance considered in the first instance. If impacts cannot be avoided, the reasons why activities are necessary must be fully detailed and evidenced in any planning submissions. Where avoidance or minimisation of impacts is not or is only partially possible, appropriate mitigation will be needed, and compensation such as the provision of replacement habitat only provided as a last resort. North Somerset Council's Ecologist will have regard to relevant considerations in determining the mitigation requirements, including survey results and calculations relating to quantity of replacement habitat. Annex 4 sets out the Habitat Evaluation Procedure (HEP) methodology and metric for calculating how much replacement habitat should be provided. Impacts on suitable foraging habitat within Band A would only be accepted if the mitigation proposed demonstrates beyond reasonable scientific doubt that the function and structure of habitats will be retained or appropriately replicated, particularly in relation to important juvenile feeding areas.

A8.3 Replacement habitat must be accessible to the bat population affected. **Replacement habitat must be located no further away from the designated SAC roosts than the proposed development site within Bands A and B.** Replacement habitat must prioritise creation of grazed pasture/rough tussocky grassland within Band A for Greater Horseshoe Bats and woodland and / or dense, mature hedgerows within Band A for Lesser Horseshoe Bats, which are their preferred habitats.

A8.4 Where the replacement provision is to be made on land off-site (outside the red line development boundary), any existing value of the off-site land as bat habitat must be factored in to the HEP calculation. Bat surveys of this land in accordance with Annex 3 will usually be required (unless very low existing value to Horseshoe bats is evidenced) in order that an enhancement over its current value to bats can be determined, and to establish a baseline for monitoring. For this reason, it is strongly advised that a HEP calculation is completed at feasibility stage or early in the design process. **Off-site options must also be considered early on to avoid requiring two seasons of bat surveys for both the development site and off-site options.**

A8.5 The baseline values for the HEP calculation will be taken as habitats with the highest value for horseshoe bats within five years leading up to submission of the planning application, based on best available evidence. This enables a worst-case scenario assessment to be completed and is similar to the approach taken under the Environment Act 2021 in terms of pre-application clearance of development sites for Biodiversity Net Gain.

A8.6 Where the replacement provision is to be off site, and land in a different ownership is involved, legal agreements via a Section 106 agreement or Conservation Covenant will be needed to ensure that the mitigation is **secured in perpetuity**.

A8.7 An Ecological Management Plan for the site must be provided setting out how the site will be managed for SAC bats in perpetuity.

A8.8 Where appropriate (e.g. for sites within a Juvenile Sustenance Zone), a Monitoring Strategy must also be provided to ensure continued use of the site by SAC bats and include measures to rectify the situation if negative results occur.

A8.9 A calculator to be used to work out the quantity of replacement habitat required is available at Somerset Council's Habitat Evaluation Process webpage.

A8.10 Strategic sites are available for the provision of mitigation and equivalent hectares can be purchased via North Somerset Council. These sites are referred to as North Somerset Nature Parks (NSNP) and have been chosen in locations where scientific modelling has demonstrated that connectivity for bats is high and habitat quality is low. Enhancement of habitat through measures including the creation of grazed pasture, woodland and dense, mature hedgerows will provide greater availability of foraging potential for bats in areas where they are already commuting, or enhance land to such an extent (e.g. conversion of land from arable to pasture), that connectivity is created.

NSNPs will be sited in locations close to maternity roosts (within Zone A). They will be available as mitigation options for any developments within North Somerset where it has been demonstrated that adequate on-site mitigation and/or compensation is not feasible.

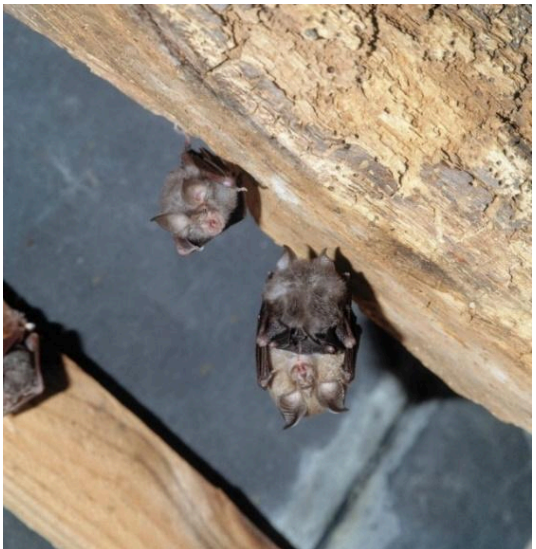
A9. Biodiversity Net Gain and the SPD Approach

A9.1 North Somerset Council has produced a separate Biodiversity SPD . More information is available at NSC's Biodiversity net gain webpage.

A9.2 Unless exempt, a proposed development will need to provide at least 10% biodiversity net gain (BNG) demonstrated through the statutory Defra metric in accordance with the requirements set out in the Environment Act 2021. Habitats resulting in BNG may not be the same habitat types required to mitigate the effects of the proposed development on bats. The requirements for horseshoe bats differ in that an abundance of prey species and their supporting flora is needed to maintain the affected population. Abundance of prey is often a product of management as opposed to BNG's focus on diversity of botanical species and habitat structure and quality. Similarly, whilst the BNG process permits mitigation remote from the development site, horseshoe bats require the mitigation to be within easy reach of the home roost.

A9.3 A key principle of BNG is that it must be **additional** to mitigation requirements, and that the ecological mitigation hierarchy must be fully followed for BNG to be achieved. The current approach, supported by planning and appeal decisions and informed by advice from Natural England, is that replacement horseshoe bat habitat can only contribute to BNG calculations up to 'no net loss'. Any quantum of created habitat must demonstrate at least 10% biodiversity net gain through the Defra metric **plus** no net loss of horseshoe bat habitat. Double counting of biodiversity gain as replacement horseshoe bat habitat is not a scientifically-valid approach. There must be clear demonstration of allocated BNG and horseshoe bat habitat within submissions, as shown on plans, GIS layers, etc. The comments section in the HEP calculations needs to be clearly annotated or described within ecological reports confirming which habitats are being considered for Biodiversity Net Gain and which are earmarked as horseshoe bat habitat.

A9.4 Replacement horseshoe bat habitat also needs to be provided in perpetuity, whereas Biodiversity Net Gain obligations only legally apply for a 30 year period. `



Lesser Horseshoe Bats: Mother and Pup
(Photo: Frank Greenaway. Courtesy Vincent Wildlife Trust)

PART B: Technical Guidance

B1 Introduction

B1.1 The North Somerset and Mendip Bats SAC was originally designated under the Habitats Directive 92/43/EEC, which was transposed into UK law under the Conservation of Habitats and Species Regulations 2017 (as amended) (known as the 'Habitats Regulations'). This means that the populations of Horseshoe bats supported by this site are of international importance. They are therefore afforded high levels of protection, placing significant legal duties on decision-makers to prevent damage to bat roosts, foraging areas and the routes used by bats to travel between these locations (commuting/dispersal corridors) to maintain Favourable Conservation Status.

B1.2 The primary reason for designation of the North Somerset and Mendip Bat SAC is the presence of two species listed under Annex II of the Habitats Directive 1992 as specified in the Habitats Regulations 12, 3:

- Greater Horseshoe Bat *Rhinolophus ferrumequinum* (maternity and hibernation roosts)*;* and
- Lesser Horseshoe Bat *Rhinolophus hipposideros* (hibernation roosts)*.*

B1.3 References in this document to 'horseshoe bats' relate to both species. Where a distinction needs to be made between different requirements, the particular species will be referred to. The Habitat Evaluation Procedure (HEP) calculations need to be completed, and to achieve no net loss of habitat for **both** horseshoe bat species, for the proposed mitigation to be acceptable. See Annex 1 for more detail on the SAC.

B1.4 The Conservation Objectives for North Somerset & Mendip Bats SAC are to ensure that the integrity of the site is maintained or restored. The SAC contributes to achieving the Favourable Conservation Status of its Qualifying Features [i.e. horseshoe bats], by maintaining or restoring:

- The extent and distribution of qualifying natural habitats and habitats of qualifying species;
- The structure and function (including typical species) of qualifying natural habitats;
- The structure and function of the habitats of qualifying species;
- The supporting processes on which qualifying natural habitats and the habitats of qualifying species rely;
- The populations of qualifying species; and,
- The distribution of qualifying species within the site.

B1.5 Habitats and features which support the populations of SAC bats outside the designated site which are functionally-linked are a material consideration in ensuring the integrity of the designated site. Functionally-linked land is considered for the purposes of Habitats Regulations Assessments in the same way as direct impacts with the boundary of designated SAC units. This principle is established in law[1].

B1.6 The purpose of this advice is not to duplicate or override existing legal requirements for protected bat species or their roosts. These aspects are well governed by the Natural England licensing procedures for protected species. This document has been developed to fulfil a particular need for quantitative and comparable assessments of impacts on foraging habitats and dispersal corridors for SAC bats to enable Habitats Regulations Assessments (HRA) to be completed under Regulation 63 of the law. This document provides a survey protocol and metric for replacement horseshoe bat foraging habitat. The survey protocol will also inform impact assessment on dispersal corridors, although qualitative rather than quantitative assessment on

[1] Detailed analysis provided in Natural England Commissioned Report NECR 207 (2016). *Functional linkage: How areas that are functionally linked to European sites have been considered when they may be affected by plans and projects - a review of authoritative decisions* NECR207_edition_1.pdf

a case-by-case basis considering landscape context is most useful for these features. Whilst impacts on roosts also need to be fully considered, best practice guidance has already established methodologies which provide a sufficient evidence base for HRA.

B1.7 The guidance applies to development proposals that could affect the SAC and trigger the requirements of the Habitats Regulations (see Annex 6). The local planning authority will consider, on the basis of evidence available, whether planning applications are likely to impact on SAC bats and hence require screening for Habitats Regulations Assessment (HRA). A HRA is required whenever there is a credible risk of significant adverse impacts on the SAC, including functionally-linked habitat, as a result of a plan or project. A Stage 1 screening Test of Likely Significant Effect is required in the first instance, with plans or projects progressing to Stage 2 Appropriate Assessment if significant adverse effects cannot be screened out. Stages 3 and 4, requiring a more complex and wider scale assessment, would apply if impacts cannot be sufficiently mitigated under Stage 2 consideration. Further detail is provided at Appropriate assessment - GOV.UK. A HRA will be required for proposals with a credible risk of significant negative impacts on functionally-linked habitat to the SAC including undesignated roosts, foraging habitat and potential dispersal corridors. A template for a Shadow HRA is provided in Annex 6, should this be required. A Stage 2 Appropriate Assessment phase is not required for minor developments, where these have no credible risk of posing significant adverse effects on functionally-linked habitat to the SAC (see Section A7).

B1.8 **An important objective of the guidance is to identify areas in which development proposals might significantly impact on the designated populations at an early stage of the planning process, in order to inform sensitive siting and design, and to avoid unnecessary delays to project.** As set out in Section A8.2, the ecological mitigation hierarchy must be followed for developments with alternative options/avoidance measures considered in the first instance, and rationale fully demonstrated for applications with likely significant impacts.

B1.9 This technical guidance is based on the advice from experts and ecological consultants[2], current best practice, operational use and the best scientific information available at the time of writing. It will be kept under review by North Somerset Council and Natural England. This SPD has been developed from work at a county level for North Somerset and Somerset. Unless there is scientific evidence specific to the North Somerset and Mendip Bats SAC to indicate otherwise, the approach and guidance has remained consistent with Somerset Council's guidance.

B2. Sensitive Zones for Horseshoe Bats

B2.1 To facilitate decision making and in order to provide key information for potential developers at an early stage using the best available data, a Consultation Zone for Greater Horseshoe Bats and Lesser Horseshoe Bats affecting North Somerset and Somerset districts (see Figures B1 and B2 below) have been identified. This is based on an accumulation of known data, including roost records from Bristol Regional Environmental Records Centre, planning submissions and the 1999, 2001 and 2020-2021 telemetry studies of Greater Horseshoe Bat maternity roosts within the SAC[3]. The data is constantly being added to and updated as further research is carried out and surveys are undertaken for development sites. Figures B1 and B2 reflect the current understanding of key roosts and habitat associated with the SAC. The guidance on

[2] See acknowledgements

[3] Billington, G. (2001). *Radio-tracking study of Greater Horseshoe bats at Brockley Hall Stables Site of Special Scientific Interest. May-August 2001.* English Nature Research Report No. 442. English Nature, Peterborough
Foxley, T., Lintott, P., Stonehouse, S., Flannigan, J. and Stone, E.L. (2024) A High Resolution Spatial Modelling Framework for Landscape-Level, Strategic Conservation Planning. *In prep*.
Geckoella (2022). *North Somerset Council Greater Horseshoe Bat Radio-tracking 2022.* Geckoella Ltd on behalf of North Somerset Council, Weston-super-Mare.
Jones, G, and Billington, G. (1999). *Radio-tracking study of Greater Horseshoe bats at Cheddar, North Somerset.* English Nature, Taunton.

band widths can be applied to additional horseshoe bat roosts if not identified in the mapping exercise which underpins this SPD, including to inform a HRA if they are likely to be functionally-linked to the SAC.

B2.2 Greater Horseshoe and Lesser Horseshoe Bat Consultation Zones illustrate the geographic area where each species is likely to be found and where functionally-linked habitat is located. As detailed in Section B2.1, this may vary as new roosts are located. The SPD has been published based on the best available scientific knowledge at the time of publication and will be subject to further review in future based on any forthcoming evidence. The zoning band widths are set out in Table B1 below, with justification provided in Annex 2. Where bands overlap, the highest level of consideration has been applied, rather than two different bandings being mapped.

B2.3 The Consultation Zone is divided into three bandings; A, B and C which represents for maternity roosts:

- Band A: the Juvenile Sustenance Zone (JSZ), which is also likely to be of critical importance for the core of the adult bat populations including lactating females;
- Band B: the wider Sustenance Zone, where adult bats have been found to regularly use foraging territories; and
- Band C: the maximum distance in which bats from maternity roosts have been recorded travelling in one evening i.e. home range.

These areas have been defined by the distance bats (including juvenile bats) have been recorded travelling from a roost site in telemetry studies and represents the home range of the local population. It is also based on recent modelling studies completed by the University of the West of England (UWE)[4]. Telemetry studies only recorded the movements of a small number of bats from each of the maternity roosts. Therefore, it is likely that any area within the Horseshoe Bat Consultation Zones could be exploited by bats.

B2.4 The original SPD (Version 1) assumed pasture within 1 km of maternity roosts for Greater Horseshoe Bats was of key importance for juvenile bats, based on historic radiotracking studies from more than 20 years ago. This updated Version 2 has increased the JSZs around Greater Horseshoe Bat maternity roosts to pasture up to 5 km, based on recent scientific studies. The increase is likely to have arisen from increased competition for insect prey as roosts have grown larger as the population recovers (e.g. at least a five-fold increase in local Greater Horseshoe Bat populations since 2001) and the decline in quality and accessibility of core foraging habitat within 1 km. Mature woodland within 600 metres (m) of a Lesser Horseshoe Bat maternity roost remains the assumed JSZ for young Lesser Horseshoe bats. This radius may be revised if new scientific evidence becomes available in future. New build developments must aim to avoid the loss of foraging habitat and connecting habitat between foraging areas and roosts, minimise loss and mitigate to a high standard.

B2.5 As the foraging territory of individual bats is based on prey availability, it is logical that the home range and furthest distance travelled by bats from the roost will expand when roosts are larger and contract when roosts are smaller (as demonstrated by evidence from UWE – see Appendix 7). An evidence-based justification based on roost counts may be accepted in some instances e.g. which estimating density bands for newly identified roosts. It must however also be considered that populations are still locally vulnerable, with concerning recent decreasing trends at key Greater Horseshoe roosts in North Somerset from 2020-2024. It is estimated that the capacity for the Greater Horseshoe Bat population nationally is approximately 60,000 bats and at present, the national population is estimated at 9000-18000[5]. Habitat management and creation must seek to create **capacity** for the bat species to forage and disperse in future as they recover as well as mitigating or compensating for current impacts.

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[4] Foxley, T., Lintott, P., Stonehouse, S., Flannigan, J. and Stone, E.L. (2024) A High Resolution Spatial Modelling Framework for Landscape-Level, Strategic Conservation Planning. *In prep*.

[5] Devon Greater Horseshoe Bat Project and Pers. Comm. Daniel Hargreaves, Vincent Wildlife Trust

B2.6 The A, B and C bandings for other (non-maternity) roosts comprise:

- Band A: not included as no Juvenile Sustenance Zone is required.
- Band B: The likely distance that core foraging habitat is located around smaller and hibernation roosts.
- Band C: The likely home range of bats from smaller and hibernation roosts.

Table B1: Band Widths for Horseshoe Bat Consultation Zone (in metres)

Band	Greater Horseshoe bat		Lesser Horseshoe bat	
	Maternity Roost	Other Roost	Maternity Roost	Other Roost
A	0-5000	N/A	0-600	N/A
B	5001-12000	0-610	601-2300	0-1250
C	12001-14000	611-2440	2301-6000	1251-2100

B2.7 The Juvenile Sustenance Zone around Greater Horseshoe Bat maternity roosts are assumed to extend to a radius of 5 km. This is based on recent radiotracking studies, including a small subset of juvenile bats, and modelling completed by the UWE based on this data. It is possible due to the small number of juvenile bats tracked, that the banding is an underestimate, highlighting the importance of site-specific considerations and appropriate surveys within Band B. In North Somerset, the JSZ includes some urban areas of Nailsea, Backwell, Cleeve, Congresbury and Yatton. The urban area of Cheddar is also included. Some of the JSZ/Band A will include existing urban areas or habitats with very limited suitability for Greater Horseshoe Bats. In these instances, the input of a qualified consultant ecologist, the Council Ecologist and/or Natural England will be needed to confirm whether impacts on SAC bats can be ruled out. Pre-application discussions would be strongly encouraged for any development within the Greater Horseshoe JSZ/Band A which may directly or indirectly impact on suitable habitat.

B2.8 The guidance applies to suitable and available habitat. Juvenile Greater Horseshoe Bats are highly dependent on prey produced by cattle grazed pasture and rough tussocky grassland within Band A.[6] It is likely to be difficult to replace existing foraging habitat within development proposals in the JSZ. Any pasture, particularly whole fields of historically grazed pasture proposed for greenfield development will need to be very carefully considered within Band A of the Greater Horseshoe Consultation Zone, with the aim of minimising or avoiding loss wherever possible, and mitigating by replacement habitat, with appropriate high quality management, as a last resort. Retention of these habitats must also be treated as a priority within Band B, as this could have a significant adverse impact on the bat SAC which may not be possible to mitigate in a manner to ensure Favourable Conservation Status of the maternity roosts. Developments on existing intensive developed brownfield land, without suitable semi-natural greenspace can make a case for exemption from the guidance as set out in Section A7. Similarly, it could be demonstrated in some exceptional circumstances, that greenspaces such as parks within the centre of urban areas may not be accessible to the species due to fragmentation and barriers such as significant light spill within continuous urban areas.

B2.9 Optimal habitat for Lesser Horseshoe Bats includes woodland, dense hedgerows and wetlands. Fields of grazed pasture surrounded by dense/thick hedgerows of high ecological value can also be of importance. Juvenile Sustenance Zones are assumed around Lesser Horseshoe Bat maternity roosts to a radius of 600 m. As few telemetry studies of Lesser Horseshoe Bat maternity roosts has been completed within North Somerset, studies from Hestercombe House in Somerset and elsewhere have been used. Radio tracking of the Hestercombe House SAC Lesser Horseshoe bat population revealed that individuals were commuting up to 6 km to hunt.[7] Radio-tracking of a colony of 300 bats in the Wye Valley radio-tracking revealed that the longest

[6] Ransome, R. D. 1996. *The management of feeding areas for Greater Horseshoe bats*: *English Nature Research Reports Number 174.* Peterborough: English Nature.

[7] Billington, G. 2005. *Radio tracking study of Lesser Horseshoe bats at Hestercombe House Site of Special Scientific Interest, July 2005.* English Nature Somerset & Gloucestershire Team; Duvergé, L. 2008. *Report on bat surveys carried out at Hestercombe House SSSI Taunton, Somerset, in 2007 and 2008.* Cullompton: Kestrel Wildlife Consultants.

distance travelled to forage was 4.2 km. Bats foraged up to half the time within 600 m of their summer roost but areas up to 2.3 km were used more than expected. Bontadina *et al* (2002) recommended that a radius of 600 m around a Lesser Horseshoe Bat maternity roost should have special consideration. [8] For this reason, the JSZ for Lesser Horseshoe Bats has been defined as being up 600 m from roosts. Juvenile Lesser Horseshoe Bats preferentially feed in woodland habitats within this area. New build development on greenfield sites which will impact directly or indirectly on woodland, wetland and/or dense mature hedgerows with trees should be very carefully designed with stringent measures to avoid, minimise and mitigate any impacts. Removal of any woodland, dense hedgerows, waterbodies and wetland habitats within 600 m of Lesser Horseshoe Bat maternity roosts must be avoided wherever possible, and where exceptionally permitted must be carefully mitigated for. It may be difficult for the biomass or shelter that woodland provides to be replaced within development schemes. Consideration also needs to be given to connecting flight routes between maternity roosts and woodlands.

B2.10 Data for Lesser Horseshoe Bat JSZs is not specific to North Somerset, where optimal woodland and wetland habitats is often fragmented around urban areas, and individual consideration should be applied on a case-by-case basis using this SPD as a guide. High quality woodland and wetland habitats more than 600 m distant from a maternity roost may, for example, be of high importance. Although the SAC citation relates solely to hibernation sites for Lesser Horseshoe bats, maternity roosts are key to ensuring Favourable Conservation Status of the species. Therefore, maternity roosts and subsidiary roosts which are likely to be an important part of the SAC population are treated as functionally-linked habitat, based on the Precautionary Principle, and are subject to the requirements of the Habitats Regulations, including HRAs where necessary. Some of the JSZ/Band A will include existing urban areas or habitats with very limited suitability for Lesser Horseshoe Bats. In these instances, the input of a qualified consultant ecologist, the Council Ecologist and/or Natural England will be needed to confirm whether impacts on SAC bats can be ruled out. Pre-application discussions would be strongly encouraged for any development within the Lesser Horseshoe JSZ which may directly or indirectly impact on suitable habitat.

B2.11 Three of the four SSSI component units of the North Somerset and Mendip Bats SAC within North Somerset are designated due to hibernation sites for Greater and Lesser Horseshoe Bats. Like other bat species, these species feed throughout the winter, depending on temperature. Radio-tracking of Lesser Horseshoe Bats revealed that they foraged on average to a maximum distance of 1.2 km from the hibernation site. One bat travelled to an absolute maximum distance of 2.1 km. The winter foraging range appears to be less than half the area covered in the summer months.[9]

B2.12 Band A is shown in orange shading; Band B in dark yellow; and Band C in pale yellow reflecting the decreasing density at which Greater and Lesser Horseshoe Bats are likely to occur away from the home roost.

B3. Consultation and Surveys

B3.1 Early discussion refers to pre-application stage prior to submission of a planning application; and, essentially, ***before*** any Master Plan proposals are designed or finalised. This will ensure that appropriate advice on site feasibility is provided and adequate survey data is obtained. It is encouraged that a site lighting plan with existing (pre-development) night time lux levels is provided at the earliest possible stage. This would evidence any areas currently exposed to high levels of light and inform likely significant impacts of any proposed changes to the site on commuting and foraging horseshoe bats.

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[8] Bontadina, F., Schofield, H. & Naef-Daenzer, B. 2002. Radio-tracking reveals that Lesser Horseshoe bats (Rhinolophus hipposideros) forage in woodland. *J. Zool. Lond. (2002) 258, 281-290*.

[9] Bat Conservation Trust/ BMT Cordah Limited. 2005. *A Review and Synthesis of Published Information and Practical Experience on Bat Conservation within a Fragmented Landscape*. The Three Welsh National Parks, Pembrokeshire County Council & Countryside Commission for Wales.

B3.2 Early discussions will also help inform likely mitigation requirements, and ensure, for example, that proposals seek to retain and enhance key features and habitats, and that sufficient land can be allocated for required mitigation and/or compensation measures. This should ensure that avoidance measures are fully considered, bespoke mitigation measures are designed in at an appropriately early stage and that the ecological mitigation hierarchy is followed.

B3.3 For development proposals within the JSZ (Band A), it is essential that North Somerset Council, and where appropriate Natural England, are consulted at an early stage of the process. It is essential that development is designed and mitigated with the utmost diligence and care, so it is of a sufficiently very high standard to be acceptable, due to the critical nature of the area in supporting the population of a maternity roost. This is likely to be particularly challenging for new build development on greenfield sites of existing value to horseshoe bats.

B3.4 Where a proposal within Bands A or B of a Greater or Lesser Horseshoe Bat Consultation Zone has the potential to affect the features identified below, early discussions with the local planning authority (who will consult Natural England as necessary) are also essential:

- Known horseshoe bat roost;
- On or adjacent to a Site of Special Scientific Interest (SSSI);
- Linear features: hedgerows, tree lines, watercourses, stone walls, railway cuttings, pasture, hay meadow, stream line, woodland, parkland or woodland edge;
- Wetland habitat: ponds, marsh, reedbed, rivers, streams, rhynes;
- Suitable buildings or bridges, if there is a large void with potential horseshoe bat access;
- Cellars, mines, ice houses, tunnels or other structures with voids which produce tunnel-like conditions;
- Development which introduces significant new lighting;
- New wind turbine and solar farm proposals (in respect of displacement)[10]; and
- Creation of Biodiversity Net Gain habitat banks, where this will result in changes in grazed or rough tussocky grassland management or quality of habitats for horseshoe Bats.

B3.5 For all proposals within the Greater Horseshoe or Lesser Horseshoe Bat Consultation Zones, an ecological consultant[11] should be commissioned at an early stage to identify and assess any potential impacts of the proposals. Pre-application discussions with the Council may also be beneficial for large-scale schemes or schemes which may have potentially high impacts on horseshoe bat habitats even outside of the Consultation Zones. It has been established that impacts some distance from horseshoe bat SACs may need to be considered through the HRA process, where schemes result in potential significant adverse effects on dispersal corridors[12].

B3.6 **Failure to provide the necessary information in support of an application is likely to lead to delays in registration and determination, and the application may need to be withdrawn. If insufficient information is submitted to allow the Council to assess the application in accordance with the Habitats Regulations, the application will be considered unacceptable, and likely recommended for refusal.** Common further information requirements include:

- Details of bat activity surveys compliant with the SPD which demonstrate the current value of sites for horseshoe bats including tabulated raw data to evidence conclusions;

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[10] Horseshoe bat casualties from wind turbines are very rare with only one Greater Horseshoe, one Bechstein's being recorded in Europe over the ten-year period 2003 to 2013. Five Barbastelle bats were recorded as being killed in the same period (Eurobats. 2014. *Report of the Intercessional Working Group on Wind Turbines and Bat Populations*. EUROBATS.StC9-AC19.12). Bats appear to be displaced by solar farms as found by Tinsley, E., Froidevaux, J.S.P., Zsebok, S., Szabadi, K. L. and Jones, G. (2023). *Renewable energies and biodiversity: Impact of ground-mounted solar photovoltaic sites on bat activity.* Journal of Applied Ecology 60 (9), 1752-1762.

[11] Consultant ecologists should be members of CIEEM www.cieem.net and have sufficient experience with Horseshoe bats.

[12] For example, appeals APP/P1133/W/19/3237127 and APP/P1133/W/18/3205558 for Land at Wolborough Barton, Newton Abbot, Devon, TQ12 1EJ

- An impact assessment based on clear landscape and layout plans, including retention and enhancement of foraging habitat and appropriately buffered dark vegetated dispersal corridors;
- Provision of HEP calculations which demonstrate that sufficient replacement horseshoe bat foraging habitat will be provided to ensure no net loss of functionally-linked habitat;
- HEP calculations for both Greater Horseshoe and Lesser Horseshoe bats;
- On or off-site mitigation to be clearly shown on a plan;
- Mitigation to be outside of residential curtilages;
- Relevant survey information and HEP calculations for any off-site components of mitigation;
- Clear delineation of replacement horseshoe bat foraging habitat from any Biodiversity Net Gain (over and above no net loss) using the Defra metric both within the calculations and as shown on a site plan; and
- Details of lighting proposals to demonstrate that there will not be significant adverse effects as a result of displacement from retained, enhanced or created habitats for horseshoe bats as set out in Section B4.14 to B4.22.

Although mitigation for bat roosts is not a key component of this SPD, compensatory roosting provision also needs to be clearly shown in an area accessible to horseshoe bats. This needs to be available before destruction or disturbance of the existing roost. Details of dimensions and access features need to be provided. Some of the details above such as accessibility to foraging habitat and dispersal corridors is of relevance to assessing suitability of proposed compensatory roosting provision. In some cases, the provision of standalone night roosts on replacement sites may help exploitation of new habitat enhancement.

B3.7 The survey methodology must be followed in relation to both foraging habitats (also called feeding or hunting grounds) and dispersal corridors (also called fly-ways or commuting routes). Surveys must determine the use of the site by horseshoe bats i.e. whether the site is being used as a commuting route, or contains foraging territories, or both. Survey results inform the HEP metric for calculating the amount of replacement foraging habitat required in the methodology set out in Annex 4. The principles of mitigation for dispersal corridors is set out in Section B4.13. Consideration must be given to the landscape context of the site and of additional or indirect impacts as a result of the operation of proposals, such as highway safety measures (e.g. hedgerow removal for visibility splays), additional enabling or construction requirements and additional street lighting required.

B3.8 Surveys should be carried out in accordance with the Survey Specification within Annex 2. Exact survey requirements will reflect the sensitivity of the site, and the nature and scale of the proposals. The ecological consultant will advise on detailed requirements following a preliminary site assessment and desk study. Any deviations from the Survey Specification must be fully evidence-based referring to scientific data and this SPD, as set out in an ecological report. It is strongly recommended that any deviations are agreed in writing with the Council, and Natural England as required, through the pre-application process.

B3.9 It is essential to note that bat surveys are **seasonally constrained**. For proposals which have the potential to significantly negatively impact on habitats used by the SAC populations during the summer months, a full season (April to October inclusive) will be required. This may not be necessary in certain circumstances, where it is demonstrated to the North Somerset Council's ecologist that habitats of value for horseshoe bat species will not be directly or indirectly impacted (See B4.23 and B4.24). The survey period may need to be extended to include autumn, winter and early spring bat activity monitoring for developments in close proximity to hibernation roosts where suitable foraging habitat and dispersal corridors will be impacted. Surveys need to be included in the plan for project delivery at an early stage to avoid a potential 12-month delay.

B3.10 Baseline habitat assessments and bat activity surveys are also required on off-site land where this is to be used for mitigating habitat loss, following the same survey methodology as set out

in Annex 2. This is important to establish the baseline value of the off-site provisions for horseshoe bats and to inform the necessary HEP calculations. There may be exceptions, for example if existing habitat quality is very low e.g. arable habitat or defunct hedgerows, where avoidance of baseline surveys for off-site habitats would be acceptable. This would need to be fully justified and agreed with the Council Ecologist, and Natural England as required.

B3.11 Favourable Conservation Status for horseshoe bats will be assessed based on the Conservation Objectives of the North Somerset and Mendip Bats SAC, as well as other guidance[13]. Outside of the Horseshoe Bat Consultation Zones, development proposals will have impacts on the Favourable Conservation Status of other bat populations and their roosts. Where there will be direct impacts on roosts for horseshoe bat species, bespoke mitigation will need to be designed by a qualified ecologist on a case-by-case basis. All species of bat and their roosts are protected by the Wildlife and Countryside Act 1981 (as amended) and maintenance of populations under the Habitats Regulations 2017 (as amended). Further advice on potential impacts to bats is contained in Natural England's Standing Advice for Development Impacts on Bats, Bat Mitigation Guidelines (English Nature, 2004), UK Bat Mitigation Guidelines 2023 (Reason and Wray, 2023) and the Bat Conservation Trust's survey guidelines 4th Edition (Collins Editor, 2023). North Somerset Council also have guidance on survey expectations as set out in Preliminary bat roost assessment and Ecological impact assessment. It is preferable for the horseshoe bats to have dedicated roosting provisions in a stand-alone structure away from human disturbance.

B4. Mitigation within the Consultation Zone

B4.1 Within the Horseshoe Bat Consultation Zones, appropriate mitigation will be required where SAC bats will or may be negatively affected by development. The aim should be to retain, enhance and create new habitat and features of value to bats, such as those listed in Section B3.4 through appropriate scheme design. North Somerset Council's Ecologist will have regard to relevant considerations in determining the mitigation requirements, including survey results and calculations relating to replacement habitat (See the methodology and metric in Annex 4).

B4.2 The following are important principles for mitigation:

- Seek to maintain the quality of all semi-natural habitats and design the development to enhance existing habitats, making sure that they remain accessible to the affected bats, including avoiding displacement by light spill and connectivity to habitat corridors.
- Maintain bat roosts *in situ*, maintain or replace night roosts and consider enhancing provision of night roosting features. Night roosts are important for resting, feeding and grooming, particularly those located at distance from the main roost.
- Consider the site context and connectivity to off-site areas of importance for Horseshoe bats.
- Consider the impacts on the invertebrate prey of horseshoe bats. For example, for larger developments on farmland, whether any herds of grazing animals can be retained within the wider landholding following the development, and whether grazed pasture will remain accessible to horseshoe bat species.

Foraging Habitat

B4.3 Where impacts on foraging habitat cannot be avoided, replacement habitat will be needed to avoid net loss of habitat. Replacement habitat should always aim to be optimal for the species affected. Examples of impacted habitats which must be retained in the first instance or appropriate replacement habitat provided include hunting habitat such as grazed pasture, hedgerows, woodland edges, tree lines, wetlands and hay meadows. The developer's ecologist must carry out the HEP calculations for both horseshoe bat species and submit them with the planning application to be reviewed by the planning officer and North Somerset Council's Ecologist. A site plan clearly showing HEP allocated areas post-construction will need to be

[13] UK conservation status assessment for S1303 - Lesser horseshoe bat (Rhinolophus hipposideros) as part of the Fourth Report by the United Kingdom under Article 17 of the EU Habitats Directive (jncc.gov.uk) ; Definition of Favourable Conservation Status for Greater horseshoe bat (Rhinolophus ferrumequinum) - RP2963 (naturalengland.org.uk).

provided alongside the HEP calculations, with areas allocated for Biodiversity Net Gain shown to demonstrate that all legal obligations will be met.

B4.4 Where replacement foraging habitat provision is necessary, the type(s) of habitat to be provided and the location of the provision shall be agreed with North Somerset Council's Ecologist and/or Natural England as appropriate. It is recommended that on-site HEP provisions are made in the first instance, with off-site provisions provided as a last resort, in accordance with the ecological mitigation hierarchy.

B4.5 Where replacement foraging habitat is proposed off-site, the land must not be a designated Site of Special Scientific Interest or in countryside stewardship to be enhanced for bats. Additionality on top of 10% Biodiversity Net Gain as set out in Section A9.3 needs to be demonstrated.

B4.6 Replacement foraging habitat must aim to be the optimal for the prey of the bat species affected (See Annex 5). The following are examples of habitats of value to horseshoe bats and which may be created or enhanced as the replacement provision. Planting will be expected to consist of native species that produce an abundance of invertebrates.

- Hedgerows with trees: tall, bushy hedgerows at least 3 metres wide and 3 metres tall, managed so that there are perching opportunities;
- Wildflower meadow or semi-improved rough grassland: managed for moths, e.g., long swards[14];
- Grazed pasture (essential for juveniles): difficult to recreate on site and only feasible with management agreements with local landowners over and above existing regimes. Even so, there may be issues which prevent grazing in the future[15] Because of this issue, a change to grazing regime without any additional enhancement to habitats present, may only be accepted in exceptional circumstances, such as where there is a clear mechanism for legally securing and enforcing the amended grazing regime. It should be noted that there have been challenges to securing and enforcing long-term (in perpetuity) provision for grazing through the planning process for other applications[16];
- Ponds: for drinking and a prey source for Lesser Horseshoe Bats;
- Woodland/copses; and
- Provision of additional roosting (e.g. night roosting) opportunities on site.

B4.7 The method for checking the adequacy of replacement habitat provided with an application or in masterplanning of a proposed development, is given in Annex 4.

B4.8 It is important that provision of the replacement habitat is carried out to timescales to be agreed by the local authority, and Natural England as required, and secured through an appropriate mechanism within the planning process (e.g. timescale to be set out in a S106 agreement). Replacement habitat should ideally be created in advance of or at least concurrent to a development proceeding to demonstrate no significant adverse effect beyond reasonable scientific doubt. This will allow for vegetation to establish and ensure continuity in HEP provisions.

B4.9 In the case of quarries, waste sites or other large-scale sites where restoration is proposed, this should not be considered as mitigation for habitat lost to horseshoe bats. The timescale to when these restorations is likely to be implemented, which may be 40 years after the quarry has been

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[14] For example, the main species of moth species eaten by Greater Horseshoe bats are Large Yellow Underwing; Small Yellow Underwing; Heart and Dart; and Dark Arches at Woodchester (Jones, G., Barlow, K., Ransome, R. & Gilmour, L. 2015. *Greater Horseshoe bats and their insect prey: the impact and importance of climate change and agri-environment schemes*. Bristol: University of Bristol). See Annex 5 for information on habitats and food plants used by these species.

[15] For example, see paragraphs 41 to 50 of Appeal Ref: APP/X1165/A/13/2205208 Land at Churston Golf Club, Churston, Devon, TQ5 0LA.

[16] For example, see paragraphs 41 to 50 of Appeal Ref: APP/X1165/A/13/2205208 Land at Churston Golf Club, Churston, Devon, TQ5 0LA.

worked, is too long to provide any replacement to maintain the existing population at the time of impact.

B4.10 **It is vital that any replacement foraging habitat is accessible to the bat population affected. This includes consideration of distance from SAC roosts and large maternity roosts, landscape connectivity and fragmentation and potential displacement as a result of barriers such as unacceptable levels of light spill.**

B4.11 An Ecological Management Plan for the site and any off-site land must be provided setting out how the site will be managed for horseshoe bats in perpetuity, with periodic review and remedial measures as required. Where appropriate, a Monitoring Strategy also needs to be included in order to ensure continued use of the site by SAC bats and includes measures to rectify the situation if negative results occur. This could form part of a Landscape and Ecological Management Plan or be provided as a stand-alone document.

Dispersal Corridors and Connectivity

B4.12 It is important to maintain connecting habitat for horseshoe bats across a proposed development site to ensure continued dispersal and function of the SAC population. Dispersal corridors are required for passage between maternity, hibernation, mating and other roosts, foraging areas and breeding between different populations to maintain genetic diversity. Features regularly used by horseshoe bats, which often fly lower than 2 m above ground level, include dark vegetated linear corridors such as mature hedgerows, built linear features such as stone walls, habitat edges e.g. woodland edges, embankments and networks of rhynes and watercourses on the North Somerset Levels and Moors. Proposals must seek to retain existing functioning linear commuting features as replacement of dark vegetated corridors such hedgerows is likely to require a significant period to establish. The HEP metric has no site-specific or landscape context and, for this reason, is not appropriate to inform creation or maintenance of dispersal corridors/commuting habitat.

B4.13 The following is required as mitigation to ensure continuous connectivity across a site, with the corridor width as wide as possible:

- For major developments[17] (which will generally have greater impacts), there should be a minimum width of 10 m of a landscape buffer of open, rough/tussocky grassland maintained each side of natural linear features such as hedgerows, woodland edge, or vegetated watercourses. Ideally, there should be a second linear feature e.g. hedgerow at the new, inner edge of the landscape buffer. **The distance must be measured from the edge and not the centreline of the feature.** In some cases, this requirement may also apply to tall, continuous built features such as embankments and significant walls.
- Significant and strategic development, for example, in a pinch-point location for horseshoe bat dispersal may require as much as a 30 m buffer or corridor.
- For minor developments, or where a narrower dark corridor can be justified ecologically, the corridor should be as above but a minimum of 6 m wide.
- Buffers must be clearly shown on an annotated plan and accompanied by scaled cross-section/profile drawings.
- The buffer area must be allocated specifically as HEP provision/horseshoe bat habitat, and not exposed to damage by human activity.
- Vegetated corridors (hedgerows and treelines) must be maintained at a minimum height of 3 m and sufficiently dense, or with an associated solid barrier (see below), to prevent light spill penetrating the corridor. This may need to be evidenced in light modelling.
- Where affected by illumination, including vertically onto planting, a minimum 1.8 m high close-boarded fence with concrete posts must be installed as a screen on the outside of the planting. In this instance, connectivity measures for other species such as hedgehog, badger, reptiles and amphibians may need to be incorporated to enable landscape

[17] Statutory definition as per Town and Country Planning (Development Management Procedure) Order 2015

permeability through the solid boundary. The distance from the light source will also need to be considered.

- If dark foraging habitat is required, the corridor may need to be far wider with the planting and management specifications carefully considered to benefit the target species.
- The dark corridor must be maintained in perpetuity and be protected from the start of construction. Appropriate planning conditions or legal agreements will be required to enable this.
- The grassland should be created and managed to maximise insect prey. To benefit moths, any grassland mix should be as species-rich as possible (suitable to the soil type) and ideally include dandelion, dock, hawkweeds, plantains, chickweed, fat hen, mouse-ear, and other herbaceous plants (see Annex 5). Use of wildflower meadow is encouraged wherever feasible. The key factor over and above species diversity is structure of the grassland and the management regime, to maximise places of shelter for invertebrates as well as providing a wide range of food plants.
- Wherever possible, the dark corridor should be incorporated into the public realm rather than being a separate, isolated, corridor. The corridor may include a mown unadopted footpath 1 m wide.

Lighting

B4.14 Loss of habitat refers not only to physical removal but also indirectly from the effects of lighting. Both horseshoe bat species are known to be very light sensitive. Recent research suggests that preferred dispersal corridors for Lesser Horseshoe bats are at lux levels even lower than previously thought: "*under natural, unlit conditions ... 0.04 lux*" Lacking evidence to the contrary, it is assumed that Greater Horseshoe Bats react in the same way.[18]

B4.15 Key issues for horseshoe bats from lighting are:

- Slower-flying, broad-winged bats, including horseshoe bats, are often light-averse and avoid lit areas.
- Many night-flying species of insect such as moths, a key prey species for horseshoe bats, are attracted to light, especially lamps that emit an ultra-violet component and particularly if it is a single light source in a dark area. Insects are attracted to illuminated areas from further afield, resulting in adjacent habitats supporting reduced numbers of insects. This is likely to further impact on the ability of the bats to be able to feed.[19]
- Streetlights have detrimental effects on local caterpillar assemblages and artificial lighting is likely to be contributing to overall declines in the moth population, reducing prey availability for SAC bat species[20].
- LEDs can offer greater control over the type, intensity and spread of light. However, recent studies have shown that light-sensitive bats avoid LED lights even when dimmed and that continuous lighting along roads introduces barriers that some bat species cannot cross[21].
- In addition to impacts on movement and feeding, light falling on a bat roost access point can delay bats from emerging. This then reduces the time available for foraging. Lighting may also cause bats to abandon a roost.
- At a landscape scale, artificial lighting can disrupt navigation along linear features as much as the physical removal of such features. Light spill onto commuting routes can force bats

[18] Average light levels recorded along preferred commuting routes of Lesser Horseshoe bats under natural unlit conditions were 0.04 lux across eight sites (Stone, E.L 2013. *Bats and Lighting – Overview of current evidence and mitigation.* Bristol: University of Bristol)

[19] Institute of Lighting Engineers/ Bat Conservation Trust. 2023. *Bats and Artificial Lighting at Night*; pers. comm. Dr Emma Stone, University of Bristol, 2009.

[20] Boyes, D. H, Evans, D. M., Fox, R., Parsons, M. S. and Pocock, M. J. O (2021). *Street Lighting has Detrimental Impacts on Local Insect Populations*. Science Advances 7 (35).

[21] Rowse, E.G., Harris, S. and Jones, G. (2016). *The Switch from Low-Pressure Sodium to Light Emitting Diodes Does Not Affect Bat Activity at Street Lights*. PLoS ONE 11(3): e0150884. https://doi.org/10.1371/journal.pone.015088. Stone, E. L., Jones, G. and Harris, S. (2012). *Conserving energy at a cost to biodiversity? Impacts of LED lighting on bats.* Global Change Biology (2012) 18, 2458-2465.

to use alternative routes (if available) and this can, in turn, result in an additional energetic burden on individual bats. If no alternative routes are available, roosts and foraging habitats may be abandoned. Lighting can, therefore, lead to bat populations becoming fragmented into smaller units which in turn become more vulnerable to local extinction.

B4.16 A development proposal will be expected to demonstrate *beyond reasonable scientific doubt* (as required by case law[22]) that bats will not be prevented from using features by the introduction of new lighting or a change in lighting levels. Lighting refers to both external and internal light sources. The following will be expected from applicants for schemes which pose a credible risk to functionally-linked foraging habitat, dispersal corridors or bat roosts for SAC bat populations:

- Baseline lighting survey – if evidence is provided to demonstrate that baseline light levels will not be exceeded or only marginally altered in a manner which is unlikely to impact on SAC bat populations, mitigation will not be required.
- Evidence to demonstrate that considerations of site design, including building orientation; and the latest techniques in lighting design have been employed in order to, ideally, avoid light spill to retained and created bat habitats.
- A Lighting Strategy detailing the proposed light layout and parameters for external and internal light spill. This must include the type of lighting (ideally make and model) proposed, indicative locations and details of any measures to mitigate or reduce light spill e.g. motion sensitive or part-night lighting.
- A lux contour plan where it is unclear in the Lighting Strategy whether levels of light spill onto retained and created habitats for horseshoe bats will remain below 0.4 lux on the vertical plane or 0.2 lux on the horizontal plane.
- All lighting with potential impacts to be considered including street lighting, security lighting and internal light spill as a result of large expanses of glazing facing onto horseshoe bat habitat.
- Evidence for futureproofing via appropriate legal mechanisms may be required e.g. for installation of lighting within gardens by householders adjacent to horseshoe bat habitat, if avoidance measures have not been clearly demonstrated within site plans.
- Impact assessment must also take into consideration the effects from lighting outside the proposed development site, for example from installation of street lighting along previously unlit sections of highway but now required to illuminate an application site's entrance.
- A post-development monitoring strategy, detailing remedial measures if light spill exceeds the required low levels, may need to be submitted, especially for higher impact applications or applications in particularly sensitive areas e.g. Density Band A for either species.

B4.17 Outline applications are not exempt; neither is Planning Permission in Principle where there is a risk of a significant adverse impact on a bat SAC (i.e. a 'Habitats Development'). This is because a HRA is undertaken at the point that the decision on the principle of development is made. At this point, applicants must demonstrate, for the competent authority to be sufficiently certain, that levels of light spill resulting from the development will not have adverse impacts on SAC bat habitat. Therefore, even for an Outline or Permission in Principle application, certainty about the potential light spill from the development is required. The use of parameter plans and with assumptions about window size, type of fitting etc. can be incorporated into a Lighting Assessment that demonstrates an acceptable lighting scheme can or could be achieved. The competent authority can undertake a HRA on that basis. A planning condition is then required so that the eventual design meets the levels of light spill shown in the Lighting Assessment, or better if possible. The Lighting Assessment must follow the guidance set out in ILP 2023 guidance[23] and model the combined effects of lighting from internal and external sources, including a worst case scenario i.e. all lights on at the same time and no curtains or blinds in use, and using a Maintenance Factor of 1 (meaning lights are at their brightest and most efficient). This evidence will then inform adequate and legally robust HRAs.

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[22] For example, *Landelijke Vereniging Tot Behoud Van De Waddenzee v Staatsecretaris Van Landbouw* (C-127/02) [2005] 2 CMLR 31

[23] Institute of Lighting Professionals (2023). *Guidance Note 8: Bats and Artificial Lighting in the UK.*

B4.18 Models must be provided to include light from all luminaires, show the worst scale scenario (i.e., a maintenance factor or 1 with no dimming unless this is a clear and enforceable parameter) and include light levels on vertical features. The ILP 2023 guidance states '*Lux contours (and/or coloured numbers) for 0.2, 0.5, 1, 5, and 10 lux must be clearly shown as well as appropriate contours for values above these. Each illuminance/lux contour plan should be accompanied by a table showing their minimum and maximum lux values… The illuminance contour plots should be accompanied by an explanatory note from the lighting professional to list where, in their opinion, sources of glare acting upon the key habitats and features may occur and what has been done/can be done to reduce their impacts...*'[24]

B4.19 For planning applications, lux contour plans on the horizontal plane (at 0-2 m above ground level) will be required for all potentially-impacted horseshoe bat habitat due to the height at which Horseshoe bats fly. The plan should include details of the lamps and any shields used to direct illumination. Solid structures such as close-boarded fencing or solid walls used to shield bat sensitive areas from lighting can be taken into consideration. Vegetated barriers are not normally an accepted solution in their own right due to seasonal variability in the density of foliage and management requirements. In addition, developers and ecologists need to be aware of street and other lighting causing illumination of the vertical surfaces of hedgerows, woodland edge and other structure used by commuting and hunting bats. Vertical calculation planes must be modelled and submitted with planning applications to demonstrate impacts wherever appropriate. Examples include along retained and created dispersal corridors, edges of retained or created foraging habitat or the façade of buildings containing roosts to show the illumination directly upon the vertical faces of the feature. Vertical planes can also show a cross-sectional view within open space.

B4.20 It is difficult to demonstrate 'complete darkness' or a 'complete absence of illumination' on vertical planes where some form of lighting is proposed on site despite efforts to reduce impacts as far as possible and where horizontal plane illuminance levels are zero. Consequently, where 'complete darkness' on a feature or buffer is required, it may be appropriate to consider this to be where illuminance is below 0.2 lux on the horizontal plane and below 0.4 lux on the vertical plane. These figures are still lower than what may be expected on a moonlit night but are in line with research findings for the illuminance found at hedgerows used by Lesser Horseshoe Bats, a species well known for its light adverse behaviour.'[25]

B4.21 Consideration should also be given to impacts from intermittent or unpredictable illuminance from sources which cannot be modelled such as glare, reflections, and car headlights.

B4.22 It is advised that mitigation measures are designed in accordance with ILP 2023 guidance. A variety of techniques will be supported to facilitate development that will avoid, minimise and/or compensate for light spill such as:

- Only using lighting where absolutely essential for health and safety reasons on sensitive sites or in sensitive areas of sites;
- Avoiding or minimising use of floodlighting/indiscriminate streetlighting and considering use of wall-mounted and directional lighting instead;
- Careful positioning of streetlighting to avoid bat crossing points for key infrastructure such as roads;
- Use of building structure, design, location and orientation to avoid/minimise lighting impacts on retained habitat;
- Use of solid barriers to protect and/or create dark corridors on site;
- Use of low transmittance glazing or measures such as light reducing coating where appropriate;

[24] Institute of Lighting Engineers/ Bat Conservation Trust. 2023. *Bats and Artificial Lighting at Night*; pers. comm. Dr Emma Stone, University of Bristol, 2009.
[25] Institute of Lighting Engineers/ Bat Conservation Trust. 2023. *Bats and Artificial Lighting at Night*; pers. comm. Dr Emma Stone, University of Bristol, 2009.

- Use of internal lighting design solutions to minimise light spill from places such as windows;
- Use of part-night lighting, dimming and motion sensors with short duration timers; and
- Use of lighting solutions such as automated blackout blinds, although these should only be used as a last resort where impacts cannot be avoided through appropriate design due to the challenge of enforcement.

Light colours should ideally be targeted 2700K or below to meet the ILP guidance. Note that the use of red lamps in street lights as mitigation, which had been shown to be effective for some bat species, is unlikely to work for horseshoe species and should not be used as mitigation.[26]

Proposed Developments with Minor Impacts

B4.23 Schemes likely to have minor impacts, and therefore, are likely to be exempt from survey requirements and HEP metric considerations are stated in Section A7.2. In circumstances of overall less potential impact, especially in Band C or outside of the Consultation Zones, mitigation may be put forward without the need for a full season's survey (See Annex 3). This approach will only be suitable where it can be clearly demonstrated that the impacts of a proposed development are proven to be minor and can be fully avoided or mitigated. In order to adopt this approach, it will be necessary for a suitably qualified ecologist to complete a site survey and Ecological Impact Assessment, referencing functionally-linked SAC bat habitat and setting out appropriate avoidance and mitigation measures associated with the proposed development for foraging and commuting habitats.

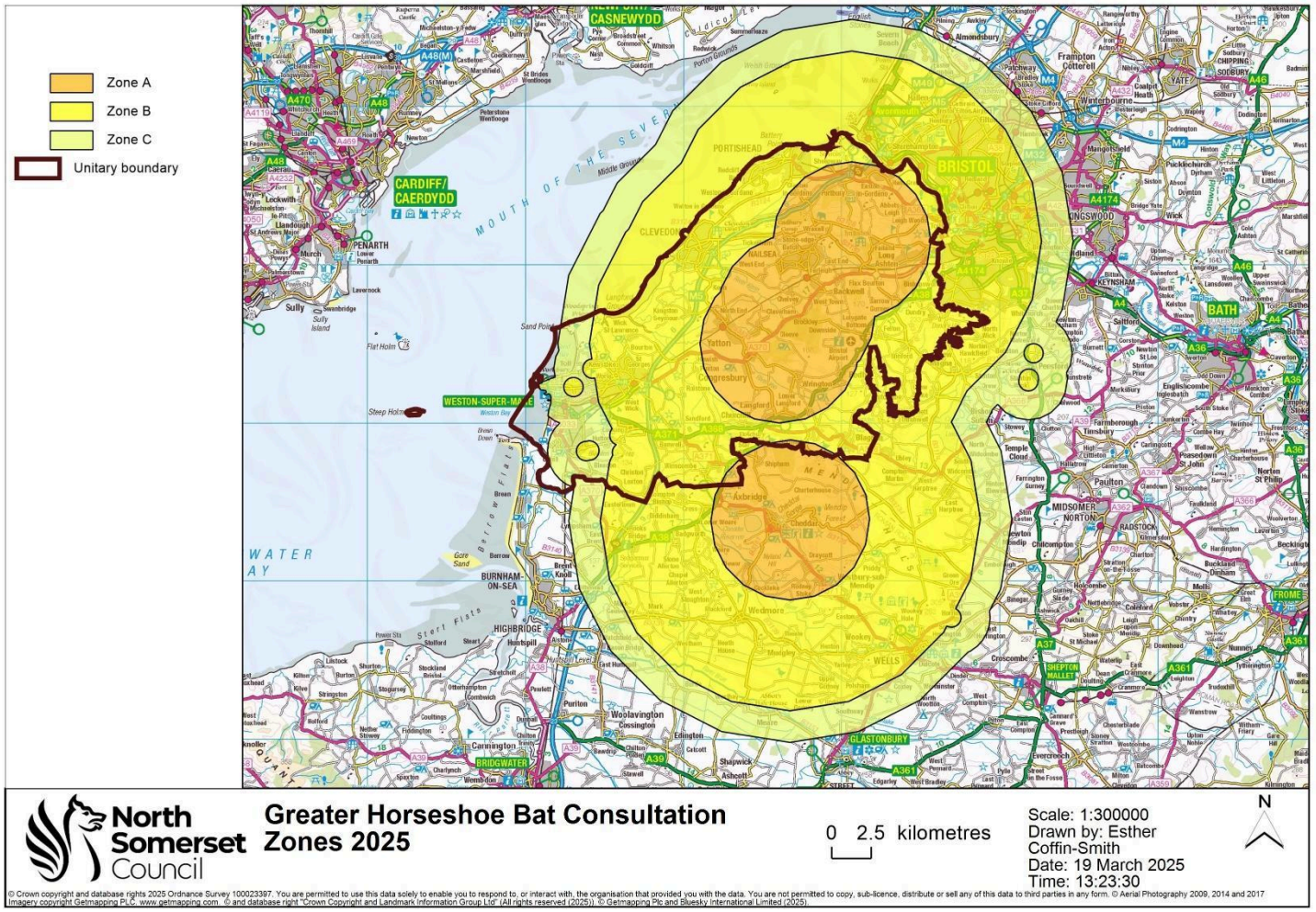
B4.24 In terms of impacts on SAC bats and habitat, it is important to bear in mind that small-scale developments may still have significant impacts on horseshoe (and other bat) roosts and result in indirect impacts such as light spill. Although some sites are exempt from the SPD approach, a case-by-case assessment must still be made in relation to potential impacts on the bat SAC, and whether appropriate, bespoke avoidance or mitigation measures are required.

Other Bat Species

B4.25 Whilst this guidance only focuses on horseshoe bats, overall mitigation and compensation requirements for development schemes will need to consider the requirements of all bat species. North Somerset has a high bat biodiversity with at least 16 of the 17 UK bat species recorded. Of particular note, the habitats within the SAC and Horseshoe Bat Consultation Zones are known to support barbastelle and Bechstein's Bats, which are also Annex II species under the Conservation of Habitats and Species Regulations 2017 (as amended) (although the SAC is not currently designated for these species). As well as providing habitat for horseshoe bats, developments must also consider requirements for these species in key areas around woodland and dense, mature field boundaries, such as retaining, buffering and enhancing these habitats.

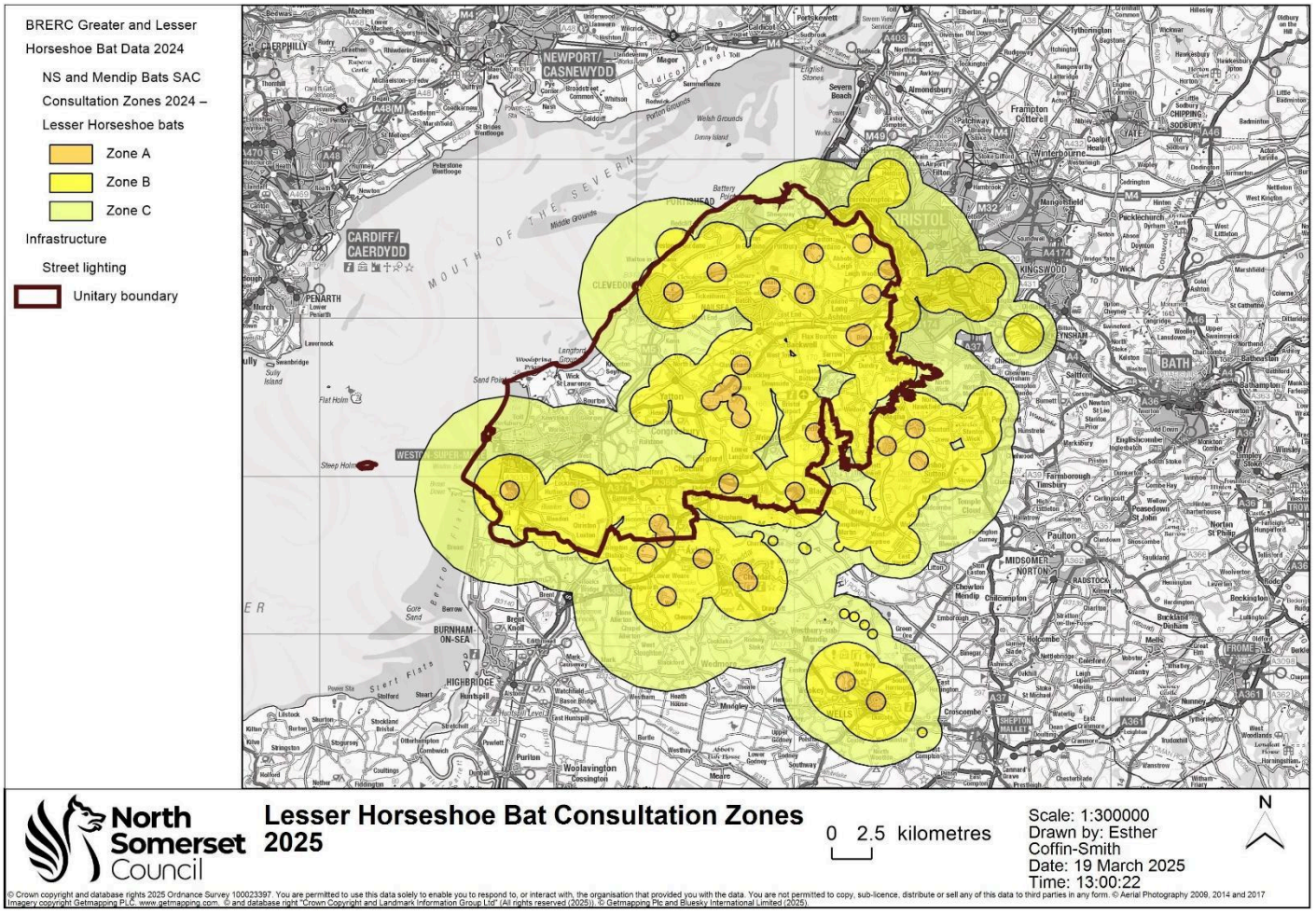
[26] Zeale, M. R. K., Stone, E. L., Zeale, E., Browne, W.J., Harris, S. & Jones, G. 2018. Experimentally manipulating light spectra reveals the importance of dark corridors for commuting bats. *Glob Chang Biol*. 2018 Dec;24(12):5909-5918.

Figure B1 Greater Horseshoe Bat Consultation Zones



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Figure B2 Lesser Horseshoe Bat Consultation Zones



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PART C: Annexes

Annex 1: Details of the North Somerset and Mendip Bats Special Area of Conservation

C1.1 The North Somerset and Mendip Bats SAC is made up of seven component Sites of Special Scientific Interest (SSSI):

- Compton Martin Ochre Mine SSSI (Bath &North East Somerset)
- Banwell Caves SSSI (North Somerset)
- Banwell Ochre Mine SSSI (North Somerset)
- Brockley Hall Stables SSSI (North Somerset)
- King's Wood and Urchin Wood SSSI (North Somerset)
- The Cheddar Complex SSSI (Somerset)
- Wookey Hole SSSI (Somerset)

C1.2 The SAC was selected on the basis of the size of population represented (3% of the UK Greater Horseshoe bat population) and structure and function, having both maternity and hibernation sites. The populations of both Lesser Horseshoe and Greater Horseshoe Bats have increased since the selection of the site, following national trends as the species recovers. The proportion of the national population of Greater Horseshoe Bats present within North Somerset may therefore have increased. The count data up to 2024 is available in Appendix 7. The SAC contains an exceptionally good range of the sites used by the population, comprising two maternity sites in lowland North Somerset and a variety of cave and mine hibernation sites in the Mendip Hills. The limestone caves of the Mendips provide a range of important hibernation sites for Lesser Horseshoe Bat.

C1.3 Greater Horseshoe Bats are long-lived (over 30 years in some cases) with the bats remaining faithful to these important roosting sites, returning year after year for generations.

C1.4 In terms of physical area, the SAC designation applies to a tiny element of the habitat required by the bat population (the maternity roosts and entrances to their hibernation sites). It is clear that the wider countryside supports the bat populations because of the following combination of key elements of bat habitat:

C1.5 *The area has to be large enough to provide a range of food sources capable of supporting the whole bat population; the bats feed at a number of locations through the night and will select different feeding areas through the year linked to the seasonal availability of their insect prey*:

- SAC bats regularly travel between feeding sites and their roosts via a network of established flyways. Radio-tracking of Greater Horseshoe Bats[27] has shown that they travel between Brockley Hall Stables and Cheddar Gorge and further afield to the Bath and Bradford-on-Avon Bat and Mells Valley Bat SACs at certain times of the year, for example, in the spring and autumn between hibernacula and maternity sites, and in the autumn to mating sites occupied by single males. Bats need a range of habitats during the year in response to the annual cycle of mating, hibernating, giving birth and raising young.
- SAC bats need to be able to move through the landscape between their roosts and their foraging areas in order to maintain 'Favourable Conservation Status'. They require linear features in the landscape to provide landscape permeability. Compared to most other bat species, the echolocation call of the Greater Horseshoe Bat attenuates rapidly in air due to its relatively high frequency. This means it cannot 'see' a great distance and is one reason why it tends to use landscape features to navigate, such as lines of vegetation (e.g. hedgerows, woodland edge, vegetated watercourses, etc.). The Greater Horseshoe Bat

[27] Billington, G. 2001. *Radio tracking study of Greater Horseshoe bats at Brockley Hall Stables Site of Special Scientific Interest, May – August 2001*. Peterborough: English Nature.

will tend to commute close to the ground up to a height of 2 m, and mostly beneath vegetation cover. Radio-tracking studies[28] and observations in the field confirm that Greater Horseshoe Bats will regularly use the interconnected flyways associated with lines of vegetation. Further studies[29] have shown that landscapes with broadleaved woodland, large bushy hedgerows and watercourses are important as they provide habitat continuity. Habitat is therefore very important to SAC bats in terms of **quality** (generation of insect prey) and **structure** (allowing them to commute and forage).

- Horseshoe bats are sensitive to light and will avoid lit areas[30]. The interruption of a flyway by light disturbance, as with physical removal/ obstruction, would force the bat to find an alternative route which is likely to incur an additional energetic burden and will therefore be a threat to the viability of the bat colony. In some circumstances, an alternative route is not available and can lead to isolation and fragmentation of the bat population from key foraging areas and/or roosts. The exterior of roost exits must be shielded from any artificial lighting and suitable cover should be present to provide darkened flyways to assist safe departure into the wider landscape[31].
- The feeding and foraging requirements of the Greater Horseshoe Bat have been reasonably well studied in the south west of England and Europe[32]. From this work, we know that often most feeding activity is concentrated in an area within 4 km of the roost (juvenile bats will generally forage within 3 km at a stage in their life when they are most susceptible to mortality). The most important types of habitat for feeding have been shown to be permanent pasture grazed by cattle or sheep, hay meadows, and wetland features such as stream lines and wet woodland. Depending upon the availability of suitable flyways and feeding opportunities, most urban areas will provide limited Greater Horseshoe Bat habitat. The North Somerset and Mendip Bats SAC situation is unusual in that the wintering Greater Horseshoe Bat population mainly hibernates in caves in Cheddar Gorge and Wookey Hole, which are located close to urban areas and are subject to visitor disturbance. Commuting routes follow the urban edge, the Cheddar Yeo and within the urban area of Cheddar[33].
- Recent radio-tracking studies[34] from the Brockley Hall Stables roost have shown that the North Somerset Greater Horseshoe maternity roost bats forage over the North Somerset Levels and Moors (particularly towards Tickenham, western edges of Nailsea, Kenn, Yatton and Congresbury/Puxton), woodlands on the ridges and pockets of woodland on the Moors and pasture particularly on the Moors as well as hillsides around Backwell, Wrington, Cleeve, Claverham and Nailsea. Several satellite day roosts were found including, surprisingly, one well-used roost in the urban centre of Clevedon. The bats are clearly using sub-optimal habitat in some circumstances, but foraging is focused within high quality habitats on urban fringes and in open countryside as found in previous studies.

C1.6 The populations of bats from the North Somerset and Mendips SAC are currently under particular stress from a number of factors, particularly the number of development applications and proposals on the urban edges of Yatton, Congresbury, Backwell, Banwell, Nailsea and Cheddar which risk fragmentation and reducing access to suitable foraging habitat. Both species are also vulnerable to changes in agricultural and livestock management, particularly

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[28] Radio-tracking studies have been undertaken by NE in the following research reports R344, R496 & R573.

[29] A L Walsh & S Harris, (1996). *Foraging habitat preferences of vespertilionid bats in Britain.* Journal of Applied Ecology, 33, 508 – 518

[30] http://www.batsandlighting.co.uk/

[31] see EN research reports R174

[32] R D Ransome and A M Hutson, (2000), *Action plan for the conservation of the greater horseshoe in Europe (Rhinolophus ferrumequinum), Convention on the Conservation of European Wildlife and Natural Habitats,* Nature and Environment No 109. http://www.swild.ch/Rhinolophus/PlanII.pdf Also see EN research reports R174, R241, R341 & R532

[33] Rush, T. & Billington, G. 2013. *Cheddar Reservoir 2: Radio tracking studies of greater horseshoe and Lesser Horseshoe bats, June and August 2013.* Witham Friary: Greena Ecological Consultancy

[34] Geckoella (2022). *North Somerset Council Greater Horseshoe Bat Radio-tracking 2022.* Geckoella Ltd on behalf of North Somerset Council, Weston-super-Mare. Foxley, T. & Stone, E. 2022. *Foxley, T., Lintott, P., Stonehouse, S., Flannigan, J. and Stone, E.L. (2024) A High Resolution Spatial Modelling Framework for Landscape-Level, Strategic Conservation Planning. In prep.*

relating to herds of cattle in fields, conversion of pasture to arable and intensive hedgerow management, all of which reduce the abundance and diversity of invertebrate prey.

Annex 2: Bat Consultation Zone

Greater Horseshoe Bats

C2.1 The Greater Horseshoe and Lesser Horseshoe Bat Consultation Zone density band widths vary between species depending on its characteristic use of its home range and are given in Table B1. As both these species use a single focus for a population, a roost, they are likely to occur at a decreasing density in the landscape the further removed from roosts[35].

C2.2 Around Cheddar, it was reported that Greater Horseshoe Bats spent most of time roaming along hedgerows whilst foraging, moving onto different hedgerows after visiting several in their 'patch'. Individuals use foraging areas that could be over 200 m in length or over 6 to 7 hectares. Within these foraging areas, each bat has localised feeding spots of about 0.35 hectares. In Germany, they visit 11 – 25 such areas per night.

C2.3 A similar study of frequency of home range use away from a maternity roost site was carried out by Bontadina & Naef-Daenzer (2002) [36] at Grisons in Switzerland. It showed a higher frequency of use than would be expected at 1.2 to 1.6 km distance when compared with uniform spatial use over the whole foraging range up to 4 km. Above 4 km, the trend in spatial use declined up to the maximum range of 7.4 km. In a radio-tracking study carried out by Rossiter et al (2002) [37] at Woodchester Manor, overlaps in core foraging areas were nearly all within 1 km of the roost with only two overlaps recorded at ~2 km and then both corresponded to a mother/daughter pair. A number of radio tracking studies have shown the maximum foraging range for most Greater Horseshoe Bats is 4 km and this distance is often quoted in the requirements of habitat conservation from a roost site.[38] However, based on current knowledge, the North Somerset population is based within several large roosts, all sited within 2.6 km and so there is likely to be significant competition for prey resource. Although there are high quality woodland and pasture habitats in the locality, the area also has large and expanding urban areas close to the roosts, within increasing pressure from greenfield development and changes in livestock management. The population may therefore not demonstrate typical home ranges/maximum ranges and behaviours found in studies focused on rural populations with access to large, uninterrupted expanses of optimal habitat.

C2.4 The bands in Table B1 for maternity roosts of Greater Horseshoe Bats are derived from four local radio-tracking studies which have been completed. The findings were as follows:

1) **Billington (2001)[39]** radio-tracked the maximum distance travelled by bats at Brockley Hall as 6.8 km, discounting one bat which travelled 10.2 km to Shipham and then subsequently day roosted in Cheddar Gorge. However, measuring the distances in GIS the furthest recorded bat fix was 7.8 km ("as the crow flies"). Billington notes that there has been deterioration in habitat near to the Brockley Hall roost where hedgerows have been removed, poorly managed or neglected.

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[35] Rainho, A. & Palmeirim, J. W. 2011. The Importance of Distance to Resources in the Spatial Modelling of Bat Foraging Habitat. *PLoS ONE, April 2011, 6, 4, e19227*; Rosenberg, D. K. & McKelvey, K. S. 1999. Estimation of Habitat Selection for Central-place Foraging Animals. *Journal of Wildlife Management 63 (3): 1028 -1038.*

[36] Bontadina, F. & Naef-Daenzer, B, 2002. *Analysing spatial data of different accuracy: the case of Greater Horseshoe bats foraging*. PhD Thesis, Universität Bern

[37] Rossiter, S. J., Jones, G., Ransome, R. D. & Barratt, E. M. 2002 Relatedness structure and kin-based foraging in the Greater Horseshoe bat (*Rhinolophus ferrumequinum*). *Behav. Ecol. Sociobiol. (2002) 51: 510-518*

[38] See Appendix 1; e.g. also see Duvergė, P. L. & Jones, G. 1994. Greater Horseshoe bats - Activity, foraging behaviour and habitat use. *British Wildlife 6, 2, 69 -77;* Ransome, R. D. 1996. *The management of feeding areas for Greater Horseshoe bats*. Peterborough: English Nature; Ransome, R. 2009. *Bath Urban Surveys: Dusk Bat Surveys for horseshoe bats around south-western Bath. Assessments Summer 2008 & Spring 2009*. Bat Pro Ltd.

[39] Billington, G. 2001. *Radio tracking study of Greater Horseshoe bats at Brockley Hall Stables Site of Special Scientific Interest, May – August 2001.* Peterborough: English Nature.

2) **Duvergé (1996)**[40] carried out radio-tracking studies in North Somerset where the summer foraging areas of adults were found to be located within 3 – 4 km of maternity roosts, and the mean adult range in one extensive study was 2.2 km. About 75% of the foraging areas are located within the mean adult range.
3) **Geckoella Limited**[41] radio-tracked 20 adult and 4 juvenile bats from the Brockley Hall Stables roost in May, June and August 2021. The maximum foraging radius from the roost was found to be 13.9 km for adults and 4.9 km for juveniles. This is much further than previously recorded, but the roost has increased significantly in size since the 1996 and 2001 studies.
4) **Foxley et al (2024)**[42] used GPS to track 14 adult bats from the Brockley Hall Stables and Iford Manor roosts in August-September 2021 and August 2022. Bats were recording regularly foraging in habitats up to 12.5 km from the roost at Brockley and up to 10 km from the roost at Iford. These data were used to build habitat suitability and connectivity models for Greater Horseshoe Bats across Somerset. Further modelling was carried out using Geckoella radio-tracking data from juvenile bats at the Brockley Hall roost, confirming that a 5 km Juvenile Sustenance Zone is appropriate at this roost.

In the two more recent studies, Greater Horseshoe Bats were recorded across the Gordano Valley and as far west as Worlebury Hill on the edge of Weston-super-Mare. It should be noted that bats were not tracked from the King's Wood maternity roosts, and so the distribution from both roosts may differ. Surprisingly, bats were also not recorded switching between the King's Wood and Brockley maternity roosts, although this is assumed to occur given that they are within 2.6 km.

C2.5 The Density Band widths In Table B1 for the non-breeding and winter roosts are derived from a radio tracking study of non-breeding roosts of Greater Horseshoe Bats in Dorset carried out by Flanders (2008).[43] A comparison of foraging ranges from various studies on Greater Horseshoe Bats is given in Appendix 1.

Lesser Horseshoe Bats

C2.6 The Band widths for Lesser Horseshoe Bats are derived from the radio-tracking study carried out by Knight (2006)[44] for a lowland study area which was located in North Somerset. The maximum distance travelled in this study was 4.1 km for an adult female and 4.5 km for a nulliparous female. The mean maximum range was 2.2 km. Bontadina et al (2002)[45], whose study found a similar maximum foraging range, recommended that conservation management should be concentrated within 2.5 km of the roost with special consideration within 600 m of the roost where the colony foraged half the time. The same result was found for the North Somerset study.

C2.7 Radio-tracking of Lesser Horseshoe Bats carried out by Bontadina et al (2002) [46] estimated the density of Lesser Horseshoe Bat foraging in their study area was 5.8 bats per hectare within 200 m of the maternity roost, decreasing to 1 bat per ha at 390 m and 0.01 bats per ha at 1200

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[40] Duvergé, L. 1996 quoted in Roger Ransome. 2009. *Bath Urban Surveys: Dusk Bat Surveys for horseshoe bats around south-western Bath. Assessments Summer 2008 & Spring 2009*. Bat Pro Ltd.
[41] Geckoella (2022). *North Somerset Council Greater Horseshoe Bat Radio-tracking 2022.* Geckoella Ltd on behalf of North Somerset Council, Weston-super-Mare.
[42] Foxley, T., Lintott, P., Stonehouse, S., Flannigan, J. and Stone, E.L. (2024) A High Resolution Spatial Modelling Framework for Landscape-Level, Strategic Conservation Planning. *In prep*.
[43] Flanders, J. R. 2008. Roost use, ranging behaviour and diet of the Greater Horseshoe bat *Rhinolophus ferrumequinum* in Dorset: in Flanders, J. R. 2008. *An integrated approach to bat conservation: applications of ecology, phylogeny and spatial modelling of bats on the Isle of Purbeck, Dorset*. PhD Thesis, University of Bristol.
[44] Knight, T. 2006. *The use of landscape features and habitats by the Lesser Horseshoe bat* (Rhinolophus hipposideros). PhD thesis. University of Bristol.
[45] Bontadina, F., Schofield, H. & Naef-Daenzer, B. 2002. Radio-tracking reveals that Lesser Horseshoe bats (Rhinolophus hipposideros) forage in woodland. *J. Zool. Lond. (2002) 258, 281-290*.
[46] Bontadina, F., Schofield, H. & Naef-Daenzer, B. 2002. Radio-tracking reveals that Lesser Horseshoe bats (*Rhinolophus hipposideros*) forage in woodland. *J. Zool. Lond. (2002) 258, 281-290*.

m. Knight (2006)[47] when carrying out radio-tracking for a Lesser Horseshoe Bat roost of 200 individuals in North Somerset estimated a foraging density of 0.13 bat/hectare within 2 km of the roost and, like the Bontadina *et al* study, density declined sharply within the first kilometer in two of the study sites and subsequently, at a lower rate out to the extent of the recorded foraging distance. A third study site in a high-quality landscape showed a steadier rate of decline in density throughout the range.

C2.8 The Band widths for the non-breeding roost are derived from England radio-tracking of Lesser Horseshoe Bats carried out in the winter. This study revealed that they foraged on average to a maximum distance of 1.2 km from the hibernation site. One bat travelled to an absolute maximum distance of 2.1 km. The winter foraging range appears to be approximately half that of the distance covered in the summer months. (Bat Conservation Trust/BMT Cordah, 2005)[48] For the purposes of this study, the ranges are similarly halved. A comparison of foraging ranges is given in Appendix 1.



Lesser Horseshoe Bat
(Photo: Frank Greenaway. Courtesy Vincent Wildlife Trust)

[47] Knight, T. 2006. *The use of landscape features and habitats by the Lesser Horseshoe bat* (Rhinolophus hipposideros). PhD thesis. University of Bristol.
[48] Bat Conservation Trust / BMT Cordah. 2005. *A Review and Synthesis of Published Information and Practical Experience on Bat Conservation within a Fragmented Landscape*. Cardiff: The Three Welsh National Parks, Pembrokeshire County Council, Countryside Council for Wales

Annex 3: Survey Specification for Planning Applications

C3.1 Three types of survey are required to inform the impact of proposed development. These are:

- Bat Surveys
- Habitat Surveys
- Lighting Surveys

Bat Surveys

C3.2 The following sets out the survey requirements for development sites within the Bat Consultation Bands A and B, in part based on the guidance given by the Bat Conservation Trust (2023)[49] and on the advice of consultants experienced in surveying for horseshoe bats. Note that the objective is to detect commuting routes and foraging areas rather than roosts. Identifying roosts requires a bespoke set of survey requirements, tailored to the site, as guided by the Bat Conservation Trust survey guidelines, including the use of Night Vision Aids (NVAs).

C3.3 The following specification is recommended in relation to development proposals within Bands A and B of the Bat Consultation Zone. It is also worth mentioning, in particular, the difficulty associated with detecting Horseshoe bat echolocation calls compared to most other British bat species due to the directionality and rapid attenuation of calls. This fact emphasises the requirement for greater surveying effort and the value of broadband surveying techniques. The most sensitive equipment available should be used, and full spectrum recording is required. For complex sites, it is also recommended that the Council Ecologist be contacted with regard to survey effort as set out in Section B3. Detailed requirements include:

(i) Surveys should pay particular attention to linear landscape features such as watercourses, transport corridors (e.g., roads, sunken lanes railways), walls, and to features that form a linear feature such as hedgerows, coppice, woodland fringe, tree lines, ditches and rhynes and areas of scrub and pasture that may provide flight lines.

(ii) The main survey effort should be using automated detectors. Automatic bat detector systems need to be deployed at an appropriate location i.e., on a likely dispersal corridor or in high quality foraging habitat. Enough detectors must be deployed so that **each individual potential dispersal corridor** is monitored through the survey period in order that temporal comparisons can be made. Deployment should also include detectors in **high quality potential foraging habitat** i.e. scoring 4 or above on the HEP metric, where a suitable location can be found. In some circumstances, locating detectors in lower quality foraging habitat may also be important for comparisons to be made. Multiple detectors will need to be deployed to allow comparative analysis of the use and quality of habitats within a site. It is not acceptable to move detectors around between locations and then to attempt to compare activity between different locations, as this could solely be a product of deployment at different times or during different weather conditions. The period of deployment should be at least 40 nights between April to October (40 nights out of 214; ≈20%) and must include at least one working week in each of the months of May, June, July, August, September[50] and October for sites within Band A. For sites located between summer roosts and winter hibernation sites which may be key dispersal corridors, deployment will also need to include at least one working week in March and April and November and December (20 nights). For sites which may be used by winter foraging bats (i.e. up to 1.2 km from hibernation sites), the period of deployment should be at least 25 nights between November and March and to include at least one working week in each of these month (25 nights out of 151; ≈16%).

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[49] Collins, J. (ed). 2023. *Bat Survey Guidelines for Professional Ecologists: Good Practice Guidelines*. (4th Edition) London: Bat Conservation Trust

[50] Note that female Barbastelle bats are absent from the home woodland during September when they disperse to find male roosts.

(iii) The number of automated detectors will vary in response to the number of linear landscape elements and foraging habitat types, the habitat structure, habitat quality and taking into account Horseshoe bat flight-altitude. Every site is different, but the objective would be to sample each habitat component equally.[51] Generally:

- With hedges, the number of detectors needed will depend on their height and width and presence of trees. Factors such as shelter in windy conditions will need to be considered in deployment locations.
- With grassland, the number depends on whether the site is grazed or not. If a site is grazed, a comparison of the fields with livestock and without livestock is required.
- In a woodland situation, a sample with three detectors is recommended: one on the woodland edge, two in the interior with one in the canopy and one at eye-level.
- Riparian corridors should have detectors deployed on both banks and vegetated edges.
- Open areas of a quarry should have two detectors reflecting the un-vegetated and vegetated cliffs so the two can be compared.

(iv) Recordings from automated detectors must be analysed to determine whether the site supports foraging or increased levels of activity as this affects the Band used in calculating the amount of replacement habitat required to mitigate losses to horseshoe bats.

(v) Night-time Bat Walkover (NBW) surveys[52] should be carried out on at least three separate evenings; with a minimum of one survey in spring (April/May), one in mid-summer (June for Lesser Horseshoe or July for Greater Horseshoe Bats) and one in autumn (September or October)[53], as the bats' movements vary through the year. For sites close to maternity roosts, an August survey to take account of potential juvenile foraging activity may also be beneficial. The static observation point at the start of the survey is likely to need to be up to an hour, with consideration given to the distance of the site from known or possible Horseshoe bat roosts. Surveys must continue for at least three hours after sunset (the upper limit of national guidelines) as horseshoe bats tend to emerge later after sunset than some other bat species. Transects must cover all habitats likely to be affected by the proposed development, including a proportion away from commuting features in the centre of fields. Moreover, manual surveys only give a snapshot of activity (3 nights out of 214; ≈1.5%) and less effective at detecting horseshoe bats; therefore, automated bat detector systems must also be deployed (see section (ii)). Increased transect activity (one per month) should be considered for particularly sensitive sites close to maternity roosts or large sites which may be particularly important for horseshoe bat populations. Depending on the location and type of roosts recorded nearby, manual surveys may be required as early as March and as late as November, although static monitoring is often more effective than transects during periods of lower activity. It is essential that a qualified ecological consultant with Horseshoe bat expertise is engaged at the earliest possible stage to advise on bespoke requirements, particular for large-scale or high impact schemes.

(vi) Surveys targeting summer activity should be carried out in sunset temperatures of at least 10°C with no strong winds or heavy rainy. These are weather conditions that provide optimal conditions for foraging as insect activity is significantly reduced at low temperatures or in moderate or high winds. Details of weather conditions during surveys must be included in the final report.

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[51] Pers. Comm. Henry Andrews, AEcol, 23/09/2016

[52] Collins, J. (ed). 2023. *Bat Survey Guidelines for Professional Ecologists: Good Practice Guidelines*. (4th Edition) London: Bat Conservation Trust

[53] Note that transect surveys often do not record horseshoe bats whereas static detectors deployed on the same night do, especially at sites further away from a roost. The active bat season can vary e.g. shortened by prolonged cold winters and lengthened by warm 'Indian summers'

(vii) It will be essential that data is analysed and considered as it is gathered to inform additional potential survey requirements. Backtracking surveys may also need to be considered where data indicates that horseshoe bat roosts, particularly those not previously identified or of unknown status, may be present nearby. Additional targeted surveys may also be required for potential crossing points or pinch-points, for example across potential barriers such as major roads.

(viii) Advanced licence bat survey techniques (ALBST), including trapping and radio-tracking, will also need to be considered where there is a particular risk of a breach of Regulation 43 (2) of the Habitats Regulations, in relation to potential significant risks to the ability of Horseshoe bat species to breed, survive, reproduce nurture their young, hibernate or migrate. The considerations for these types of surveys are detailed in the Bat Conservation Trust's national survey guidelines. Non-invasive methods should be used wherever possible to minimise the impact on sensitive horseshoe bats, but invasive methods may be necessary to evidence decisions in exceptional circumstances. Decisions will need to be led by a suitably licensed and experienced ecologist (Natural England Bat Survey Class Licence Level 3 or Level 4).

(ix) Transect surveys should preferably be with most sensitive equipment available. Digital echolocation records of the survey should be made available on request with the final report, along with details of the type of the detector.

(x) Surveys must be carried out by suitably qualified and experienced persons. Numbers of personnel involved must be indicated in any report and be sufficient to thoroughly and comprehensively survey the size of site in question. Surveys should be designed to complete several repetitions of a transect route on one night i.e. large sites will need to be divided into small transect routes. The transect should start in a different location and/or direction on each visit to enable activity to be sampled at different times after sunset.

(xi) Surveys should also include desktop exercises in collating any records and past data relating to the site via Environmental Records Centres, local Bat Groups, etc. All larger sites (>0.5 ha) will be expected to have completed a Bristol Regional Environmental Record Centre (BRERC) or Somerset Environmental Record Centre (SERC) data search.

(xii) All bat activity must be clearly marked on maps and included within the report. Horseshoe bat activity should be reported as bat passes per hour as set out in Chapter 10 of the BCT survey guidelines.

(xiii) Basic details of records for the site must be passed to the appropriate Environmental Records Centre after determination of the application.

C3.4 Survey effort in Band C is dependent on whether commuting habitats are present and the suitability of on-site and adjacent habitat to support prey species hunted by horseshoe bats. Nonetheless, surveys must be in accordance with Bat Conservation Trust guidelines. It must also be remembered that the national guidance applies to sites with potential to support all bat species, so transect surveys will be required for development sites of a certain size of habitat quality.

Habitat Surveys

C3.5 Integrated Habitat System or UK Habitat Classification surveys should be carried out for all land use developments within the Bat Consultation Zone. Where the surveys have been done using Phase 1 designations these should be converted to one of the other two systems for the purpose of assessing the value of the proposed site to bats (UK Habitat Classification is required for Biodiversity Net Gain assessments in any case). Surveys should also include information on the habitats on site for the five years previous to the current survey, which can be assessed using aerial photographs, previous site photographs, ecological or other reports, Streetview, etc.

C3.6 Surveys must be extended to include the management and use of each field, e.g., whether the field is grazed or used as grass ley, and the height, width and management of hedgerows, over the past five years in the period of bat activity, generally May to October. Information can be sought from the landowner and through examination of aerial photographs. If grazed, the type of stock and management regimes must be detailed. Habitat mapping must include approximate hectarage of habitats to inform the methodology for calculating replacement habitat required.

C.3.7 Habitat surveying should be undertaken by a competent ecologist with suitable botanical experience i.e. FISC Level 4 or similar'. Full evidence of habitat quality, including the findings of sample quadrats for grassland, must be provided within ecological reports.

Lighting Surveys

C3.7 Surveys of existing baseline light levels on proposed development sites (where applicable) and proposed off-site locations for replacement horseshoe bat habitat should be undertaken and submitted with the planning application in accordance with guidance provided by the ILP in 2023.[54] This should cover the full moon and dark of the moon periods so that an assessment of comparative SAC bat activity on a proposed site can be ascertained.

C3.8 Baseline measurements should be taken systematically across the site or features in question. At each sample location, a reading should be taken at ground level on the horizontal plane (for illuminance hitting the ground) and vertical readings should also be taken at each sample location at 1.5m above ground level. The orientation for vertical readings should be perpendicular to the surface/edge of the habitat feature in question (such as a hedgerow) to produce a 'worst case' reading. Further measurements at other orientations may prove beneficial in capturing influence of all luminaires in proximity to the feature or principal directions of flight used by bats. This survey data can then be used to inform the masterplan of a project.

C3.9 Lighting surveys should also include an off-site assessment of the illumination of the vertical faces of structures, such as hedgerows and existing buildings in order that the proposed development site can be assessed in the context of the wider locale.

C3.10 Surveys should also consider lighting, and the absence of such where a road would be subsequently street lit post development, outside the red line boundary of the proposed development site. This particularly applies to schemes which may require additional off-site infrastructure, such as lit pedestrian footways.

C3.11 As detailed in Section B.14 to B.22, this information will then be used to inform lux contour modelling and lighting mitigation, as input into the Lighting Strategy for sites.

[54] *Guidance Note 08/23 Bats and Artificial Lighting at Night* (Institute of Lighting Engineers/ Bat Conservation Trust, 2023

Annex 4: Habitat Requirements of Horseshoe Bats

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Greater Horseshoe Bats

Prey

C4.1 Dietary analysis of Greater Horseshoe Bat droppings shows three main prey items: cockchafer *Melolontha melolontha*; dung beetles *Aphodius* sp. (Coleoptera: Scarabaeidae); and moths (Lepidoptera). Moths form the largest part of the diet but beetles are important at certain times of year.[55] They are conservative in their prey selection. Three secondary prey sources are also exploited: crane flies (Diptera: Tipulidae), Ichneumonids (Hymenoptera: Ichneumonidae) of the *Ophian luteus* complex, and caddis flies (Trichoptera) [but less so at Brockley Hall Stables].[56]

General

C4.2 Greater Horseshoe Bat populations are sustained by a foraging habitat which consists primarily of permanently-grazed pastures interspersed with blocks or strips of deciduous woodland, or substantial hedgerows. Such pasture/woodland habitats can generate large levels of their favoured prey, especially moths and dung beetles, but also tipulids and ichneumonids. Preferably pastures should be cattle-grazed, as their dung sustains the life-cycles of the most important beetles to Greater Horseshoe Bats, but sheep and horse grazing can also be beneficial in a rotation to reduce parasite problems. Sheep-grazing, which results in a short sward, may also benefit the life-cycles of tipulids and cockchafers.

C4.3 The periods through the year when these prey species are hunted is outlined below:

(a) The preferred key prey in April for all bats that have survived the previous winter is the large dung beetle *Geotrupes*.
(b) In May, the preferred key prey is the cockchafer *Melolontha melolontha*.
(c) In April and May, in the absence of sufficient key prey, bats switch to secondary prey such as tipulids, caddis flies and the ichneumonid *Ophion*. As a last resort, they eat small dipterans.
(d) In June and early July, pregnant females feed on moths, their key prey at that time, and continue to do so after giving birth, until late August. They usually avoid *Aphodius rufipes* even when they are abundant, as long as moths are in good supply. If both are in poor supply, they switch to summer chafers (*Amphimallon* or *Serica*).
(e) Moth supplies usually fall steadily in August and September, due to phonological population declines, or rapidly at a particular dawn or dusk due to temporary low temperatures. If either happens adult bats switch to secondary, single prey items, or combine moths with them. Tipulids are often the first alternative, but *Aphodius rufipes* is also taken. In very cold spells, Ichneumonids of the *Ophion luteus* complex are consumed. They are common prey in October and through the winter as they can fly at low ambient temperatures. However, in summer they are used as a last resort.
(f) Juvenile bats do not feed at all until they are about 29 or 30 days old, when they normally feed on *Aphodius rufipes*, which is their key prey. This dung beetle species is a fairly small (90mg), easily-caught and usually abundant prey, which reaches peak numbers at the time that the young normally start to feed in early August.[57]

C4.4 The top five feeding areas for Greater Horseshoe Bats over the active period in Gloucestershire include:

- pasture with cattle as single stock or part of mixed stock (38.6%);

[55] Ransome (1996) carried out dietary analyses of Greater Horseshoe Bats in June and July and found that 60 – 80% of their diet was moths.
[56] Ransome, R. D. 1997. *The management for Greater Horseshoe bat feeding areas to enhance population levels*: English Nature Research Reports Number 241. Peterborough: English Nature.
[57] Ransome, R. D. & Priddis, D. J. 2005. *The effects of FMD-induced mass livestock slaughter on greater horseshoe bats in the Forest of Dean.* English Nature Research Reports Number 646. Peterborough: English Nature.

- ancient semi natural woodland (16.6%);
- pastures with stock other than cattle (10.3%);
- meadows grazed by cattle in the autumn (9.4%); and
- other meadows and broadleaved woodland (4.9%).[58]

C4.5 These frequency at which these habitats are used changes with the seasons. Woodlands and pasture adjoining wood are used in spring and early summer. As summer progresses, feeding switches to areas further away and tends to be fields used for grazing cattle and other types of stock. Meadows that have been cut and where animals are grazing are also used. A balance of woodland and pasture of about 50% and 50% provides optimum resources for Greater Horseshoe Bats.[59] Billington (2000)[60] identified that there were four principal habitat types: scrub, meadow, deciduous woodland and grazed pasture.

C4.6 Within suitable habitat, a range of three roosts types must be present for a colony to exist. A single maternity roost, with many surrounding night roosts nearby (usually up to 4 km, but exceptionally up to 14 km) for resting between foraging bouts, and a range of suitable hibernacula within a 60 km radius. Three types of hibernacula have been identified which should be as close as possible, but within 15 km of the maternity roost.[61]

Grassland

C4.7 The most important factor for supporting juvenile Greater Horseshoe Bat populations is grazed pasture[62]. Cattle are preferred to smaller grazers, since they create the ideal structural conditions for perch-hunting bats in hedgerows and woodland edge. Within the Juvenile Sustenance Zone (i.e up to 5km from Brockley Hall Stables), the presence of permanent grazed pasture is critical. A high density of grazing animals should be present giving high presence of dung. Within the remainder of the roost foraging range, grazing regimes can be more flexible provided adequate pasture is available.[63]

C4.8 *Aphodius* beetles live in cow, sheep and horse dung. Short grazed habitat, such as produced by sheep, benefits *Melontha* and Tupilid species which require short grass to oviposit. Sheep dung also provides dung-based prey. Large dung beetles, *Geotrupes* spp., can provide a major dietary component of Greater Horseshoe bats. Most favour cattle dung, but some also use sheep dung.

C4.9 Longer swards benefit the larvae of noctuid moths.[64] The main species of moth eaten by Greater Horseshoe Bats during the maternity period at Woodchester in Gloucestershire are Large Yellow Underwing; Small Yellow Underwing; Heart and Dart; and Dark Arches. The former two species are on the increase whilst the latter two are in decline.[65]

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[58] Duvergė, P. L. & Jones, G. 1994. Greater Horseshoe bats - Activity, foraging behaviour and habitat use. *British Wildlife Vol. 6 No 2*

[59] Ransome, R. D. 1996. *The management of feeding areas for Greater Horseshoe bats*. Peterborough: English Nature; Bontadina, F. & Naef-Daenzer, B, 2002. *Analysing spatial data of different accuracy: the case of Greater Horseshoe bats foraging*. PhD Thesis, Universität Bern

[60] Billington, G. 2000. *Radio tracking study of Greater Horseshoe bats at Mells, Near Frome, Somerset*. Peterborough: English Nature

[61] R D Ransome and A M Hutson, (2000), Action plan for the conservation of the greater horseshoe in Europe (Rhinolophus ferrumequinum), Convention on the Conservation of European Wildlife and Natural Habitats, Nature and Environment No 109. http://www.swild.ch/Rhinolophus/PlanII.pdf

[62] Ransome, R. D. 1997. *The management for Greater Horseshoe bat feeding areas to enhance population levels*: English Nature Research Reports Number 241. Peterborough: English Nature.

[63] Ransome, R. D. 1996. *The management of feeding areas for Greater Horseshoe bats*. Peterborough: English Nature

[64] Ransome, R. D. 1996. *The management of feeding areas for Greater Horseshoe bats*. Peterborough: English Nature; Ransome, R. D. 1997. *The management for Greater Horseshoe bat feeding areas to enhance population levels*: English Nature Research Reports Number 241. Peterborough: English Nature

[65] Jones, G., Barlow, K., Ransome, R. & Gilmour, L. 2015. *Greater Horseshoe bats and their insect prey: the impact and importance of climate change and agri-environment schemes*. Bristol: University of Bristol.

- Large Yellow Underwing are found in a range of habitats, including agricultural land, gardens, waste ground, and has a range of food plants including dandelion, dock, grasses and a range of herbaceous plants both wild and cultivated, including dog violet and primrose. It will also visit flowers such as Buddleia, ragwort, and red valerian. The larva is one of the 'cutworms' causing fatal damage at the base of virtually any herbaceous plant, including hawkweeds, grasses, plantains and dandelions and a range of cultivated vegetables and flowers. This moth flies at night from July to September and is freely attracted to light.
- Small Yellow Underwing are found on flower-rich grassland, including meadows, roadside verges, open woodland and grassy embankments. The food plants are as for those listed for the Large Yellow Underwing but also include foxglove, sallow, hawthorn, blackthorn and silver birch. The larvae feed on the flowers and seeds of mouse-ear (*Cerastium spp.*), especially common mouse-ear. This moth flies in May and June in the daytime so may be gleaned at night.
- Heart and Dart are found in agricultural land, meadows, waste land, gardens and places where their food plants grow. Food plants include dock, plantain, chickweed, fat hen, turnip, sugar beet and many other herbaceous plants. The larvae feed on various wild and garden plants. The moth flies from May to July, when it is readily attracted to light.
- Dark Arches are found in meadows and other grassy place and food plants include cocksfoot, couch grass and other grasses. The larvae feed on the bases and stems of various grasses. The moth is on the wing from July to August and is readily attracted to light.[66]

C4.10 Through review of bat surveys accompanying planning applications, the highest concentration of feeding Greater Horseshoe Bats recorded by automated detector within the local area is in unmanaged semi-improved grassland and along mature hedgerows with wide rough grass margins.

<u>Woodland</u>

C4.11 Rides and footpaths are used by Greater Horseshoe Bats when flying in woodland feeding areas. Grassy rides and glades in woodland increase the range of food and provide opportunity for perch hunting.[67]

C4.12 Woodland supports high levels of moth abundances. Macro (and micro) moths are densest where there is grass or litter, less so where there are ferns, moss, bare ground or herbs. They are richer where there is native tree diversity and trees with larger basal areas. Species such as oak, willow and birch have large numbers of moths, whereas beech has small numbers even when compared to non-native species such as sycamore. Uniform stands of trees are poorer in invertebrates than more diversely structured woodland.[68]

C4.13 Greater Horseshoe Bats feed through the winter when prey species become active, for example when *Ophion* wasps swarm in woodlands above 5˚C. They have been found to spend significant times in woodland, being sheltered, often warmer at night, and insects are much more abundant than in open fields. However, in another study Billington (2000) carried out in the summertime found that there was limited foraging of adults recorded in woodlands, of only a

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[66] Ransome, R. D. 1996. *The management of feeding areas for Greater Horseshoe bats*. Peterborough: English Nature; http://ukmoths.org.uk/species/noctua-pronuba/; http://ukmoths.org.uk/species/panemeria-tenebrata/; http://ukmoths.org.uk/species/agrotis-exclamationis; http://ukmoths.org.uk/species/apamea-monoglypha/

[67] Duvergė, P. L. & Jones, G. 1994. Greater Horseshoe bats - Activity, foraging behaviour and habitat use. *British Wildlife Vol. 6 No 2;* Ransome, R. D. 1996. *The management of feeding areas for Greater Horseshoe bats*. Peterborough: English Nature; Bontadina, F. & Naef-Daenzer, B, 2002. *Analysing spatial data of different accuracy: the case of Greater Horseshoe bats foraging*. PhD Thesis, Universität Bern.

[68] Ransome, R. D. 1997. *The management for Greater Horseshoe bat feeding areas to enhance population levels*: English Nature Research Reports Number 241. Peterborough: English Nature; Fuentes-Montemayor, E., Goulson, D., Cavin, L., Wallace, J.M. & Park, K. J. 2012. Factors influencing moth assemblages in woodland fragments on farmland: Implications for woodland management and creation schemes. *Biological Conservation 153 (2012) 265–275*; Kirby, K. J. (ed). 1988. *A woodland survey handbook*. Peterborough: Nature Conservancy Council.

few minutes duration, except during medium-heavy rainfall when most of the foraging time was spent in broadleaf and coniferous woodland. Use, therefore, is likely to be dependent on season and weather conditions.[69]

Hedgerow

C4.14 Larger hedgerows are required for commuting as well as foraging by Greater Horseshoe Bats. Continuous lines of vegetation of sufficient height and thickness to provide darkness when light levels are still relatively high are needed for commuting bats. Ransome (1997) recommended the retention of existing hedgerows and tree lines linking areas of woodland, encouraging hedgerow improvement to become 3 to 6 m wide, mean 3 m high with frequent standard emergent trees.[70]

C4.15 Substantial broad hedgerows with frequent trees can provide suitable structure for foraging conditions for Greater Horseshoe Bats if woodland is scarce. Cattle in fields associated with hedgerows are preferred to smaller grazers, since they create the ideal structural conditions for perch-hunting bats in hedgerows and woodland edge. A tall thick hedgerow is a very efficient way of producing a maximum level of insect prey using a minimum land area and important creators of physical conditions that enhance insect concentrations and reduce wind speeds for economical hunting flight. The vast majority of insects (over 90%) found near hedge lines do not originate in the hedge but come from other habitats brought in on the wind.[71]

Scrub

C4.16 Scrub also seems to be an important foraging habitat for Greater Horseshoe Bats. Billington (2000) records the frequent use by the species during radio tracking carried out for the Mells Valley SAC in June. Scrub in disused quarries is important.[72]

C4.17 Large Yellow Underwing moths are attracted to buddleia. Buddleia grows in abundance in limestone quarries and flowers from July to September, when demands on lactating female horseshoe bats are high. Removing large areas of buddleia scrub all in one hit and at the wrong time of year could deprive Horseshoe bats of an important foraging resource.[73]

C4.18 However, similarly to Lesser Horseshoe bats, large areas of continuous scrub, particularly single stands of one species such as bramble, are likely to be avoided by Greater Horseshoe Bats.[74]

Other Habitats

C4.19 Ditches and rhynes are used as flight corridors to access foraging areas in the Somerset Moors south of Cheddar, flying below ground level. This is also likely to be the case in North Somerset. Greater Horseshoe Bats have also been radio tracked flying straight across the open water of Cheddar Reservoir.[75]

C4.20 Tipulid larval development is favoured by damp conditions. Therefore, any aquatic

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[69] Ransome, R. D. 1996. *The management of feeding areas for Greater Horseshoe bats*. Peterborough: English Nature; Billington, G. 2000. *Radio tracking study of Greater Horseshoe bats at Mells, Near Frome, Somerset*. Peterborough

[70] Ransome, R. D. 1996. *The management of feeding areas for Greater Horseshoe bats*. Peterborough: English Nature; Ransome, R. D. 1997. *The management for Greater Horseshoe bat feeding areas to enhance population levels*: English Nature Research Reports Number 241. Peterborough: English Nature.

[71] Ransome, R. D. 1996. *The management of feeding areas for Greater Horseshoe bats*. Peterborough: English Nature; Bat Conservation Trust. 2003. *Agricultural practice and bats: A review of current research literature and management recommendations*. London: Defra project BD2005.

[72] Billington, G. 2000. *Radio tracking study of Greater Horseshoe bats at Mells, Near Frome, Somerset*. Peterborough: English Nature.

[73] Pers. comm. Henry Andrews. AEcol, 22/09/2016.

[74] Schofield, H. W. 2008. *The Lesser Horseshoe Bat Conservation Handbook*. Ledbury: The Vincent Wildlife Trust.

[75] Jones, Dr. G. & Billington, G. 1999. *Radio tracking study of Greater Horseshoe bats at Cheddar, North Somerset*. Taunton: English Nature; Rush, T. & Billington, G. 2013. *Cheddar Reservoir 2: Radio tracking studies of greater horseshoe and Lesser Horseshoe bats, June and August 2013*. Witham Friary: Greena Ecological Consultancy.

environments and/or marshes can provide a secondary prey source. Aquatic environments could also favour the production of caddis flies in certain months, such as May and late August / September when other food supplies may be erratic. There is significant caddis fly consumption at roosts close to extensive river or lake habitats.[76]

C4.21 In Devon, the River Dart, a large river system, mostly banked by broadleaved woodland was also found to be a key habitat.[77]

C4.22 Habitats which are of little use to Greater Horseshoe Bats include urban areas, arable land and amenity areas such as playing fields. Lights, such as street lights or security lamps, are strong deterrents to Greater Horseshoe Bats, both when they emerge from roosts, and when they forage. However, radio tracking shows that bats regularly commute through urban areas of Cheddar and will fly along hedgerows adjoining arable areas to reach hunting grounds. It is suspected that they will fly through (but not along) a line of street lights, probably at the darker points between lamps, as evidenced by radio tracking. In North Somerset, they have been recorded within urban areas, including Clevedon and Nailsea, but here lights are switched off after midnight or dimmer in many places. More detail on North Somerset lighting reduction schemes is available at North Somerset Council's Lighting Map.

C4.23 During the winter period, Greater Horseshoe Bats are likely to forage closer to roost sites than during the summer and in areas sheltered from the wind, and on south and southwest facing slopes.[78]

Lesser Horseshoe Bats

Prey

C4.24 The diet of the Lesser Horseshoe Bat consists mostly of Diptera of the crepuscular sub-order Nematocera. Families of Nematocera Diptera recorded in the diet include Tipulidae (crane-flies), Ceratopogonidae (biting midges), Chironomidae (non-biting midges), Culicidae (mosquitoes), and Anisopodidae (window midges). Lepidoptera (moths), Trichoptera (caddis-flies) and Neuroptera (lacewings) are also eaten.[79] Due to their small body size they cannot cope with large prey, such as cockchafers. By comparison, they eat smaller moth species than the Greater Horseshoe Bat. The principal prey species for Lesser Horseshoe Bats, using data collected at Hestercombe House SAC are from the Diptera and Lepidoptera families. At this location, there were seven major prey categories comprised over 70% of the diet: Tipulidae (crane flies), Anisopodidae (window gnats), Lepidoptera (moths), Culicidae (mosquitoes), Hemerobiidae (brown lacewings), Trichoptera (caddis flies) and Ichneumonidae (ichneumon wasps)[80]

General

C4.25 '*The primary foraging habitat for Lesser Horseshoe bats is broadleaf woodland where they often hunt high in the canopy. However, they will also forage along hedgerows, tree-lines and well-wooded riverbanks*.'[81] Lesser Horseshoe Bats are primarily a woodland feeding bat using deciduous woodland or mixed coniferous woodland and hedgerows. It has been found that

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[76] Ransome, R. D. 1997. *The management for Greater Horseshoe bat feeding areas to enhance population levels*: English Nature Research Reports Number 241. Peterborough: English Nature.
[77] Billington, G. 2003. *Radio tracking study of Greater Horseshoe bats at Buckfastleigh Caves, Site of Special Scientific Interest*. Peterborough: English Nature.
[78] Ransome, R. D. 2002. *Winter feeding studies on Greater Horseshoe bats*: English Nature Research Reports Number 449. Peterborough: English Nature.
[79] Vaughan, N., Jones, G. & Harris, S. 1997. Habitat use by bats (Chirpotera) assessed by means of a broad-band acoustic method. *Journal of Applied Ecology 1997, 34, 716-730*; Boye, Dr. P. & Dietz, M. 2005. English Nature Research Reports Number 661: *Development of good practice guidelines for woodland management for bats*. Peterborough: English Nature.
[80] Boye, Dr. P. & Dietz, M. 2005. English Nature Research Reports Number 661: *Development of good practice guidelines for woodland management for bats*. Peterborough: English Nature; Knight Ecology. 2008. *Hestercombe House, Taunton, Somerset: Lesser Horseshoe bat Diet Analysis*. Clutton: Knight Ecology
[81] Schofield, H. W. 2008. *The Lesser Horseshoe Bat Conservation Handbook*. Ledbury: The Vincent Wildlife Trust.

landscapes that were most important contained a high proportion of woodland, parkland and grazed pasture, linked with linear features, such as overgrown hedgerows.

C4.26 Downs et al (2016) identified a preference for woodland habitats above all others, particularly broadleaf woodland. Wet broadleaf woodland was used for foraging by five of the thirteen tracked bats. Parkland, grazed grassland and un-grazed grassland were also selected. Arable land was the least selected. The study revealed a preference for grazed over un-grazed grassland. Grazed grassland was also selected above parkland (only some of which was grazed), suggesting that the presence of cattle may be more important than mature parkland trees.[82]

C4.27 Downs et al (2016) also noted that comparing the sexes, females showed an increased preference for woodland and a decreased preference for grassland. Although they are able to forage within other habitats such as scrub and isolated trees, and cross open gaps, these foraging situations are likely to be sub-optimal.[83]

Woodland

C4.28 Lesser Horseshoe Bats prefer to hunt in woodland interiors where micromoth abundance is greatest. In the Wye valley in Monmouthshire, studies revealed that Lesser Horseshoe Bats significantly spend the majority of their time foraging in woodland. Broadleaved woodland predominated over other types of woodland and was shown to be a key habitat for the species. In the core foraging areas used by bats, woodland accounted for 58.7 ± 5.2% of the habitats present. Although Lesser Horseshoe bats prefer deciduous woodland as foraging habitat, they will occasionally hunt in conifer plantations. For example, they have been recorded hunting within a Sitka spruce plantation on the Mendip Hills. The biomass in coniferous woodland is smaller, but where smaller blocks are surrounded by habitat productive in insect prey they will be used.[84]

C4.29 The Ciliau SSSI, designated for its Lesser Horseshoe Bats, and also the River Wye, is surrounded by predominately pastoral habitats, with cattle grazing on lowlands and sheep grazing on higher areas. There are, however, high densities of broadleaved woodland, especially along watercourses, and some conifer plantations. Again, Lesser Horseshoe Bats foraged predominately in broadleaved woodland along the banks of the River Wye and its tributary streams. Woodland with watercourses has more importance. They were also recorded foraging in conifer plantations.[85]

C4.30 Furthermore, radio tracking carried out in the spring also revealed that coniferous woodland appeared to be more used for foraging than deciduous woodland and that coniferous woodland close to maternity colonies may provide refuge in certain weather conditions[86]

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[82] Downs, N. C., Cresswell, W. J., Reason, P., Sutton, G., Wells, D. & Wray, S. 2016. *Sex-Specific Habitat Preferences of Foraging and Commuting Lesser Horseshoe Bats Rhinolophus hipposideros (Borkhausen, 1797) in Lowland England. Acta Chiropterologica* 18(2), (1 December 2016).

[83] Downs, N. C., Cresswell, W. J., Reason, P., Sutton, G., Wells, D. & Wray, S. 2016. *Sex-Specific Habitat Preferences of Foraging and Commuting Lesser Horseshoe Bats Rhinolophus hipposideros (Borkhausen, 1797) in Lowland England*. *Acta Chiropterologica* 18(2), (1 December 2016).

[84] Bontadina, F., Schofield, H. & Naef-Daenzer, B. 2002. Radio-tracking reveals that Lesser Horseshoe bats (Rhinolophus hipposideros) forage in woodland. *J. Zool. Lond. (2002) 258, 281-290*; Schofield, H. W. 2008. *The Lesser Horseshoe Bat Conservation Handbook*. Ledbury: The Vincent Wildlife Trust.

[85] Schofield, H., Messenger, J., Birks, J. & Jermyn, D. 2003. *Foraging and Roosting Behaviour of Lesser Horseshoe bats at Ciliau, Radnor.* Ledbury: The Vincent Wildlife Trust; Barataud, M., Faggio, G., Pinasseau, E. & Roué, S. G. 2000. *Protection et restauration des habitats de chasse du Petit rhinolophe*. Paris: Société Français pour l'Etude et la Protection des Mammifères.

[86] Bat Conservation Trust. 2005. A Review and Synthesis of Published Information and Practical Experience on Bat Conservation within a Fragmented Landscape. Cardiff: The Three Welsh National Parks, Pembrokeshire County Council, Countryside Council for Wales

C4.31 Although Lesser Horseshoe Bats prefer woodland in which to forage, there is a further requirement as to the structure of the woodland. In Bavaria, except in one area where Lesser Horseshoe Bats were recorded, the distance between trees was large and in dense stands no activity was recorded. In Belgium, it was found that the density of taller trees, either broadleaved or coniferous, must be low enough to allow the development of an understorey of shrub and coppice.[87]

Grassland

A4.32 Radio-tracking research shows that cattle must be actively grazing the field for Lesser Horseshoe Bats to forage over pasture. Once cattle are removed from a field, foraging by Lesser Horseshoe bats ceases immediately. Pasture in such use offers a valuable and predictable food source at a time of year when bats are energetically stressed (pre- to post-weaning), because they are feeding their young. The report recommended a grazing density of 0.5 -1 cows per hectare. Scatophagidae can be one of the major prey categories in the diet of Lesser Horseshoe bats. The larvae of the Yellow Dung-fly *Scatophaga stercoraria* develop in cattle dung. The presence of pasture is also indispensable to the larval stage of development for certain species (Tipulids), which form a significant proportion of the prey hunted by Lesser Horseshoe Bats.[88]

Hedgerows

C4.33 Belgian research similarly showed that the feeding grounds for Lesser Horseshoe Bats were deciduous woodland along with copses or mixed coniferous woodland. Woodland occupied 25% of the area within 1 kilometre of the roost. However, some foraging was observed in hedgerows. Hedgerows had an average density of 47 metres per hectare. Generally, bats selected areas that were of undulating countryside with hedgerows, tree lines and woodland in preference to flat open intensively farmed areas. In Austria, hedgerows, tree lines and streams were only exploited where there was less forest.[89]

C4.34 Commuting corridors, such as tall bushy hedgerows, are important features for Lesser Horseshoe Bats as they avoid crossing open areas and are vulnerable to the loss of these corridors. In Belgium, no Lesser Horseshoe Bats were recorded more than 1 metre from a habitat corridor. Stonewalls have been reported in use as commuting routes in Ireland.[90]

C4.35 At Ciliau SSSI Lesser Horseshoes only crossed the River Wye when fully dark. Lesser Horseshoe Bats have been observed crossing roads where the tops of trees connect to form a tunnel.[91]

Other Habitats

C4.36 Lesser Horseshoe Bats avoid dense scrub cover[92].

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[87] Holzhaider, J., Kriner, E., Rudolph, B-U. & Zahn, A. 2002. Radio-tracking a Lesser Horseshoe bat (Rhinolophus hipposideros) in Bavaria: an experiment to locate roosts and foraging sites. *Myotis, 49, 47-54*; Motte, G. & Libois, R. 2002. Conservation of the Lesser Horseshoe bat (*Rhinolophus hipposideros* Bechstein, 1800) (Mammalia: Chiroptera) in Belgium. A case study in feeding requirements. *Belg. J. Zool., 132 (1): 47-52*.

[88] Cresswell Associates. 2004. *Bats in the Landscape Project*. The National Trust, Sherborne Park Estate; Knight,T. 2006. *The use of landscape features and habitats by the lesser horseshoe bat* (Rhinolophus hipposideros). PhD Thesis: University of Bristol.

[89] Holzhaider, J., Kriner, E., Rudolph, B-U. & Zahn, A. 2002. Radio-tracking a Lesser Horseshoe bat (Rhinolophus hipposideros) in Bavaria: an experiment to locate roosts and foraging sites. *Myotis, 49, 47-54*; Motte, G. & Libois, R. 2002. Conservation of the Lesser Horseshoe bat (*Rhinolophus hipposideros* Bechstein, 1800) (Mammalia: Chiroptera) in Belgium. A case study in feeding requirements. *Belg. J. Zool., 132 (1): 47-52*.

[90] Motte, G. & Libois, R. 2002. Conservation of the Lesser Horseshoe bat (*Rhinolophus hipposideros* Bechstein, 1800) (Mammalia: Chiroptera) in Belgium. A case study in feeding requirements. *Belg. J. Zool., 132 (1): 47-52;* Biggane, S. & Dunne, J. 2002. A study of the ecology of the lesser horseshoe colony at the summer roost in Co. Clare, Ireland: In *European Bat Research Symposium (9, 2002, Le Havre). Abstracts of presentations at the 9th European Bat Research Conference, August 26-30 at Le Havre, France. Bat Research News 43(3): 77*.

[91] Schofield, H., Messenger, J., Birks, J. & Jermyn, D. 2003. *Foraging and Roosting Behaviour of Lesser Horseshoe bats at Ciliau, Radnor. Ledbury*: The Vincent Wildlife Trust;

[92] Schofield, H. W. 2008. *The Lesser Horseshoe Bat Conservation Handbook*. Ledbury: The Vincent Wildlife Trust.

C4.37 Tipulid larval development is favoured by damp conditions. Therefore, any aquatic environments and/or marshes can provide a secondary prey source. Aquatic environments could also favour the production of caddis flies in certain months, such as May and late August / September when other food supplies may be erratic. There is significant caddis fly consumption at roosts close to extensive river or lake habitats. [93] Woodland associated with wetland habitat is particularly favoured by foraging Lesser Horseshoe Bats[94].

[93] Ransome, R. D. 1997. *The management for Greater Horseshoe bat feeding areas to enhance population levels*: English Nature Research Reports Number 241. Peterborough: English Nature.

[94] Barataud, M., Faggio, G., Pinasseau, E. & Roué, S. G. 2000. *Protection et restauration des habitatas de chasse du Petit rhinolophe (*Rhinolophus hipposideros*) Année 2000*. Paris : Ministère de l'Environnement – Direction de la Nature et des Paysages

Annex 5: Methodology for Calculating Replacement Foraging Habitat

Introduction

C5.1 The method used to calculate the amount of habitat required to replace that lost to Horseshoe bat populations due to development is based on the requirements for habitat to support their viability in the long term. It uses an approach similar to the Habitat Evaluation Procedures (HEP) developed by the U.S. Fish and Wildlife Service (1980) to provide '*…for mitigation and compensation that can allow fair use of the land and maintain healthy habitats for affected species'.* HEP is structured around the calculation of Habitat Units (HU), which are the product of a Habitat Suitability Index (quality) and the total area of habitat (quantity) affected or required[95].

C5.2 A key assumption is that habitat type, amount and distribution influence the distribution of associated animal species. It is also important to recognise that Habitat Suitability Index (HSI) models predict habitat suitability, not actual occurrence or abundance of species populations.[96] The values are a proxy for suitability and are based on the best available scientific information and locally specific-professional practice i.e. surveys for planning applications, telemetry data and modelling.

C5.3 Habitat descriptions are derived from the Integrated Habitat System (IHS), developed by Somerset Environmental Records Centre[97], and the UKHab habitat classifications described below. The HEP requires a Habitat Suitability Index for the species scored on IHS and or UKHab descriptions.

C5.4 The HEP process is necessary to obtain an objective quantitative assessment that provides improved confidence in agreed mitigation being likely to be adequate. The methods help to ascertain beyond reasonable scientific doubt that a development will not significantly reduce the quantity or quality of habitat available to a SAC bat population, whereas qualitative ecological impact assessments are often based on subjective interpretations. This helps to inform robust Habitats Regulations Assessments. As set out in Section A7, qualitative assessments may be acceptable for smaller scale proposals where a **significant** adverse impact is not anticipated.

C5.5 In Somerset, the methodology has been used since 2009 to inform the adequacy of replacement bat habitat provided by the developer. The methodology has been reviewed and further developed with the Bat Conservation Trust in 2014 and has been scrutinised through planning inquiries including for a Nationally Significant Infrastructure Project. Natural England have been involved with developing this guidance and have been consulted throughout the process. The methodology in Version 2 has been updated to ensure consistencies with Biodiversity Net Gain approaches and recent scientific evidence from additional telemetry and modelling studies.

Habitat Suitability Index Calculation

C5.6 The methodology values each polygon area of habitat, or line in the case of hedgerows and other linear features, for its value to bats in terms of habitat suitability. Each IHS 'Habitat' or UKHab 'Primary Habitat' category is scored for each horseshoe bat species on a scale of 0 to 8 (as defined in Appendix 2 and Appendix 3), according to the suitability of that habitat for the species.

<u>UK Habitat Classification (UKHab)</u>

C5.7 Since the UKHab classification was introduced in 2018, it has become increasingly used to

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[95] U. S. Fish and Wildlife Service. 1980. *Habitat Evaluation Procedures ESM102*. Washington, D. C.: Department of the Interior.

[96] Dijak, W. D. & Rittenhouse, C. D. 2009. Development and Application of Habitat Suitability Models to Large Landscapes: in Millspaugh, J. J. & Thompson, F. R. 2009. *Models for Planning Wildlife Conservation in Large Landscapes*. London: Academic Press.

[97] www.somerc.com.

record habitats during field surveys to inform ecological assessments. UKHab classification forms the basis of the Defra Biodiversity Net Gain metric.[98]

C5.8 UKHab classification has two main parts, a hierarchical Primary Habitat system and a list of Secondary Codes.[99] The Primary Habitats have five levels:

Level 1: Major ecosystem.
Level 2: Nine ecosystem type, based upon the Mapping and Assessment of Ecosystems and their Services typology and corresponding with the EUNIS major habitat types.
Level 3: Twenty Broad habitat types, corresponding with the UK Biodiversity Action Plan (BAP) habitats and closely with EUNIS.
Level 4: Eighty five habitats, including forty-six UK BAP priority habitats, and further division of Level 3 habitats.
Level 5: One hundred and nineteen habitats, including seventy-two Annex 1 Habitats Directive habitats and further division of Level 4 habitats.

C5.9 Levels 3 to 5 are used as Habitat Codes for scoring the suitability for Horseshoe bat species in the HEP metric. This has been updated from Version 1 to ensure consistency with other habitat mapping protocols.

C5.10 The Habitat Codes are further defined by the use of the Secondary Codes, added as a string to the Habitat Code and which give information about the management, environment of the habitat. This has also been accommodated into the HEP metric for Version 2.

Integrated Habitat System (IHS)

C5.11 The Integrated Habitat System coding is used as a basis for describing habitats and their management, to create a Habitat Suitability Index score. The IHS[100] classification comprises over 400 habitat categories, the majority drawn from existing classifications, together with descriptions and correspondences arranged in a logical hierarchy. The classification can be customised for a geographical area or special project use without losing data integrity.

C5.12 The IHS represents a coded integration of existing classifications in use in the UK with particular emphasis on Broad Habitat Types, Priority Habitat Types, Annex 1 of the Habitats Directive and Phase 1[101].

C5.13 The Habitat Codes used result from standard habitat definitions from these classifications combined into a hierarchy starting at the level of Broad Habitat Types, through to Priority Habitat types, Annex 1 and vegetation communities.

C5.14 IHS Habitat Codes are hierarchical with the numbers in the code increasing as the habitat becomes more specific. Descriptions of habitats can be found in IHS Definitions (Somerset Environmental Records Centre)[102]. For example:

- WB0 Broadleaved, mixed and yew woodland (Broad Habitat Type)
- WB3 Broadleaved woodland (Broad Habitat Type)
- WB32 Upland mixed ashwoods (Priority Habitat Type)
- WB321 Tilio-Acerion forests on slopes, screes and ravines (upland) (Annex 1 Habitat)

C5.15 Codes are added as a string to the main Habitat Code to provide further description.

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[98] Defra 2024. *The Statutory Biodiversity Metric: User Guide*. Defra, London.
[99] Butcher, B., Varey, P., Edmonds, R., Norton, I., & Treweek, J. 2022. *The UK Habitat Classification User Manual Version 2.0* at http://www.ukhab.org/
[100] Integrated Habitat System (IHS) - Somerset Environmental Records Centre (somerc.com)
[101] Phase 1 (JNCC, 1993) habitat mapping can be converted to UKHab by reference to the spreadsheet available on http://www.ukhab.org/
[102] Phase 1 (JNCC, 1993) habitat mapping can be converted to UKHab to IHS by using the software provided by Somerset Environmental Records Centre http://www.somerc.com

Bat Habitat Suitability Indices

Introduction

C5.16 A form of Habitat Suitability Indices (HSI) has been used in the United States and Canada since the early 1980s as a way of assessing the impacts of development on species' populations and distributions. In addition, HSI have been used to predict replacement habitat creation required to maintain species' populations. The process assumes that the suitability of habitat for a species can be quantified. The overall value of an area for a species can be represented as a product of the geographic extents of each habitat and the suitability of those habitats for the species[103].

Description

C5.17 In constructing the HSI using IHS, the index scores are applied to each Habitat, and Secondary Codes in UKHab and/or Matrix, Formation and Land Use/Management codes in IHS based on analysis of the ecological requirements, from existing literature and professional judgement, for each species assessed or mapped. A mixture of UK Habitat Classification and IHS can be used where this is helps provide more specific information about habitat conditions and management. For example, if a native hedgerow (h2a) is overgrown with standard trees, LM31 can be used as the management code (see below), even if the baseline survey has been categorised using UK Habitat Classification codes. Both horseshoe bat species have different, if overlapping, habitat requirements, and so a HSI has been created for each species.

C5.18 The approach can be used where detailed habitat surveys have not been provided e.g. for strategic planning purposes. Each IHS 'Habitat' category is scored on a scale of 0 to 8 (as defined below) using a potential or precautionary approach as a starting point, e.g., Broadleaved, mixed and yew woodland is assumed to be the Annex 1 broadleaved woodland habitat unless it is demonstrated otherwise. The full range of scoring is used before the modifiers (the UKHab secondary Codes or the IHS Formation and Management codes) are applied. It is recognised that not all habitat patches of the same type have equal value in terms of resource to a species, for example see Dennis, 2010[104]. However, in scoring the overall HSI, a higher value is given as a precaution. Where surveys have been completed, the aim should be to categorised habitats and their management as accurately as possible, taking a precautionary approach by defaulting to higher scoring categories where there is uncertainty or variations in habitat condition. For example, if habitat has been grazed by cattle alternated or on rotation with a hay cut, the management should be categorised as cattle grazed (see below on Management Codes). The highest scoring habitat and management over the past five years needs to be considered as set out in Sections 3.5 and 3.6.

C5.19 The Habitat Code scoring is considered in combination with the IHS Matrix codes[105]. These are either added or subtracted from the Habitat code, e.g., grassland scoring 4 + scattered scrub scoring 1 would equal a HSI of 5. In this example, the metric is weighted to acknowledge that grassland with a matrix of scattered scrub may marginally improve the quality and range of the invertebrate prey of horseshoe bats.[106] Habitat Codes have a range of 0 to 8 but when considered in combination must not exceed a score of 8 or fall below a score of 0. Where there is no effect from a Matrix type, then a default score of 0 is used and where there is no effect

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[103] U. S. Fish and Wildlife Service. 1980. *Habitat Evaluation Procedures ESM102*. Washington, D. C.: Department of the Interior.

[104] Dennis, R.L.H. 2010. *A Resource-Based Habitat View for Conservation. Butterflies in the British Landscape.* Chichester: Wiley-Blackwell.

[105] IHS considers that patches of scrub and single trees are Matrix habitat acting in combination with main habitat types rather than separate habitats in their own right. It is possible that further sub codes be added to the grassland habitat codes, e.g., calcareous grassland with scattered scrub, etc. but this would lead to a proliferation of coding and current IHS GIS mapping would need amending to take this into account. By providing a positive multiplier, the needs of species which require a mosaic of grassland and scrub is taken into account. There are no Matrix type codes within UKHab.

[106] IHS considers that patches of scrub and single trees are Matrix habitat acting in combination with main habitat types rather than separate habitats in their own right.

from a formation or management factor as default of 1 is used. An example demonstrating how Habitat and supplementary codes work is provided in Table C1.

Table C1: Example of HSI Calculation for Greater Horseshoe Bat

	Habitat Code	Matrix Code	Formation Code	Land Use / Management Code	HSI Score
IHS Code	**GI0**	**SC2**	**-**	**GM12**	
UKHab Code	**g4**	**10**	**-**	**60**	
Description	**Improved Grassland**	**Scattered Scrub**	**-**	**Sheep Grazed**	
HSI Score	**3**	**1**	**1**	**1.2**	**4.8**

C5.20 All UK Hab Secondary Codes and Formation and Land Use/Management Codes are scored between 0 and 1 and are multipliers. Where there is no effect from a UK Hab Secondary Code or an IHS Formation or Management Code, then a default score of 1 is used. Formation codes relate to the structure and function of a habitat. As an example, woodland may be native self-seeded secondary woodland (WF11) or may be a plantation (WF2). Management codes relate to management interventions such as the type of grazing or mechanical approaches.

C5.21 A precautionary approach, based on best available knowledge, has been taken in developing the scoring, with multipliers used to fine tune values. For example, as grassland is most valuable to juvenile horseshoe bats when grazed, all grassland is awarded the maximum score of 8 in the HSI. The management modifier for grazing would then maintain the habitat score at this high level by a multiplier of 1. If the management does not involve grazing, a decimal multiplier is applied to reduce the value of the habitat. Only one IHS management code is allowed.

C5.22 No allowance for seasonal variations, i.e., due to the availability of prey species at different times of year, has been made in developing the HSI. A habitat valued at 8 which is of high seasonal value will remain at a value of 8. This is to recognise that the habitat is necessary to support the target species when other prey or other resources may not be readily available.

C5.23 The worksheet (see Appendix 8) is available in the form of an online spreadsheet at [NSC WEBSITE LINK TO BE INSERTED]. There are drop-down tabs for habitats and supplementary codes. There is also a drop-down to confirm whether the spreadsheet is for Greater Horseshoe Bat or Lesser Horseshoe Bat.

C5.24 The Habitat Suitability Index for Greater Horseshoe Bats can be found in Appendix 2 and that for Lesser Horseshoe Bats in Appendix 3. Values are also detailed within the worksheet. This has been updated since Version 1 of this SPD.

Lighting

C5.25 The value of a habitat for horseshoe bats may be reduced by lighting, either from street lighting or other sources such as security or flood lights. Baseline lighting surveys may demonstrate that areas are sufficiently well-lit that use by horseshoe bats is unlikely (although subject to caution

as horseshoe bats have been occasionally found using brightly lit areas if no other habitat is available). Post-development modelling may also show that habitat is likely to be inaccessible or unsuitable for use by Horseshoe bats as a result of predicted light spill. These findings can be accounted for by reducing the HSI for the habitat to low or zero score according to use. If this reduction is applied, a note must made in the Excel spreadsheet used in calculating the habitat amount, and full evidence provided in any accompanying ecological report. Note the requirements for lighting information as set out in B4.14-B4.22 and C3.7-C3.10.

Validation

C5.26 An HSI model can be reviewed against occurrence data held by the biological or environmental records centre. Habitat mapping can be produced and matched with species data at the biological records centre and the model refined to fit the records with a view to errors of omission and commission. Garshelis (2000)[107] concluded that the '...*utility of the models is to guide further study or help make predications and decisions regarding complicated systems; they warrant testing but the testing should be viewed as a never-ending process of refinement, properly called bench-marking or calibration*.' The validation should be seen as a continuous refinement process and HSI scoring should be reviewed from time to time and updated.

C5.28 A full review of field records and HSI scoring has been undertaken as part of the Version 2 update and will be periodically undertaken in future. However, the scores are likely to be varied through additional reviews, further research findings or to reflect local conditions based on survey. If varied by consultants, the revised values must be agreed with the Council's Ecologist, and the reason for the variation must be given and fully supported by evidence. It is recommended that any proposed variations in values are included in pre-application discussions for agreement with Natural England and North Somerset Council's ecologist, particularly where a proposed reduction of HSI values applies.

Density Bandings and Field Survey Results

C5.29 The HSI score is multiplied by the location of the proposed site in relation to that of the horseshoe bat roost. The Consideration Zone (CZ) is divided into three Density Bands. The three Bands are, 'A' closest to the record, 'B' and 'C' furthest from the record valued at 3, 2 and 1 respectively. When two Bands occur within one field or one parcel of habitat, the higher value needs to be taken as the score.

C5.30 Density bandings can be assessed accurately using the Greater Horseshoe and Lesser Horseshoe Consultation Zone layers at North Somerset's Planning constraints portal. The Density Banding adjustment is based on the modelled layers as mapped in the Planning Constraints Portal, as well as survey findings.

C5.31 Following ecological surveys for horseshoe bats carried out for the proposed development the Density Band score may be modified up depending on whether feeding activity was recorded or not or whether absence is recorded. This reflects uneven use of a home range and refines the value of the habitat for a species (e.g. see Bontadina & Naef-Daenzer, 2002[108]). Surveys need to be completed in accordance with the methodology in Annex 3, to ensure a high level of confidence in the survey findings. In the standard workbook, this is accommodated into the 'Density Band – Consideration Zone Band' column. This takes into account whether Horseshoe bats are present and whether feeding or commuting activity is recorded. The following criteria are used to modify the Band following the results of site surveys and applied to the whole of the proposed development site:

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[107] Garshelis, D. L. 2000. Delusions in Habitat Evaluation: Measuring Use, Selection, and Importance: in Boitam, L. & Fuller, T. K. (eds.) 2000. *Research Techniques in Animal Ecology: Controversies and Consequences*. New York: Columbia University Press.

[108] Bontadina, F. & Naef-Daenzer, B. 2002. Analysing spatial data of different accuracy: the case of Greater Horseshoe bats foraging: in Bontadina, F. 2002. Conservation Ecology in Horseshoe Bats. PhD thesis. Universität Bern.

- Not present – Where potential habitat is present reduce the Band score down by 0.5, e.g. at A from 3 to 2.5; at B from 2 to 1.5; except at C where it reduced to 0.
- Commuting only – as the Band the site falls within
- Commuting and Foraging – increase the band score by 0.5 e.g. at C from 1 to 1.5; at B from 2 to 2.5; A stays as it is.

C5.32 The identification of 'foraging' (i.e., a higher level of activity) for bat species is defined as either:

a) The criteria for foraging for horseshoe bat species, which have low intensity calls, makes use of Miller's (2001) Activity Index.[109] '*Call sequences with a negative minute on either side (i.e., a minute in which the species was not recorded) are judged to be commuting contacts, whereas contacts in two consecutive minutes or more are judged to be foraging contacts*.' 'Foraging' is defined as six or more such minutes over any two nights (minimum 3 x 2 consecutive minute occurrences) on any one automated detector during the recording period. [110]

[TO BE DISCUSSED WITH CONSULTANTS DURING CONSULTATION]

b) Observed hunting behaviour in the field.

C5.33 **Consultant ecologists must submit the raw automated detector data for SAC bats in order that the type of contact can be assessed by North Somerset Council's ecologist to ensure the correct assessment is made.** The preferred format is for the time and date of Horseshoe bat passes to be provided, along with sunset and sunrise times for these days. The method of analysis (i.e. manual analysis or type of software confirmed) must be provided. In some cases, original sonograms may be requested, although this is not a routine requirement.

C5.34 Where data is absent or deficient, for example due to insufficient coverage by automated detectors, foraging activity must be assumed and the highest score applied to the whole site. In these circumstances, it is also possible for important sites such as large sites within Band A, that a lack of data may lead to an inability to complete an evidenced-based Habitats Regulations Assessment. The application may subsequently be refused or may need to be withdrawn until sufficient survey data is available.

Calculating the Species Unit Value

C5.35 The value of the proposed site to Horseshoe bat species is calculated by using the HSI Score, Density Bandings, use by the Horseshoe bat species and area of habitat (See Table C3 below). The outcome of the Species Units used in the HEP is on a scale of 0 to 24[111].

C5.36 Unlike the Defra Biodiversity Net Gain Metric, hedgerows and linear features are measured by area and not length. A default width of 3 m is used where the width of a linear feature is unknown, and multiplied by the length to give an area in hectares. These values are usually small and do not significantly affect the overall area of a site, and for simplicity's sake and considering their value to wildlife are not deducted from the area of bordering fields, compartments or mapping polygons.

C5.37 Although assigned a value in the calculations, it must be remembered that the HEP is based on quantifying **foraging** habitat. Hedgerow and other dispersal corridors have a functional role, which must be considered separately to their foraging suitability. All suitable linear dispersal

[109] Miller, B. 2001. *A method for determining relative activity of free flying bats using a new activity index for acoustic monitoring. Acta Chiropterologica* 3 (1): 93 – 105.

[110] Miller uses 9 consecutive passes when recording mostly *Myotis* species. As the hunting behaviour of *Rhinolophus* species is more difficult to record the number of passes has reduced by the coefficient applied to European bats species by Barataud for open to semi open environments, *Myotis* 1.67 compared to *Rhinolophus ferrumequinum* 2.5. (Barataud, M. 2015. *Acoustic Ecology of European Bats: Species Identification, Study of their Habitats and Foraging Behaviour*. Paris: Muséum nationale d'Histpire naturelle.

[111] This range is in line with that used for the habitat metric used by Defra in its pilot projects 2012 -2014.

corridors must be maintained or replaced, retaining suitable conditions such as minimal light spill, to maintain connectivity for bats across a proposed development site in accordance with the specifications set out in B4.12 and B4.13.

C5.38 **The species Habitat Evaluation Procedure calculations for development sites is calculated on the basis that the total site area would be lost to a species and would therefore produce a maximum replacement requirement to develop the site.** If habitat will be retained, it would usually be requested that this remains outside of the redline boundary, unless there is a reason (such as additional habitat creation or Biodiversity Net Gain enhancements) for this area to be included. Unlike Biodiversity Net Gain calculations, temporary removal of habitat during construction must be considered as habitat loss, even if it is subsequently replaced within several years. Once horseshoe bats are displaced from habitat, they may not return for a long period of time. The latest Excel workbook available from North Somerset and Somerset Council's websites accounts for retained habitats, which need to be inputted back into the habitat creation tab. These are automatically assigned a difficulty/temporal multiplier of 1.

C5.39 The habitat replacement value required is calculated by multiplying the score by the hectarage of the habitat affected (hectares x [HSI x Band]) giving figure in **Habitat Units** as shown in Table C2. For example, an HSI x Band score of 12 for an area of 1.50 hectares would give a value of 18 Habitat Units. The resultant total of Habitat Units for the whole proposed development site can then be divided by 24 (8 [HSI] x 3 [Band]) to arrive at the minimum area in hectares of accessible replacement habitat required to develop the proposed site.

Table C2: Matrix Combining Habitat Suitability Score and Density Band

		Habitat Suitability Score				
		Poor **1**	**Marginal** **2**	**Average** **4**	**Good** **6**	**Excellent** **8**
	A (3)	3	6	12	18	24
	B (2)	2	4	8	12	16
	C (1)	1	2	3	6	8

Metric Summary

C5.40 For each habitat type affected within a proposed development site:

- **The Habitat Suitability Index = Habitat Code (Range 0 to 8) + or – Matrix Code (Range 0 to 1, Default 0) x Formation Code (Range 0 to 1, Default 1) x Management Code (Range 0 to 1.3, Default 1)**
- **HSI x Density Banding/Field Survey Modifier = Species Habitat Units required.**
- **Species Habitat Units divided by 24 = equivalent hectares required**

C5.41 A dedicated spreadsheet in which figures used to the calculate the amount of replacement horseshoe bat habitat required as mitigation for a proposed development is available on North Somerset Council's website at [INSERT LINK]. This also contains linked spreadsheets to calculate the value of the replacement habitat provided on- or off-site and a further spreadsheet to calculate the baseline HSI value for an off-site receptor site.

Replacement Habitat

C5.42 Requirements for replacement foraging habitat will need to be fully integrated into the design process for a development and considered at the earliest possible stage. It must be ensured that replacement habitat fully mitigates the loss and is accessible to the bat population affected (including remaining sufficient dark to ensure use by Horseshoe bats). Replacement habitat must provide at least no net loss of habitat to improve the situation for horseshoe bats and must clearly demonstrate in a scientific manner that the integrity of the SAC will not be adversely impacted. Location and habitat considerations are key to ensuring provision delivers.

C5.43 To check whether the Masterplan for the proposed development site provides enough replacement horseshoe bat foraging habitat, a second Excel worksheet is provided within the workbook. The scores for post-development habitats are entered following the same scoring protocol as used for the baseline assessment. Whether the habitat is retained, enhanced or created needs to be stated. It will be need to be demonstrated that any retained habitats will be protected during the construction process. Any habitats subject to disturbance and then reinstatement should be categorised as 'created'. This is because even temporary removal or indirect impacts such as disturbance and construction lighting onto habitats can essentially make these temporarily unusable for foraging or dispersing horseshoe bats. Habitat enhancement only applies to habitats which are retained in structure and form, and enhanced through additional planting, over-seeding or management changes. Habitat creation must be aimed at providing optimal foraging habitat for horseshoe bats. Feasibility of delivering suitable long-term management (e.g. grazing), future-proofing and creation of sufficient prey diversity must all be fully considered and evidenced.

C5.44 Retained and enhanced habitat areas must be accessible to horseshoe bats and careful consideration given to the maintenance of connectivity into and through the site. Measures detailed in Section B4.13 in relation to creation of habitat corridors must be demonstrated. The landscape context and impact on any proposed or potential nearby development (e.g. allocated sites in the Local Plan) must be fully considered. Sufficient evidence will be required with any application (including Outline applications) to demonstrate that replacement habitat will be suitable and accessible.

C5.45 Outline applications present a particular challenge for calculating on-site replacement habitat as often detailed landscaping plans are not available at planning submission stage. Evidence beyond reasonable scientific doubt is still required for Outline applications for Habitats Regulations Assessments to be completed. There is provision under Regulation 70 of the Conservation of Habitats and Species Regulations 2017 (as amended) for parameters or a framework to be agreed and secured by condition, with full details to be secured under the Reserved Matters application or other appropriate detailed design stage. For Outline applications, it is therefore advised that HEP calculations are completed based on Precautionary assumptions about habitat (i.e. using highest reasonable baseline values and lowest reasonable post-development values) to inform whether on-site or off-site replacement habitat (or a combination of both) is required, based on the parameters and zoning of a development site. An updated HEP and/or compliance statement will be required with the Reserved Matters application.

C5.46 Full details would then be secured by condition, to be discharged at Reserved Matters stage. Reserved Matters applications would need to be refused if they do not meet the requirements for replacement habitat as set out in the approved approach for the Outline application. Habitats Regulations Assessments would also need to be updated accordingly for the Reserved Matters application if there have been any significant changes. A similar approach is used for Biodiversity Net Gain.

C5.47 Light spill must be taken into account for all applications (including Outline applications), as this can act as a barrier to horseshoe bat species accessing replacement habitat. Requirements for lighting information are set out in B4.14-B4.22. This may need to include, for example, a

Lighting Strategy with lux contour plans (see Section C5.46). If it is not demonstrated beyond reasonable scientific doubt that replacement habitat will be suitable and accessible, it must be awarded a value of 0 in the calculations.

C5.48 Standard prescriptions used for replacement habitats can be found in Annex 6.

C5.49 In delivering replacement habitat, there may also be a risk with delivering a functional offset and the timing of the impact. This particularly true for difficult to create habitats or management elements which may be difficult to enforce e.g. specified grazing regimes. There could potentially be a risk to maintaining a species population whilst a habitat is establishing or management is rectified, even though it may recover in time. Therefore, it is important that functioning replacement habitat is in place before development commences on site wherever feasible. A lead-in period for replacement habitat creation is advised as functionality may not be achieved until several years after creation. Frontloading habitat creation also allows time for alternatives or remedial measures to be delivered if habitat creation fails due to the difficulty in recreating or restoring habitats. Fraction Multipliers are used to account for these possibilities. These are applied to the calculation for the value of the replacement habitat proposed.

C5.50 Appendices 4 and 5 provide a guide to difficulty in creating and restoring habitats and the time frame required to reach maturity or functionality. The values are consistent with Biodiversity Net Gain metric multipliers.

Delivery Risk

C5.51 Habitats vary in levels of difficulty and risk in creation or restoration. Appendix 4 gives an indicative guide to risk levels which have been assigned to the difficulty of habitat creation using expert opinion by Defra through the Biodiversity Net Gain metric process. Factors such as substrate, nutrient levels, state of existing habitat, etc. will have an impact on the actual risk factor, which may need to be taken into account. The value of multipliers used for the HEP, as based on the Defra metric, are shown in Table C3.

Table C3: Delivery Risk Multipliers

Difficulty of recreation/restoration	Multiplier
Very High	0.1
High	0.33
Medium	0.67
Low	1

Temporal Risk

C5.52 There may be a difference in timing between the implementation of the development and the functionality and maturity of the replacement habitat in terms of providing a resource for Horseshoe bats. This time lag would be minimised by implementation of the habitat creation and/or restoration in consultation with the local authority and other nature conservation organisations in advance of planning approval or development commencing. However, unlike Biodiversity Net Gain, habitat banking or habitat creation decades in advance is challenging in relation to horseshoe bat mitigation and off-setting. It is challenging to ring-fence replacement habitat from a long-term increase in carrying capacity and prey availability across the bats home range, so a pragmatic and proportional approach needs to be taken and justified. In some cases, the replacement habitat may be planted or managed concurrently with that of the site development.

C5.53 Where a time lag will occur, a multiplier will be applied to take account of the risk involved to the 'no net loss' objective. This will require more habitat to be provided to compensate for the risk. The temporal multiplier values are set out in Table C4 below. Appendix 5 gives general guidance on the time required for different habitats to reach maturity, consistent with Defra Biodiversity Net Gain guidance. The multiplier used needs to be judged on a case-by-case basis, and can be varied providing sufficient justification and evidence is submitted with a planning application.

C5.54 It is considered that some priority habitats cannot be recreated due to the length of time that they have evolved and the irreplaceability of some constituent organisms, at least in the short and medium terms. In the medium and longer terms, the management of any replacement habitat may be uncertain. Table C4 has been constrained to a maximum period of 30 years. In some cases, the time lag for the development of a habitat to support a population may be too long to be acceptable and alternative, deliverable options for habitat creation provided. For Horseshoe bats, there are a number of options which are deliverable over a 30 year time frame.

Table C4: Temporal Risk Multipliers

Time to Target Condition			
Time (years)	**Multiplier**	**Time (years)**	**Multiplier**
0	1.000	16	0.566
1	0.965	17	0.546
2	0.931	18	0.527
3	0.899	19	0.508
4	0.867	20	0.490
5	0.837	21	0.490
6	0.808	22	0.490
7	0.770	23	0.490
8	0.752	24	0.490
9	0.726	25	0.490
10	0.700	26	0.490
11	0.676	27	0.490
12	0.652	28	0.490
13	0.629	29	0.490
14	0.607	30	0.490
15	0.586		

Spatial Risk

C5.55 A factor is added for spatial risk to cover instances where the replacement habitat is provided off-site and where to site of the replacement habitat is located in another Density Band than that of the development site, for example the development occurred in Band B and the off-site replacement habitat is located in Band A.

C5.56 In all cases, the creation of replacement habitat in a lower band, i.e. Band C for a development occurring in Band B must be avoided, as set out in Section A8.3. Habitat lost within Band A must be replaced within Band A and, unless full justification is provided and evidenced, at a more accessible location (i.e. closer to known roosts) for the SAC population

Off-Site Replacement Habitat

C5.57 Where the replacement habitat cannot be created on-site within the red line boundary, the baseline value of the existing habitat on the intended off-site location for replacement habitat creation site needs to be calculated. This is to account for off-site habitat which will be lost or altered in value as a result of replacement habitat creation. As set out in Section A8.4, selection of suitable off-site locations will also need to be informed by bat surveys and considerations regarding accessibility to the target bat species.

C5.58 Off-site habitat creation is completed in the ‘Habitat Creation’ worksheet in the proforma spreadsheet alongside on-site created and risks are applied in the same manner as detailed above.

Annex 6: Habitat Creation Prescriptions

C6.1 The following are standard prescriptions that can be used as replacement habitat both on development sites and at off-site locations. In order to minimise the area required, habitat scoring higher in the HSI should be used. The following gives prescriptions for habitat that are likely to score highly.

Greater Horseshoe Bats[112]

Pasture

C6.2 Ideally, existing pasture should be enhanced or new grazed pasture created for Greater Horseshoe Bats. It is unlikely that a grazing regime could continue within a development site, unless a sizeable dedicated area without public access is created. This has been achieved for some sites (for example, Cobthorn Way in Congresbury) so should not be totally ruled out. Grazing cannot be considered as mitigation in isolation on off-site mitigation sites. There are inherent issues in using third parties to create new pasture as replacement habitat in perpetuity in terms of reasonableness and enforceability. These were highlighted in the Churston Golf Club planning appeal which was refused as grazing could not be sustained.[113] If grazing management is proposed, this needs to be accompanied by changes in quantity and type of habitat to ensure that any replacement habitat will deliver for Horseshoe bats in the long-term. Robust legal agreements such as Conservation Covenants will need to be in place. Organic grazing, without use of antiparasitic drugs which target the invertebrate prey of horseshoe bats, should be implemented.

Grassland

C6.3 The creation of species-rich or moderate diverse, rough (infrequently cut) semi-improved grassland is the more feasible option in response to providing replacement habitat to mitigate the impacts of a development. This will need to be managed to produce a long sward to support an abundance of Noctuid moths, one of the main prey items hunted by Greater Horseshoe Bats. Specified seed mixes should include food plants, as well as grasses, such as dandelion, dock, hawkweeds, plantains, ragwort, chickweed, fat hen, mouse-ear and red valerian and other herbaceous plants. Buddleia and bramble, in particular, and other scrub species may be planted within or on the edges of the grassland. The grassland should be divided into parcels and cut in rotation once a year in late October and the cuttings removed. Where grassland is established as a field margin or corridor, this should be at least 6 m or 10 m wide.

Woodland

C6.4 The replacement of coniferous woodland with broadleaved woodland would benefit Greater Horseshoe Bats, provided the woodland is accessible to the species through the use of rides or paths. The replacement of coniferous woodland should be carried out gradually over a period of time to avoid extensive clear-felling. Macro-moth abundance is higher at the edge of woodland than in the interior. All woodlands should be permeated by grassy rides and contain glades. Glades ideally need to be at least 10 - 15 m across before they will be used for feeding. Macro-moth abundance and species richness are positively affected by tree species richness and by the relative abundance of native trees in a woodland patch. Of dominant ground types, ‘grass’ and ‘litter’ have higher abundances and species-richness than bare ground, herbs, moss or ferns. Woodland size is positively related to macro-moth abundance. Woodlands over 5 ha have the highest values of moth diversity and abundance. However, relatively small patches (e.g., woodlands between 1 and 5 ha) still seem to contain relatively large moth populations.

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[112] Derived from Ransome, R. D. 1996. The management of feeding areas for greater horseshoe bats. English Nature research report No.174. Peterborough: English Nature; Fuentes-Montemayor, E., Goulson, D.,Cavin, L., Wallace, J. M. & Park, K. J. 2012. Factors influencing moth assemblages in woodland fragments on farmland: Implications for woodland management and creation schemes. *Biological Conservation* 153 (2012) 265–275; Merckx, T. & Macdonald, D. W. 2015. Landscape-scale conservation of farmland moths: in Macdonald, D. W. & Feber, R. E. (eds) 2015. *Wildlife Conservation on Farmland. Managing for Nature on Lowland Farms*. Oxford: Oxford University Press; Fuentes-Montemayor, E., Goulsion, D.& Park, K. J. 2010, The effectiveness of agri-environment schemes for the conservation of farmland moths: assessing the importance of a landscape-scale management approach. *Journal of Applied Ecology* 48, 532-542

[113] Paragraphs 41 to 50 of Appeal Ref: APP/X1165/A/13/2205208 Land at Churston Golf Club, Churston, Devon, TQ5 0LA.

When creating woodland for horseshoe bats, the target species must be considered as the specification will be different (see Lesser Horseshoe Bats below).

Hedgerow

C6.5 Hedgerow acts as a commuting structure and provides feeding perches for Greater Horseshoe Bats. Over 90% of prey caught by bats is brought in on the wind from adjacent habitats. New hedge lines could be planted within a biodiversity enhancement area or off-site to divide large grazed fields into smaller units and link them to blocks of woodland. Hedgerows should be 3 to 6 m wide and 3 m high with standard trees planted frequently along their length. The provision of trees increases moth abundance. Cutting should be restricted to the minimum needed to ensure visibility or retain hedgerow structure. Hedgerows are best cut every 2-3 years, working on rotation on only one part or side at any time.

C6.6 One study found that night-flying moth abundance and diversity correlated positively with the number of bramble clumps along a hedgerow[114]. Another study found that macro-moth abundance was related to the frequency of trimming hedgerows and that at least a three-year cycle was required to produce an abundance favourable to bats.[115]

C6.7 A species-rich grass strip, a minimum of 6 m wide, with a long sward, managed as described above, should accompany hedgerow creation as this will enhance moth abundance.[116]

Lesser Horseshoe Bats[117]

Woodland with Water

C6.8 Lesser Horseshoe Bats hunt a variety of insects which are generally smaller than those consumed by Greater Horseshoe Bats. These include micro-moths, gnats, midges, mosquitoes, craneflies, brown lacewings, caddis flies and ichneumon wasps. Barataud et al (2000) found the woodland associated with water was the most preferred habitat by Lesser Horseshoe Bats.

C6.9 Micro-moth abundance is positively related to the relative abundance of native trees[118] and, unlike macro-moths, the percentage cover of understory in a woodland patch. Micro-moth abundance was higher within the woodland interior than at the edge. The shape of the woodland patch was important particularly for woodland micro-moth species, indicating that patches of compact shapes (with proportionally less edge exposed to the surrounding matrix) sustain a larger number and larger populations of woodland species of micro-moths. This highlights the importance of designing patches of compact shapes, especially when the patch to be created is small. Brown lacewings, a key prey item, can be found amongst conifers.

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[114] Coulthard, E. 2015. The Visitation of Moths (Lepidoptera) to Hedgerow Flowering Plants in Intensive Northamptonshire Farmland: in Coulthard, E. 2015. *Habitat and landscape-scale effects on the abundance and diversity of macro-moths (Lepidoptera) in intensive farmland*. PhD. University of Northampton.

[115] Froidevaux, J. S. P., Broyles, M. & Jones, G. 2019. Moth responses to sympathetic hedgerow management in temperate farmland. *Agriculture, Ecosystems and Environment,* 270 -271 (2019), 55 - 64

[116] Merckx, T. & Macdonald, D. W. 2015. Landscape-scale conservation of farmland moths: in Macdonald, D. W. & Feber, R. E. 2015. *Wildlife Conservation on Farmland. Managing for Nature on Lowland Farms*. Oxford: Oxford University Press.

[117] Derived from Barataud, M., Faggio, G., Pinasseau, E. & Roué, S. G. 2000. *Protection et restauration des habitatas de chasse du Petit rhinolophe (*Rhinolophus hipposideros*) Année 2000*. Paris : Ministère de l'Environnement – Direction de la Nature et des Paysages ; Fuentes-Montemayor,E., Goulson, D.,Cavin, L., Wallace, J. M. & Park, K. J. 2012. Factors influencing moth assemblages in woodland fragments on farmland: Implications for woodland management and creation schemes. *Biological Conservation* 153 (2012) 265–275; Chinery, M. 2007. *Insects of Britain and Western Europe*. London: A & C Black; Fuentes-Montemayor, E., Goulsion, D.& Park, K. J. 2010, The effectiveness of agri-environment schemes for the conservation of farmland moths: assessing the importance of a landscape-scale management approach. *Journal of Applied Ecology* 48, 532-542; Entwistle, A. C., Harris, S., Hutson, A. M., Racey, P. A., Walsh, A., Gibson, S. D., Hepburn, I. & Johnston, J. 2001. *Habitat management for bats: A guide for land managers, land owners and their advisors*. Peterborough: Joint Nature Conservation Committee.

[118] Fuentes-Montemayor, E., Goulson, D.,Cavin, L., Wallace, J. M. & Park, K. J. 2012. Factors influencing moth assemblages in woodland fragments on farmland: Implications for woodland management and creation schemes. *Biological Conservation* 153 (2012) 265–275]; Entwistle, A. C., Harris, S., Hutson, A. M., Racey, P. A., Walsh, A., Gibson, S. D., Hepburn, I. & Johnston, J. 2001. *Habitat management for bats: A guide for land managers, land owners and their advisors*. Peterborough: Joint Nature Conservation Committee.

C6.10 Woodland trees and shrubs should be planted in naturalistic non-linear patterns. Scalloped edges and bays will provide sheltered areas with higher insect concentrations. Providing a variety of types of vegetation from trees to shrubs and rough grass will also benefit Lesser Horseshoe bats. Overhanging branches and bushy shrubs should be left to provide cover.

Ponds

A6.11 Mosquitoes and caddies fly larvae are aquatic, as can be gnat larvae. Gnats and midges also use damp places near water to breed. Therefore, the incorporation of ponds in association with woodland habitat is likely to increase their value to Lesser Horseshoe bats. Ponds with permanent water should be created. It is possible that these could form attenuation features as part of the surface water mitigation for a development. They should be designed so that water is maintained within them throughout the year.

C6.12 Variation on the banks of ponds favours high insect and structural diversity. Design in as many natural features as possible, including varied depths, diverse aquatic and bankside vegetation, and overhanging trees. Grassy margins, scrub and overhanging vegetation provide excellent conditions for insects. Habitat diversity can often be achieved simply through allowing growth of taller vegetation. Where bank management is necessary, restrict it to a small area and work on one bank at a time. Carry out management sensitively, aiming to enhance variation in vegetation. Use fencing to prevent livestock from causing excessive damage to water margins.

Grassland

C6.13 Long sward grassland is also of benefit to Lesser Horseshoe Bats as that described above for Greater Horseshoe bats. The management of grassland should be as that for Great Horseshoe Bats. Rough grassland and scrub are an important predictor of micro moth abundance.

Hedgerow

C6.14 Hedgerow acts as commuting structure and provides feeding perches for Lesser Horseshoe Bats. Over 90% of prey caught by bats is brought in on the wind from adjacent habitats. New hedge lines could be planted within a biodiversity enhancement area or off-site to divide up large grazed fields into smaller units and link them to blocks of woodland. Hedgerows should be 3 to 6 m wide and 3 m high with standard trees planted frequently along their length. The provision of trees increases moth abundance.

Annex 7: Application of the Habitats Regulations

C7.1 The Habitats Regulations protect identified *sites* by designation as Special Areas of Conservation (SACs). However, the Habitats Regulations also protects *habitat* (Functionally Linked Land) which is important for the Favourable Conservation Status of the cited species.[119]

C7.2 Achieving Favourable Conservation Status of a site's features "… *will rely largely on maintaining, or indeed restoring where it is necessary, the critical components or elements which underpin the integrity of an individual site. These will comprise the extent and distribution of the qualifying features within the site and the underlying structure, functions and supporting physical, chemical or biological processes associated with that site and which help to support and sustain its qualifying features.*"[120]

C7.3 Regulation 63 of the Habitats Regulations states that:

A competent authority, before deciding to undertake, or give any consent, permission or other authorisation for, a plan or project which –

(a) is likely to have a significant effect on a European Site … (either alone or in combination with other plans or projects), and
(b) is not directly connected with or necessary to the management of that site must make an appropriate assessment of the implications for that site in view of that site's conservation objectives.

C7.4 An assessment to meet Regulation 63 requires a two-stage procedure: (Stage 1) a screening stage where the "competent authority" has grounds to conclude whether a plan or project is likely to have a significant effect on a European site **without mitigation**[121], and (Stage 2) the Appropriate Assessment stage if it concludes that a significant effect is likely, including consideration of the impacts of mitigation.

C7.5 In accordance with Regulation 63, information submitted with a planning application will be used by North Somerset Council to determine whether the proposal is likely to have a significant effect on the SAC. Councils carry out a Habitats Regulations Assessment for proposals which involve or may involve:

- Loss or disturbance to bat roosts, including undesignated roosts, used by SAC bat populations (outside of the scope of this SPD);
- Loss of foraging habitat for SAC bats;
- Removal or fragmentation of commuting habitat for SAC bats;
- Increase in luminance in close proximity to a roost and/or increase in luminance to foraging or commuting habitat causing displacement of SAC bat populations; and/or
- Any other form of disturbance which could displace horseshoe bats from foraging habitat or dispersal corridors.

It could be argued that other indirect impacts, such as removal of grazing and reduction of prey sources, could cause a significant adverse effect.

C7.6 The Court of Justice of the European Union clarified what is required in that there is a '…. *need to identify and examine the implications of the proposed project for the species present on that site, and for which that site has not been listed, and the implications for habitat types and*

[119] See European Site Conservation Objectives for North Somerset and Mendip Bats Special Area of Conservation at Part B, paragraph 1.4
[120] Natural England Standard: Conservation Objectives for European Sites in England Standard 01.02.2014 V1.0 http://publications.naturalengland.org.uk/publication/6734992977690624
[121] As established in People Over Wind and Peter Sweetman v Coillte Teoranta

species to be found outside the boundaries of the site. Provided those implications are liable to affect the conservation objectives of the site'.[122]

C7.7 When considering whether a project is likely to have a significant effect on a SAC, the competent authority in Stage 1 of the Habitats Regulations Assessment, does not take account of mitigation measures for effects on the features of the European site.[123] Where mitigation measures are required, a Stage 2 Appropriate Assessment must be completed in accordance with the Sweetman / People over Wind judgement.

C7.8 Mitigation measures are measures which are designed to *avoid* or *reduce* adverse effects on a SAC. Where compensatory measures are required (i.e., for impacts within the designated site), these will not be taken into account in the Appropriate Assessment (Stage 2). It is important to distinguish mitigation from compensatory measures which are designed to compensate for unavoidable adverse effects on a European site and follow the "Three Tests".[124]

C7.9 The precautionary principle underpins the Habitats Directive[125] and hence the Habitats Regulations and must be applied by the Council as the Competent Authority as a matter of law.[126] The decision as to whether or not an appropriate assessment is necessary must be made on a precautionary basis.[127] In addition, the Waddenzee judgement[128] requires a very high level of certainty when it comes to assessing whether a plan or project will adversely affect the integrity of a European site. The judgement states that the competent authority must be sure, certain, convinced that the scheme will not adversely affect the integrity of the site. It goes on to state that that there can be no reasonable scientific doubt remaining as to the absence of adverse effects on the integrity of the site.

C7.10 For planning authorities to be able to conclude with enough certainty that a proposed project or development will not have a significant effect on the SAC, the proposal or project must therefore be supported by adequate evidence and bespoke, reasoned mitigation. It is the duty of the applicant, supported by technical experts they may engage to assist, to provide sufficient information to inform an assessment. If sufficient information is not submitted, impacts cannot be assessed. Schemes should not be approved, in accordance with the law, if there is insufficient information to complete a Habitats Regulations Assessment (HRA), following the Precautionary Principle. A Shadow HRA may be requested from the applicant for sites where there are any complexities in survey information and mitigation which need to be analysed and presented clearly. Shadow HRAs are highly likely to be required for major schemes, but may also be requested for smaller schemes where there is a particular risk of significant adverse effects. A shadow HRA template for North Somerset is included in Figure C7.1 below. An editable version can be provided on request from North Somerset Council. Shadow HRAs are likely to be required for the following developments:

- Major schemes within Band A and Band B for either Horseshoe bat species;
- Major schemes in Band C or for particularly significant schemes outside of the Horseshoe Bat Consultation Zones where these have a credible risk of significant adverse impacts on the SAC;
- Minor schemes within Band A and Band B which will result in removal of or significant adverse impacts on foraging habitat for Horseshoe bats; and

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[122] Court of Justice of the European Union (Holohan, Guifoyle, Guifoyle & Donegan v An Bord Pleanála. Case C-461 /17)
[123] A decision by the Court of Justice of the European Union (*People Over Wind and Sweetman v Coillte Teoranta* (C-323/17)) means that mitigation (avoidance and reduction) measures may no longer be taken into account by competent authorities at the HRA "screening stage" i.e., when judging whether a proposed project is likely to have a significant effect on a European site.
[124] See ODPM circular 06/2005
[125] Council Directive 92/43/EEC on the conservation of natural habitats and of wild fauna and flora (known as the 'Habitats Directive')
[126] *Assessing Projects under the Habitats Directive: Guidance for Competent Authorities* 2011, CCW p.15
[127] ODPM Circular 06/2005 para13
[128] ECJ judgement: C-127/02 [2004] ECR-I

- Any scheme where important dispersal corridors for horseshoe bats are likely to be removed, damaged, fragmented or where displacement of bats may occur as a result of light spill or disturbance;
- Minor schemes and householder schemes immediately adjacent to designated SAC units;
- Any maternity or hibernation roosts anywhere within North Somerset; and
- Day roosts used by multiple Horseshoe bats within the Horseshoe Bat Consultation Zones.

When Shadow HRAs are completed, the Council will complete their own assessment based on full scrutiny for legal purposes, cross-referencing the Shadow HRA. Further information may be requested to fully evidence HRAs. It is the applicant's duty to provide any reasonable information to inform HRAs as set out under Regulation 63, and applications are likely to be refused if sufficiently detailed evidence is not submitted. A balance should be struck between providing sufficient evidence to inform the HRA beyond reasonable scientific doubt and excess evidence being requested. For example, a full-scale population impact assessment is usually not necessary for impacts on smaller scale roosts. Pragmatism and proportionality should be used when completing the HRA template, keeping documents as simple as possible, but with clearly evidenced statements, and linking directly to other documents which full detail evidence with a scientific basis e.g. light modelling, ecological survey reports, etc. Aside from the triggers for Shadow HRAs detailed above, the Council may need to complete its own HRA screening assessment, or Appropriate Assessments, for smaller schemes or sites without anticipated significant impacts. A Shadow assessment is not always necessary in these instances, as will be decided on a case-by-case basis by the Council's Ecologists.

C7.11 Once impacts have been assessed and an acceptable approach to mitigation provided and evidenced *beyond reasonable scientific doubt,* an Ecological Management Plan including monitoring during and / or post development, will need to be secured through either planning conditions or a S106 agreement or both. Where appropriate, a long-term monitoring plan will be expected to assess whether the bat populations have responded favourably to the mitigation, with an approach set out as to how remedial measures will be considered and applied. It is important that consistent monitoring methods are used pre- and post-development, to facilitate the interpretation of monitoring data. Data from monitoring will be used by the planning authorities to determine how the bat populations have responded to mitigation, to increase the evidence base and ensure management of sites are revised toward supporting the bat populations affected.

Figure C7.1 North Somerset Shadow HRA Template

ASSESSMENT OF LIKELY SIGNIFICANT EFFECT ON A EUROPEAN SITE Conservation of Habitats and Species Regulations 2017 (as amended)	SHADOW DOCUMENT SUPPLIED BY THE APPLICANT FOR POTENTIAL ADOPTION BY NORTH SOMERSET COUNCIL Ecologist: Company: Date:

HABITATS REGULATIONS ASSESSMENT (HRA)

App ref No: **Site Address:**	
Proposal:	
DC Case Officer:	

This application has been considered in light of the assessment requirements of Regulation 63 of the Conservation of Habitats and Species Regulations 2017 (as amended by the Conservation of Habitats and Species (Amendment) (EU Exit) Regulations 2019) by North Somerset Council which is the Competent Authority responsible for authorising the project.

Habitats Regulations Assessment (HRA) process

Consideration of the potential impacts of a development proposal pursuant to Regulation 63 Habitats Regulations is a two-stage process:

63 (1) A Competent Authority before deciding to undertake or give any consent, permission or other authorisation for a plan or project which –

a) Is likely to have a significant effect on a European Site or a European offshore marine site (either alone or in combination with other plans or projects), and

b) is not directly connected with or necessary to the management of that site,

Must make an appropriate assessment of the implications for that site in view of that site's conservation objectives

63 (5) in the light of the conclusions of the assessment, and subject to regulation 64 (considerations of overriding public interest), the competent authority may agree to the plan or project only after having ascertained that it will not adversely affect the integrity of the European site or the European off shore marine site (as the case may be).

Assessment pursuant to the Habitats Regulations therefore involves: a Screening stage (which, since the People over Wind[129] decision must exclude measures intended to avoid or reduce potential harmful effects on a European site), followed by an Appropriate Assessment if potential harmful effects on a European site cannot be quickly ruled out. The Competent Authority has a duty to have regard to any potential impacts that a project may have.

[129] People Over Wind and Sweetman v Coillte Teoranta (C-323/17)

Name of European Site:

North Somerset and Mendip Bats Special Area of Conservation (SAC)

Component SSSI/s:

Within North Somerset: Banwell Caves SSSI, Banwell Ochre Caves SSSI, Brockley Hall Stables SSSI, King's Wood and Urchin Wood SSSI
Outside of North Somerset (but connected populations):The Cheddar Complex SSSI, Wookey Hole SSSI, Compton Martin Ochre Mine SSSI

Reasons for Designation:

Site description: The limestone caves and mines of the Mendips and the North Somerset hills provide a range of important breeding and hibernation sites for lesser horseshoe bat *Rhinolophus hipposideros* and greater horseshoe bat *Rhinolophus ferrumequinum*. King's Wood and Urchin Wood also comprises semi-natural ancient woodland over limestone with a diverse shrub layer and ground flora including ferns and mosses. Outside of North Somerset, the Cheddar complex and Wookey Hole component units also support a wide range of habitats including semi-natural dry grasslands and grassland on shallow limestone soils which also provide feeding grounds for bats.
Qualifying habitats: The site is designated under article 4(4) of the Directive (92/43/EEC) as it hosts the following habitats listed in Annex I:

- Tilio-Acerion forests of slopes, screes and ravines (mixed woodland on base-rich soils associated with rocky slopes)
- Caves not open to the public
- Semi-natural dry grasslands and scrubland facies on calcareous substrates (dry grasslands and scrublands on chalk or limestone)

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

- Greater horseshoe bat *Rhinolophus ferrumequinum*
- Lesser horseshoe bat *Rhinolophus hipposideros*

Conservation Objectives and Qualifying Sensitive Interest Features:

With regard to the SAC and the natural habitats and/or species for which the site has been designated (the 'Qualifying Features' listed below), and subject to natural change;

Ensure that the integrity of the site is maintained or restored as appropriate, and ensure that the site contributes to achieving the Favourable Conservation Status of its Qualifying Features, by maintaining or restoring;

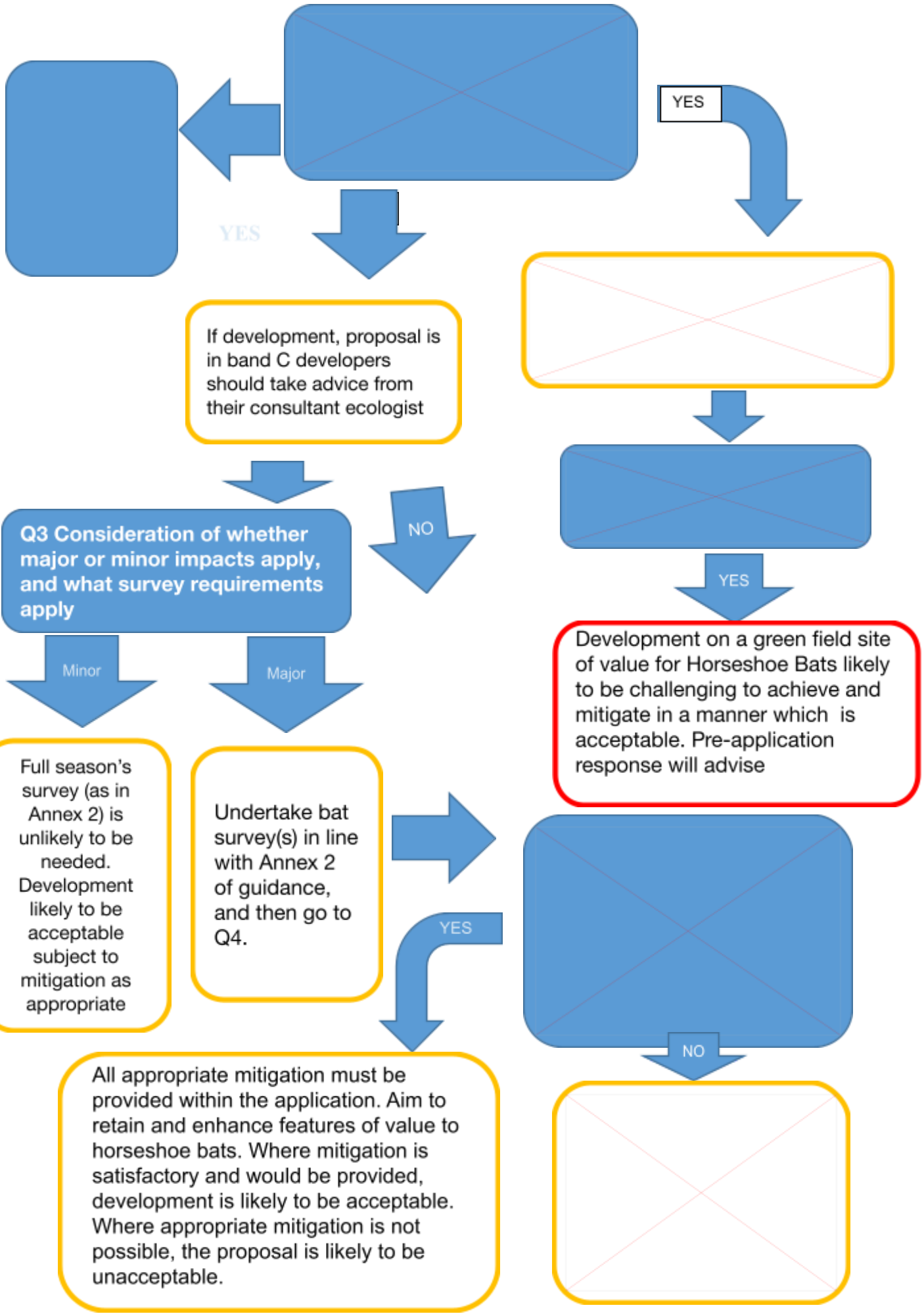
- The extent and distribution of qualifying natural habitats and the habitats of qualifying species
- The structure and function of the habitats of qualifying natural habitats
- The structure and function of the habitats of qualifying species
- The supporting processes on which qualifying natural habitats and the habitats of qualifying species rely
- The populations of qualifying species, and,
- The distribution of qualifying species within the site.

Qualifying Features:

H6210. Semi-natural dry grasslands and scrubland facies: on calcareous substrates (*Festuco-Brometalia*); Dry grasslands and scrublands on chalk or limestone
H8310. Caves not open to the public
H9180. *Tilio-Acerion* forests of slopes, screes and ravines; Mixed woodland on base-rich soils associated with rocky slopes
S1303. *Rhinolophus hipposideros*; Lesser horseshoe bat
S1304. *Rhinolophus ferrumequinum*; Greater horseshoe bat

Development Site location in relation to SAC/s:	
1. Screening stage	
Is the project likely to have a significant effect on a European site when considered on its own?	
[*Detail impacts on Horseshoe bat roosts, foraging habitat and commuting habitat without mitigation]*	
Is the project directly connected to the management of the SAC?	**Yes/No**
A risk of a "likely significant effect" on the SAC can/cannot be ruled out without relying on mitigation measures. **Proceed to stage 2.**	
2. Appropriate Assessment	
Consider mitigation measures	*[Detail impacts on Horseshoe bat roosts, foraging habitat and commuting habitat with mitigation, fully referencing mitigation proposals e.g. supplementary drawings]*
Consider the possibility of in-combination effects	[*Consider any schemes within sphere of influence and detail whether any in-combination effects may occur*] Therefore, there will / will not be any significant adverse effects as a result of in-combination impacts.
CONCLUSION	Following an Appropriate Assessment in accordance with the Regulations, the competent authority has ascertained that the project would / would not have an adverse effect on the North Somerset and Mendip Bats SAC either alone or in combination with other plans or projects providing mitigation is delivered as outlined.
North Somerset Council Comments	
Date:	
Name:	**[ecologist]** **North Somerset Council**
3. Consultation with Natural England	
Natural England opinion:	
Date	
Name:	**TBC** **Natural England**

Annex 8: Horseshoe Bat Survey and Mitigation Flow Chart



Part D: Appendices

Appendix 1: Comparison of Home Ranges Derived from Radio-Tracking Studies

Greater Horseshoe Bats

Results	Average Distance (km)	Maximum Distance (km)	Reference
Non-Breeding Roost			
Mean maximum distance from roost to foraging area (maximum distance for each tracked individual averaged over the colony, foraging areas estimated used 90% cluster analysis) 2.17km, range 0.95-2.93km (Boar Mill) and 2.44km, range 0.61-3.76 (Creech).	2.17	2.93	Flanders, J. & Jones, G., 2009. Roost use, ranging behaviour and diet of Greater Horseshoe bats (*Rhinolophus ferrumequinum)* using a transitional roost. *Journal of Mammalogy* 90: 888-896.
	2.44	3.76	
Maternity Roosts			
Maximum foraging radius from the roost was 13.9km for adults and 4.9km for juveniles.		13.9	Geckoella (2022). *North Somerset Council Greater Horseshoe Bat Radio-tracking 2022.* Geckoella Ltd on behalf of North Somerset Council, Weston-super-Mare.
Bats were recording regularly foraging in habitats up to 12km from the roost. Modelling confirmed that a 5 km Juvenile Sustenance Zone is likely to apply.	8*	12	Foxley, T. (2024) *Using spatial modelling to inform a strategic, landscape-level approach to bat conservation. University of the West of England, Bristol*. Available from: https://uwe-repository.worktribe.com/output/11641307 *Average maximum distance
Maximum distance travelled from roost 4km for juveniles and 8km for adults. Majority of foraging areas are within 6km of roost.		8	Billington, G. 2003. *Radio tracking study of Greater Horseshoe bats at Buckfastleigh Caves Site of Special Scientific Interest*: English Nature Research Report no. 573. Peterborough: English Nature.
Maximum distance travelled from roost 7.5km for adult bats. The majority of foraging areas are within 5km of roost.		7.5	English Nature Research Report no. 496
Maximum distance travelled from roost 6.8km, mean 1.9km (22 May-5 June), 13.9km, mean 6.2km (18-31 July). Overall 92% of foraging time spent within 6km of the roost and 60% within 4km. In May-June 92.7% foraging was within 3km, in July only 9.7% occurred within 3km. Only one bat flew further than 6km during May.	1.9	6.8	Robinson, M. F., Webber, M. & Stebbins, R. E. 2000. *Dispersal and foraging behaviour of Greater Horseshoe bats, Brixham, Devon*. English Nature Research Report No. 344. Peterborough: English Nature.
Maximum distance travelled from roost 4.5km (juvenile) and 6.8km (adult). Majority of time spent within 4km. However,, measured in GIS the range is 8km		8.0	Billington, G. 2001. *Radio tracking study of Greater Horseshoe bats at Brockley Hall Stables Site of Special Scientific Interest, May – August 2001*.English Nature Research Report No. 442. Peterborough: English Nature.

Results	Average Distance (km)	Maximum Distance (km)	Reference
Maximum distance travelled from roost 3.6km (juvenile) 4.5km (adult).	2.2	4.5	Duverge, P., 1996. Foraging activity, habitat use, development of juveniles, and diet of the Greater Horseshoe bat (*Rhinolophus ferrumequinum* - Schreber 1774) in south-west England. PhD Thesis, University of Bristol.
Maximum distance travelled from roost 5.52km, mean distance from roost to foraging event (extended period of relatively stable signal strength indicating foraging behaviour), averaged over all fixes of all individuals tracked 1.68km ± 0.09.		5.52	Rossiter, S.J., Jones, G., Ransome, R.D., Barratt, E.M., 2002. Relatedness structure and kin-biased foraging in the Greater Horseshoe bat (*Rhinolophus ferrumequinum*). *Behavioural Ecology and Sociobiology* 51: 510-518.
Maximum distance 5.75km measured from radio tracking fixes in GIS		5.75	Jones, Dr. G. & Billington, G. 1999. *Radio tracking study of Greater Horseshoe bats at Cheddar, North Somerset*. Taunton: English Nature.
Greater Horseshoe bat maximum foraging distance from the roost was 5.81km in June and 5.98km in August, with average distances being approximately 3.58km and 3.83km, respectively. These are similar figures to the 1999 study, where greater horseshoes were proven to forage up to 5.75km from the roost (Jones and Billington, 1999).	3.58	5.81	Rush,T. & Billington, G. 2013. *Cheddar Reservoir 2: Radio tracking studies of greater horseshoe and Lesser Horseshoe bats, June and August 2013*. Witham Friary: Greena Ecological Consultancy.
	3.83	5.98	
Maximum distance 4km measured from radio tracking fixes in GIS		4	Billington, G. 2000. *Radio tracking study of Greater Horseshoe bats at Mells, Near Frome, Somerset*. Peterborough: English Nature
Average distance to foraging areas was <3km until the end of May and after that it was around 5km. The longest distance travelled by one bat was 10.5km.	3	5	Billington, G. 2000. *Combe Down Greater Horseshoe bats: radio tracking study*. Bat Pro Ltd on behalf of Bath & North East Somerset Council
Maximum distance travelled from roost 7.4km. 50% of bat locations were within 1.7km of the roost.	1.7	7.4	Bontadina, F. 2002. Conservation ecology in the horseshoe bats *Rhinolophus ferrumequinum* and *Rhinolophus hipposideros*. PhD Thesis, University of Bern.

Lesser Horseshoe Bats

Results	Average Distance (km)	Maximum Distance (km)	Reference
Maximum distance travelled from roost, where home range had reached asymptote 273 - 4177m, mean maximum distance 1955m. Fifty percent of tracking locations were within 600m of maternity roost.	1.96	4.18	Bontadina, F., Schofield, H., Naef-Daenzer, B., 2002. Radio-tracking reveals that Lesser Horseshoe bats (*Rhinolophus hipposideros*) forage in woodland. *Journal of Zoology* 258: 281-290.
Bats were recorded ranging 6km to the north, 1.5km east, 2km south and 5km to the west.		6	Billington, G. 2005. *Radio tracking study of Lesser Horseshoe bats at Hestercombe House Site of Special Scientific Interest, July 2005.* English Nature Somerset & Gloucestershire Team.

Results	Average Distance (km)	Maximum Distance (km)	Reference
The bats foraged within a radius of 1.0-4.0km from the roost, with the majority remaining within 2.0km. The average foraging radius in May was slightly higher than that recorded in August (1.93km v/s 1.52km)	1.93	4	Duvergé, L. 2008. *Report on bat surveys carried out at Hestercombe House SSSI Taunton, Somerset, in 2007 and 2008.* Cullompton: Kestrel Wildlife Consultants.
Lesser Horseshoe bat maximum foraging distance from the roost was 3.24km in June and 6.08km in August, with average distances being approximately 2.26km and 3.72km, respectively.	2.26	3.42	Billington, G. 2013. *Cheddar Reservoir 2: Radio tracking studies of greater horseshoe and Lesser Horseshoe bats, June and August 2013.* Witham Friary: Greena Ecological Consultancy.
	3.72	6.08	
The mean maximum range distance from the maternity roost for adult females was identical in each landscape (2.0 km) although the maximum distance an individual adult female was recorded flying to did vary. The value was 4.1 km for lowland, 3.5 km for high quality and 3.3 km for upland. Nulliparous females and juveniles were recorded a maximum of 4.5 km and 3.8 km respectively from the maternity roost in the lowland landscape.	2	4.1	Knight, T. 2006. *The use of landscape features and habitats by the Lesser Horseshoe bat* (Rhinolophus hipposideros). PhD Thesis, University of Bristol.
	2	3.5	
	2	3.3	
Maximum distance from maternity roost to centre of furthest foraging area 3.6km, 3.2km and 2.8km respectively. Mean distance from maternity roost to night roosts 1.71km ± 0.98 SD, 2.4km ± 1.44 SD and 1.34km ± 0.86 SD respectively.		3.6	Knight, T., Jones, G., 2009. Importance of night roosts for bat conservation: roosting behaviour of the Lesser Horseshoe bat *Rhinolophus hipposideros*. *Endangered Species Research 9: 79-86.*
		3.2	
		2.8	
One individual tracked - Maximum distance travelled from roost 3.6km, mean distance between roost and foraging area (calculated using MCPs, no further info given) 2.4km	2.4	3.6	Holzhaider, J., Kriner, E., Rudolph, B.-U., Zahn, A., 2002. Radio-tracking a Lesser Horseshoe bat (*Rhinolophus hipposideros*) in Bavaria: an experiment to locate roosts and foraging sites. *Myotis 40: 47-54*.

Appendix 2: Greater Horseshoe Bat Habitat Suitability Index

Text Colour
Black = Habitat Codes
Blue = Matrix Codes
Green = Formation Codes
Red = Management Codes

Note that matrix, formation and management codes in IHS and secondary codes in UKHab are listed under the most likely habitat association. However, they can be attached to other habitat types if appropriate and justified in accompanying ecology reports.

IHS Code[130]	UKHab Code[131]	Label	HSI	Notes
Woodland Habitat Codes				
WB1	w1h	**Mixed woodland**	7	Woodland has high levels of moths (Ransome,1997). Macro- and micro-moths densest where grass/litter, less where there are ferns, moss, bare ground, herbs. Richer where native tree diversity and larger basal area. Species such as oak, willow and birch have large numbers of moths whereas beech has few comparable to non-native species such as sycamore. Moth diversity is greatest on oak and willow species and oak woodlands support high moth diversity. (Fuentes-Montemayor et al, 2012; Greenaway, 2004; Sierro, 1999) Uniform stands of trees are poorer in invertebrates than more diversely structured woodland (Kirby, 1988). Found to spend significant times in woodland, being sheltered, often warmer at night, and insects are much more abundant than open fields. Limited foraging of adults was recorded in woodlands of only a few minutes duration except during medium-heavy rainfall when most of the foraging time was spent in broadleaf and coniferous woodland. (Billington, 2000). Limited foraging recorded within woodland itself (Billington, 2003). Rides, footpaths … were used by GHB when flying in these feeding areas. (Duvergé & Jones, 1994). In woodland, mainly use clearings and woodland edge (Billington, 2009). Extensive use of woodland edge. Support the retention of all mature ancient semi-natural deciduous woodland, old orchards and parkland (Ransome, 1997).
WB33	w1c	**Beech and yew woodlands**	6	
WB34	w1d	**Wet woodland**	5	
WB36	w1f	**Lowland mixed deciduous woodland**	7	
WB3Z	w1g	**Other broadleaved woodland**	7	
LF12	w1g6	**Line of trees**	7	
WC0	w2	**Coniferous woodland**	4	
Woodland Formation Codes				
	38	**Secondary woodland (e.g., abandoned, regrown or neglected)**	0.5	
WF11	47.37	**Native semi-natural**	1	
WF12	48.37	**Non-native semi-natural**	0.75	
WF2	36	**Plantation**	0.75	
Woodland Management Codes				
WM1	55	**High forest**	1.2	
WM2	52	**Coppice with standards**	0.3	
WM3	51	**Pure coppice**	0.25	
WM5	20	**Wood-pasture and parkland**	1.1	
WM52	33	**Relic wood pasture/parkland**	1.1	
WG2	53	**Recently felled/coppiced woodland clearing**	0.5	
WG4	56	**Recently planted trees (Only use for existing)**	0.25	

[130] A complete list with full descriptions and parameters of the habitat labels can be obtained from Somerset Environmental Records Centre. www.somerc.com
[131] A complete list of UKHab codes can be found in Butcher, B., Varey, P., Edmonds, R., Norton, I., & Treweek, J. 2023. *The UK Habitat Classifications V2* at http://www.ukhab.org/

IHS Code[130]	UKHab Code[131]	Label	HSI	Notes
Grassland Habitat Codes				
GA1	g1a	**Lowland dry acid grassland**	5	Most important factor is grazed pasture (Ransome, 1997). Within 1 kilometre of the roost the presence of permanent grazed pasture is critical for juvenile greater horseshoe bats. A high density of grazing animals should be present giving high presence of dung. Within the remainder of the roost foraging range grazing regimes can be more flexible provided adequate pasture is available. Longer swards benefit the larvae of noctuid moths, the main prey of females through the summer period. (Ransome, 1996) Density of moths high over blossoms of thistles (Dietz et al, 2009). Specified seed mixes should include food plants, as well as grasses, such as dandelion, dock, hawkweeds, plantains, ragwort, chickweed, fat hen, mouse-ear and red valerian and other herbaceous plants. Buddleia and bramble in particular, and other scrub species may be planted within or on the edges of the grassland. The short turf produced by sheep grazing may be responsible for high *Melolontha* levels. Sheep dung provides prey Short grazed habitat for Melolontha and Tupilids. All species requires short grass to oviposit. Aphodius live in cow, sheep and horse dung (Ransome, 1997) Meadows which have been cut, and where animals are grazing, were also used (Duverge & Jones, 1994) Support the retention of all old orchards (Ransome, 1997)
GC1	g2a	**Lowland calcareous grassland**	5	
GN0	g3	**Neutral grassland**	5	
GN1	g3a	**Lowland meadows**	5	
GU0	g4/g3c	**Semi-improved grassland**	4	
GI0	g4	**Improved Grassland**	4	
Grassland Matrix Codes				
SC2	10	**Open/scattered scrub (area less than 0.25ha)**	1	
TS0	11	**Scattered trees**	0	
TS1	49	**Scattered trees some veteran**	1	
PA3	12	**Scattered bracken**	0	
	13	**Scattered dwarf shrubs**	1	
	14	**Scattered rushes**	0	
	15	**Rushes dominant**	0	
OT0	16	**Tall herb and fern (excluding bracken)**	0.5	
OT3	16	**Tall ruderal**	0.5	
OT4	16	**Non-ruderal**	0.5	
HS0	17	**Ephemeral/short perennial herb**	0	
BG1	73	**Bare ground**	0	
Grassland Management Codes				
GM11	59	**Cattle grazed**	1.3	
GM12	60	**Sheep grazed**	1.2	
GM13	61	**Horse grazed**	1.3	
GM1Z	62	**Other grazing**	1.2	
GM2	64	**Mown**	0.3	
GM22	65	**Hay**	0.2	
GM23	66	**Frequent mowing**	0.1	
GM3	59.65	**Hay and aftermath grazing**	1.1	
GM4	161	**Unmanaged (tall and tussocky sward)**	1.5	
CL31	21	**Traditional orchards**	1.2	
Bracken Habitat Code				
BR0	g1c	**Bracken**	1	
Heathland and Scrub Habitat Codes				
HE0	h1	**Dwarf shrub heath**	0	Scrub seems to be an important foraging habitat for Greater Horseshoe Bats. Billington (2000) records the frequent use by the species during radio tracking carried out for the Mells Valley SAC in June. Large Yellow Underwing moths are attracted to Buddleia.
SC1	h3	**Dense scrub**	1	
	h3a	**Blackthorn scrub**	3	
	h3b	**Hazel scrub**	2	

IHS Code[130]	UKHab Code[131]	Label	HSI	Notes
	h3d	**Bramble scrub**	4	Buddleia grows in abundance in limestone quarries and flowers from July to September, when demands on lactating female horseshoe bats are high.
	h3e	**Gorse scrub**	4	
	h3f	**Hawthorn scrub**	2	
	h3g	**Rhododendron scrub**	1	
	h3h	**Mixed scrub**	3	
		Buddleia scrub	5	
Wetland Habitat Codes				
EM31	f2c	**Fens [and flushes - lowland]**	2	Tipulid larval development is favoured by damp conditions, any aquatic environments and/or marshes should be retained Aquatic environments will also favour the production of caddis flies (Trichoptera) (Ransome, 1997b; Ransome, 1997a) in certain months, May and late August/September when other food supplies may be erratic (Ransome 1997a)
EM312	128	**Springs**	2	
EM4	f2b	**Purple moor grass and rush pastures [Molinia-Juncus]**	4	
Freshwater and Lakes Habitat Codes				
AS4	r1a5	**Eutrophic standing waters**	5	Significant Trichopteran consumption at roosts close to extensive river or lake habitats (Ransome, 1997). The River Dart, a large river system, mostly banked by broadleaved woodland was also a key habitat (Billington, 2003) Ditches used for commuting. to cross the central Moors south of Cheddar where the bats frequently fly below ground level in drainage channels such as the Cheddar Canal (Jones & Billington, 1999)
AC14	r1e	**Canals**	5	
AR0	r2	**Rivers and streams**	5	
Freshwater and Lakes Formation Codes				
AC1	39	**Freshwater man-made (including ditches, gravel pits, ornamental lakes, drains and artificial ponds)**	0.75	
AC2	41	**Freshwater - natural includes ponds, lakes, streams and rivers**	1	
AP11	19	**Ponds of high ecological quality (priority habitat)**	1	
Arable Habitat Codes				
CR1	c1b	**Grass and grass-clover leys**	1	The wider the field margin the higher the abundance of macro-moths compared to standard margins. The presence of trees has no significant effect on moth abundance. Sites with higher nectar availability also had higher abundances of moths. Plant species richness and vegetation height may provide higher larval food availability and shelter from potential predators. (Delieu et al, 2007; Fuentes-Montemayor et al, 2010) The caterpillar of Large Yellow Underwing can feed on grape vines.
CR2	c1c	**Cereal crops**	1	
CR3	c1d	**Non-cereal crops including woody crops**	2	
CR31	c1e	**Intensively managed orchards**	2	
CR33	c1d7	**Vineyards**	3	
CR34	c1a8	**Game crops**	2	
CR35	c1d5	**Miscanthus**	0	
CR3Z	c1d8	**Other non-cereal crops including woody crops**	2	
CR61	c1a	**Arable field margins**	4	
CL2	c1f	**Market garden and horticulture**	0	
Inland Rock Habitat Codes				
RE0	s1	**Inland rock**	0	Codes for grassland matrix habitats can be added, e.g., scattered scrub
RE11	s1a	**Natural rock outcrop and scree habitats**	0	
RE21	352	**Quarry (disused)**	0	
RE22		**Spoil heap**	0	

IHS Code[130]	UKHab Code[131]	Label	HSI	Notes
RE2Z		**Other artificial rock exposure and waste**	0	
Inland Rock Formation Codes				
RE21	105	**Quarry - hard rock**	0	
RE21	106	**Quarry - sand and gravel**	0	
Linear Habitat Codes				
LF111	h2a	**Important hedgerows**	8	Support the retention of existing hedgerows and tree lines linking areas of woodland. Encourage hedgerow improvement to become 3 to 6 metres wide, mean 3 metres high with frequent standard emergent trees (Ransome, 1997) Hedges used as perching sites (Duverge & Jones, 1994) The vast majority (over 90%) of insects found near hedges do not originate in the hedge but come from other habitats brought in on the wind (BCT, 2003) Hedges managed under agri-environment Schemes did not offer any benefit over conventionally managed hedgerows with regard to macro-moths (Fuentes-Montemayor et al, 2010)
LF11Z	h2b	**Non-important hedgerows**	7	
LF23	853	**Wall**	0	
LF24	50	**Dry ditch**	3	
LT4	431	**Road verge**	2	
LT3	432	**Railway corridor**	4	
UL3		**Path or trackway**	1	
Linear Management Codes				
LH3		**Recently planted hedge (Only use for existing habitat)**	0.2	
LM1	76,81	**Cut hedge (less than 2m high)**	0.3	
LM11		**Cut hedge with standards**	0.3	
LM12	76,81	**Cut hedge without standards**	0.2	
LM2	77	**Uncut hedge (2m to 3m high)**	0.9	
LM21		**Uncut hedge with standards**	0.9	
LM22	77	**Uncut hedge without standards**	0.8	
LM3	78	**Overgrown hedge (over 3m high)**	1	
LM31		**Overgrown hedge with standards**	1	
LM32	78	**Overgrown hedge without standards**	0.9	
	82	**Laid hedge**	0.4	
Built Up Area and Gardens Habitat Codes				
UR0	u1	**Built-up areas and gardens**	0	
	u1a	**Open Mosaic Habitats on Previously Developed Land**	1	
	u1b	**Developed land; sealed surface**	0	
	u1c	**Artificial unvegetated, unsealed surface**	0	
	u1d	**Suburban/ mosaic of developed/ natural surface**	1	
Built Up Area and Gardens Management Codes				
	828	**Vegetated garden**	0.25	
UA32	232	**Un-vegetated garden**	0	
UA33	910	**Allotments**	0.5	

Appendix 3: Lesser Horseshoe Bat Habitat Suitability Index

Text Colour
Black = Habitat Codes
Blue = Matrix Codes
Green = Formation Codes
Red = Management Codes

A complete list with full descriptions and parameters of the habitat labels can be obtained from Somerset Environmental Records Centre.

IHS Code[132]	UKHab Code[133]	Label	HSI	Notes
Woodland Habitat Codes				
WB1	w1h	**Mixed woodland**	8	The primary foraging habitat for LHB is broadleaf woodland where they often hunt high in the canopy. They will also forage along hedgerows, tree-lines and well-wooded riverbanks.' (Schofield, 2008). LHB prefer to hunt in woodland interiors where micromoth abundance is greatest. In the Wye Valley in Monmouthshire studies revealed that Lesser Horseshoe Bats significantly spend the majority of their time foraging in woodland. Broadleaved woodland predominated over other types of woodland and was shown to be a key habitat for the species. Juveniles select broadleaved woodland habitat (Knight, 2006). In lowlands broadleaved and mixed woodland is the most used habitat (Knight, 2006) Lesser horseshoe bats are primarily a woodland feeding bat using deciduous woodland or mixed coniferous woodland and hedgerows. It has been found that habitats that were most important contained a high proportion of woodland, parkland and grazed pasture woodland, combined with linear features, such as overgrown hedgerows. Woodland with watercourses has more importance. Broadleaved woodland predominated over other types of woodland and was shown to be a key habitat for the species. In the core foraging areas, woodland accounted for 58.7 ± 5.2% of the habitats present. (Barataud et al, 2000; Bontadina et al, 2002). Broadleaved, mixed middle age mature woodland with the presence of a river or pond on at least one side most favourable (Barataud et al, 2000) In Bavaria foraged in all available forest types except dense riparian forest. The large part of the time foraging time in forest of deciduous trees (*Fagus sylvatica*) (Holzhaider et al, 2002). Clear cutting must be avoided (Motte & Libois, 2002)
WB33	w1c	**Beech and yew woodlands**	6	
WB34	w1d	**Wet woodland**	8	
WB36	w1f	**Lowland mixed deciduous woodland**	8	
WB3Z	w1g	**Other broadleaved woodland**	7	
LF12	w1g6	**Line of trees**	8	
WC0	w2	**Coniferous woodland**	4	
Woodland Formation Codes				
	38	**Secondary woodland (e.g., abandoned, regrown or neglected)**	0.75	
WF11	47.37	**Native semi-natural**	1	
WF12	48.37	**Non-native semi-natural**	0.75	
WF2	36	**Plantation**	0.75	
Woodland Management Codes				
WM1	55	**High forest**	1.2	
WM2	52	**Coppice with standards**	0.75	
WM3	51	**Pure coppice**	0.25	
WM5	20	**Wood-pasture and parkland**	1.1	
WM52	33	**Relic wood pasture/parkland**	1.2	
WG2	53	**Recently felled/coppiced woodland clearing**	0.5	
WG4	56	**Recently planted trees (Only use for existing)**	0.25	

[132] A complete list with full descriptions and parameters of the habitat labels can be obtained from Somerset Environmental Records Centre. www.somerc.com
[133] A complete list of UKHab codes can be found in Butcher, B., Varey, P., Edmonds, R., Norton, I., & Treweek, J. 2023. *The UK Habitat Classifications V2* at http://www.ukhab.org/

IHS Code[132]	UKHab Code[133]	Label	HSI	Notes
Grassland Habitat Codes				
GA1	g1a	**Lowland dry acid grassland**	4	A habitat index produced as a result of surveys carried out in four different habitats; plantation woodland; improved grassland, semi-improved grassland and arable (root crops) produced the following index 1, 0.33, 0.2 and 0.05 for lesser horseshoe bat prey species abundance respectively (Biron, 2007). Radio tracking research of LHB shows that in foraging over pasture cattle must be actively grazing the field. Once cattle are removed from a field foraging by LHB ceases immediately. However, pasture in such use offers a valuable and predictable food source at a time of year when bats are energetically stressed (pre- to post-weaning), because they are feeding their young. The majority of foraging areas around Glynllifon are associated with semi-improved pasture bounded by hedgerows and scrub (Billington & Rawlinson, 2006) Presence of scattered trees in grassland/arable is likely to increase opportunity for foraging and increase insect diversity/biomass. Parkland habitats have been noted for LHB foraging. There are a high number of Tipulid species in this habitat. The presence of cattle is a factor in access to foraging (Cresswell Associates, 2004). Dung flies have been shown to be an element of the diet but less so at Hestercombe House (Knight, 2008). Scatophagidae are a key element of their diet, and together with Sphaeroceridae, are frequently associated with dung (Knight, 2006). The presence of pasture is indispensable to the larval stage of development for certain species (Tipulids), which form a significant part of LHB diets (Motte & Libois, 2002; Boye & Dietz, 2005).
GA1Z	g1a6	**Other lowland dry acid grassland**	4	
GN0	g3	**Neutral grassland**	4	
GN1	g3a	**Lowland meadows**	4	
GNZ	g4/g3c	**Semi-improved grassland**	4	
GI0	g4	**Improved Grassland**	4	
Grassland Matrix Codes				
SC2	10	**Open/scattered scrub (area less than 0.25ha)**	2	
TS0	11	**Scattered trees**	1	
TS1	49	**Scattered trees some veteran**	3	
PA3	12	**Scattered bracken**	0	
	13	**Scattered dwarf shrubs**	0	
	14	**Scattered rushes**	0	
	15	**Rushes dominant**	1	
OT0	16	**Tall herb and fern (excluding bracken)**	0.5	
OT3	16	**Tall ruderal**	0.5	
OT4	16	**Non-ruderal**	0.5	
HS0	17	**Ephemeral/short perennial herb**	0	
BG1	73	**Bare ground**	0	
Grassland Management Codes				
GM11	59	**Cattle grazed**	1.2	
GM12	60	**Sheep grazed**	0.8	
GM13	61	**Horse grazed**	1.1	
GM1Z	62	**Other grazing**	1	
GM2	64	**Mown**	0.3	
GM22	65	**Hay**	0.2	
GM23	66	**Frequent mowing**	0.1	
GM3	59.65	**Hay and aftermath grazing**	0.8	
GM4	161	**Unmanaged (tall and tussocky sward)**	1.2	
CL31	21	**Tradition orchards**	1.2	
Bracken Habitat Code				
BR0	g1c	**Bracken**	3	Bracken cover hosts over 40 species of invertebrates. Bracken and heath are used by LHB in upland areas (Knight, 2006).
Heathland and Scrub Habitat Codes				
HE0	h1	**Dwarf shrub heath**	3	Avoids dense scrub cover (Schofield 2008).
SC1	h3	**Dense scrub**	1	

IHS Code[132]	UKHab Code[133]	Label	HSI	Notes
	h3a	**Blackthorn scrub**	2	
	h3b	**Hazel scrub**	1	
	h3d	**Bramble scrub**	4	
	h3e	**Gorse scrub**	3	
	h3f	**Hawthorn scrub**	1	
	h3g	**Rhododendron scrub**	2	
	h3h	**Mixed scrub**	2	
		Buddleia scrub	4	
Wetland Habitat Codes				
EM31	f2c	**Fens [and flushes - lowland]**	4	Tipulid larval development is favoured by damp conditions, any aquatic environments and/or marshes (Ransome, 1997b; Ransome, 1997a).
EM312	128	**Springs**	3	
EM4	f2b	**Purple moor grass and rush pastures [Molinia-Juncus]**	4	
Freshwater and Lakes Habitat Codes				
AS4	r1a5	**Eutrophic standing waters**	6	Culicidae were more abundant in the Hestercombe House diet compared with previous studies in Britain (8% compared with 1%) suggesting that the colony is using standing water sources and adjacent areas for foraging. Caddis flies supply 5% of diet. Mayflies less than 5%. Midge larvae develop in lakes, ponds, slow-moving streams, drainage ditches, and wet mud and even in highly polluted sewage water. In Ireland activity as found to be greater around expanses of water than along roadside hedgerows. Foraging was concentrated around tree lined rivers and ponds (McAney & Fairley, 1988). An increase in the number of chironomids results from eutrophication. Adults are commonly found near lights at night or on foliage near water. Watercourses are the most used habitat in uplands (Trichoptera in diet) (Knight, 2006).
AC14	r1e	**Canals**	6	
AR0	r2	**Rivers and streams**	4	
Freshwater and Lakes Formation Codes				
AC1	39	**Freshwater man-made (including ditches, gravel pits, ornamental lakes, drains and artificial ponds)**	0.75	
AC2	41	**Freshwater - natural includes ponds, lakes, streams and rivers**	1	
AP11	19	**Ponds of high ecological quality (priority habitat)**	1	
Arable Habitat Codes				
CR1	c1b	**Grass and grass-clover leys**	1	It has been shown that organic farms are more heavily used by bats than otherwise (Wickramasinghe et al, 2003).
CR2	c1c	**Cereal crops**	1	
CR3	c1d	**Non-cereal crops including woody crops**	1	
CR31	c1e	**Intensively managed orchards**	1	
CR33	c1d7	**Vineyards**	1	
CR34	c1a8	**Game crops**	1	
CR35	c1d5	**Miscanthus**	0	
CR3Z	c1d8	**Other non-cereal crops including woody crops**	1	
CR61	c1a	**Arable field margins**	3	
CL2	c1f	**Market garden and horticulture**	0	
Inland Rock Habitat Codes				
RE0	s1	**Inland rock**	0	Codes for grassland matrix habitats can be added e.g., scattered scrub

IHS Code[132]	UKHab Code[133]	Label	HSI	Notes
RE11	s1a	**Natural rock outcrop and scree habitats**	0	
RE21	352	**Quarry (disused)**	0	
RE22		**Spoil heap**	0	
RE2Z		**Other artificial rock exposure and waste**	0	
Inland Rock Formation Codes				
RE21	105	**Quarry - hard rock**	0	
RE21	106	**Quarry - sand and gravel**	0	
Linear Habitat Codes				
LF111	h2a	**Important hedgerows**	8	In a report for some of the Welsh Authorities by the Bat Conservation Trust (2005), it is stated that in fragmented habitats linear features, such as hedgerows, provided valuable corridors between roosts and foraging areas. Commuting corridors are important features for LHB as they avoid crossing open areas and are vulnerable to the loss of these corridors. Where LHB foraged along linear features, such as hedgerows, it was always within 10 metres of the feature (BatCT, 2005). Commuting corridors, such as tall bushy hedgerows, are important features for LHB as they avoid crossing open areas and are vulnerable to the loss of these corridors. In Belgium no LHB bat was recorded more than 1 m from a feature (Motte & Dubois, 2002). Linking features in a landscape of fragmented woodlands are highly important to the survival of lesser horseshoe bats. Motte & Dubois (2002) in their study wrote that, 'What is striking is that all places were linked to the roost and to each other by a wooded element.' The vast majority (over 90%) of insects found near hedges do not originate in the hedge but come from other habitats brought in on the wind (BCT, 2003) Hedges managed under Agri-environment Schemes did not offer any benefit over conventionally managed hedgerows with regard to micro and macro-moths (Fuentes-Montemayor et al, 2010).
LF11Z	h2b	**Non-important hedgerows**	6	
LF23	u1e, 70 or 71 0r 72	**Wall**	0	
LF24		**Dry ditch**	3	
LT4	431	**Road verge**	2	
LT3	432	**Railway corridor**	4	
UL3		**Path or trackway**	1	
Linear Management Codes				
LH3		**Recently planted hedge (Only use for existing habitat)**	0.2	
LM1		**Cut hedge (less than 2m high)**	0.3	
LM11		**Cut hedge with standards**	0.3	
LM12		**Cut hedge without standards**	0.2	
LM2		**Uncut hedge (2m to 3m high)**	0.9	
LM21		**Uncut hedge with standards**	0.9	
LM22		**Uncut hedge without standards**	0.8	
LM3		**Overgrown hedge (over 3m high)**	1	
LM31		**Overgrown hedge with standards**	1	
LM32		**Overgrown hedge without standards**	0.9	
	82	**Laid hedge**	0.4	
Built Up Area and Gardens Habitat Codes				
UR0	u1	**Built-up areas and gardens**	1	
	u1a	**Open Mosaic Habitats on Previously Developed Land**	2	
	u1b	**Developed land; sealed surface**	0	
	u1c	**Artificial unvegetated, unsealed surface**	0	
	u1d	**Suburban/ mosaic of developed/ natural surface**	1	
Built Up Area and Gardens Management Codes				
	828	**Vegetated garden**	0.5	
	232	**Un-vegetated garden**	0	
UA33	910	**Allotments**	1	

IHS Code[132]	UKHab Code[133]	Label	HSI	Notes

Appendix 4: Risk Factors for Restoring or Recreating Habitats

The following factors are taken from the statutory Defra Biodiversity Net Gain metric. These assignments are meant purely as an indicative guide. The starting position with regard to substrate, nutrient levels, state of existing habitat, etc. will have a major impact in the actual risk factor. Final assessments of risk may need to take other factors into account. Many factors influence how long a habitat takes to go from the point of creation or restoration to the desired end point condition. Factors are often site dependent but can include soil nutrient status, soil types and pH, site preparation, climate and the neighbouring habitats and species matrix available to colonise the new or restored habitat. The timeframe is also resource dependent. With sufficient time and money most habitats can be recreated more rapidly but allowing a more gradual process may be more beneficial to wildlife in the longer term. The decision-making process for difficulty risk multiplier values **must be documented and justified** in an accompanying ecological report.

The table list the time in years after which a created or restored habitat becomes of substantial use to bats, not the 'good' condition used in BNG.

The decision-making process for temporal risk multiplier values **must be documented and justified** in an accompanying ecological report.

Creation / Enhancement	Habitat	Technical Difficulty	Score	Temporal Difficulty (Years)	Score
Created	Mixed woodland	Low	1	30	0.49
Created	Beech and yew woodlands	High	0.33	30	0.49
Created	Wet woodland	Medium	0.67	15	0.586
Created	Lowland mixed deciduous woodland	High	0.33	30	0.49
Created	Other broadleaved woodland	Low	1	15	0.586
Created	Line of trees	Low	1	20	0.49
Created	Coniferous woodland	Low	1	30	0.49
Created	Lowland dry acid grassland	High	0.33	20	0.49
Created	Other lowland dry acid grassland	Low	1	10	0.7
Created	Lowland calcareous grassland	High	0.33	10	0.7
Created	Neutral grassland	Low	1	5	0.837
Created	Lowland meadows	High	0.33	10	0.7
Created	Other neutral grassland	Low	1	5	0.837
Created	Improved Grassland	Low	1	4	0.867
Created	Bracken	N/A	1	N/A	1
Created	Dwarf shrub heath	High	0.33	25	0.49
Created	Dense scrub	Low	1	1	0.965
Created	Blackthorn scrub	Low	1	5	0.837
Created	Hazel scrub	Medium	0.67	10	0.7
Created	Bramble scrub	Low	1	1	0.965

Created	Gorse scrub	Low	1	5	0.837
Created	Hawthorn scrub	Low	1	5	0.837
Created	Rhododendron scrub	Low	1	1	0.965
Created	Mixed scrub	Low	1	5	0.837
Creation / Enhancement	**Habitat**	**Technical Difficulty**	**Score**	**Temporal Difficulty (Years)**	**Score**
Created	Buddleia scrub	Low	1	1	0.965
Created	Fens [and flushes - lowland]	High	0.33	20	0.49
Created	Springs	High	0.33	20	0.49
Created	Purple moor grass and rush pastures [Molinia-Juncus]	High	0.33	20	0.49
Created	Eutrophic standing waters	Low	1	3	0.899
Created	Other eutrophic standing water (includes canals, ditches, rhynes)	Low	1	3	0.899
Created	Gravel Pits, ornamental lakes	Low	1	3	0.899
Created	Rivers and streams	High	0.33	5	0.837
Created	Grass and grass-clover leys	Low	1	1	0.965
Created	Cereal crops	Low	1	1	0.965
Created	Non-cereal crops including woody crops	Low	1	1	0.965
Created	Intensively managed orchards	Low	1	1	0.965
Created	Vineyards	Low	1	1	0.965
Created	Game crops	Low	1	1	0.965
Created	Miscanthus	Low	1	1	0.965
Created	Other non-cereal crops including woody crops	Low	1	1	0.965
Created	Arable field margins	Low	1	1	0.965
Created	Market garden and horticulture	Low	1	1	0.965
Created	Inland rock	Medium	0.67	20	0.49
Created	Natural rock outcrop and scree habitats	High	0.33	20	0.49
Created	Quarry	Medium	0.67	1	0.965
Created	Spoil heap	Low	1	1	0.965
Created	Other artificial rock exposure and waste	Medium	0.67	1	0.965
Created	Important hedgerows	Low	1	10	0.7
Created	Non-important hedgerows	Low	1	10	0.7
Created	Wall	Low	1	1	0.965
Created	Dry ditch	Medium	0.67	5	0.837
Created	Road verge	Low	1	1	0.965
Created	Railway corridor	Low	1	1	0.965
Created	Path or trackway	Low	1	1	0.965
Created	Built-up areas and gardens	Low	1	1	0.965
Created	Open Mosaic Habitats on Previously Developed Land	Medium	0.67	4	0.867
Created	Developed land; sealed surface	Low	1	1	0.965

Created	Artificial unvegetated, unsealed surface	Low	1	1	0.965
Created	Suburban/ mosaic of developed/ natural surface	Low	1	1	0.965
Enhanced	Mixed woodland	Low	1	20	0.49
Creation / Enhancement	**Habitat**	**Technical Difficulty**	**Score**	**Temporal Difficulty (Years)**	**Score**
Enhanced	Beech and yew woodlands	High	0.33	30	0.49
Enhanced	Wet woodland	Medium	0.67	15	0.586
Enhanced	Lowland mixed deciduous woodland	High	0.33	30	0.32
Enhanced	Other broadleaved woodland	Low	1	10	0.7
Enhanced	Line of trees	Low	1	20	0.49
Enhanced	Coniferous woodland	Low	1	25	0.41
Enhanced	Lowland dry acid grassland	High	0.33	20	0.49
Enhanced	Other lowland dry acid grassland	Low	1	10	0.7
Enhanced	Lowland calcareous grassland	High	0.33	10	0.7
Enhanced	Neutral grassland	Low	1	10	0.7
Enhanced	Lowland meadows	Medium	0.67	10	0.7
Enhanced	Other neutral grassland	Low	1	3	0.837
Enhanced	Improved Grassland	Low	1	3	0.837
Enhanced	Bracken	N/A	1	Not Possible	Not Possible
Enhanced	Dwarf shrub heath	High	0.33	Not Possible	Not Possible
Enhanced	Dense scrub	N/A	1	5	0.837
Enhanced	Blackthorn scrub	Low	1	5	0.837
Enhanced	Hazel scrub	Low	1	10	0.7
Enhanced	Bramble scrub	Low	1	5	0.837
Enhanced	Gorse scrub	Low	1	5	0.837
Enhanced	Hawthorn scrub	Low	1	5	0.837
Enhanced	Rhododendron scrub	N/A	1	Not Possible	Not Possible
Enhanced	Mixed scrub	Low	1	5	0.837
Enhanced	Buddleia scrub	Low	1	5	0.837
Enhanced	Fens [and flushes - lowland]	High	0.33	12	0.652
Enhanced	Springs	High	0.33	12	0.652
Enhanced	Purple moor grass and rush pastures [Molinia-Juncus]	High	0.33	10	0.7
Enhanced	Eutrophic standing waters	High	0.33	10	0.7
Enhanced	Other eutrophic standing water (includes canals, ditches, rhynes)	High	0.33	10	0.7
Enhanced	Gravel Pits, ornamental lakes	High	0.33	10	0.7
Enhanced	Rivers and streams	Medium	0.67	4	0.867
Enhanced	Grass and grass-clover leys	N/A	1	Not Possible	Not Possible
Enhanced	Cereal crops	N/A	1	Not Possible	Not Possible
Enhanced	Non-cereal crops including woody crops	N/A	1	Not Possible	Not Possible

Enhanced	Intensively managed orchards	N/A	1	Not Possible	Not Possible
Enhanced	Vineyards	N/A	1	Not Possible	Not Possible
Enhanced	Game crops	N/A	1	Not Possible	Not Possible
Enhanced	Miscanthus	N/A	1	Not Possible	Not Possible
Creation / Enhancement	**Habitat**	**Technical Difficulty**	**Score**	**Temporal Difficulty (Years)**	**Score**
Enhanced	Other non-cereal crops including woody crops	N/A	1	Not Possible	Not Possible
Enhanced	Arable field margins	Low	1	Not Possible	Not Possible
Enhanced	Market garden and horticulture	N/A	1	Not Possible	Not Possible
Enhanced	Inland rock	Low	1	Not Possible	Not Possible
Enhanced	Natural rock outcrop and scree habitats	Medium	0.67	Not Possible	Not Possible
Enhanced	Quarry	N/A	1	Not Possible	Not Possible
Enhanced	Spoil heap	N/A	1	Not Possible	Not Possible
Enhanced	Other artificial rock exposure and waste	Low	1	Not Possible	Not Possible
Enhanced	Important hedgerows	Low	1	3	0.899
Enhanced	Non-important hedgerows	Low	1	3	0.899
Enhanced	Wall	N/A	1	N/A	1
Enhanced	Dry ditch	Low	1	Not Possible	Not Possible
Enhanced	Road verge	N/A	1	N/A	1
Enhanced	Railway corridor	N/A	1	N/A	1
Enhanced	Path or trackway	N/A	1	N/A	1
Enhanced	Built-up areas and gardens	N/A	1	N/A	1
Enhanced	Open Mosaic Habitats on Previously Developed Land	Medium	0.67	4	0.867
Enhanced	Developed land; sealed surface	N/A	1	N/A	1
Enhanced	Artificial unvegetated, unsealed surface	N/A	1	N/A	1
Enhanced	Suburban/ mosaic of developed/ natural surface	N/A	1	N/A	1

Appendix 5: Example of HEP Calculation and Case Studies

The following tables, 1, 2 and 3 gives an example of the HEP calculation for Greater Horseshoe Bats (using IHS coding). A proforma spreadsheet can be found at [INSERT WEBSITE REFERENCE]. TO BE UPDATED FOR WIDER CONSULTATION.

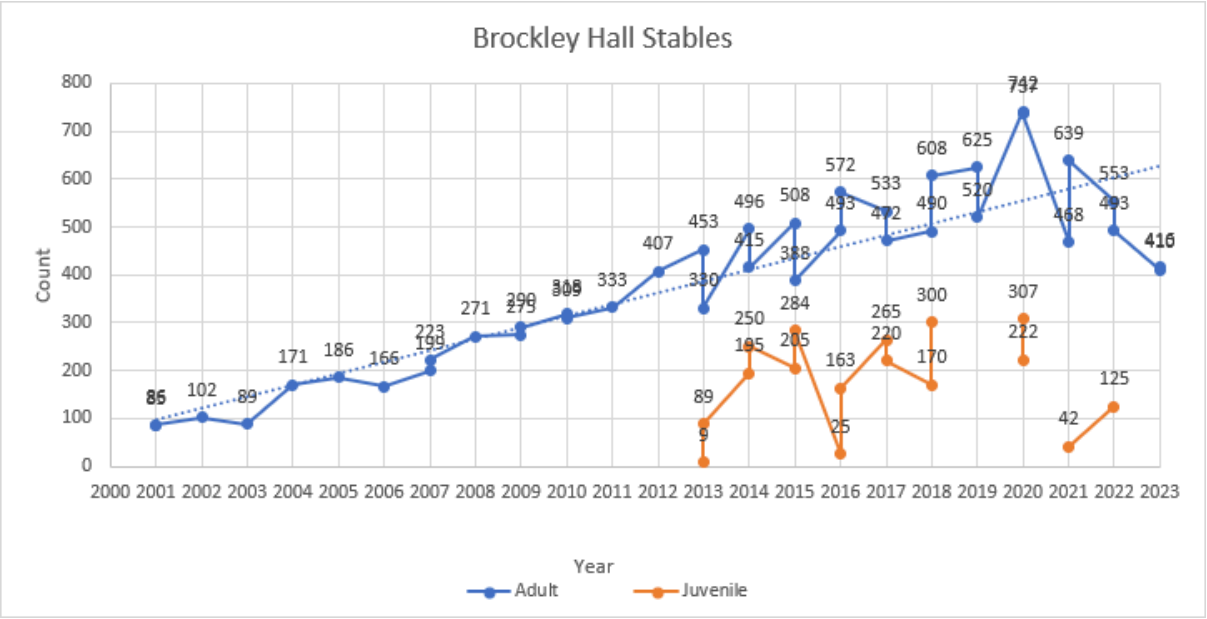
Table 2: Value of Mitigating Habitat Created on the Developed Site

Table 3: Value of an Off-Site Receptor Site to Mitigate Habitat Loss on a Developed Site

[INSERT CASE STUDIES – PERMISSIONS TO BE AGREED]

Appendix 6: Supporting Information and Research

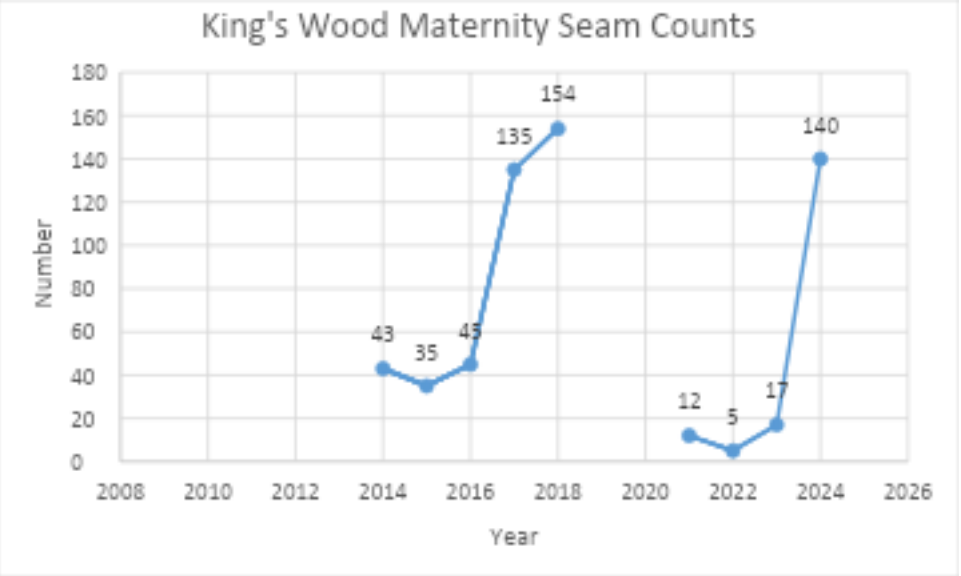
Figure 6.1 Brockley Hall Stables Greater Horseshoe Maternity Roost Counts



Data source: Vincent Wildlife Trust

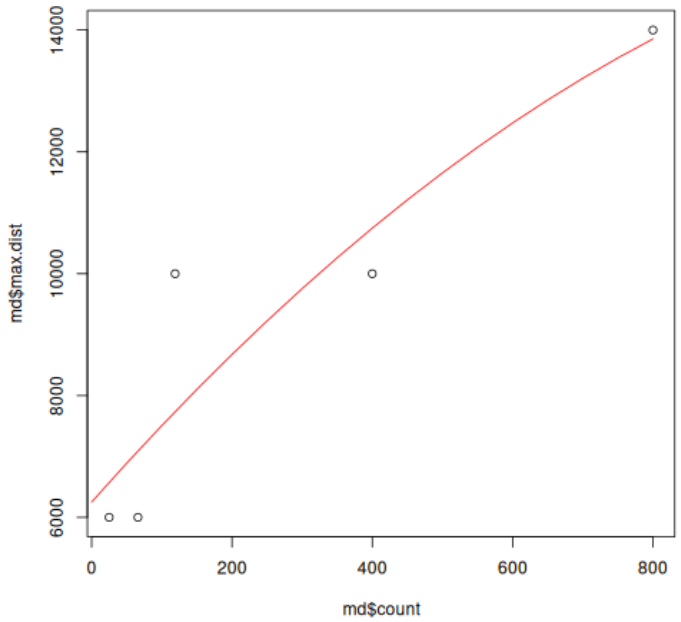
The 2024 count recorded a maximum of approximately 180 emerging adults, confirming a significant and concerning recent decline of this roost.

Figure 6.2 King's Wood Greater Horseshoe Maternity Roost Counts



Data source: Avondale Ecology, Avon Wildlife Trust and Yatton and Congresbury Wildlife Action Group
NB – Due to a comprehensive and co-ordinated survey of the mines in summer 2024 as part of the North Somerset Woodlands – Species Recovery Fund project (funded by Natural England and delivered by Avon Bat Group), it was discovered that there are two main maternity roost clusters for Greater Horseshoe Bat. All counts pre-2024 relate only to one maternity cluster. The 2024 results relate to both maternity clusters. It appears that the maternity clusters are used in a dynamic manner. The King's Wood population appears likely to be stable overall. The numbers recorded do not account for the recent declines in the Brockley Hall Stables roost.

Figure 6.3 Roost Size vs Maximum Foraging Distance (Foxley, 2024)



Data Source: Foxley, T. , University of the West of England, 2024.

Figure 6.4: North Somerset Habitat Importance Index for Greater Horseshoe Bats

[TO BE PROVIDED BY T. FOXLEY]

A Habitat Index (HI) and Connectivity Index (CI) has been developed for Greater Horseshoe Bats within North Somerset using GPS telemetry data, habitat suitability and landscape connectivity models.[134]. The HI shows areas of importance to *R. ferrumequinum* with values between 0 (likely to be of no or little use to the species) and 6 (likely to be of high importance in supporting the population) as shown above.

In future, there are ambitions to do the same for Lesser Horseshoe Bat. As this has not been completed at the time of publication, it would not be appropriate for the HEP calculations to be adapted to include consideration of the indices. It is hoped that this will be possible in future to refine the modelling to be more location and habitat-specific (as opposed to distance-based Density Bands).

[134] Foxley, T., Lintott, P., Stonehouse, S., Flannigan, J. and Stone, E.L. (2024) A High Resolution Spatial Modelling Framework for Landscape-Level, Strategic Conservation Planning. *In prep*.



Roosting Lesser Horseshoe Bats (Photo Jim Mullholland)