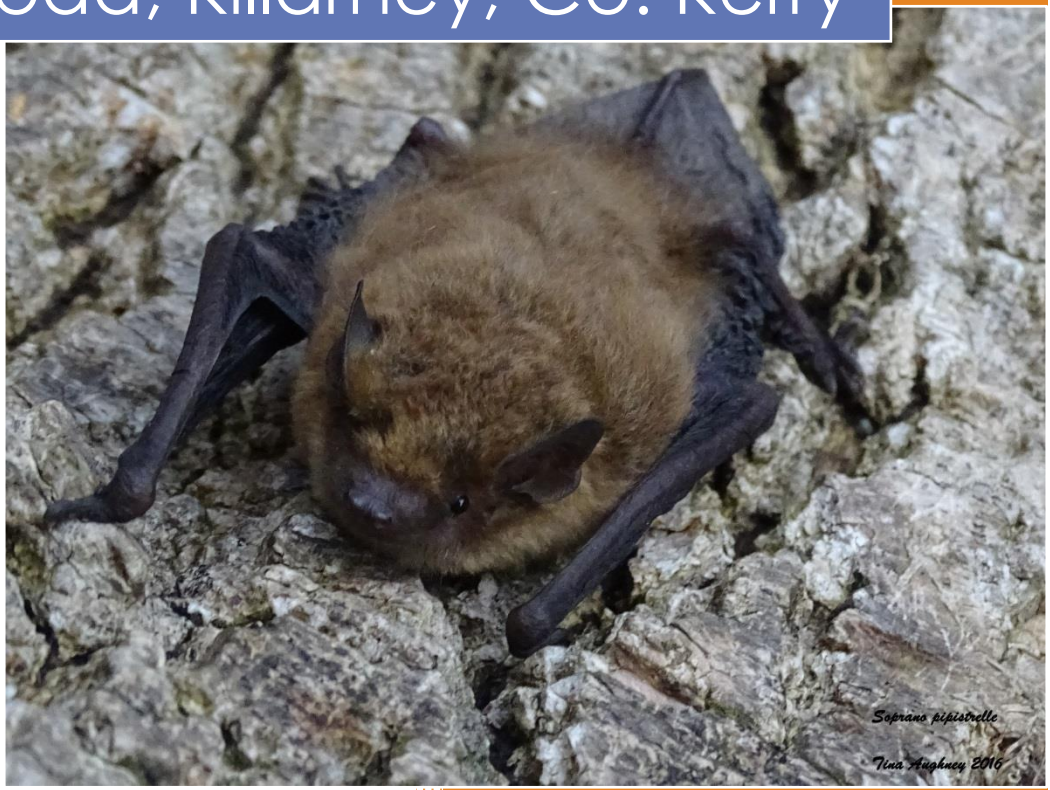
2023

Supplementary Bat Survey – Port Road, Killarney, Co. Kerry



Dr Tina Aughney

Bat Eco Services

Bat Eco Services, Ulex House, Drumheel, Lisduff, Virginia, Co. Cavan. A82 XW62.

Licensed Bat Specialist: Dr Tina Aughney (tina@batecoservices.com, 086 4049468)
NPWS licence C17/2023 (Licence to handle bats, expires 23rd January 2026);
NPWS licence 27/2023 (Licence to photograph/film bats, expires 31st December 2024);
NPWS licence DER/BAT 2022-36 (Survey licence, expires 24th March 2025).

Statement of Authority: Dr Aughney has worked as a Bat Specialist since 2000 and has undertaken extensive survey work for all Irish bat species including large scale development projects, road schemes, residential developments, wind farm developments and smaller projects in relation to building renovation or habitat enhancement. She is a monitoring co-ordinator and trainer for Bat Conservation Ireland. She is a co-author of the 2014 publication *Irish Bats in the 21st Century*. This book received the 2015 CIEEM award for Information Sharing. Dr Aughney is a contributing author for the Atlas of Mammals in Ireland 2010-2015.

All analysis and reporting is completed by Dr Tina Aughney. Data collected and surveying is completed with the assistance of a trained field assistant.

Mr. Shaun Boyle (Field Assistant) NPWS licence DER/BAT 2022-37 (Survey licence, expires 24th March 2025).

Client: Malachy Walsh & Partners

Project Name & Location: Port Road, Killarney, Co. Kerry.

Report Revision History

Date of Issue	Draft Number	Issued To (process of issuing)
9th August 2023	Draft 1	By email
30th September 2023	Draft 2	By email
2nd October 2023	Final	By email

Purpose

This document has been prepared as a Report for Malachy Walsh & Partners. Only the most up to-date report should be consulted. All previous drafts/reports are deemed redundant in relation to the named site.

Bat Eco Service accepts no responsibility or liability for any use that is made of this document other than by the client for the purposes for which it was originally commissioned and prepared.

Carbon Footprint Policy

It is the policy of Bat Eco Services to provide documentation digitally in order to reduce carbon footprint. Printing of reports etc. is avoided, where possible.

Bat Record Submission Policy

It is the policy of Bat Eco Services to submit all bat records to Bat Conservation Ireland database one year post-surveying. This is to ensure that a high level bat database is available for future desktop reviews. This action will be automatically undertaken unless otherwise requested, where there is genuine justification.

Executive Summary

Project Name & Location: Port Road, Killarney, Co. Kerry

Proposed work: Residential development.

Bat Survey Results - Summary

Bat Species	Roosts	Foraging	Commuting
Common pipistrelle *Pipistrellus pipistrellus*		√	√
Soprano pipistrelle *Pipistrellus pygmaeus*		√	√
Nathusius' pipistrelle *Pipistrellus nathusii*			
Leisler's bat *Nyctalus leisleri*		√	√
Brown long-eared bat *Plecotus auritus*			
Daubenton's bat *Myotis daubentonii*		√	√
Natterer's bat *Myotis nattereri*		√	√
Whiskered bat *Myotis mystacinus*		√	√
Lesser horseshoe bat *Rhinolophus hipposideros*	√	√	√

Bat Survey Duties Completed (Indicated by red shading)

Tree PBR Survey	◯	Daytime Building Inspection	◯
Static Detector Survey	◯	Daytime Bridge Inspection	◯
Dusk Bat Survey	◯	Dawn Bat Survey	◯
Walking Transect	◯	Driving Transect	◯
Trapping / Mist Netting	◯	IR Camcorder filming	◯
Endoscope Inspection	◯	Other	◯
		Thermal Imagery filming	

Citation: Bat Eco Services (2023) Supplementary Bat Survey of Port Road, Killarney, Co. Kerry. Unpublished report prepared for Malachy Walsh & Partners.

Contents

1. Introduction

Bat Eco Services was commissioned to provide consultation in relation to the potential impact of a proposed development along the boundary of the Killarney National Park and the Port Road in Killarney, Co. Kerry. Concerns were expressed about the potential impact of proposed street lighting and lighting of the proposed development on lesser horseshoe bats, particularly on individuals commuting and foraging along the River Deenagh boundary with Port Road. Further information was requested on lesser horseshoe bat activity within this area.

Malachy Walsh & Associates undertook static surveillance while Bat Eco Services undertook additional bat surveys to supplement this static surveillance.

To complete this action, the following was undertaken:

- Emergence survey of lesser horseshoe bat roost in the Tea House, Killarney National Park;
- Investigation of potential commuting of lesser horseshoe bats along the River Deenagh.

1.1 Relevant Legislation & Bat Species Status in Ireland

1.1.1 Irish Statutory Provisions

A small number of animals and plants are protected under Irish legislation (Nelson, *et al.,* 2019). The principal statutory provisions for the protection of animal and plant species are under the Wildlife Act 1976 (as amended) and the European Communities (Birds and Natural Habitats) Regulations 2011, as amended. The Flora (Protection) Order 2015 (S.I. no. 356 of 2015) lists the plant species protected by Section 21 of the Wildlife Acts. See www.npws.ie/ legislation for further information.

The codes used for national legislation are as follows:

- WA = Wildlife Act, 1976, Wildlife (Amendment) Act, 2000 and other relevant amendments
- FPO = Flora (Protection) Order, 2015 (S.I. No. 356 of 2015)

1.1.2 EU Legislation

The Birds Directive (Directive 2009/147/EC) and Habitats Directive (Council Directive 92/43/EEC) are the legislative instruments which are transposed into Irish law, *inter alia,* by the European Communities (Birds and Natural Habitats) Regulations 2011 (S.I. No. 477 of 2011) ('the 2011' Regulations), as amended.

The codes used for the Habitats Directive (Council Directive 92/43/EEC) are:

- Annex II Animal and plant species listed in Annex II
- Annex IV Animal and plant species listed in Annex IV
- Annex V Animal and plant species listed in Annex V

The main aim of the Habitats Directive is the conservation of biodiversity by requiring Member States to take measures to maintain or restore natural habitats and wild species listed on the Annexes to the Directive at a favourable conservation status. These annexes list habitats (Annex I) and species (Annexes II, IV and V) which are considered threatened in the EU territory. The listed habitats and species represent a considerable proportion of biodiversity in Ireland and the Directive itself is one of the most important pieces of legislation governing the conservation of biodiversity in Europe.

Under Article 11 of the Directive, each member state is obliged to undertake surveillance of the conservation status of the natural habitats and species in the Annexes and under Article 17, to report to the European Commission every six years on their status and on the implementation of the measures taken under the Directive. In April 2019, Ireland submitted the third assessment of conservation status for 59 habitats and 60 species. There are three volumes with the third listing details of the species assessed.

Article 12 of the Habitats Directive requires Member States to take measures for the establishment of a strict protection regime for animal species listed in Annex IV(a) of the Habitats Directive within the whole territory of Member States. Article 16 provides for derogation from these provisions under defined conditions. These provisions are implemented under Regulations 51 and 54 of the 2011 Regulations.

1.1.3 IUCN Red Lists

The International Union for the Conservation of Nature (IUCN) coordinates the Red Listing process at the global level, defining the categories so that they are standardised across all taxa. Red Lists are also produced at regional, national and subnational levels using the same IUCN categories (IUCN 2012, 2019). Since 2009, Red Lists have been produced for the island of Ireland by the National Parks and Wildlife Service (NPWS) and the Northern Ireland Environment Agency (NIEA) using these IUCN categories. To date, 13 Red Lists have been completed. The Red Lists are an assessment of the risk of extinction of each species and not just an assessment of their rarity. Threatened species are those species categorised as Critically Endangered, Endangered or Vulnerable (IUCN, 2019) – also commonly referred to as 'Red Listed'.

1.1.4 Irish Red List - Mammals

Red Lists in Ireland refer to the whole island, i.e. including Northern Ireland, and so follow the guidelines for regional assessments (IUCN, 2012, 2019). The abbreviations used are as follows:.

- RE Regionally Extinct
- CR Critically Endangered
- EN Endangered
- VU Vulnerable
- NT Near Threatened
- DD Data Deficient
- LC Least Concern
- NA Not Assessed
- NE Not Evaluated

There are 27 terrestrial mammals species in Ireland, which includes the nine resident bat species listed. The terrestrial mammal, according to Marnell *et al.,* 2019, list for Ireland consists of all terrestrial species native to Ireland or naturalised in Ireland before 1500. The IUCN Red List categories and criteria are used to assess that status of wildlife. This was recently completed for the terrestrial mammals of Ireland. Apart from the two following two mammal species (grey wolf *Canis lupus* (regionally extinct) and black rat *Rattus rattus* (Vulnerable)), the remaining 25 species were assessed as least concern in the most recent IUCN Red List publication by NPWS (Marnell *et al*., 2019).

1.1.5 Irish Bat Species

All Irish bat species are protected under the Wildlife Act (1976) and Wildlife Amendment Acts (2000 and 2010). Also, the EC Directive on The Conservation of Natural habitats and of Wild Fauna and Flora (Habitats Directive 1992), seeks to protect rare species, including bats, and their habitats and requires that appropriate monitoring of populations be undertaken. All Irish bats are listed in Annex IV of the Habitats Directive and the lesser horseshoe bat *Rhinolophus hipposideros* is further listed under Annex II. Across Europe, they are further protected under the Convention on the Conservation of European Wildlife and Natural Habitats (Bern Convention 1982), which, in relation to bats, exists to conserve all species and their habitats. The Convention on the Conservation of Migratory Species of Wild Animals (Bonn Convention 1979, enacted 1983) was instigated to protect migrant species across all European boundaries. The Irish government has ratified both these conventions.

Also, under existing legislation, the destruction, alteration or evacuation of a known bat roost is an offence. The most recent guidance document is "Guidance document on the strict protection of animal species of Community interest un the Habitats Directive (Brussels, 12.10.2021 C(2021) 7391 final".

Regulation 51(2) of the 2011 Regulations provides –

(*"(2) Notwithstanding any consent, statutory or otherwise, given to a person by a public authority or held by a person, except in accordance with a licence granted by the Minister under Regulation 54, a person who in respect of the species referred to in Part 1 of the First Schedule—*

(a) deliberately captures or kills any specimen of these species in the wild, (b) deliberately disturbs these species particularly during the period of breeding, rearing, hibernation and migration,

(c) deliberately takes or destroys eggs of those species from the wild,

(d) damages or destroys a breeding site or resting place of such an animal, or

(e) keeps, transports, sells, exchanges, offers for sale or offers for exchange any specimen of these species taken in the wild, other than those taken legally as referred to in Article 12(2) of the Habitats Directive,

shall be guilty of an offence."

The grant of planning permission does not permit the commission of any of the above acts or render the requirement for a derogation licence unnecessary in respect of any of those acts.

Any works interfering with bats and especially their roosts, may only be carried out under a derogation licence granted by National Parks and Wildlife Service (NPWS) pursuant to Regulation 54 of the European Communities (Birds and Natural Habitats) Regulations 2011 (which transposed the EU Habitats Directive into Irish law).

There are eleven recorded bat species in Ireland, nine of which are considered resident on the island. Eight resident bat species and one of the vagrant bat species are vesper bats and all vespertilionid bats have a tragus (cartilaginous structure inside the pinna of the ear). Vesper bats are distributed throughout the island. Nathusius' pipistrelle *Pipistrellus nathusii* is a recent addition while the Brandt's bat has only been recorded once to-date (Only record confirmed by DNA testing, all other records has not been genetically confirmed). The ninth resident species is the lesser horseshoe bat *Rhinolophus hipposideros*, which belongs to the Rhinolophidea and has a complex nose leaf

structure on the face, distinguishing it from the vesper bats. This species' current distribution is confined to the western seaboard counties of Mayo, Galway, Clare, Limerick, Kerry and Cork. The eleventh bat species, the greater horseshoe bat, was only recorded for the first time in February 2013 in County Wexford and is therefore considered to be a vagrant species. A total of 41 SACs have been designated for the Annex II species lesser horseshoe bat (1303), of which nine have also been selected for the Annex I habitat 'Caves not open to the public' (8310).

Irish bat species list is presented in Table 1 along with their current status.

Table 1: Status of the Irish bat fauna (Marnell *et al.,* 2019).

Species: Common Name	Irish Status	European Status	Global Status
Resident Bat Species ^			
Daubenton's bat *Myotis daubentonii*	Least Concern	Least Concern	Least Concern
Whiskered bat *Myotis mystacinus*	Least Concern	Least Concern	Least Concern
Natterer's bat *Myotis nattereri*	Least Concern	Least Concern	Least Concern
Leisler's bat *Nyctalus leisleri*	Least Concern	Least Concern	Least Concern
Nathusius' pipistrelle *Pipistrellus nathusii*	Least Concern	Least Concern	Least Concern
Common pipistrelle *Pipistrellus pipistrellus*	Least Concern	Least Concern	Least Concern
Soprano pipistrelle *Pipistrellus pygmaeus*	Least Concern	Least Concern	Least Concern
Brown long-eared bat *Plecotus auritus*	Least Concern	Least Concern	Least Concern
Lesser horseshoe bat *Rhinolophus hipposideros*	Least Concern	Least Concern	Least Concern
Possible Vagrants ^			
Brandt's bat Myotis brandtii	Data deficient	Least Concern	Least Concern
Greater horseshoe bat *Rhinolophus ferrumequinum*	Data deficient	Near threatened	Near threatened

^ Roche *et al.,* 2014

1.2 Relevant Guidance Documents

This report will draw on guidelines already available in Europe and will use the following documents:

- National Roads Authority (2006) Best Practice Guidelines for the Conservation of Bats in the Planning of National Road Schemes
- Collins, J. (Editor) (2016) Bat Surveys for Professional Ecologists: Good Practice Guidelines (3rd edition). Bat Conservation Trust, London
- McAney, K. (2006) A conservation plan for Irish vesper bats, Irish Wildlife Manual No. 20 National Parks and Wildlife Service, Department of Environment, Heritage and Local Government, Dublin, Ireland.
- Marnell, F., Kelleher, C. & Mullen, E. (2022) Bat mitigation guidelines for Ireland v2. Irish Wildlife Manuals, No. 134. National Parks and Wildlife Service, Department of Housing, Local Government and Heritage, Ireland (Version 1: Kelleher & Marnell, 2006).
- The status of EU protected habitats and species in Ireland: Conservation status in Ireland of habitats and species listed in the European Council Directive on the Conservation of Habitats,

Flora and Fauna 92/43/EEC. National Parks and Wildlife Service, Department of Environment, Heritage and Local Government.

- Bat Conservation Trust (2018) Bats and artificial lighting in the UK: bats and the built environment series. Guidance Note 08/2019. BCT, London.
- Guidance document on the strict protection of animal species of Community interest un the Habitats Directive (Brussels, 12.10.2021 C(2021) 7391 final.
- EPA (2017) Guidelines on the information to be contained in Environmental Impact Assessment Reports.

Collins (2016) is the principal document used to provide guidance in relation to bat survey effort required but the level of surveying is assessed on a case-by-case basis taking into consideration the historical bat records for the survey area, presence of built, structures and trees potentially suitable for roosting bats and the presence of suitable bat habitats for foraging and commuting. Additional reference is made to this document in relation to determining the value of buildings, trees etc. as bat roosts. The tables referred to from this document are described in the following section and in the section on methodology.

Marnell *et al.* (2022) is referred to for guidance in relation to survey guidance (timing and survey design), derogation licences and mitigation measures.

1.2.1 Bat Survey Requirements & Timing

With reference to Collins (2016) and Marnell *et al.* (2022), the information presented in this section is used to determine the bat survey requirements for the proposed development site. Collins (2016) provides a trigger list in relation to determining if a bat survey is required and this is presented Appendix 3 (Figure B) for reference. In addition, Chapter 2 of Collins (2016) discusses that a bat survey is required when proposed activities are likely to impact on bats and their habitats. The level of surveying is to be determined by the ecologist and these are influenced by the following criteria:

- Likelihood of bats being present;
- Type of proposed activities;
- Scale of proposed activities;
- Size, nature and complexity of the site;
- Species concerned;
- No. of individuals.

Collins (2016) also provides the following table detailing when different survey components should be undertaken.

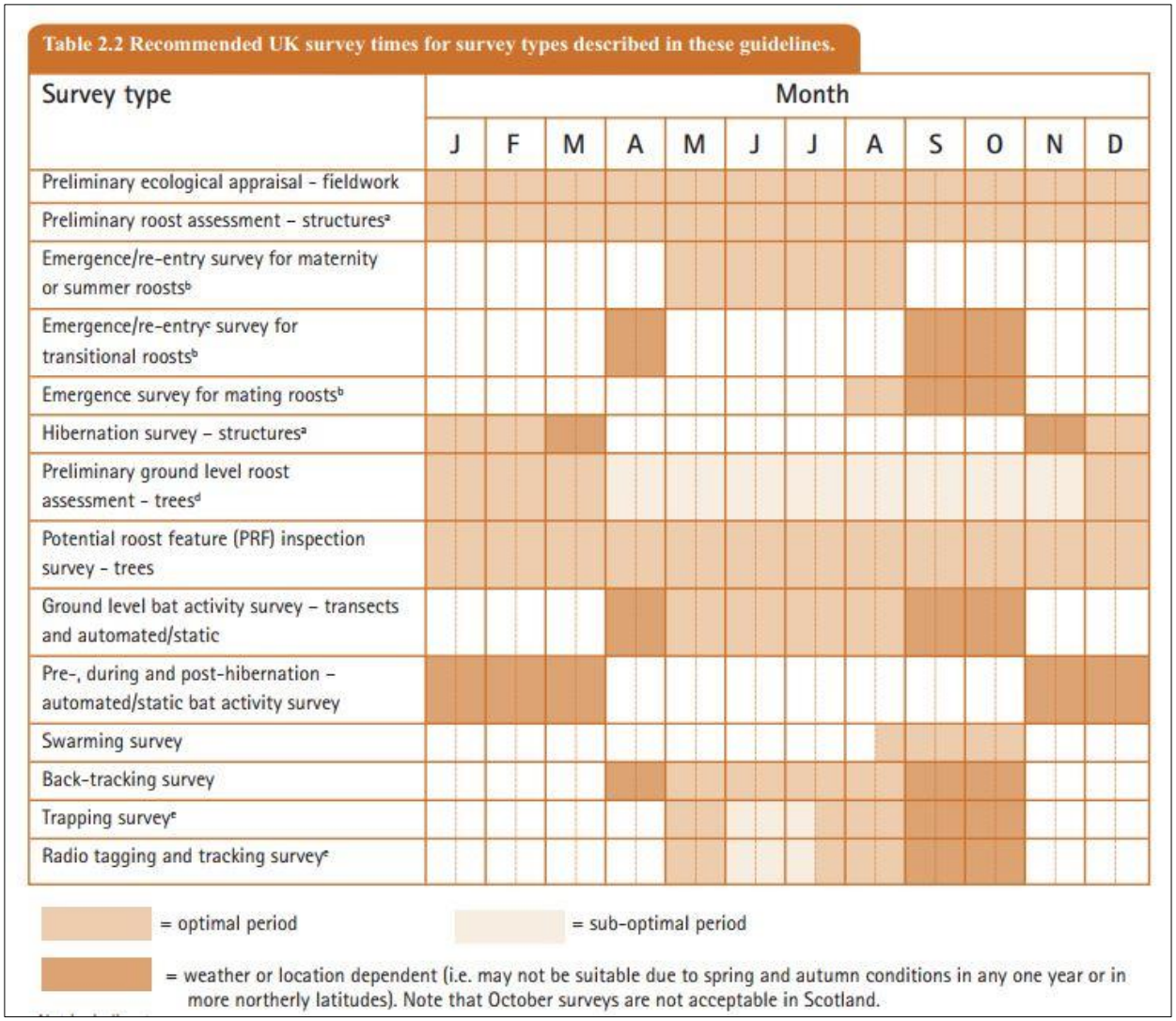


Table 2.2 Recommended UK survey times for survey types described in these guidelines.

Survey type	Month											
	J	F	M	A	M	J	J	A	S	O	N	D
Preliminary ecological appraisal - fieldwork												
Preliminary roost assessment – structures[a]												
Emergence/re-entry survey for maternity or summer roosts[b]												
Emergence/re-entry[c] survey for transitional roosts[b]												
Emergence survey for mating roosts[b]												
Hibernation survey – structures[a]												
Preliminary ground level roost assessment - trees[d]												
Potential roost feature (PRF) inspection survey - trees												
Ground level bat activity survey – transects and automated/static												
Pre-, during and post-hibernation – automated/static bat activity survey												
Swarming survey												
Back-tracking survey												
Trapping survey[e]												
Radio tagging and tracking survey[e]												

= optimal period

= sub-optimal period

= weather or location dependent (i.e. may not be suitable due to spring and autumn conditions in any one year or in more northerly latitudes). Note that October surveys are not acceptable in Scotland.

Figure 1a: Table 2.2 reproduced from Collins (2016).

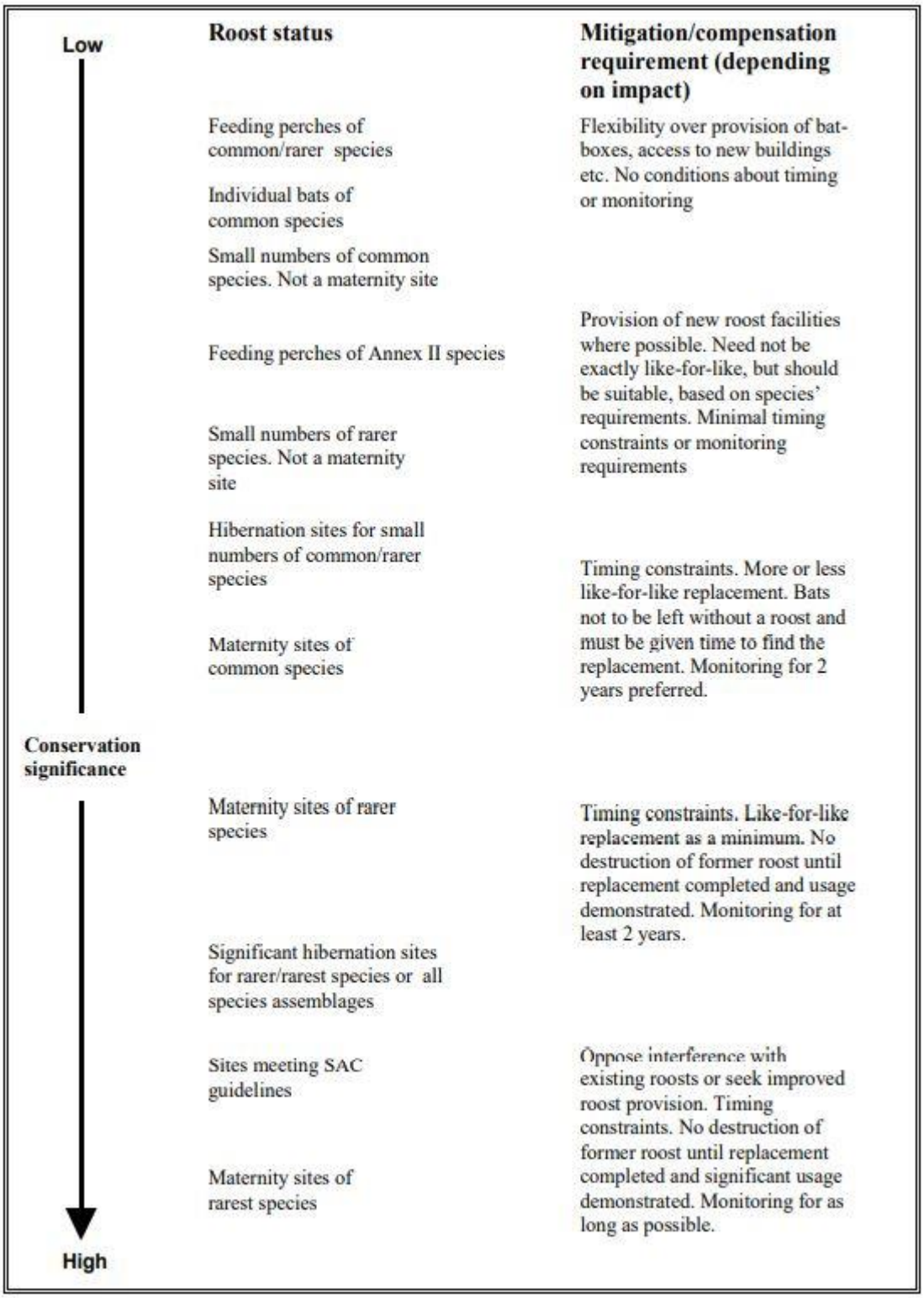


Figure 20 Guidelines for proportionate mitigation. The definition of common, rare and rarest species requires regional interpretation.

Figure 1c: Figure 20 (p 46) Reproduced from Marnell *et al.* (2022).

Table 4 The scale of main impacts at the site level on bat populations. [**NB** This is a general guide only and does not take into account species differences. Medium impacts, in particular, depend on the care with which any mitigation is designed and implemented and could range between high and low.]

Roost type	Development effect	Scale of impact		
		Low	Medium	High
Maternity	Destruction			✓
	Isolation caused by fragmentation			✓
	Partial destruction; modification		✓	
	Temporary disturbance outside breeding season	✓		
	Post-development interference			✓
Major hibernation	Destruction			✓
	Isolation caused by fragmentation			✓
	Partial destruction; modification		✓	
	Temporary disturbance outside hibernation season	✓		
	Post-development interference			✓
Minor hibernation	Destruction			✓
	Isolation caused by fragmentation			✓
	Partial destruction, modification		✓	
	Modified management		✓	
	Temporary disturbance outside hibernation season	✓		
	Post-development interference		✓	
	Temporary destruction, then reinstatement	✓		
Mating	Destruction		✓	
	Isolation caused by fragmentation		✓	
	Partial destruction	✓		
	Modified management	✓		
	Temporary disturbance	✓		
	Post-development interference	✓		
	Temporary destruction, then reinstatement	✓		
Night roost	Destruction	✓		
	Isolation caused by fragmentation	✓		
	Partial destruction	✓		
	Modified management	✓		
	Temporary disturbance	✓		
	Post-development interference	✓		
	Temporary destruction, then reinstatement	✓		

Figure 1d: Table 4 (p 44) Reproduced from Marnell *et al.* (2022).

Different parameters are considered for the overall assessment of the potential impact(s) of a proposed development on local bat populations.

The overall impacts of the proposed project on local bat populations is assessed using the following criteria:

- Impact Quality using the parameters Positive, Neutral or Negative Impact (based on EPA, 2017)

Table 2a: Criteria for assessing impact quality based on EPA, 2017,

Quality of Effect	Criteria
Positive	A change which improves the quality of the environment (for example, by increasing species diversity; or the improving reproductive capacity of an ecosystem, or by removing nuisances or improving amenities).
Neutral	No effects or effects that are imperceptible, within normal bounds of variation or within the margin of forecasting error.
Negative	A change which reduces the quality of the environment (for example, lessening species diversity or diminishing the reproductive capacity of an ecosystem; or damaging health or property or by causing nuisance).

- Impact Significance of potential impact parameters on specific bat species in relation to particular elements (e.g. roosting sites, foraging area and commuting routes) are assessed with reference to the following:
    - Table 4 of Marnell *et al.* (2022) (Figure 1a);
    - the known ecology and distribution of the bat species in Ireland;
    - bat survey results including type of roosts (if any recorded), pattern of bat usage of the survey area, level of bat activity recorded etc.
    - and bat specialist experience.

- Impact Significance of the proposed development on local bat populations maybe determine, where applicable, using the parameters listed in Table 2b (based on EPA, 2017).

Table 2b: Criteria for assessing significance of effects based on EPA, 2017,

Significance of Effects	Definition
Imperceptible	An effect capable of measurement but without significant consequences.
Not significant	An effect which causes noticeable changes in the character of the environment but without significant consequences.
Slight	An effect which causes noticeable changes in the character of the environment without affecting its sensitivities.
Moderate	An effect that alters the character of the environment in a manner that is consistent with existing and emerging baseline trends.
Significant	An effect which, by its character, magnitude, duration or intensity alters a sensitive aspect of the environment.
Very Significant	An effect which, by its character, magnitude, duration or intensity significantly alters most of a sensitive aspect of the environment.
Profound	An effect which obliterates sensitive characteristics

The following terms will be used, where possible and applicable, when quantifying the duration of the potential effects (selected from EPA, 2017):

- Temporary – effects lasting less than a year
- Short-term – effects lasting 1 to 7 years
- Medium term – effects lasting 7 to 15 years
- Long term – effects lasting 15 to 60 years
- Permanent – effects lasting over 60 years
- Reversible – effects that can be undone, for example through remediation or restoration.

1.3 Lesser Horseshoe Bat

The Further Information Request placed a specific emphasis on the Annex II bat species Lesser horseshoe bat. The following text is a literature review of this species with information on designations for this species in proximity of the proposed development site.

1.3.1 Lesser Horseshoe Bats – Morphology & Ecology

The lesser horseshoe bat is a relatively small sized species of *Rhinolophus.* Typically it weighs between 4-8g and has a wingspan of 225-250mm (McAney, 2016). It is easily distinguishable from other Irish bat species by the fleshy, circular nose-leaf structure surrounding the nostrils. This species echolocation call is a distinctive melodic warble when heard on a bat detector tuned to 110 kHz.

This bat species will typically feed on a range of insects including midges, craneflies, caddisflies, lacewings and moths (McAney, 2016). The BCIreland Landscape Model indicates that the species' habitat preference is for areas with broadleaf and mixed woodland and that a mosaic of habitats is important (Roche *et al.,* 2014). It tends to commute along distinct linear habitat features such as stonewalls and hedgerows and avoids flying out in the open. It travels short distances from summer roosts to foraging areas, typically 2km.

Females form maternity colonies in buildings from April to September with a single pup born in June or July. The knowledge of roosting sites for this species is extensive as a result of an intensive survey completed in six Counties by the Vincent Wildlife Trust between 1994 and 2004 (McAney *et al*., 2013). In general, this species has a preference for buildings constructed prior to the 1900s, built of stone with slate rooves (Schofield, 2008). Such sites are also relatively undisturbed and uninhabited by people. Kelleher (2006) documented a demise in the quality of buildings used by lesser horseshoe bats in Ireland. Many summer roosting sites are now in one-storey buildings often roofed with corrugated iron and this may be an indication that optimal sites are less available to the species (McAney *et al.,* 2013).

Hibernation typically occurs from October to March and hibernation sites in Ireland are typically found underground, although at a number of buildings have been recorded as hibernation sites. The bats have been recorded hibernating in ground storey rooms during the winter months and there is a general trend in such hibernacula towards greater numbers of bats in buildings with two storeys or more (Roche *et al*., 2012).

1.3.2 Lesser Horseshoe Bats – Global Status & Status in Ireland

The lesser horseshoe bat is distributed across Europe from Portugal and Ireland to the Ukraine and Poland. It is present in northern Africa and parts of the middle east (Csorba *et al.,* 2003).

The lesser horseshoe bat is mainly found in counties on Ireland's western seaboard (Mayo, Galway, Clare, Limerick, Kerry and Cork) and its strongholds are found in County Kerry, west Cork and County Clare. A single animal has also been recorded in Co. Roscommon in 2004 (B. Keeley, pers. comm.) and bat droppings were recorded in Tubercurry, Co. Sligo (C. Kelleher, pers. comm.). A single bat (male) was also recorded in Ballina, Co. Tipperary in 2015 (pers. comm, Dr Áine Lynch, NPWS). The lesser horseshoe bat is Ireland's only Annex II-listed bat species (EU Habitats Directive [92/43/EU]). As a consequence, a roost monitoring scheme is operated by NPWS and managed by Bat Conservation Ireland (BCIreland). BCIreland carried out analysis of the lesser horseshoe bat database in 2012, and concerns were expressed about the state of deterioration of many of its roosting sites (McAney, 2014; Roche *et al.*, 2015) as well as the finding that there are genetically distinct clusters within the Irish population (Dool *et al.*, 2013) that are likely to have arisen due to landscape connectivity constraints.

In Roche *et al*. (2015), the status of the roosting resource of the lesser horseshoe bat was closely examined and the results highlighted a number of locations in Ireland where clusters of roosts or hibernacula appear to have declined, including in parts of Co. Limerick. Figures 2a and 2b, below, are taken from the monitoring report from BCIreland (Aughney *et al.,* 2018) and illustrate the changes in winter and summer roosts monitored annually by NPWS.

As discussed previously, the modelled Core Area for lesser horseshoe bat s is a relatively small area is restricted to the Counties on the western seaboard (5,993km^2). Given this small range, significant impacts on this species may occur even with small levels of habitat modification or changes to roost availability (Roche *et al,* 2014).

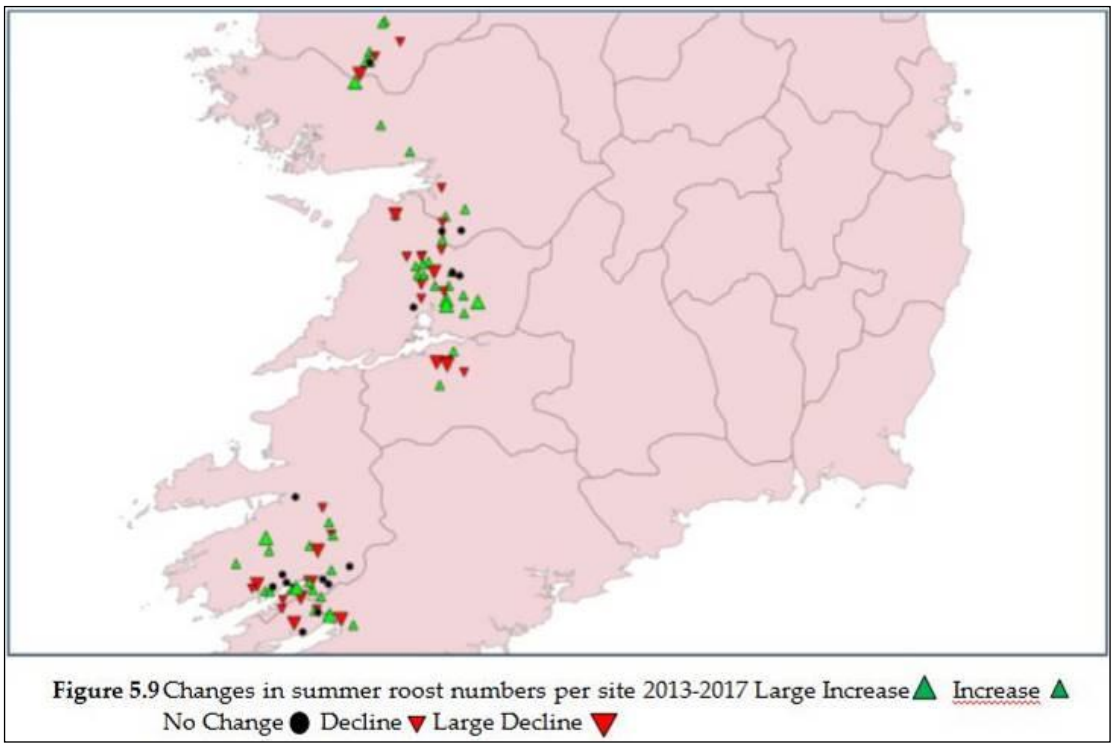


Figure 2a: Changes in Lesser horseshoe bat summer roost numbers (Aughney *et al.,* 2018)

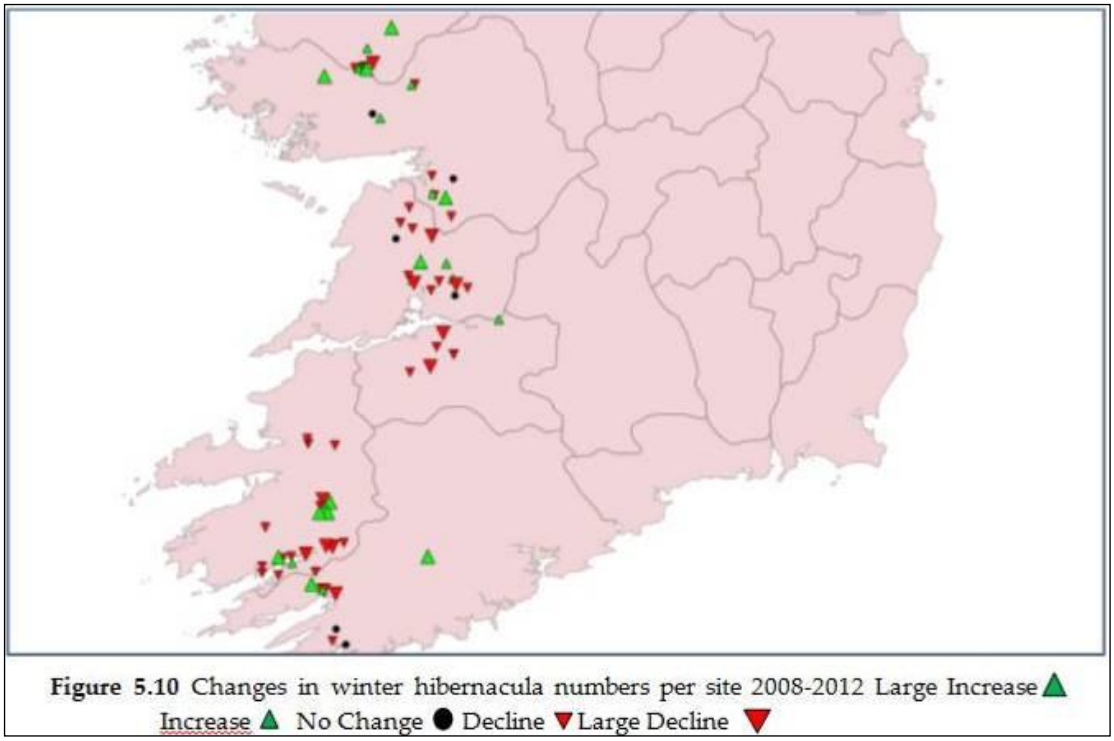


Figure 2b: Changes in Lesser horseshoe bat winter roost numbers (Aughney *et al.,* 2018)

According to Roche *et al,* 2014 the primary concerns for this species is as follows:

- Increased urbanisation;
- Mono cultural landscape (e.g. large swathes of coniferous forestry and high intensity farmed landscapes);
- Roost loss due to deterioration, demolition or renovations;
- Street lighting;
- Recreational cave visits etc to hibernation sites;
- Natural flooding of underground site.

Additional research present by Dr Andrew Harrington on the population genetics of lesser horseshoe bat in Ireland (Dr Harrington's Ph.D. thesis Title: The Development of Non-Invasive Genetic Methods for Bats of the British Isles, July 2018) examined the lesser horseshoe bat's range across Ireland with DNA samples from 21 colonies examined. This was to determine the level of interbreeding and possible risk of inbreeding within this population.

Harrington *et al. (*2019) at All Ireland Mammal Symposium (AIMS) stated that maintaining the gene flow within the Irish population is essential to "prevent the future risk of inbreeding depression or local extinctions". His research work showed that the Irish lesser horseshoe population was further sub-divided than previously thought with evidence of isolated subpopulations in Cork-Kerry (Southern), Limerick, Clare-South Galway (Central) and North Galway-Mayo (Northern). As a consequence, this means that this species is in serious risk of negative effects of operations that increase barriers to dispersal to these current sub-populations. The study further identified that the point separating the North Galway-Mayo population from the Clare-South Galway population is an area to the south-east of Galway City (the Galway Gap).

One aspect of the study was to determine the sex ratio of colonies examined (Harrington *et al.,* 2017). Previously, it was assumed that 25% of the maternity roost colonies was comprised of 25% males. However, Dr Harrington's work showed that in reality the percentage of males can be much higher with a range of 14.2% to 74.3% recorded. As a result the estimated population of lesser

horseshoes in Ireland is considered to be lower than previously reported (14,010 individuals as reported by Roche *et al.,* 2012).

Article 17 reporting (NPWS, 2019) for this species of bat concluded the following:

- Range = Inadequate
- Population = Favourable
- Habitat for species = Inadequate
- Overall Assessment of Conservation Status = Inadequate
- Overall trend in Conservation Status = Deteriorating

1.3.3 Bat Mitigation Measures

1.3.3.1 Bats & Lighting

All European bat species, including Irish bat species, are nocturnal. Light levels as low as typical full moon levels, i.e. around 0.1 LUX, can alter the flight activity of bats (Voigt *et al.* 2018). Any level of artificial light above that of moonlight can mask the natural rhythms of lunar sky brightness and, thus, can disrupt patterns of foraging and mating and might, for instance, interfere with entrainment of the circadian system.

Artificial light pollution is an increasing global problem (Rich and Longcore, 2006) and Artificial light at night (ALAN) is considered a major threat to biodiversity, especially to nocturnal species. As urbanisation expands into the landscape, the degree of street lighting also expands. Its ecological impacts can have a profound affect the behaviour of nocturnal animals including impacts on reproductive behaviours, orientation, predator-prey interaction and competition among others, depending on the taxon and ecosystem in question (Longcore and Rich 2004). It is considered by Hölker *et al.* (2010) to be a key biodiversity threat to biodiversity conservation. In relation to bats, the potential impacts of artificial night lighting can result in habitat fragmentation (Hanski, 1998), delay in roost emergence (Downs *et al.,* 2003) and a reduction in prey items.

In the context of behavioural ecology, lights can work to attract or repel certain animals. Many groups of insects, including moths, lacewings, beetles, bugs, caddisflies, crane flies, midges, hoverflies and wasps, can be attracted to artificial light (Eisenbeis and Hassel 2000; Frank 1988; Kolligs 2000). Attraction depends on the spectrum of light. In the context of street lights, white (mercury vapour) lamps emit a white light that includes ultraviolet. High pressure sodium lights (yellow) emit some ultraviolet, while low pressure sodium lamps (orange) emit no ultraviolet light (e.g. Rydell 2006). As a result of the attractiveness of lights to aerial invertebrates, swarms of insects often occur in and around street lights and, particular bat species such as aerial insect predators, can exploit the swarming insects to their advantage. Such attraction can also take prey items away from dark zones where light sensitive species are foraging, thus reducing their likelihood of feeding effectively.

Rydell (2006) divides bats into four categories in terms of their characteristic behaviours at street lamps. The four categories are based on bat size, wing morphology and echolocation call characteristics which were highlighted by Norberg and Rayner (1987) to determine flight speed, manoeuvrability, and prey detection capabilities of bats. Rydell (2006) stated that the large, fast flying bats, which are confined to open airspace, fly high over lit areas and are rarely observed near ground level. None of these, typically large free-tailed bats (e.g. large species of the family Molossidae), are found in Ireland. The second category are the medium-sized fast flying species, including the *Nyctalus* species, which patrol the street well above the lights and can be seen occasionally as they dive for prey into the light cone. This group includes the Leisler's bat, which is found in Ireland. Rydell's third category describes the small but fast flying bats that are manoeuvrable enough to

forage around light posts or under the lights, and includes the small *Pipistrellus* species of the old world, three of which are found in Ireland. The fourth category includes broad-winged slow flyers, most of which are seldom or never observed at lights. Slow flying bat species may be more vulnerable to predation by diurnal birds of prey and this may restrict their exploitation of insects around artificially illuminated areas (e.g. Speakman 1991). There are also the concerns that some bat species are more light sensitive and therefore actively avoid lit up areas. This is particularly relevant for lesser horseshoe bats. Therefore from this, we can categorise the suite of Irish bats species as follows (please note that the sensitivity category is the author's description):

Table 3a: Potential light sensitivity of the Irish bat fauna using categories described by Rydell, 2006.

Species: Common Name	Rydell Category	Sensitivity
Daubenton's bat *Myotis daubentonii*	Category 4	Light sensitive
Whiskered bat *Myotis mystacinus*	Category 4	Light sensitive
Natterer's bat *Myotis nattereri*	Category 4	Light sensitive
Leisler's bat *Nyctalus leisleri*	Category 2	Light tolerant
Nathusius' pipistrelle *Pipistrellus nathusii*	Category 3	Semi-tolerant
Common pipistrelle *Pipistrellus pipistrellus*	Category 3	Semi-tolerant
Soprano pipistrelle *Pipistrellus pygmaeus*	Category 3	Semi-tolerant
Brown long-eared bat *Plecotus auritus*	Category 4	Light sensitive
Lesser horseshoe bat *Rhinolophus hipposideros*	Category 4	Light sensitive

The ability of different bat species to exploit insects gathered around street lights varies greatly. Gleaning species such as *Myotis* bats rarely forage around street lights (Rydell and Racey, 1995). The ecological effects of illuminating aquatic habitats are also poorly known. Moore *et al.* (2006) found that light levels in an urban lake, subject simply to sky glow and not direct illumination from lights, reached the same order of magnitude as full moonlight.

All European bat species, including Irish bat species, are nocturnal. As a consequence, the scientific literature provides evidence that artificial lighting does impacts on bats. The degree of impact depends on the light sensitivity of the bat species and the type of luminaire. Lesser horseshoe bats are light sensitive and therefore adversely effected by the presence of lighting in all aspects of their life strategies (e.g. foraging, commuting, drinking and roosting).

The potential impacts of street lighting can be summarised as follows:

- Attracting Prey Items

Lights can work to attract or repel certain animals. Many groups of insects can be attracted to artificial light and this attraction depends on the spectrum of light. As a result of the attractiveness of lights to aerial invertebrates, swarms of insects often occur in and around street lights. Such attraction can also take prey items away from dark zones where light sensitive species, such as lesser horseshoe bats, are foraging, thus reducing their likelihood of feeding effectively.

- Reducing Foraging Habitat

The research documents that there is less bat species diversity foraging in habitats lit up by artificial lighting. Only bat species considered to be light tolerant are generally able to exploit habitats with lighting present, but overall, all bat species activity tends to be less in lit up habitats compared to non-lit up habitats.

- Fragmenting The Landscape

Scientific evidence shows that lighting is a barrier to the movement of light sensitive bat species, such as lesser horseshoe bats. Light sensitive bat species will actively seek dark corridors to commute along and therefore the presence of lighting in commuting habitats will restrict their movement of such species in the landscape.

- Reducing Drinking Sites

There is increasing evidence that drinking sites for bats is an essential component for local bat population survival and that the presence of artificial lighting at waterbodies prevents bats from availing of this resource.

Lighting, including street lights come in an array of different types but for street lights they typically include High Pressure Sodium, Low Pressure Sodium, Mercury Vapour and the more modern Light Emitting Diodes (LED). An array of field-based research has been undertaken to document the potential impact of lighting on bat flight activity. LED lighting is predicted to constitute 70% of the outdoor and residential lighting markets by 2020. While the use of LEDs promotes energy and cost savings relative to traditional lighting technologies, little is known about the effects these broad-spectrum "white" lights will have on wildlife, human health, animal welfare, and disease transmission. As a consequence, a large array of research has been undertaken recently on the potential impact of LED on bats.

Stone *et al.* (2012) undertook research in relation to "Cool" LED street lights on an array of local bat species in England. Overall the presence of LED street lights had a significant negative impact on lesser horseshoe bats and *Myotis* spp. for all light treatments investigated while there was no sign impact of light treatment type on *Pipistrellus pygmaeus* (soprano pipistrelle – a common Irish bat species) or *Nyctalus* (Leisler's bats is part of this bat family and is a common Irish bat species)/*Eptesicus* species. This research paper also documented behavioural changes for the different bat species. Lesser horseshoe bats and *Myotis* spp. did not avoid lights by flying along the other side of the hedge but altered their commuting behaviour altogether. It was concluded that LEDs can fragment commuting routes causing bats to alter their behaviour with potentially negative conservation consequences. Lesser horseshoe bat activity was significantly lower during high intensity treatment than medium, but at all treatment levels (even as low as 3.6 LUX), activity was significantly lower than unlit control (LUX level measurements were taken at 1.7m at the hedge below the light).

Russo *et al.* (2017) investigated the impact of LED lighting on drinking areas for bats in Italy. Drinking sites are considered to be important components for the survival of local bat populations. Drinking sites were illuminated with a portable LED outdoor light emitting (48 high-power LEDs generated a light intensity of 6480 lm (4000–4500 K) at 25°C, two peaks of relative luminous flux at 450 and 590 nm). *Plecotus auritus* (brown long-eared bat – resident in Ireland), *Pipistrellus pygmaeus* (soprano pipistrelle – resident in Ireland) and *Rhinolophus hipposideros* (lesser horseshoe bat – resident in Ireland) did not drink when troughs were illuminated.

Rowse *et al.* (2018) researched the impacts of LED lights (portable lights, 97W 4250K LED on 10m high poles) in England on local bat populations. Treatments were either 100% light intensity; dimmed

(using pulse width modulation) at 50% or 25% light intensity; and unlit. Sites were in suburban areas along busy roads but with vegetation and tree lines adjacent. High light levels (50% & 100% light treatments) increased activity of opportunistic *Pipistrellus pipistrellus* (common pipistrelle – resident in Ireland) but reduced activity of *Myotis* species group. Conversely 25% and unlit sites had no difference from each other. The research paper conclude that dimming could be an effective strategy to mitigate ecological impacts of street lights.

Wakefield *et al.* (2017) stated that an important factor to be aware of in relation to LED is the direction of the light projected. Therefore it is recommended that highly focused/shielded LEDS designed to filter out short wavelengths of light may should be used as they attract relatively fewer insects. Less insects attracted to street lights means less insects leaving dark zones where light sensitive bat species primarily feed.

Martin *et al.* (2021) showed that LED street lights lead to a reduction in the total number of insects captured with light traps in a wide range of families. Coleoptera and Lepidoptera orders were the most sensitive groups to ecological light pollution in the study area. The paper suggested that LED was the least attractive light system for most of the affected groups both because of its very little emitted short-wavelength light and because of its lower light intensity. They also concluded that reduction in insect attraction to LED could be even larger with current LED technologies emitting warmer lights, since other research showed that LED emitting “warmer white” colour light (3000 K) involves significantly lower attraction for insects than “colder white” LED (6000 K).

Wilson *et al.* (2021) investigate the impact of LED on biting insects and concluded because LED is highly malleable with regard to spectral composition, they can be tailored to decrease or increase insect catches, depending on situation. Therefore this design control of LED could greatly assist in reducing impact of street lighting on local bat populations.

Stone *et al*. (2015) reviewed the impacts of ALAN on bat roosts and flight paths in order to provide recommendations in relation to street lighting. The principal recommendations were to avoid lighting places where bats are present and to ensure that there are interconnected light exclusion zones and variable light regimes with reduced intensity of light in specific areas (e.g. important foraging and commuting habitats) as responses to street lighting may vary between species. It recommends that there should be a 'light threshold'.

1.3.3.1.1 Lighting Guidelines – Effective Mitigation Measures

As a consequence of this extensive amount of research there are two principal guideline documents available for best practice for effective mitigation relating to outdoor lighting.

EUROBATS (Voigt *et al.,* 2018) guidelines recommends the following:

- ALAN should be strictly avoided, and artificial lighting should be installed only where and when necessary coupled with the following:
    - Dynamic lighting schemes, where possible.
    - Use a minimal number of lighting points and luminaires on low positions in relation to the ground for minimising light trespass to adjacent bat habitats or into the sky.
    - Use focused light, e.g. by using LED or shielded luminaires which limit the light flux only to the required areas and prevent light trespass into adjacent bat habitats.
    - Create screens, either by erecting walls or by planting hedgerows or trees, to prevent light trespass, e.g. from illuminated roads, to surrounding bat habitats.
    - Exits of bat roosts and a buffer zone around them should be protected from direct or indirect lighting to preserve the natural circadian rhythm of bats.

This BCT (2018) guidelines provided a list of recommendations in relation to luminaire design, which was based on the extensive research completed at the time on the potential impact of lighting on bats, and therefore provides best practice mitigation measures. These recommendations have been updated with the new BCT (2023) guidelines:

- All luminaires should lack UV elements when manufactured. Metal halide, compact fluorescent sources should not be used.
- LED luminaires should be used where possible due to their sharp-cut-off, lower intensity, good colour rendition and dimming capability,
- A warm white light source (2700 Kelvin or lower) should be adopted to reduce blue light component.
- Light sources should feature peak wavelengths higher than 550nm to avoid the component of light most disturbing to bats.

DEFINITION: Red Light refers to the light sources in the red spectrum and mainly consist of long wavelength light above 600nm with an RA value of 60 (for good colour recognition). This wavelength of light is considered to the have the least impact on bats.

- Internal luminaires can be recessed (as apposed to using a pendant fitting) where installed in proximity to windows to reduce glare and light spill.
- Waymarking inground markers (low output with cowls or similar to minimised upward light spill) to delineate path edges.
- Column heights should be carefully considered to minimise light spill and glare visibility. This should be balanced with the potential for increased numbers of columns and upward light reflectance as with bollards.
- Only luminaires with a negligible or zero Upward Light Ration, and with good optical control, should be considered.
- Luminaires should always be mounted horizontally, with no light output above 90^{o} and/or no upward tilt.
- Where appropriate, external security light should be set on motion sensors and set to as short a possible a timer as the risk assessment will allow (e.g. 1-2 minute timer).
- Use of a Central Management System (CMS) with additional web-enables devices to light on demand.
- Use of motion sensors for the local authority street lighting may not be feasible unless the authority has the potential for smart metering through a CMS.
- The use of bollard or low-level downward-directional luminaires is strongly discouraged.
- Only if all other options have been explored, accessories such as baffles, hoods or louvres can be used to reduce light spill and direct it only to where it is needed.

Due to the large array of research undertaken on the potential impact of ALAN on bats, the new guidelines from the BCT (2023) has provided an updated table on the potential impact of ALAN on UK bat species. Extracting data from this table, the following is a summary of the effect of LAN on Irish Bat species. Please note that this information is drawn from European studies and as does not have information for all Irish bat species for each of the various topics listed, it is indicative only.

Table 3b: Potential light sensitivity of the Irish bat fauna using categories described by Rydell, 2006.

YELLOW: Positive effect **GREY**: No effect **BLUE**: Negative effect **NA**: No data available

Species	Roost	Flight Corridor	Foraging Area	Drinking Site	Migration	Landscape Level	Habitat Type
Lesser horseshoe bat			NA	NA	NA		Clutter
Brown long-eared bat					NA		Clutter
Natterer's bat		NA	NA		NA	NA	Clutter
Daubenton's bat	NA			NA	NA		Edge
Whiskered bat	NA	NA	NA	NA	NA	NA	Edge
Common pipistrelle	NA				NA		Edge
Soprano pipistrelle				NA			Edge
Nathusius' pipistrelle	NA	NA	NA	NA			Edge
Leisler's bat	NA	NA	NA		NA		Open

BCT (2023) also state key messages in this document, some of which are presented below:

Key Message 1.18

"It is important to minimised ALAN close to vegetation, particularly for slower-flying species, and the need to increase dense vegetation in urban landscape to provide, not just roosting opportunities, but also protection against ALAN for open-space foraging bats in city landscapes".

Key Message 1.20

"When considering how bats move through the landscape, ALAN has been shown to be particularly harmful along river corridors, near woodland edges and hedgerows".

Key Message 1.39

"This research highlights the importance of integrating avoidance measures (as per the first step of the mitigation hierarchy see Figure 2) into the development design, by retaining ecologically functional 'dark corridors' within scheme where feasible, and in preference to seeking lighting mitigation strategies".

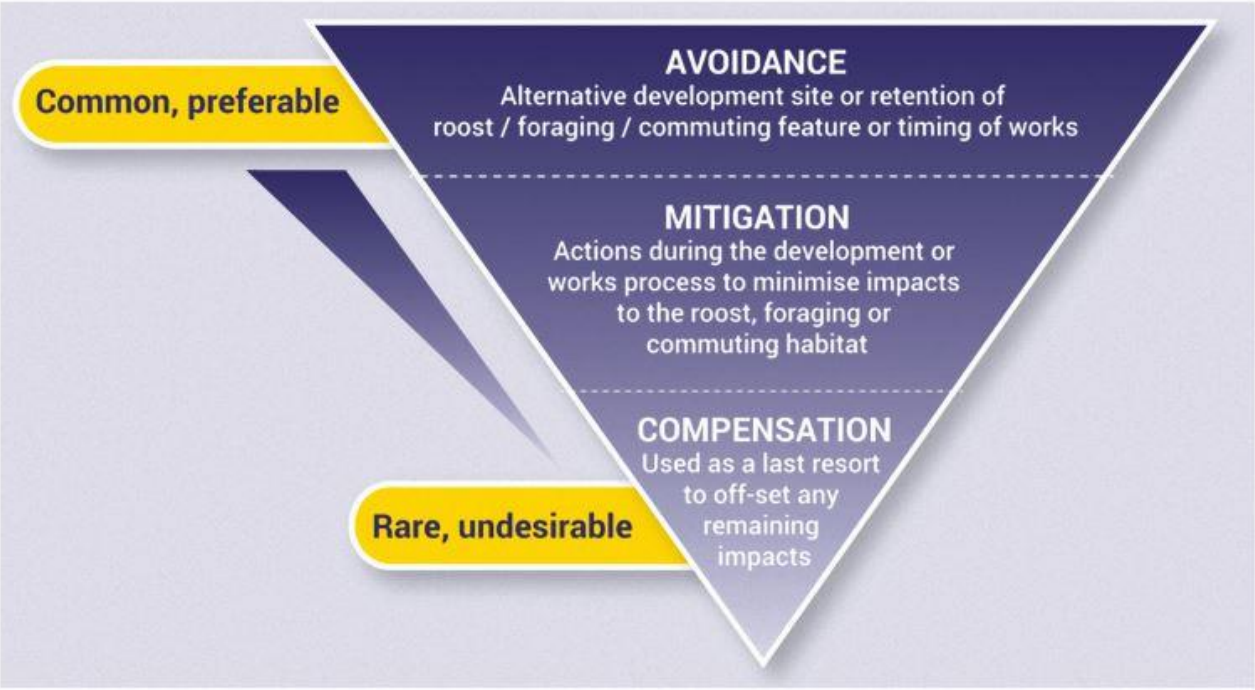


Figure 2. Mitigation hierarchy emphasising the importance of considering avoidance in the first instance (credit Bat Conservation Trust).

Figure 3a: Taken from BCT (2023) – Mitigation Hierarchy.

Key Message 3.13

"There are no lux level thresholds available for individual species to negate the need for site specific advice. Every site is different … The key in the first instance is to maintain or reduce existing light levels, and reduce blue content to protect the bat species present … Ideally light levels should always be designed to minimise potential environmental impacts and to maximise the potential of habitat and species enhancement work …"

1.3.3.2 Landscaping For Bats

Bats depend on the landscape for foraging, roosting and commuting. Different bat species will travel different distances, to and from their principal roosting sites, depending on their morphology, life stage and preferred foraging areas. Bats in Ireland are insect eating mammals and feed on an array of insects, whose populations are ultimately supported by vegetation. Areas of rich vegetation habitat tend to support higher abundances of insect populations and therefore a higher abundance of bats. In addition, many bat species rely on continuous linear habitats (e.g. treelines and hedgerows) to commute along. As a consequence landscaping as part of a proposed development project is an important element to the goal of retaining local bat populations.

The Bat Conservation Trust publication "Landscape and Urban Design for bats and biodiversity" (Gunnell *et al.,* 2012) is a resource for planning landscape design in our urban areas. This resource encourages measures to enhance existing bat foraging habitat, create water features such as ponds (drinking sites for bats and as a source of emerging insects), manage species rich grassland and planting of tall vegetation to ensure that exiting treelines and hedgerows are linked. It also recommends that use of landscaping as a means to creating dark zones or dark corridors for this mammal group to fly along in our lit urban areas. This is also support by the BCT Lighting Guidelines (BCT, 2018) where landscape design can be utilised to buffer potential light spillage from developments.

1.3.3.3 Seasonality of Bat Mitigation Measures

The NPWS Bat Mitigation Guidelines (Marnell *et al.* 2022) provides best practice guidance in relation to the timing of bat mitigation measures. It states that the most common and effective method of avoiding potential harm to a bat is to carry out the work at an appropriate time of the year. The following table provides a summary of timings.

Table 5 Optimum season for works in different types of roosts.

Bat usage of site	Optimum period for carrying out works (some variation between species)
Maternity	1st October – 1st May
Summer (not a proven maternity site)	1st September – 1st May
Hibernation	1st May – 1st October
Mating/swarming	1st November – 1st August

Figure 3b: Table 5 (p 50) Reproduced from Marnell *et al.* (2022).

Timing of bat mitigation measures is relevant to the proposed tree felling of Potential Bat Roosts (PBRs). Felling is recommended outside the principal maternity season and during mild weather conditions (to avoid cold weather that would encourage bats to hibernate). This coupled with dusk/dawn surveys and additional daytime inspections is best practice to ensure that tree felling is completed without causing harm to potentially roosting bats. The preferred tree felling months also avoids the bird nesting season.

2. Proposed Development Description

2.1 Site Location

The proposed development site is located along Port Road, Killarney, Co. Kerry.

Figure 4: Aerial photograph of proposed development site (Red line boundary).

3. Bat Survey Methodology

3.1 Night-time Bat Detector Surveys

3.1.1 Dusk Emergence Bat Survey

A Dusk Emergence Survey was completed of the known lesser horseshoe bat roost in the Tea House of Killarney National Park from 10 minutes before sunset to at least 80 minutes post sunset on 28th July 2023. One surveyor was located to the rear of the building to count bats during emergence (Surveyor 5). In addition, 3 surveyors (Locations 1, 3 & 5) and three static units (Locations 2, 4 & 6) were positioned in vicinity of the roost to determine the direction of commuting bats towards and along the River Deenagh. A fifth surveyor (Surveyor 1) was also located in vicinity of potential foraging and commuting habitats of the lesser horseshoe bat roost in adjacent woodland habitat.

The following equipment was used:

Surveyor 1 (Principal surveyor): Anabat Walkabout Full Spectrum Bat Detectors.

Surveyors 2 to 4: Anabat Scout Full Spectrum Bat Detectors (Locations 1, 3 & 5).

Surveyor 5: Counter.

Statics: Wildlife Acoustics Mini Bat Full Spectrum Static Unit (x 3 units, Locations 2, 4 & 6 with microphones directed towards the roost location).

Figure 5a: Survey locations during dusk emergence survey.

3.1.2 Filming

A Guide TrackIR Pro19 thermal imagery scope filming was also deployed to capture potential emerging bats from the lesser horseshoe bat roost. This was deployed to determine the commuting routes. This night vision aid equipment was used as an additional survey support system and due to set-up method, the information recorded was deemed suitable as standalone survey information. This was deployed from 10 minutes before sunset to 80 minutes post sunset on 28th July 2023.

3.1.3 Passive Static Bat Detector Survey

Passive Static Bat Surveys were completed on 2nd August to 3rd August 2023. Eight units were deployed along the River Deenagh / Port Road (See Figure 5b). Static 1 and Static 2 were located upstream of the gap in the existing tall vegetation along the River Deenagh (and therefore the boundary of the Port Road and Killarney National Park). Static 3 and Static 4 were located downstream of the gap in the existing tall vegetation along the River Deenagh (and therefore the boundary of the Port Road and Killarney National Park) while all other static units were located to detect potential commuting Lesser horseshoe bats emerging from the roost in the Tea House.

A Passive Static Bat Surveys involves leaving a static bat detector unit (with ultrasonic microphone) in a specific location and set to record for a specified period of time (i.e. a bat detector is left in the field, there is no observer present and bats which pass near enough to the monitoring unit are recorded and their calls are stored for analysis post surveying). The bat detector is effectively used as a bat activity data logger and the habitat type of where the bat detector is location is noted to allow interpretation of the results. Static surveillance results in a far greater sampling effort over a shorter period of time. Bat detectors with ultrasonic microphones are used as the ultrasonic calls produced by bats cannot be heard by human hearing.

The microphone of the unit was positioned horizontally to reduce potential damage from rain and the units were position so that the microphone as directed downstream in order to increase the potential to recorded individuals commuting north, during emergence, from the roost located in the Tea House.

Wildlife Acoustics Song Meter Mini Bat Platform Units use Real Time recording as a technique to record bat echolocation calls and using specific software, the recorded calls are identified. It is these sonograms (2-d sound pictures) that are digitally stored on the SD card (or micro SD cards depending on the model) and downloaded for analysis.

The recordings are analysed using Wildlife Acoustics Kaleidoscope Pro. The Auto-Id function is used for all sound files but manual verification was used to ensure the auto-id function is accurate. This is particularly important for less common bat species and cryptic bat species such as *Myotis* species. In addition, “Noise” and “Unidentified” sound files are also checked and identified, where possible, to species level. Each sequence of bat pulses are noted as a bat pass to indicate level of bat activity for each species recorded. This was either expressed as the number of bat passes per hour and per survey night.

Audio files are a maximum of 15 seconds long and each audio file is taken as a bat pass for each bat species recorded within the audio file. Each bat pass does not normally equate to the number of individuals of bats flying in vicinity of the recording device but is representative of bat activity levels, but this is dependent on the bat species recorded. Some species such as the pipistrelles will continuously fly around a habitat and therefore it is likely that a series of bat passes within a similar time frame (i.e. separate audio files within a small time frame) is one individual bat. On the other hand, Leisler’s bats tend to travel through an area quickly and therefore an individual sequence of echolocation calls or bat pass is more likely to be indicative of individual bats. In relation to Lesser

horseshoe bats, due to the fact that this species produces a narrow range and quiet echolocation call, any bat encounters recorded is likely to be attributed to an individual.

The following static units were deployed during this static bat detector survey:

Table 6: Static Bat Detectors deployed during Static Bat Detector Surveys.

Static Unit Code	Bat Detector Type	Recording Function	Microphone
Mini Bat units	Wildlife Acoustics Mini Bat FS	Passive Full Spectrum	SMM-U2

Figure 5b: Location of static units during static surveillance.

4. Bat Survey Results

A bat survey is comprised of a number of different elements. The results of these different types of surveys are presented below in a step-wise fashion and summarised at the end of the section. It is important that the whole section is read in order to gain a full impression of the potential bat value of the survey area.

4.1 Night-time Bat Detector Surveys

4.1.1 Dusk Bat Survey

A total of 340 lesser horseshoe bats were recorded emerging from the roost during the dusk survey. 338 individuals were recorded commuting along the arrows presented in the figure below (in an approximate proportion of 30% along the yellow arrow and 70% along the orange arrow). Individuals were recorded commuting through the woodland vegetation by Surveyor 1 (represented by the Orange circles, Figure 6a).

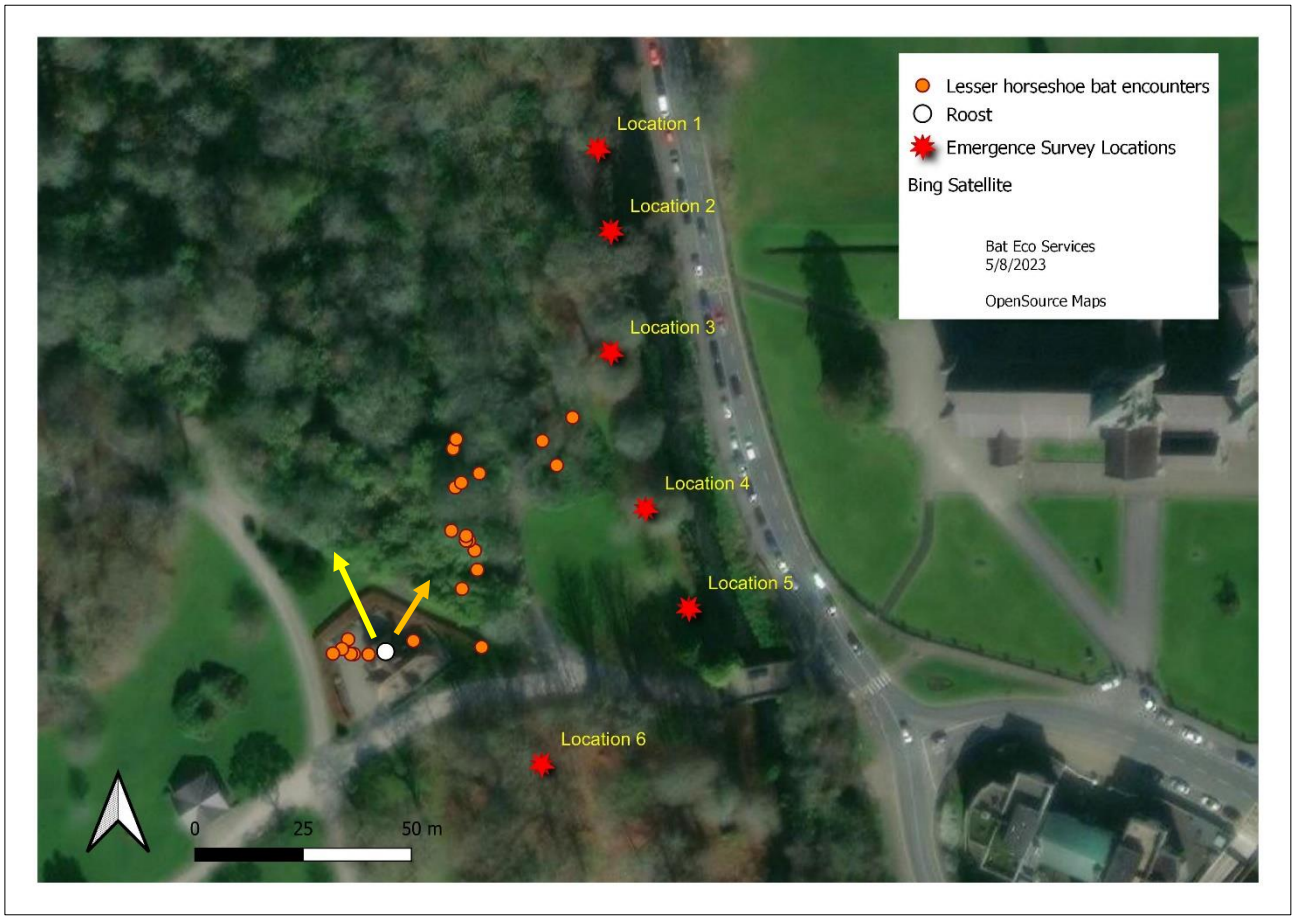


Figure 6a: Survey locations during dusk emergence survey.

In relation to the recordings of lesser horseshoe bats at locations, no lesser horseshoe bats were recorded on the static units located at Locations 2, 4 and 6. Lesser horseshoe bats were recorded by the surveyors at Location 1 (7 bat encounters at 22:32, 22:33, 22:34 and 22:34 hrs), Location 3 (1 bat encounter at 22:32 hrs) and Location 5 (1 bat encounter at 22:32 hrs).

4.1.2 Filming

A Guide TrackIR Pro19 thermal imagery scope filming confirmed that emerging bats commuted directly to vegetation located north and north-east of the Tea House. No bats were recorded commuting across the principal path in front of the Tea House to the adjacent woodland.

4.1.3 Passive Static Bat Detector Survey

The following table summarises the number of Lesser horseshoe bat encounters recorded on the static units deployed for one night of surveillance.

Table 4a: Results of Static Bat Detectors deployed during Static Bat Detector Surveys.

Static Code	Location Description / Bat Habitat Type	Survey Period	Total number of bat encounters
Static 1	Along bank of River Deenagh	1 night 2nd to 3rd August 2023	45 bat encounters
Static 2	On tree along walking track adjacent to River Deenagh	1 night 2nd to 3rd August 2023	8 bat encounters
Static 3	Along bank of River Deenagh	1 night 2nd to 3rd August 2023	49 bat encounters
Static 4	On tree along walking track adjacent to River Deenagh	1 night 2nd to 3rd August 2023	7 bat encounters
Static 5	Along bank of River Deenagh	1 night 2nd to 3rd August 2023	24 bat encounters
Static 6	Treeline on top of bank of River Deenagh	1 night 2nd to 3rd August 2023	40 bat encounters
Static 7	Along bank of River Deenagh	1 night 2nd to 3rd August 2023	Unit failed to record
Static 8	Along bank of River Deenagh	1 night 2nd to 3rd August 2023	121 bat encounters

The recorded data was divided into hourly categories to represent the timing of the bat encounters. Due to the nature of Lesser horseshoe bat echolocation calls, it can be deemed that each bat encounter recorded represents an individual bat of this species. Emergence of this bat species tends to start approximately 30 minutes after sunset with the majority of individuals emerging within an hour thereafter. However to err on the side of caution, the number of bat encounters in the 21:00 hrs, 22:00 hr and 23:00 hrs slots were deemed to represent emerging bats while returning bats (i.e. bats returning to the roost prior to sunrise) were represented by bat encounters from the 03:00 hrs to 05:00 hrs slots. Any bats recorded in the 00:00 hrs, 01:00 hrs and 02:00 hrs slots were deemed to be foraging individuals.

Table 4b: Results of Static Bat Detectors deployed during Static Bat Detector Surveys.

Code	21:00 hrs	22:00 hrs	23:00 hrs	00:00 hrs	01:00 hrs	02:00 hrs	03:00 hrs	04:00 hrs	05:00 hrs
Static 1	1	22	6	6	0	3	2	5	0
Static 2	2	2	1	1	1	1	0	0	0
Static 3	2	21	5	8	1	2	2	3	0
Static 4	0	3	3	1	0	0	0	0	0
Static 5	0	1	4	2	4	5	2	5	1
Static 6	0	0	2	10	12	2	9	5	0
Static 7	No data	No data	No data	No data	No data	No data	No data	No data	No data
Static 8	1	17	32	21	27	5	14	1	4

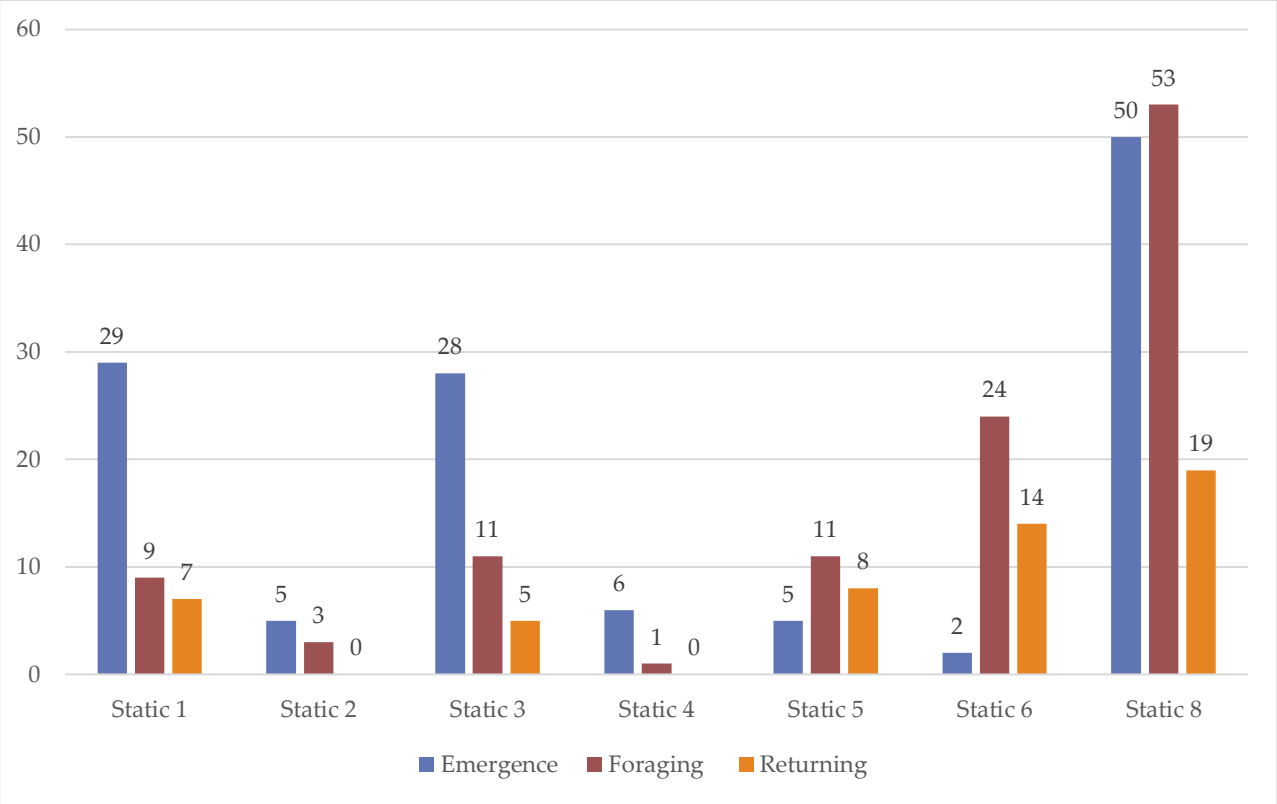


Figure 6b: No. of bat passes recorded for Lesser horseshoe bats during Emergence, Foraging and Returning periods on all statics units (Please note: Static 7 failed to record).

Static 1 and Static 3 were located on the bank of the River Deenagh upstream and downstream, respectively, of the gap in the tall vegetation across from the entrance to the proposed development on Port Road. A similar level of Lesser horseshoe bat activity was recorded on both static units during emergence with a potential of 29 individuals commuting along the River Deenagh in this area. This represents 8.5% of the total number of Lesser horseshoe bats recorded emerging from the Tea House roost on 28th July 2023.

The static units Static 2 and Static 4 were located either on the track or treeline adjacent to the River Deenagh (within the boundary of the Killarney National Park) and represent an additional 11 individuals commuting in vicinity of the gap in the tall vegetation across from the entrance to the proposed development on Port Road. Therefore the results indicate that on the 2nd August 2023, 40 Lesser horseshoe bats likely commuted in vicinity of the gap in the tall vegetation across from the

entrance to the proposed development on Port Road and this represents 11.8% of the total number of Lesser horseshoe bats recorded emerging from the Tea House roost on 28th July 2023.

The number of "Emergence" individuals recorded on Static 8, a static also located on the banks of the River Deenagh and closer to the location of the roost, recorded a likely 50 Lesser horseshoe bat individuals, which represents 14.7% of the total number of Lesser horseshoe bats recorded emerging from the Tea House roost on 23th July 2023, commuting along the river on the survey date (28th July 2023).

Therefore to account for the different levels of recorded bat passes for lesser horseshoe bats between the static locations, it is likely the there are a number of commuting routes north of the roost in the Tea House. These are represented on the figure presented below.

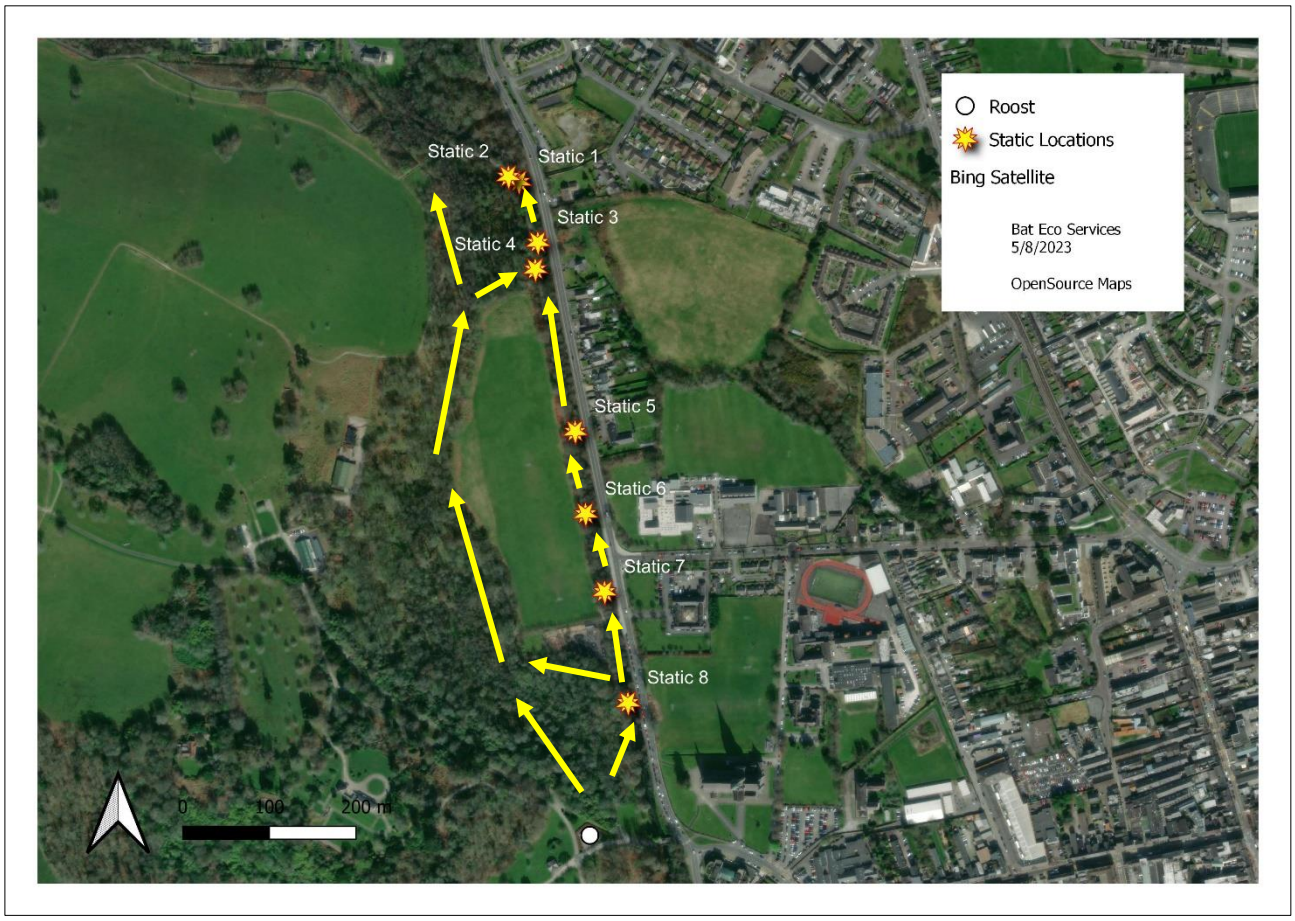


Figure 6c: Location of static units during static surveillance.

A lower level of lesser horseshoe bat activity was recorded during the "Foraging" period and the "Returning" period. In relation to "Foraging" period, this may indicate that the River Deenagh is primarily a commuting habitat for this species of bat. In relation to the "Returning" period, the microphones of the static units were deliberately positioned to "face" the direction of commuting lesser horseshoe bats during the "Emergence" period and therefore the direction of the microphones would be less suitable for recording commuting bats during the period prior to sunrise.

Other bat species recorded during the static surveillance included: Daubenton's bat, Natterer's bat, whiskered bat, common pipistrelle, soprano pipistrelle and Leisler's bat. A break down of the results for these bat species is presented in the appendices.

4.1.4 Environmental Designations

Within a 15km buffer of the proposed development site the following Special Area of Conservation (SACs) are presented:

- Killarney National Park, Macgillycuddy's Reeks And Caragh River Catchment SAC (Site Code 000365)
    - Lesser horseshoe bat is listed as a qualifying interest for this SAC.

The conservation objectives, in relation to lesser horseshoe bat, as presented in the list publications is provided as a screenshot below.

NPWS (2017) Conservation Objectives: Killarney National Park, Macgillycuddy's Reeks and Caragh River Catchment SAC 000365. Version 1. National Parks and Wildlife Service, Department of Culture, Heritage and the Gaeltacht

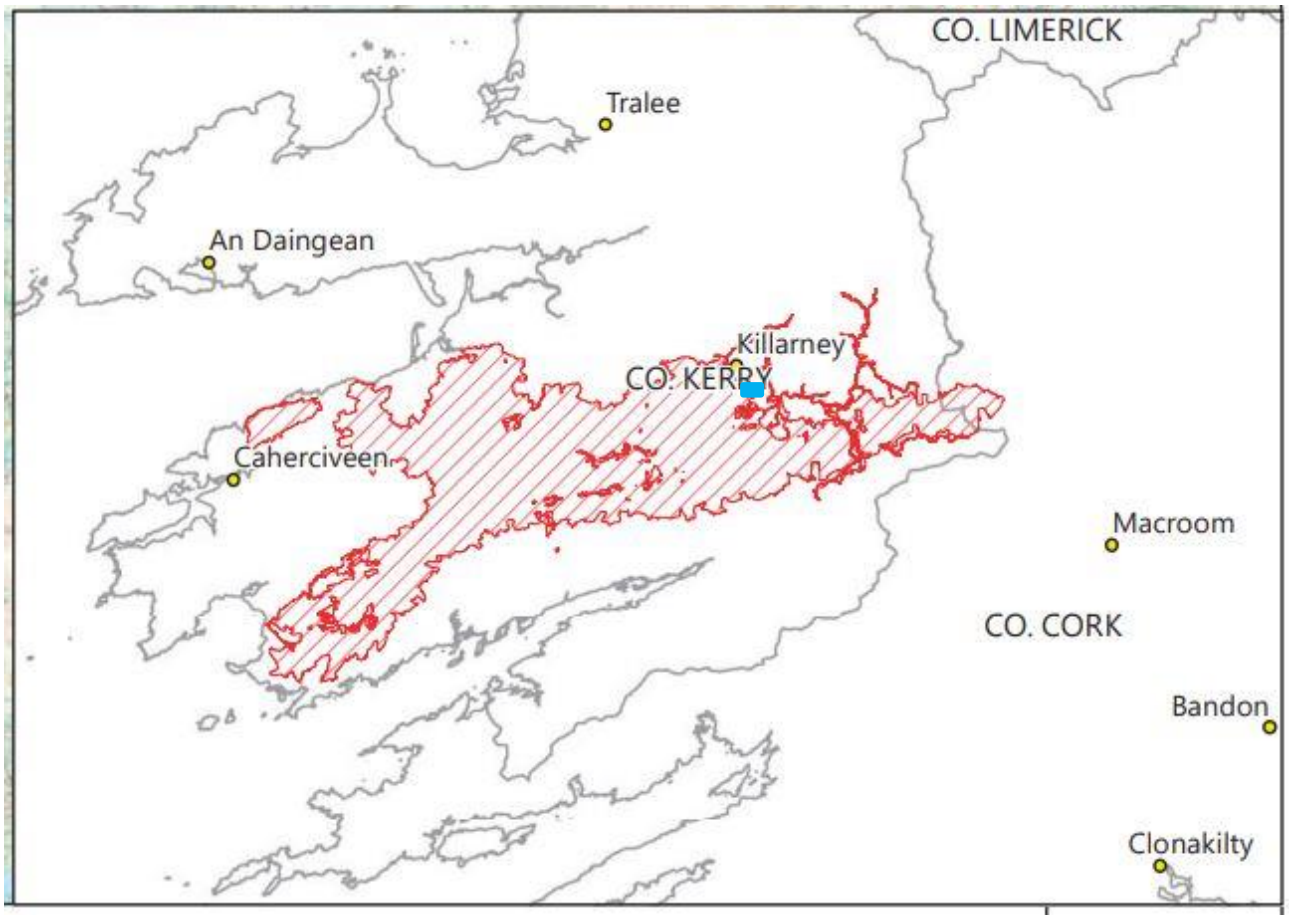


Figure 7a: Location of Killarney National Park, Macgillycuddy's Reeks and Caragh River Catchment SAC 000365 (Source: www.npws.ie). Approximate location of proposed development site represented as Blue Rectangle.

Figure 10c (below) is Map 10 extracted from NPWS document cited above and referred to in the table (Figure 10b). This indicates that there are three important lesser horseshoe bats roosts located south of the proposed development site. Bat Code 296 (summer roost with a minimum number of 315 individuals) is located within the grounds of Killarney National Park along the Port Road and therefore it is likely that individuals from this colony commute along the River Deenagh, woodland of the national park and connecting habitats in the landscape (Note: This roost is also used as a hibernation site). The 2.5km value is listed as the potential distance around a known maternity roost

for this species that is deemed important to ensure connectivity from the maternity roost to foraging habitats.

Conservation Objectives for : Killarney National Park, Macgillycuddy's Reeks and Caragh River Catchment SAC [000365]

1303 Lesser Horseshoe Bat *Rhinolophus hipposideros*

To maintain the favourable conservation condition of Lesser Horseshoe Bat in Killarney National Park, Macgillycuddy's Reeks and Caragh River Catchment SAC, which is defined by the following list of attributes and targets:

Attribute	Measure	Target	Notes
Population per roost	Number	Minimum number of 182 bats in winter for Roost ID 623; minimum number of 127 in winter and 358 in summer for Roost ID 505; minimum number of 176 in winter and 315 in summer for Roost ID 296; minimum number of 218 in summer for Roost ID 615. See map 10	Figures of 100 bats for summer roosts and 50 bats for winter roosts were set as the minimum qualifying standards (MQS) when SACs were being selected for lesser horseshoe bat (*Rhinolophus hipposideros*). NPWS conduct annual counts at each qualifying roost. Qualified means from the 2010-2016 data have been calculated whereby the year with the highest maximum count and the year with the lowest maximum count over that period were removed, and the mean of the remaining years was calculated. This mean is set as the target figure for the roost except where the figure falls below the MQS, then the MQS (100 or 50 as appropriate) is used as the target. Some structures may host qualifying winter roosts AND qualifying summer roosts, in which case separate targets have been set for each season using the summer and winter count data
Winter roosts	Condition	No decline	Killarney National Park, Macgillycuddy's Reeks and Caragh River Catchment SAC has been selected for lesser horseshoe bats because of the presence of a number of internationally important winter roosts. Damage or disturbance to a roost or to the habitat immediately surrounding a roost will lead to a decline in its condition (Mitchell-Jones et al., 2007)
Summer roosts	Condition	No decline	Killarney National Park, Macgillycuddy's Reeks and Caragh River Catchment SAC has been selected for lesser horseshoe bats because of the presence of a number of internationally important summer roosts. Damage or disturbance to a roost or to the habitat immediately surrounding a roost will lead to a decline in its condition (Kelleher and Marnell, 2006)
Number of auxillary roosts	Number and condition	No decline	Lesser horseshoe bat populations will use a variety of roosts during the year besides the main summer maternity and winter hibernation roosts. Such additional roosts within the SAC may be important as night roosts, satellite roosts, etc. In addition, in response to weather conditions for example, bats may use different seasonal roosts from year to year; this is particularly noticeable in winter. Several other winter and summer roosts that support lesser horseshoe bats, but at numbers below the MQS figures, are known from this SAC. A database of all known lesser horseshoe roosts is available on the National Biodiversity Data Centre website. NB further unrecorded roosts may also be present within this SAC
Extent of potential foraging habitat	Hectares	No significant decline	Lesser horseshoe bats normally forage in woodlands/scrub within 2.5km of their roosts (Schofield, 2008). See map 10 which shows a 2.5km zone around the above named roosts and identifies potential foraging grounds
Linear features	Kilometres	No significant loss, within 2.5km of qualifying roosts. See map 10	This species follows commuting routes from its roost to its foraging grounds. Lesser horseshoe bats will not cross open ground. Consequently, linear features such as hedgerows, treelines and stone walls provide vital connectivity for this species, most importantly within 2.5km around each roost (Schofield, 2008)

Figure 7b: Table extracted from NPWS Conservation Objectives report.

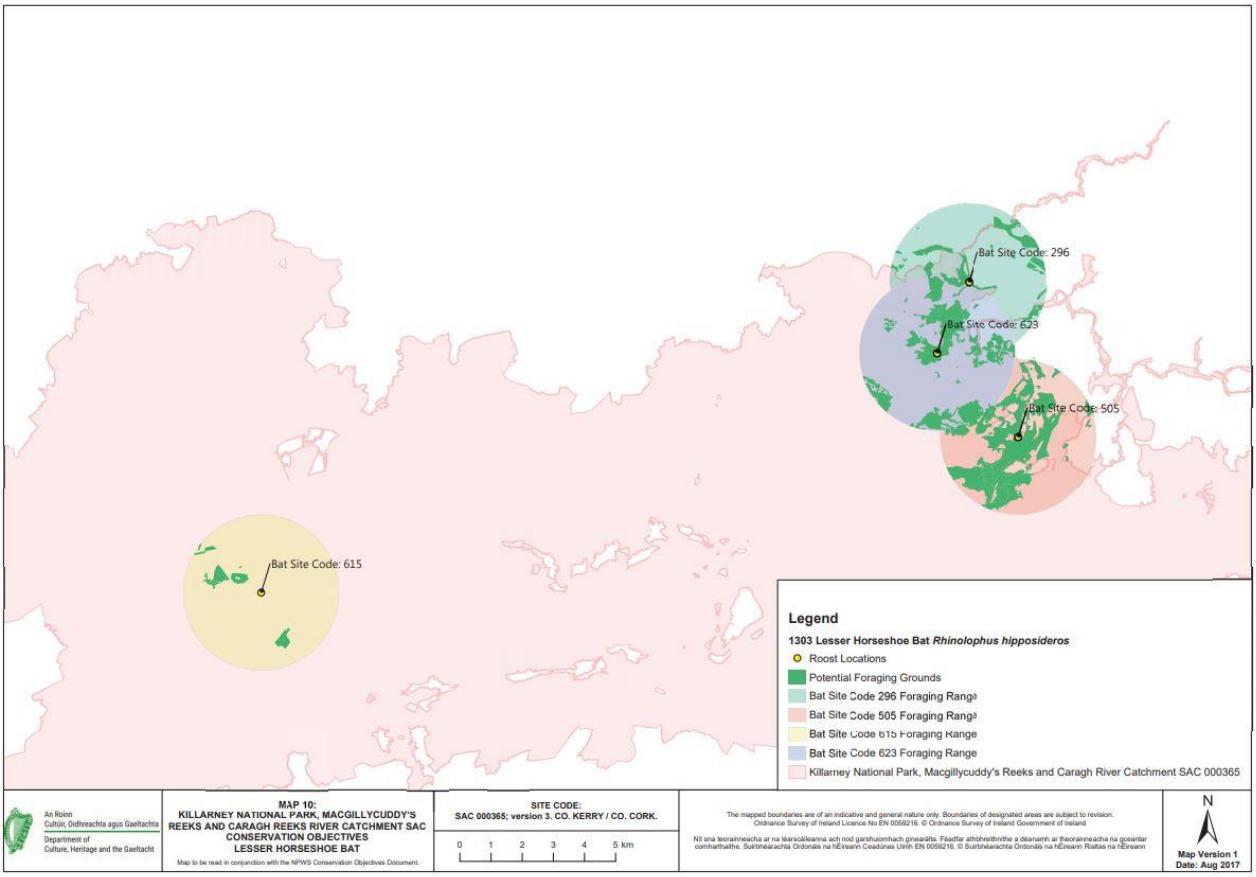


Figure 7c: SAC Site Code 00365 with 2.5km buffers around important lesser horseshoe bat roost sites as listed in Qualifying Interest table for this species (SAC data source: www.npws.ie).

Lesser horseshoe bat roosts are counted by NPWS and VWT staff as part of the Lesser Horseshoe Bat Roost Monitoring (managed by Bat Conservation Ireland under the Irish Bat Monitoring Programme). This involves annual winter and summer counts. In 2020 the maximum count at any one site was 580 bats at a cottage, Killarney, Co. Kerry (Site Code 505) (Aughney *et al.,* 2021), which is located further south of Bat Site Code 296.

The trend for the lesser horseshoe bats in the summer roosts, similar to winter, has been one of increases over the course of the monitoring scheme, albeit at a much more moderate pace in recent years. Since the start of the survey (1992) the annual growth rate has been 2.3% per annum in summer while the more recent short term (six year 2015-2020) trend is at 2.7% increase per annum (Aughney *et al.,* 2021).

In an earlier monitoring report (Aughney *at al.,* 2020), Bat Conservation Ireland presented a map of all of the lesser horseshoe sites surveyed between 2008-2017 under the roost monitoring scheme. This map was collated to represent the extensive checking of historical sites known to NPWS. As shown in Figure 10d, the sites known in the Killarney area were all reported to be occupied by lesser horseshoe bats.

The publication Aughney *at al.,* 2018 undertook analysis of population trends of individual roost sites. The three principal summer roost sites in the Killarney area have some small changes in the monitoring period 2013-2017, with two roosts increasing and one roost declining. It is considered that the local lesser horseshoe population is, overall, stable.

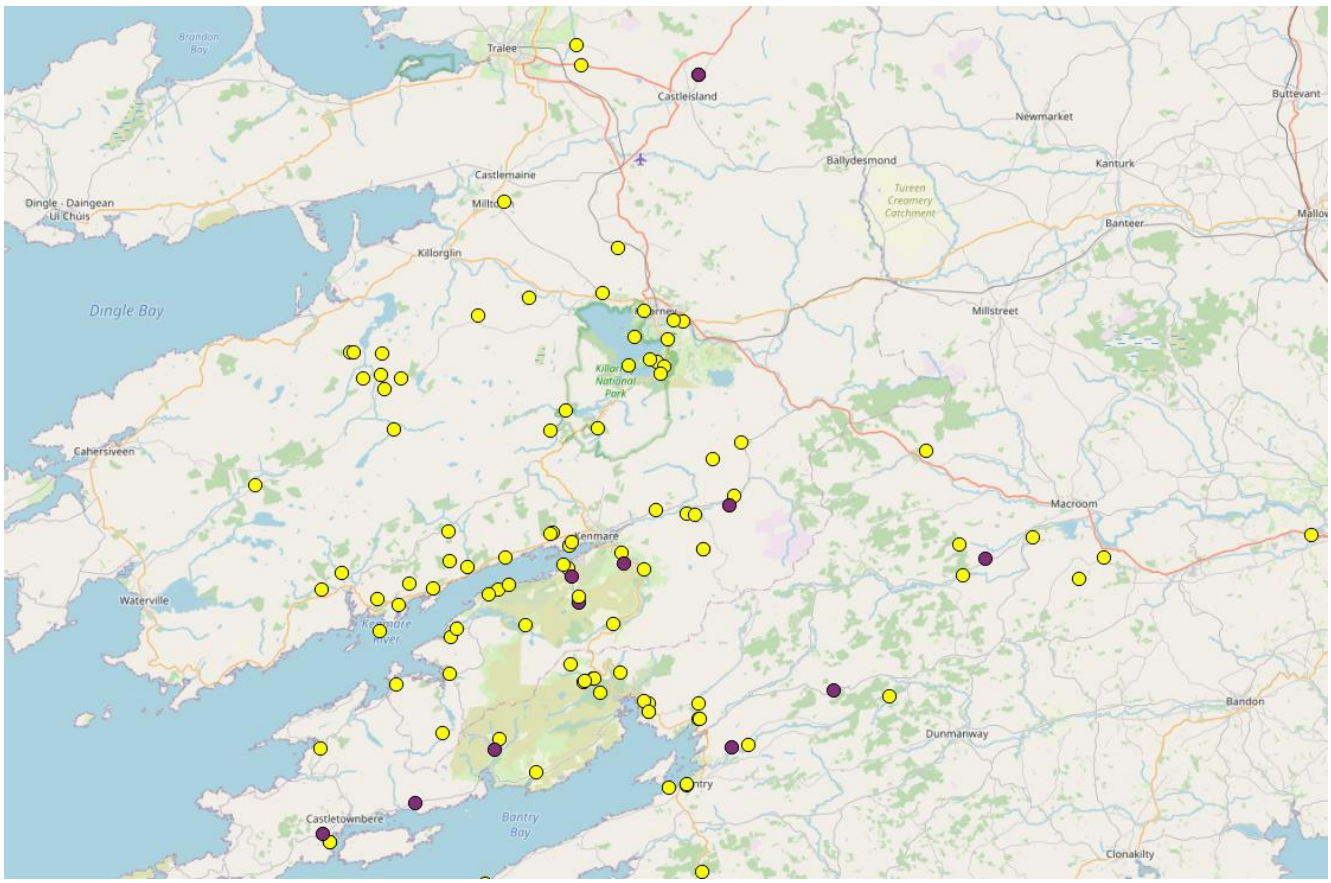


Figure 7d - Extracted from Aughney *et al.,* 2020 – "Figure 6.3: Sites surveyed in Kerry and Cork from 2008-2017 and where bats were present are highlighted in yellow. Additional sites surveyed 2018-2019 and where bats were present are highlighted in purple…".

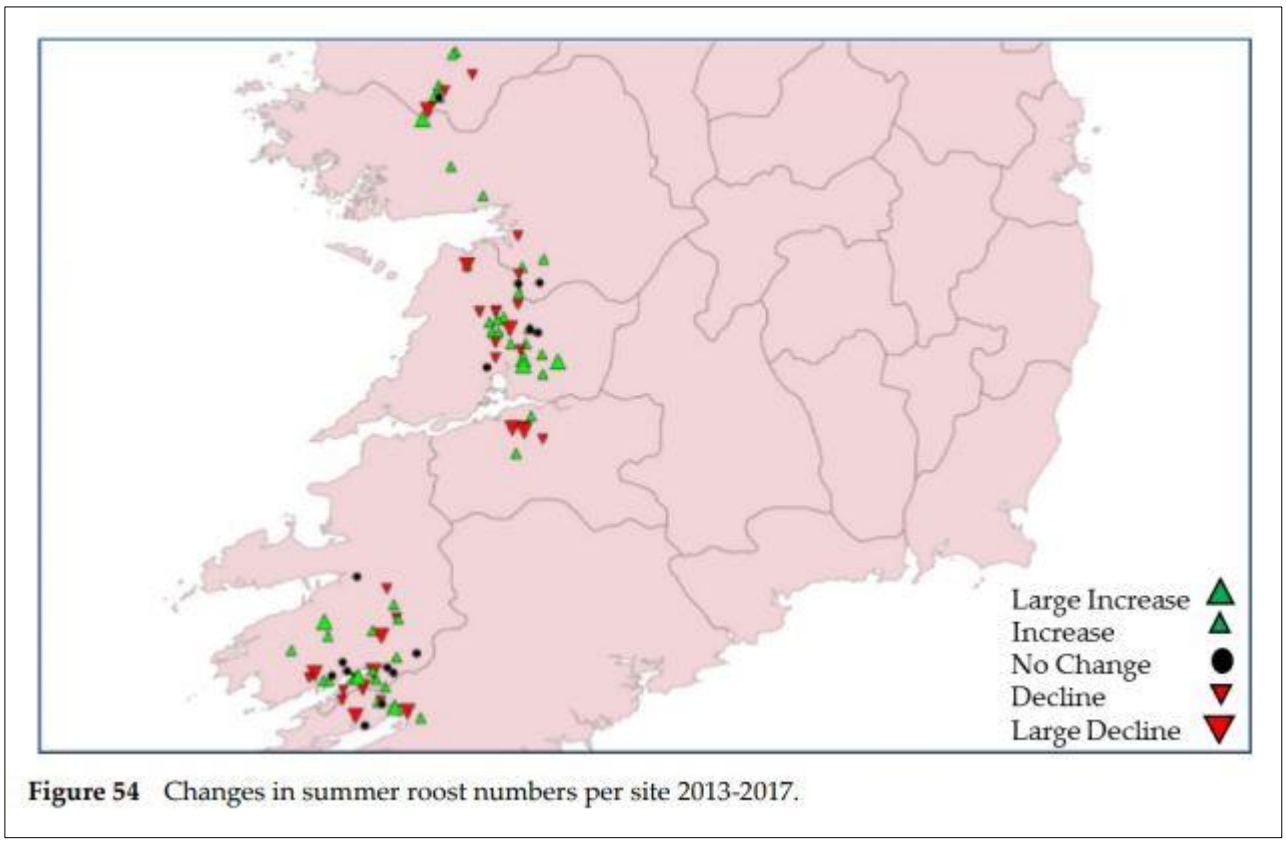


Figure 7e - Extracted from Aughney *et al.,* 2018 – "Figure 54: Changes in summer roost numbers per site 2013-2017".

4.2 Survey Effort, Constraints & Survey Assessment

The following table details any Survey Constraints encountered and a summary of Scientific Assessment completed.

Table 5: Survey Effort, Constraints & Survey Assessment Results.

Category	Discussion
Timing of surveys	All surveys were undertaken in the preferred summer survey period and completed according to Collins (2016).
Survey Type	Bat Survey Duties Completed (Indicated by red shading) Tree PBR Survey ◯ Daytime Building Inspection ◯ Static Detector Survey ■ Daytime Bridge Inspection ◯ Dusk Bat Survey ■ Dawn Bat Survey ◯ Walking Transect ◯ Driving Transect ◯ Trapping/Mist Netting ◯ IR Camcorder filming ◯ Endoscope Inspection ◯ Other Thermal imagery filming ■
Weather conditions	Favourable weather conditions during dusk survey and the static surveillance period.
Survey Constraints	None
Survey effort	Dusk survey (5 surveyors – 8 hrs), static surveillance (56 hours) = TOTAL 64 hrs
Extent of survey area	Roost and River Deenagh along Port Road/Killarney National Park
Equipment	All in good working order.

The extent of the surveys undertaken has achieved to determine:

- Emergence count of LHB roost;
- Potential commuting routes from roost;
- Extent and pattern of usage by LHB along River Deenagh.

Surveying was completed according Collins (2016) and, while, the timing meets guidelines the survey level meets and exceeds this guidance document.

It is therefore deemed that the Scientific Assessment completed is Appropriate in order to completed the aims of the bat survey.

5. Bat Ecological Evaluation

The lesser horseshoe bat, an Annex II bat species, was the primary focus of the supplementary bat surveys undertaken by Bat Eco Services and the surveys were undertaken in view of the potential lighting impacts only.

These supplementary bat surveys documented that the River Deenagh is an important commuting route for individuals of the lesser horseshoe bat maternity colony roosting in the basement of the Tea House. While these surveys were only brief, they did indicated that a potential 14.7% of the Tea House colony commuted along the River Deenagh directly after emergence. In addition, 11.8% of the Tea House colony continued commuted along the River Deenagh in vicinity of the proposed development area. As a consequence, this high level of lesser horseshoe bat usage it is seemed that the River Deenagh is an important commuting habitat for the local lesser horseshoe bat population.

The lesser horseshoe bat is an Annex II bat species.

Lesser horseshoe bat

- Lesser horseshoe bat is an Annex II bat species under the EU Habitats Directive. The status of this bat species is listed as Least Concern. The national lesser horseshoe bat population is considered to be stable with a steady annual increase (Aughney *et al.,* 2021).
- The modelled Core Area for Lesser horseshoe bats is a relatively restricted area that covers six western seaboard counties Ireland (5,993km^2) but with two distinct areas highlighted: one in Kerry/west Cork and the second in Clare/Galway. The Irish Landscape Model indicated that the lesser horseshoe bat habitat preference is for areas with broadleaf woodland and riparian habitats (Roche *et al.,* 2014).

While the local lesser horsehsoe bat population in Killarney National Park is favourable, the overall trend for the country is less favourable. Article 17 reporting (NPWS, 2019) for this species of bat concluded the following:

- Range = Inadequate
- Population = Favourable
- Habitat for species = Inadequate
- Overall Assessment of Conservation Status = Inadequate
- Overall trend in Conservation Status = Deteriorating

As a consequence, it is important to ensure that the Killareny National Park population is protected and conserved.

6. Assessment of Potential Impact

The lesser horseshoe bat, an Annex II bat species, was the primary focus of the supplementary bat surveys undertaken by Bat Eco Services. These supplementary bat surveys documented that the River Deenagh is an important commuting route for individuals of the lesser horseshoe bat maternity colony roosting in the basement of the Tea House. While the surveys were only brief, they did indicated that a potential 14.7% of the Tea House colony commuted along the River Deenagh directly after emergence. In addition, 11.8% of the Tea House colony continued commuted along the River Deenagh in vicinity of the proposed development area. As a consequence, this high level of lesser horseshoe bat usage indicates that proposed lighting of the immediate road area, of the proposed development area and potential "glare" from turning vehicles will likely impact on the river linear as a linear bat habitat.

This impact is considered to be, at a minimum, **Moderate Negative** and will be **Permanent** in relation to local lesser horseshoe bat populations commuting along the River Deenagh. Therefore, bat mitigation measures are required to reduce this impact.

6.1 Bat Mitigation Measures

The bat mitigation measures described below take into consideration Marnell *et al.* (2022) as well as best practice guidelines from Collins (2016) and BCT (2023). The measures described are those considered to be practical and effective based on past experience of the principal bat specialist, for the proposed development site. Measures are also reflective to published scientific research, where available and applicable to Irish bat populations. As stated by Marnell *et. Al.* (2022) "Any mitigation intended to ensure that there is no impact or minimal impact on the bats must be clearly described in detail, giving examples of how it worked in other places". Please see Section 1.2.3 for more information.

6.1.1 Lighting Design

In order to reduce the impact of the lighting design for both the Local Authority street lights and any lighting associated with the proposed development, the following is required to be taken into consideration by the lighting design team:

- No lighting should be considered where possible in vicinity of the River Deenagh and documented commuting routes.

Where lighting is deemed necessary, the following are required:

- All luminaires should lack UV elements when manufactured. Metal halide, compact fluorescent sources should not be used.
- LED luminaires should be used where possible due to their sharp-cut-off, lower intensity, good colour rendition and dimming capability,
- A warm white light source (2700 Kelvin or lower) should be adopted to reduce blue light component of luminaires. This is particularly important for the Local Authority street lighting directly adjacent to the River Deenagh and any street lighting associated with the proposed development. While standard street lighting tends to be 3,000 to 4,000 Kelvins, it is important to note that such Kelvin values are standards adopted by Local Authorities but that these can be and should be changed to accommodate biodiversity needs. Given the circumstances of this particular project and the concerns of lighting impact on an Annex II species, all efforts are required to reduce the potential impact by all parties concerned and therefore a minimum of 2700 Kelvins should be adapted by any proposed street lighting proposed within the survey

area (both for upgrades and newly proposed lighting). At the recent Bat Conservation Ireland bat conference (March 2023), Sabre Lighting provided a demonstration on the colour of lighting of the different Kelvin values. A 2700 Kelvin luminaire appears as a warm yellow due to the reduction in the stark blue light associated with higher Kelvin values (e.g. 4000 Kelvins). The "warmer" the light, the less of an impact on nocturnal wildlife. The progression of LED technology means that the majority of luminaires are available at 2700 Kelvins and lower. Therefore, it is recommended that such luminaires are standard for "biodiversity areas" and as LED technology develops, 2200 Kelvins may become more commonly available in future years.

- Light sources should feature peak wavelengths higher than 550nm to avoid the component of light most disturbing to bats. Consideration of using red lighting, particularly for road street lighting directly adjacent to the River Deenagh, should be investigated (i.e. Local Authority street lighting). However, if red light is considered too "different" of a light source, >550nm should be the minimum standard set for this project.

DEFINITION: Red Light refers to the light sources in the red spectrum and mainly consist of long wavelength light above 600nm with an RA value of 60 (for good colour recognition). This wavelength of light is considered to the have the least impact on bats.

- Internal luminaires, in relation to buildings within the proposed development area, can be recessed (as opposed to using a pendant fitting) where installed in proximity to windows to reduce glare and light spill.
- Waymarking inground markers (low output with cowls or similar to minimised upward light spill) to delineate path edges, if required, for pedestrian zones within the proposed development area should be used.
- Column heights should be carefully considered to minimise light spill and glare visibility. This should be balanced with the potential for increased numbers of columns and upward light reflectance as with bollards.
- Only luminaires with a negligible or zero Upward Light Ration, and with good optical control, should be considered.
- Luminaires should always be mounted horizontally, with no light output above 90^{o} and/or no upward tilt.
- Where appropriate, external security light should be set on motion sensors and set to as short a possible a timer as the risk assessment will allow (e.g. 1-2 minute timer).
- Use of a Central Management System (CMS) with additional web-enables devices to light on demand. If possible, it should be determined if the Local Authority street lighting immediately adjacent to the River Deenagh and particular luminaires of concern, can be managed in a manner to reduce the amount of lighting required as the night progresses (i.e. reduction in lighting for specific hours of the night). This Part-Night lighting may require further survey work to determine if dimming is of value to local lesser horseshoe bat population.
- Only if all other options have been explored, accessories such as baffles, hoods or louvres can be used to reduce light spill and direct it only to where it is needed.

It is important to ensure that the design of individual luminaires directly adjacent to the River Deenagh are designed to ensure that there is no lighting spillage onto the surface of the water.

In order to assist this, buffering using vegetation and fencing mitigation is presented below.

6.1.2 Buffers

One of the primary concerns expressed about lighting resulting from the proposed development is the glare from turning vehicles exiting and entering the proposed development site. The vegetation on the Port Road-side of the River Deenagh in vicinity of the developments exit point is minimum (i.e. there are gaps in the vegetation). As a consequence there is light spillage on the river water surface. Therefore, the following is recommended:

- An assessment should be undertaken to determine if new planting can be undertaken along the river bank within any gaps along the Port Road / River Deenagh from the location of the Tea House roost to at least 100m beyond the proposed development site. Discussions are required with NPWS, Kerry Co. Co and developers on the best course of action to achieve this.
- Where vegetation can be planted, only native vegetation should be planted choosing plant species to provide a buffer of vegetation to at least 2-3m height above the existing wall boundary.
- In relation to the gap in vegetation in the immediate area of the proposed development side, an appropriate solid fence is required to be erected. The height of fencing should be agreed in consultation with NPWS and should complement the proposed vegetation planting (while ensuring that the minimum height of the fence prevents light spillage onto the surface of the river). This should be erected on the existing wall boundary and should extend at least 5m either side of the gap in vegetation but the exact length should be finalised in discussion with NPWS. This should be left in position and maintained until bank-side vegetation is sufficiently well-established to provide a natural buffer.

6.1.3 Landscaping

Planting dense vegetation zones can assist to “buffer” potential light spillage. In addition to 6.1.2, the following is recommended:

Proposed Development Site – the landscape plan for the proposed development site should ensure that the boundary of the site along the port road is planted with a native hedgerow and interspersed trees to achieve a height to reduce light spillage from street lighting within the proposed development site.

Area adjacent to the Tea House roost – the area immediately around the Tea House should be assessed by NPWS to determine how to increase the linear vegetation connectivity to achieve the following:

a) Facilitating bats to cross the existing path in front of the Tea House towards the woodland (i.e. encourage new commuting routes during emergence to the south of the immediate area towards the River Deenagh. At the moment, all of the bats emerge from the Tea House and commute to the north or east in adjacent woodlands).
b) Facilitating bat to commute south along the River Deenagh.

The green area along the River Deenagh immediately south of the Tea House is a large open space with a lot of light spillage from the existing street lights along the local road. As a consequence, During the brief survey, no lesser horseshoe bats were recorded commuting south along the River Deenagh. Therefore it is recommended that planting along both river banks of the River Deenagh is undertaken to create a “dark corridor” in order to facilitate bats to commute south along the river. By creating a dark corridor, this commuting route may become favourable and therefore increase the scope for dispersal for the local bat population.

While the author recognises that this may be a viewing point of the town's cathedral from the Tea House, due to the sloping nature of the ground from the Tea House to the river, it is possible that a native hedgerow with small trees (e.g. Rowan) could be planted without interrupting this view. While this planting area is outside the proposed development zone, this is a recommendation for Kerry Co. Co. and NPWS.

6.1.4 Monitoring

In Ireland, we are often depending research and guidelines from outside the country e.g. BCT (2023) guidelines. However, this project provides an ideal opportunity to determine if the mitigation measures adopted successfully reduce the potential impact of lighting on lesser horseshoe bats. Therefore it is recommended that this project is used as a Case Study to inform future works and that a suitable monitoring project is designed by an integrated team of an bat ecologist and lighting engineer with input from NPWS and Kerry Co. Co.

It will also be important that compliance is demonstrated during the operation of the proposed development and also the public street lighting of Port Road.

7. Survey Conclusions

The lesser horseshoe bat, an Annex II bat species, was the primary focus of the supplementary bat surveys undertaken by Bat Eco Services. These supplementary bat surveys documented that the River Deenagh is an important commuting route for individuals of the lesser horseshoe bat maternity colony roosting in the basement of the Tea House.

As a consequence, this high level of lesser horseshoe bat usage indicates that proposed lighting of the immediate road area, of the proposed development area and potential "glare" from turning vehicles will likely impact on the river linear as a linear bat habitat.

This impact is considered to be, at a minimum, **Moderate Negative** and will be **Permanent** in relation to local lesser horseshoe bat populations commuting along the River Deenagh. Therefore, bat mitigation measures are required to reduce this impact.

The strict implementation of the bat mitigation measures will reduce the negative impact on local lesser horseshoe bat populations commuting along the River Deenagh.

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9. Appendices

9.1 Appendix 1 Other Bat Species Recorded during Static Surveillance

Code	Daubenton's bat	Whiskered bat	Natterer's bat	Myotis species	Soprano pipistrelle	Common pipistrelle	Leisler's bat
Static 1	116	158	5	0	9	26	0
Static 2	8	11	1	8	223	309	23
Static 3	121	89	3	0	13	23	0
Static 4	12	14	2	0	60	56	2
Static 5	21	90	0	0	55	69	2
Static 6	227	27	0	0	108	56	1
Static 7	No recordings	No recordings	No recordings	No recordings	No recordings	No recordings	No recordings
Static 8	111	42	0	2	912	180	1