2022

Bat Assessment – Hayden's Lane, Lucan, Co. Dublin

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Bat Eco Services

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NPWS licence C13/2020 (Licence to handle bats, expires 31st December 2022);
NPWS licence 08/2020 (Licence to photograph/film bats, expires 31st December 2022);
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: Oppermann Associates

Project Name & Location: Hayden's Lane, Lucan, Co. Dublin.

Report Revision History

Date of Issue	Draft Number	Issued To (process of issuing)
21st April 2021	Draft 1	Oppermann Associates (by email)
6th April 2022	New assessment - Final	Oppermann Associates (by email)
7th April 2022	New assessment - Final a	Oppermann Associates (by email)

Purpose

This document has been prepared as a Report for Oppermann Associates. 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: Hayden's Lane, Lucan, Co. Dublin.

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	○

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Please note that this is an updated assessment since the report issued in 2021.

Contents

1. Introduction

Bat Eco Services was commissioned by Oppermann Associates to undertake a bat survey of Hayden's Lane, Lucan, Co. Dublin. A survey was undertaken in 2015 but due to the fact that this data is six years old, a new survey was undertaken in 2021 to update the information previously recorded.

The bat assessment completed in 2021 and reported in 2021 was in view of the proposed application at that time. The current proposed application presented in this revised 2022 report has been re-assessed according to the bat information gathered in 2021 and in reflection of data gathered in 2015. This report has also been up dated according to new bat survey guidelines (Marnell *et al.*, 2022) and as a consequence there is additional information present about bat mitigation measures.

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.

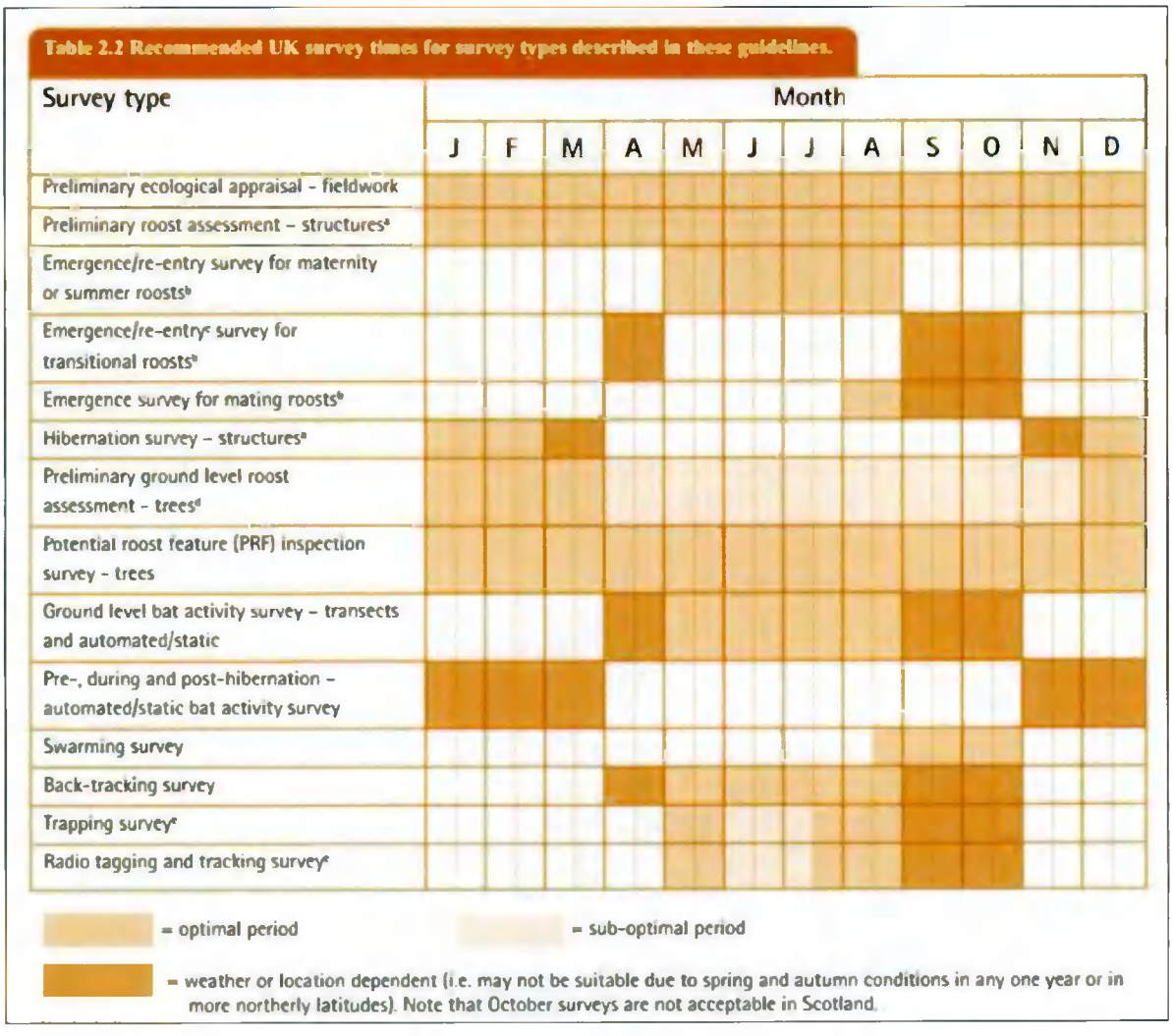

Figure 1a: Table 2.2 reproduced from Collins (2016).

1.2.1.1 Buildings

In Marnell *et al.* (2022), Table 3 (The applicability of survey methods) provides information on the type of surveys that can be undertaken according to the different seasons.

Marnell *et al.* (2022) states that it is more suitable to survey buildings in the summer months. The following is a summary of the principal points:

1. The presence of a significant bat roost (invariably a maternity roost) can normally be determined on a single visit at any time of year, provided that the entire structure is accessible and that any signs of bats have not been removed by others. However, a visit during the summer or autumn has the advantage that bats may be seen or heard.
2. Roosts used by a small number of bats, as opposed to maternity sites, can be particularly difficult to detect and may require extensive searching backed up (in summer) by bat detector surveys or emergence counts.
3. If the entire building is not accessible or signs of bats may have been removed by others, or by the weather, bat detector or exit count methodologies may be required to back up a limited search.

Table 3. The applicability of survey methods.

Season	Roost type	Inspection	Bat detectors and emergence counts
Spring (Mar – May)	Building	Suitable (signs, perhaps bats)	Limited, weather dependent
	Trees	Difficult (best for signs before leaves appear)	Rarely useful
	Underground	Suitable (signs only)	Static detectors may be useful
Summer (June-August)	Building	Suitable (signs and bats)	Suitable
	Trees	Difficult	Limited; use sunrise survey
	Underground	Suitable (signs only)	Rarely useful
Autumn (September -November)	Building	Suitable (signs and bats)	Limited, weather dependent
	Trees	Difficult	Rather limited weather dependent; use sunrise survey?
	Underground	Suitable (signs, perhaps bats)	Static detectors may be useful
Winter (December-February)	Building	Suitable (signs, perhaps bats))	Rarely useful
	Trees	Difficult (best for signs after leaves have gone)	Rarely useful
	Underground	Suitable (signs and bats)	Static detectors may be useful

Figure 1b: Table 3 reproduced from Marnell *et al.* (2022).

The following table is used to determine the level and timing of surveys for buildings/structures with reference to the surrounding habitat. Buildings are assessed to determine their suitability as a bat roost and are described using the parameters Negligible, Low, Medium or High suitability in view of Table 2 from Marnell *et al.* (2022). The level of suitability informs the level of surveying and timing of surveys required based on Table 7.3 of Collins, 2016 (Note: These two tables are presented in Appendix 1 but a summary is provided in the table below).

Table 2a: Building Bat Roost Classification System & Survey Effort (Adapted from Collins, 2016 and Marnell *et al.*, 2022).

Suitability Category	Description (examples of criteria)	Survey Effort (Timings)
Negligible	Building have no potential as a roost site Urban setting, heavily disturbed, building material unsuitable, building in poor condition etc.	No surveys required.
Low	Building has a low potential as a roost site. No evidence of bat usage (e.g. droppings)	One dusk or dawn survey.
Medium	Building with some suitable voids / crevices for roosting bats. Some evidence of bat usage Suitable foraging and commuting habitat present.	At least one survey in May to August, minimum of two surveys (one dusk and one dawn).
High	Building with many features deemed suitable for roosting bats. Evidence of bat usage. Largely undisturbed setting, rural, suitable foraging and commuting habitat, suitable roof void and building material.	At least two surveys in May to August, with a minimum of three surveys (at least one dusk survey and one dawn survey).

1.2.1.2 Trees

Marnell *et al.* (2022) recommends the following in relation to detecting roosts in trees:

- "The best time to carry out surveys for suitable cavities is between November and April, when the trunk and branches are not obscured by leaves. If inspection suggests that the tree has suitable cavities or roost sites, a bat detector survey at dusk or dawn during the summer may help to produce evidence of bats, though the nomadic nature of most tree-dwelling species means that the success rate is very low.
- It can also be difficult to pinpoint exactly which tree a bat emerged from. A dawn survey is more likely to be productive than a dusk one as swarming bats returning to the roost are much more visible than those leaving the roost. Because tree-dwelling bats move roosts frequently, a single bat-detector survey is unlikely to provide adequate evidence of the absence of bats in trees that contain a variety of suitable roosting places.
- Several dawn or dusk surveys spread over a period of several weeks from June to August will greatly increase the probability of detecting significant maternity roosts and is recommended where development proposals will involve the loss of multiple trees".

As a consequence, the BTHK (2018) Potential Roost Features (PRFs) list and the classification system adapted from Collins (2016) is recommended as part of the daytime inspection of trees to determine their PBR or Potential Bat Roost value. Details of the methodology followed is presented in Section 3.2.2.

1.2.1.3 Underground Structures

Marnell *et al.* (2022) recommends the following in relation to underground structures:

1. Underground structures are used mainly for hibernation, so surveys should generally be carried out during the winter.

1.2.2 Evaluation & Assessment Criteria

Based on the information collected during the desktop studies and bat surveys, an ecological value is assigned to each bat species recorded based on its conservation status at different geographical scales (Table 2b). For example, a site may be of national ecological value for a given species if it supports a significant proportion (e.g. 5%) of the total national population of that species.

Table 2b: The six-level ecological valuation scheme used in the CIEM Guidelines (2016) Ecological Value

Ecological Value	Geographical Scale of Importance
International	International or European scale
National	The Republic of Ireland or the island of Ireland scale (depending on the bat species)
Regional	Province scale: Leinster
County	County scale: County Dublin
Local	Proposed development and immediate surroundings
Negligible	None, the feature is common and widespread

If bat roosts are recorded, their roost status is determined using Figure 20 from Marnell *et al.* (2022). This figure is presented below (Figure 1c). This figure is also used to determine the conservation significance of the roost in order to prepare appropriate bat mitigation measures.

Impacts on bats can arise from activities that may result in:

- Physical disturbance of bat roosts e.g. destruction or renovation of buildings
- Noise disturbance e.g. increase human presence, use of machinery etc.
- Lighting disturbance
- Loss of roosts e.g. destruction or renovation of buildings
- Modifications of commuting or foraging habitats
- Severance or fragmentation of commuting routes
- Loss of foraging habitats.

It is recognised that any development will have an impact on the receiving environment, but the significance of the impact will depend on the value of the ecological features that would be affected. Such ecological features will be those that are considered to be important and potentially affected by the proposed development.

The guidelines consulted recommend that the potential impacts of a proposed development on bats are assessed as early as possible in the design stage to determine any areas of conflicts. In particular the Table 4 (presented as Figure 1d below) and Figure 20 (presented as Figure 1c) from Marnell *et al.* (2022) are referenced during this process.

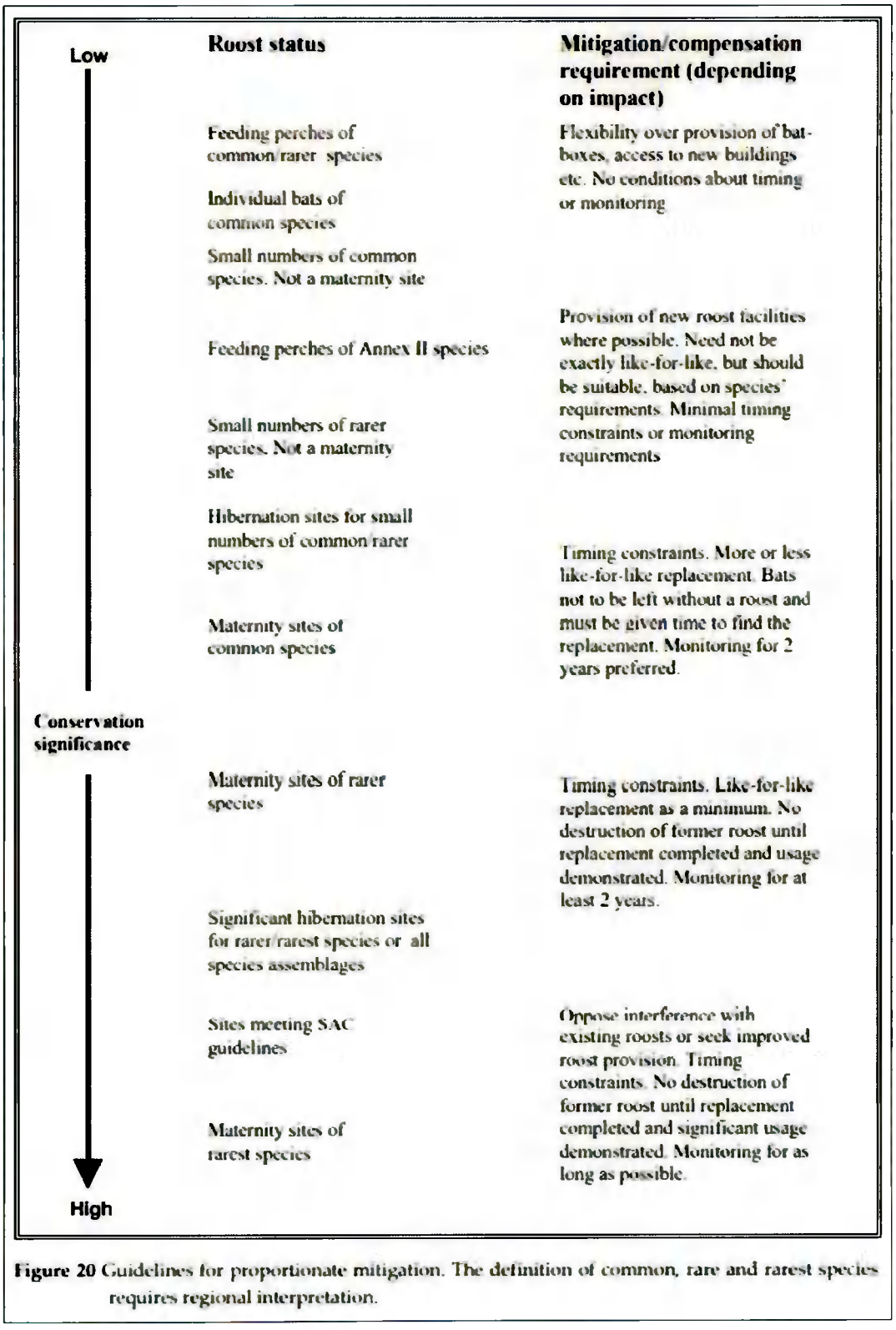

Figure 20 Guidelines for proportionate mitigation. The definition of common, rare and rarest species requires regional interpretation.

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 2c: 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 2d (based on EPA, 2017).

Table 2d: 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

1.2.3 Bat Mitigation Measures

1.2.3.1 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 2e: 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'.

1.2.3.1.1 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 (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 provides a list of recommendations in relation to luminaire design, which is based on the extensive research completed to-date on the potential impact of lighting on bats, and therefore provides best practice mitigation measures. These recommendations are the basis of mitigation measures pertaining to bats listed in this report and are summarised as follows:

- All luminaires used should lack UV/IR elements to reduce impact.
- A warm white spectrum (<2700 Kelvins should be used to reduce the blue light component of the LED spectrum).
- Luminaires should have a peak wavelengths higher than 550nm to avoid the component of light most disturbing to bats.
- Only luminaires with an upward light ratio of 0% and with good optical control should be used.
- Luminaires should be mounted on the horizontal, i.e. no upward tilt.
- Column heights should be carefully considered to minimise light spill. The shortest column height allowed should be used where possible.
- Bollard lighting should be considered for pedestrian, parks and greenway areas, if deemed necessary.

1.2.3.2 Bat Box Schemes

Bat Boxes are frequently used as part of bat mitigation to retain local bat populations within an area proposed to be development. The NPWS Survey and Mitigation Guidelines (Marnell *et al.* 2022) considers that where roosts of low conservation significance (Figure 20, Marnell *et al.* (2022)) are to be lost due to a development, bat boxes may provide an appropriate form of mitigation and the effectiveness depends on the type of bat box provided, which should be appropriate to the bat species (Figure 1f).

Table 7 The types of bat box used by different species.

Species	Summer/ maternity	Summer/non breeding	Hibernation*	Notes
Rhinolophus hipposideros	N/A	N/A	N/A	Horseshoe bats cannot use bat boxes
Myotis daubentonii	H	H		
Myotis mystacinus	H	H		
Myotis nattereri	H	?		
Pipistrellus nathusii	H	H		
Pipistrellus pipistrellus	C	C/H	C	H are rarely used as maternity roosts.
Pipistrellus pygmaeus	C	C/H	C	
Nyctalus leisleri	H	H	H?	
Plecotus auritus	H	H		Maternity roosts

Key

* Large well-insulated hibernation boxes may be more successful

N/A -not applicable, bat boxes should not be considered as replacement roosts

H – tree hollow-type box, providing a void in which bats can cluster

C – tree crevice-type box, with 25-35mm crevices

? – few data on which to base an assessment

Figure 1f: Table 7 (p 58) Reproduced from Marnell *et al.* (2022).

1.2.3.2.1 Effectiveness of Bat Boxes as a Mitigation Measure

Two publications that provide good scientific advise in relation to the effectiveness of bat boxes are presented below. McAney & Hanniffy (2015) reviewed the use of bat boxes in Ireland in relation to the bat usage of the following bat box schemes: 62 Schwegler boxes of three models erected in Portumna Forest Park (Bat box scheme consisted of 30x 1FF design, 30x 2FN design and 2x 1FW design); 50 2FN boxes erected in Coole-Garryland Nature Reserve and 50 2FN boxes erected in Knockma Nature Reserve of which 40 were later transferred to Glengarriff Nature Reserve County Cork. The bat box schemes were set up in March 1999 and data was collected up to 2015. Eight of the nine resident bat species were recorded roosting in bat boxes (lesser horseshoe bats cannot use bat boxes due to their need to fly, rather than crawl, into roosts). The main summary points are as follows:

- Leisler's, brown long-eared and *Pipistrellus* spp. were recorded in boxes at all three Galway woods, Daubenton's bat was only recorded in Garryland, Natterer's bat was only recorded in Glengarriff and whiskered/Brandt's was recorded just twice.
- There was a 31% chance of encountering a bat at Portumna Forest Park compared to 11.5% and 10% at Coole-Garryland Nature Reserve and Knockma Nature Reserve respectively.
- Pipistrellus spp. preferred 1FF boxes as this bat box design offer crevice-like roosting conditions. This species group also showed a seasonal preference with more bats present later in the season (visual observations confirmed the bats were using the boxes as mating roosts) and their numbers increased from the time that the bat box scheme was originally established.
- Brown long-eared bats preferred 2FN boxes that mimic holes in trees, the natural roosting sites for this species. This species also showed no seasonal pattern to their occurrence in the boxes. However one aspect of 2FN boxes that this report mentions is the high occupancy by birds which can be an issue in relation to nesting material reducing the availability of bat boxes for roosting bats.
- Leisler's bat showed no preference for box model but showed a seasonal preference with more bats present later in the season.
- Aspect was not a significant factor for occupancy but most boxes received dappled sunshine for part of the day.
- The other factor that proved significant was the length of time the boxes were in place, with occupancy rates increasing for all three species, although in the case of pipistrelles this increase appears to have stabilised. So, although the boxes were occupied very quickly, it took several years before they were regularly occupied and before clusters of bats were formed and breeding was confirmed.

Collins *et al.* (2020) investigated the implementation and effectiveness of bat roost mitigation, which included bat boxes, in building developments completed between 2006 and 2014 in England and Wales. The bat species studied were: common and soprano pipistrelle, brown long-eared bat and *Myotis* species, all of which are present in Ireland. A summary of the main points relating to bat boxes are as follows:

- Bat boxes were the most frequently deployed roosting provision (i.e. alternative roosts), being installed at 64% (n = 71) of sites surveyed as a compensation or enhancement measure.
- Box frequencies ranged from 1 to 41 at sites where they were installed, with an average of 6.6 boxes per site.
- Bats, or evidence of bats, were recorded in 20% of these bat boxes.

- Bat boxes mounted externally on buildings showed the highest occupation rate regardless of species while Common pipistrelle showed a preference for these over tree mounted boxes; the opposite was true for soprano pipistrelle.
- The four most popular bat box models used by consultants in the study were all Schwegler woodcrete bat boxes. Bat presence was highest in the 1FF bat box design (32%, n = 53) and lowest for birds (8%). The tree-mounted 2F and wall-integrated 1FR/2FR models both demonstrated similar bat presence rates of 23% (n = 43) and 25% (n = 32) respectively. The 2FN tree-mounted model showed the lowest presence rate for bats (11%, n = 19) and the highest for birds (58%). There were also 26 timber bat boxes, none of which were used by bats.

The author has also erected a number of bat box schemes and, where possible, has completed occasional monitoring visits. One such example is a bat box scheme erected in Kileshandra, Co. Cavan which consists of 8 Schwegler woodcrete bat boxes of various designs. The bat boxes were erected on mature trees located in a linear woodland adjacent to a river. This bat box scheme was erected in 2012 as part of mitigation for the demolishment of a large derelict building where small satellite roosts were recorded for *Pipistrellus* spp. and Daubenton's bat. Two site visits have been completed since 2012 and during these visits the bat boxes were checked for evidence of bat usage. The first site visit was on 25/8/2015 and one bat box was occupied by a single Leisler's bat while the additional seven bat doxes had evidence of bat droppings (*Pipistrellus* spp. and *Myotis* spp.). During the second site visit (27/7/2019) four bat boxes were occupied by bats (Soprano pipistrelle x1 individual (adult male), Leisler's bat x1 individual (adult male) and two bat boxes with x16 Daubenton's bats and x10 Daubenton's bats respectively). Biometrics was recorded for the 12 of the bats (which included 10 of the Daubenton's bats recorded in the bat box with 16 individuals) and five of these Daubenton's bats were lactating females with the remaining five Daubenton's bats recorded as juveniles, thereby indicating that this bat box was used as a maternity roost. The remaining four bat boxes all had droppings within for *Pipistrellus* spp and Leisler's bats. This bat box scheme, while just one example, demonstrates that when bat boxes are erected in an area with good bat habitat (bat survey documented a high level of bat activity for the named bat species), a high level of occupancy of bat boxes will occur.

In relation to bat boxes, Marnell *et al.* (2022), a document that provides guidelines that are considered to be practical and effective based on past experience, recommends that the design life of potential bat boxes, including essential maintenance, should be about 10 years, as this would be comparable with the lifespan of the tree roosts that bat boxes are designed to mimic. The guidelines continues by stating that the "This lifespan can be achieved with good quality wooden boxes and exceeded by woodcrete bat boxes or other types of construction that ensure any softwoods are protected from the weather and attack by squirrels" (note – this includes woodstone bat boxes).

In relation to the number of bat boxes recommended to be erected, Lintott & Mathews (2018) found that the greater the number of bat boxes deployed, the greater the probability of at least one of the boxes becoming occupied and that the odds of bats occupying at least one box increased by approximately 7% with each additional bat box that was deployed. Bat boxes are erected, as part of this proposed development, to mitigate for the loss of potential roosts in trees. Therefore the number of bat boxes are calculated according to the number of trees with additional boxes added for greater bat conservation value.

Therefore Schwegeler woodcrete bat boxes are recommended as a bat mitigation measure and the authors preference to use 1FF designs as this box is open at the bottom which reduces build-up of droppings (i.e. it is a self-cleaning bat box). Both McAney & Hannify (2015) and Collins *et al.* (2020) demonstrated that usage of this bat box design by bat species recorded in this survey report. This

bat box is also less likely to be used by birds and therefore retaining it for bat usage between monitoring visits. An additional two units of 1F are also recommended to provide a 2nd type of bat box for bat usage and is a design noted by the author to be occupied by Leisler's bats. To increase occupancy of bat boxes by bats it is important to erect bat boxes 4m or higher (to ensure that bat boxes are out of reach from disturbance by humans and predation by other mammals) and that they should be located where bats have been documented foraging and commuting. The aspect of the bat box is not an influencing factor in relation to occupancy. These recommendations have all been included in this report.

1.2.3.3 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.

The above guidelines have been consulted in the design of landscaping for bats as part of this proposed development.

1.3 Project Description

1.3.1 Site Location

The proposed development is located on Hayden's Lane, Lucan, Co. Dublin. The proposed development site consists of a vacant industrial site surrounded by treelines/hedgerows. It is located adjacent to the Griffeen Valley Park. The proposed development site is located in a largely urban setting.

Figure 2a: Aerial photograph of proposed development site: Hayden's Lane, Lucan, Co. Dublin.

1.3.2 Proposed Project

The development description is as follows:

- Construction of a residential development comprising 3 no. 2-5 storey blocks of 66 no. apartments (18 no. 1-bed, 45 no. 2-bed and 3 no. 3-bed) all with associated private balconies/terraces to the north/south/east/west elevations;
- Vehicular and pedestrian access from Hayden's Lane to the north west of the site and closure of the second existing vehicular entrance at south west of site;
- A pedestrian access from Griffeen Park to the south east of the site;
- Provision of car and cycle parking, public and communal spaces, bin stores and all associated site development and clearance works, landscaping, boundary treatments and other servicing works.

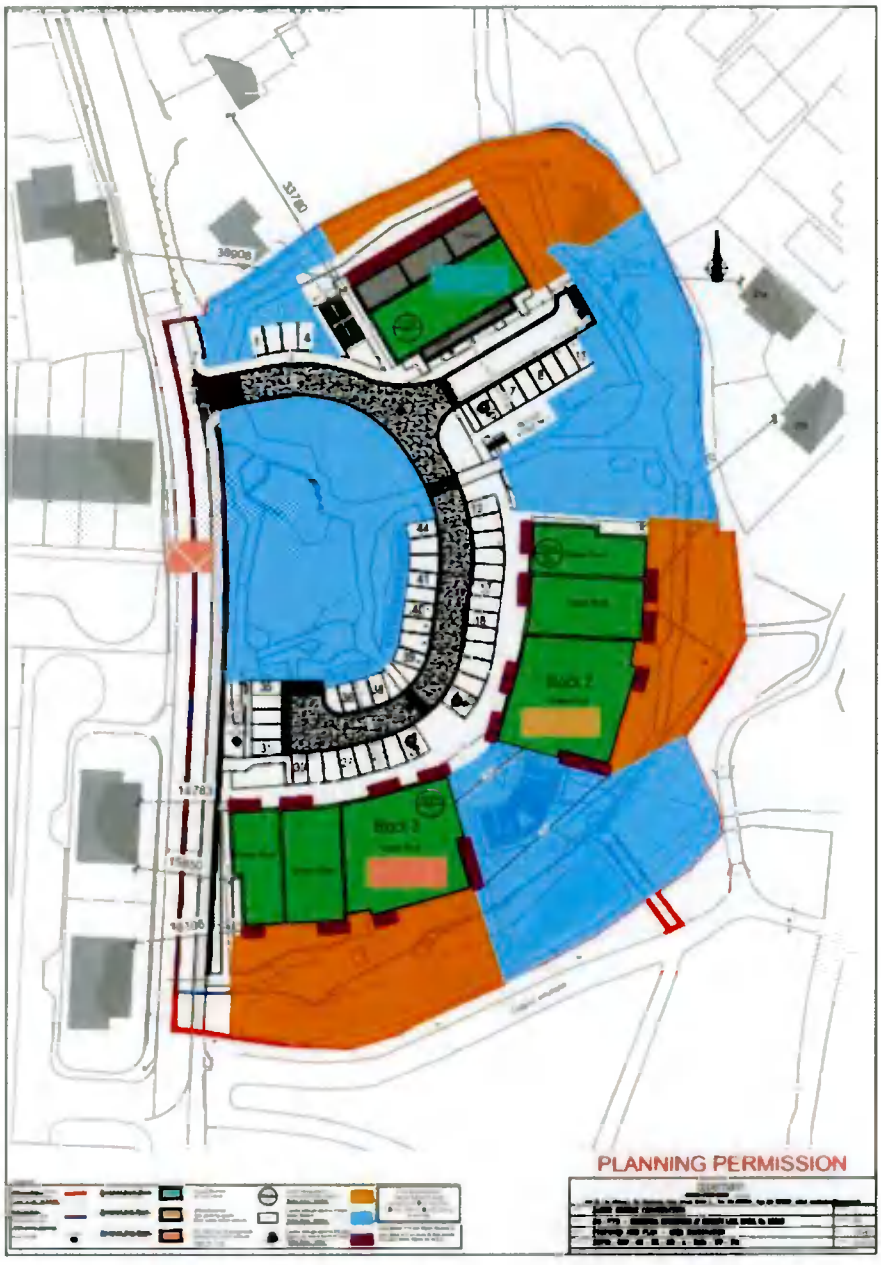

Figure 2b: Layout of proposed development site: Hayden's Lane, Lucan, Co. Dublin.

2. Bat Survey Methodology

2.1 Daytime Inspections

One purpose of daytime inspections is to determine the potential of bat roosts within the survey area. Due to the transient nature of bats and their seasonal life cycle, there are a number of different type of bat roosts. Where possible, one of the objectives of the surveys is to be able to identify the types of roosts present, if any. However, the determination of the type of roost present depends on the timing of the survey and the number of bat surveys completed. Consequently, the definition of roost types, in this report, will be based on the following:

Table 3: Bat Roost Types (adapted from Collins 2016).

Roost Type	Definition	Time of Survey
Day Roost	A place where individual bats or small groups of males, rest or shelter in the daytime but are rarely found by night in the summer.	Anytime of the year
Night Roost	A place where bats rest or shelter in the night but are rarely found in the day. May be used by a single bat on occasion or it could be used regularly by the whole colony.	Anytime of the year
Feeding Roost	A place where individual bats or a few bats rest or feed during the night but are rarely present by day.	Anytime of the year
Transitional Roost	A place used by a few individuals or occasionally small groups for generally short periods of time on waking from hibernation or in the period prior to hibernation.	Outside the main maternity and hibernation periods.
Swarming Site	Where large numbers of males and females gather. Appear to be important mating sites.	Late summer and autumn
Mating Site	Where mating takes place.	Late summer and autumn
Maternity Site	Where female bats give birth and raise their young to independence.	Summer months
Hibernation Site	Where bats are found, either individually or in groups in the winter months. They have a constant cool temperature and humidity.	Winter months in cold weather conditions
Satellite Roost	An alternative roost found in close proximity to the main nursery colony and is used by a few individuals throughout the breeding season.	Summer months

2.1.1 Building & Structure Inspection

There are no buildings within the proposed development site.

2.1.2 Tree Potential Bat Roost (PBRs) Inspection

Trees that may provide a roosting space for bats were classified using the Bat Tree Habitat Key (BTHK, 2018) and the classification system adapted from Collins (2016). The Potential Roost Features (PRFs) listed in this guide were used to determine the PBR value of trees.

Trees identified as PBRs were inspected during the daytime, where possible, for evidence of bat usage. Evidence of bat usage is in the form of actual bats (visible or audible), bat droppings, urine staining, grease marks (oily secretions from glands present) and claw marks. In addition, the presence of bat fly pupae (bat parasite) also indicated that bat usage of a crevice, for example, has occurred in the past.

A Phase 1 inspections was undertaken of trees within the proposed development site that may be suitable as roosting sites for bats. Inspections were undertaken visually with the aid of a strong torch beam (LED Lenser P14.2) during the daytime searching for PRFs, if visible. To aid this Phase 1 inspection, the tree report was consulted to supplement data collected.

Table 4: Tree Bat Roost Category Classification System (adapted from Collins, 2016).

Tree Category	Description
1 High	Trees with multiple, highly suitable features (Potential Roosting Features = PRFs) capable of supporting larger roosts
2 Moderate	Trees with definite bat potential but supporting features (PRFs) suitable for use by individual bats;
3 Low	Trees have no obvious potential although the tree is of a size and age that elevated surveys may result in cracks or crevices being found or the tree supports some features (PRFs) which may have limited potential to support bats;
4 Negligible	Trees have no potential.

2.1.3 Bat Habitat & Commuting Routes Mapping

The survey site was assessed during daytime walkabout surveys, in relation to potential bat foraging habitat and potential bat commuting routes. Such habitats were classified according to Fossit, 2000 (Appendix 1, Table 1.B) while hedgerows were classified according to BATLAS 2020 classification (Bat Conservation Ireland, 2015) (Appendix 1, Table 1.A). Bat habitats and commuting routes identified were considered in relation to the wider landscape to determine landscape connectivity for local bat populations through the examination of aerial photographs.

2.2 Night-time Bat Detector Surveys

2.2.1 Dusk & Dawn Bat Surveys

Dusk Emergence Surveys were completed from 10 minutes before sunset to at least 110 minutes post sunset and the surveyor position himself within the proposed development site to determine if bats were roosting in the mature trees along the boundary of the proposed development site.

The following equipment was used:

Surveyor 2: Bat Logger M2 Full Spectrum Bat Detector and Pettersson D200 Heterodyne Bat Detector.

A walking transects was completed post Dusk Emergence Surveys and involved the surveyor walking the park adjacent to the proposed development site (Griffeen Valley Park). Mapping of bat encounters was undertaken using Google My Map facility (Longitude & Latitude co-ordinates, Excel CSV file). Validation of bat records was completed by the principal bat surveyor prior to mapping.

2.2.2 Passive Static Bat Detector Survey

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. This 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 position horizontally to reduce potential damage from rain. Bat Logger A+ units and Wildlife Acoustics Song Meter SM2, SM2 BAT+ SM4 Bat FS and SM3 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. These results are depicted on a graph showing the number of bat passes per species per hour/night. Each bat pass does not correlate to an individual bat but is representative of bat activity levels. 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 is one individual bat. On the other hand, Leisler's bats tend to travel through an area quickly and therefore an individual sequence or bat pass is more likely to be indicative of individual bats

The recordings are analysed using Wildlife Acoustics Kaleidoscope Pro. Each sequence of bat pulses are noted as a bat pass to indicate level of bat activity for each species recorded. This is either expressed as the number of bat passes per hour or per survey night.

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

Table 5: Static Bat Detectors deployed during Static Bat Detector Surveys.

Static Unit Code	Bat Detector Type	Recording Function	Microphone
SM Mini Bat Units 1 - 3	Wildlife Acoustics SongMeter 2 Bat+	Passive Full Spectrum	SMM-U2

2.3 Desktop Review

2.3.1 Bat Conservation Ireland Database

Bat Conservation Ireland acts as the central depository for bat records for the Republic of Ireland. Its' bat database is comprised of >60,000 bat records. The database primarily contains bat records from the following datasets:

- Irish Bat Monitoring Programme

The Irish Bat Monitoring Programme is comprised of four surveys (Car-based Bat Monitoring Scheme (2003-), All Ireland Daubenton's Bat Waterways Survey (2006-), Brow Long-eared Bat Roost Monitoring Scheme (2007-) and Lesser Horseshoe Bat Monitoring Scheme (1980s-). Apart from the latter survey, all monitoring data is stored on the BCIreland database.

- BATLAS 2020 & 2010

BCIreland has undertaken two all-Ireland species distribution surveys (2008-2009 for BATLAS 2010 and 2016-2019 for BATLAS 2020) of four target bat species (Common and soprano pipistrelle, Leisler's bats and Daubenton's bat).

- Ad Hoc Bat Records

Ad hoc bat records from national bat groups, ecological consultants and BCIreland members are also stored on the BCIreland database.

- Roost Records

These records are only report at a 1km level to protect the location of private dwellings and to protect such important bat records.

A 1km radius search was requested for the Irish Grid Reference O0345433028.

2.3.2 Bat Conservation Landscape Favourability

Bat Conservation Ireland produced a landscape conservation guide for Irish bat species using their database of species records collated during the 2000 - 2009 survey seasons. An analysis of the habitat and landscape associations of all bat species deemed resident in Ireland was undertaken and reported in Lundy *et al.*, 2011. The geographical area suitable for individual species was used to identify the core favourable areas of each species. This was produced as a GIS layer for local authorities and planners in order to provide a guide to the consideration of bat conservation. The island is divided into 5km squares and the landscape favourability of each 5km square for each species of bat was modelled. A caveat is attached to the model and it is that the model is based on records held on the BCIreland database, while core areas have been identified, areas outside the core area should not be discounted as unimportant as bats are a landscape species and can travel many kilometres between roosts and foraging areas nightly and seasonally. This model was used as part of the desktop study for this report.

2.4 Photographic Record

A photographic record is completed for the survey and is presented within the text.

2.5 Previous Bat Survey Report

A previous bat survey report was completed by Bat Eco Services in 2015. A daytime inspection and dusk survey was completed on 18th July 2015 and a dawn survey was completed on 19th July 2015. Two static recording units were deployed for one night's surveillance.

Dusk surveying was also completed using a bat detector (Wildlife Acoustics EM3 and Pettersson D200 Heterodyne Bat Detector) from 21:30 hrs to 00:00 hours and 03:30 hrs to 05:00 hrs. Two units of Wildlife Acoustic SongMeter 2 Platform Unit were also deployed and located as follows:

SM1 located to the rear of factory along boundary hedge
SM2 located to gable side of factory, adjacent to halting site

The results of the 2015 bat survey are as follows: there was no evidence of bats roosting in any of the buildings located on site. The survey area has a low potential of providing foraging areas for bats due to its location within a highly built up area with extensive street lighting.

Dusk Survey Results

- four common pipistrelles were recorded commuting from the direction of halting site towards green fields.

Dawn Survey Results

- No bats were recorded during the dawn survey, re-confirming that there are no roosting bats.

SongMeters Results

- Two species of bat was recorded on the SongMeter unit located to the rear of the factory.
- Common pipistrelles (10 passes) were recorded in the 22:00-23:00 hr reflecting commuting bats, similar to the Dusk Survey results.
- Between the hours of 01:00 hrs and 04:00 hrs occasional passes from soprano pipistrelle and common pipistrelle were recorded and indicative of foraging individuals. But the number of passes were low.

Report Citation: Aughney, T. (2015) Bat Survey: Hayden's Lane, Lucan, Co. Dublin. Unpublished report prepared for JNP, Dublin. Bat Eco Services.

3. Bat Survey Results

3.1 Daytime Inspections

3.1.1 Tree Potential Bat Roost (PBRs) Inspection

The trees located along the boundary of the proposed development site were inspected and the following trees were deemed to have a Potential Bat Roost value (PBR):

Table 6: Tree PBR inspection results.

Tree No.	Tree Species	Grid Reference	PRFs	Bat Usage	Value
T013	Salix alba	00349233008	Split limbs, damage to trunk	None recorded	Category 2
T023	Eucalyptus	00347332973	Tree holes, spilt limbs	None recorded	Category 2

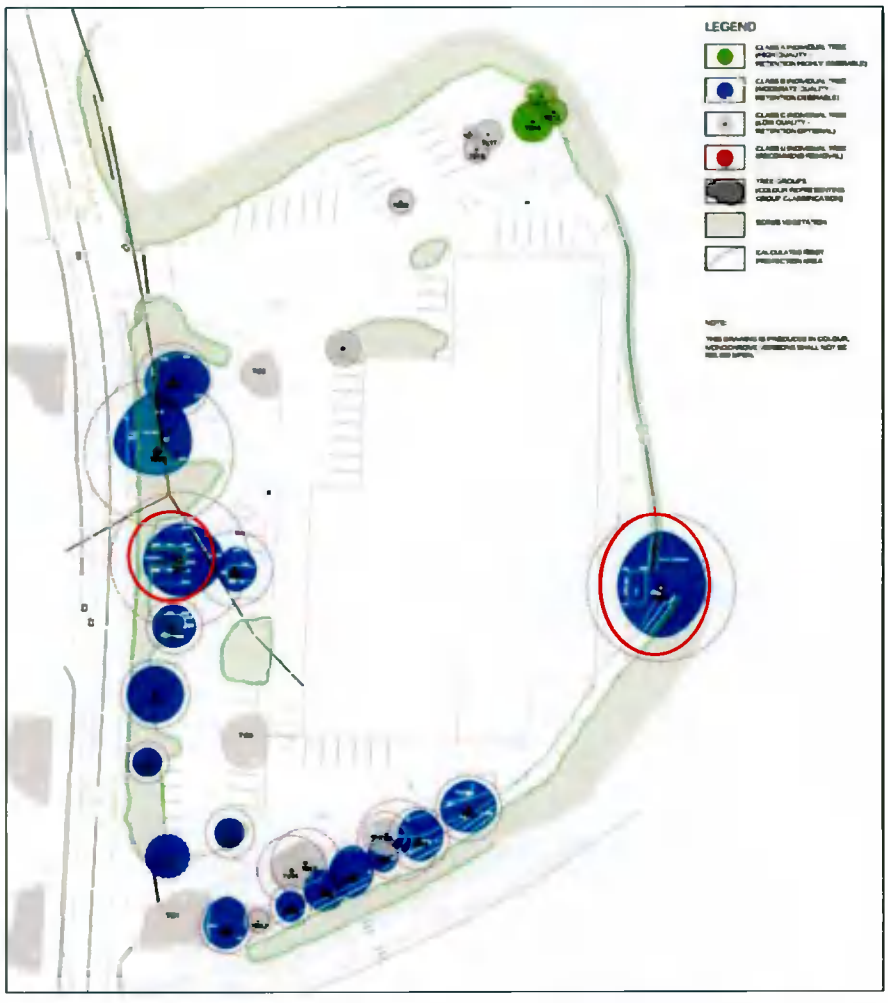

Figure 3: Tree Survey Report - Hayden's Lane, Lucan, Co. Dublin with PBRs enclosed in Red Circles (Source: Cunnane, Stratton & Reynolds).

3.1.2 Bat Habitat & Commuting Routes Mapping

The habitat types, with reference to Fossit (2000) were recorded both within the survey area and adjacent to the survey area.

Table 7a: Habitat types present within survey area.

Habitat	Yes	Habitat	Yes	Habitat	Yes	Habitat	Yes
Cultivated land		Salt marshes		Exposed rock		Fens/flushes	
Built land	Yes	Brackish waters		Caves		Grasslands	
Coastal structures		Springs		Freshwater marsh		Scrub	
Shingle/gravel		Swamps		Lakes/ponds		Hedges/treelines	Yes
Sea cliffs/islets		Disturbed ground	Yes	Heath		Conifer plantation	
Sand dunes		Watercourse		Bog		Woodland	

Table 7b: Habitat types present adjacent to survey area.

Habitat	Yes	Habitat	Yes	Habitat	Yes	Habitat	Yes
Cultivated land		Salt marshes		Exposed rock		Fens/flushes	
Built land	Yes	Brackish waters		Caves		Grasslands	Yes
Coastal structures		Springs		Freshwater marsh		Scrub	
Shingle/gravel		Swamps		Lakes/ponds		Hedges/treelines	Yes
Sea cliffs/islets		Disturbed ground		Heath		Conifer plantation	
Sand dunes		Watercourse	Yes	Bog		Woodland	

3.2 Night-time Bat Detector Surveys

3.2.1 Dusk Bat Survey & Walking Transects

The following figures summarises the results of the bat detector survey completed on 15/4/2021 (Weather conditions: 7oC, partial cloud cover, light breeze and dry). Three species of bat were recorded: common pipistrelle, soprano pipistrelle and Leisler's bat during the survey period (20:06 hrs to 23:06 hrs).

A total of 29 common pipistrelle bat encounters were recorded during the survey. The first common pipistrelle was recorded at 20:27 hrs. Individuals were recorded commuting through the proposed development site towards the adjacent park (Figure 4a, Red arrow). Individuals were recorded foraging around the perimeter of the proposed development site.

A total of 41 soprano pipistrelle bat encounters were recorded during the survey. The first soprano pipistrelle was recorded at 20:39 hrs. Individuals were recorded commuting through the proposed development site towards the adjacent park (Figure 4b, Yellow arrow). Individuals were recorded foraging around the perimeter of the proposed development site.

A total of 4 Leisler's bat encounters were recorded during the survey. The first Leisler's bat was recorded at 21:03 hrs. Individuals were recorded commuting through the proposed development site towards the adjacent park, but no individuals of this species was recorded foraging within the park during the walking transect.

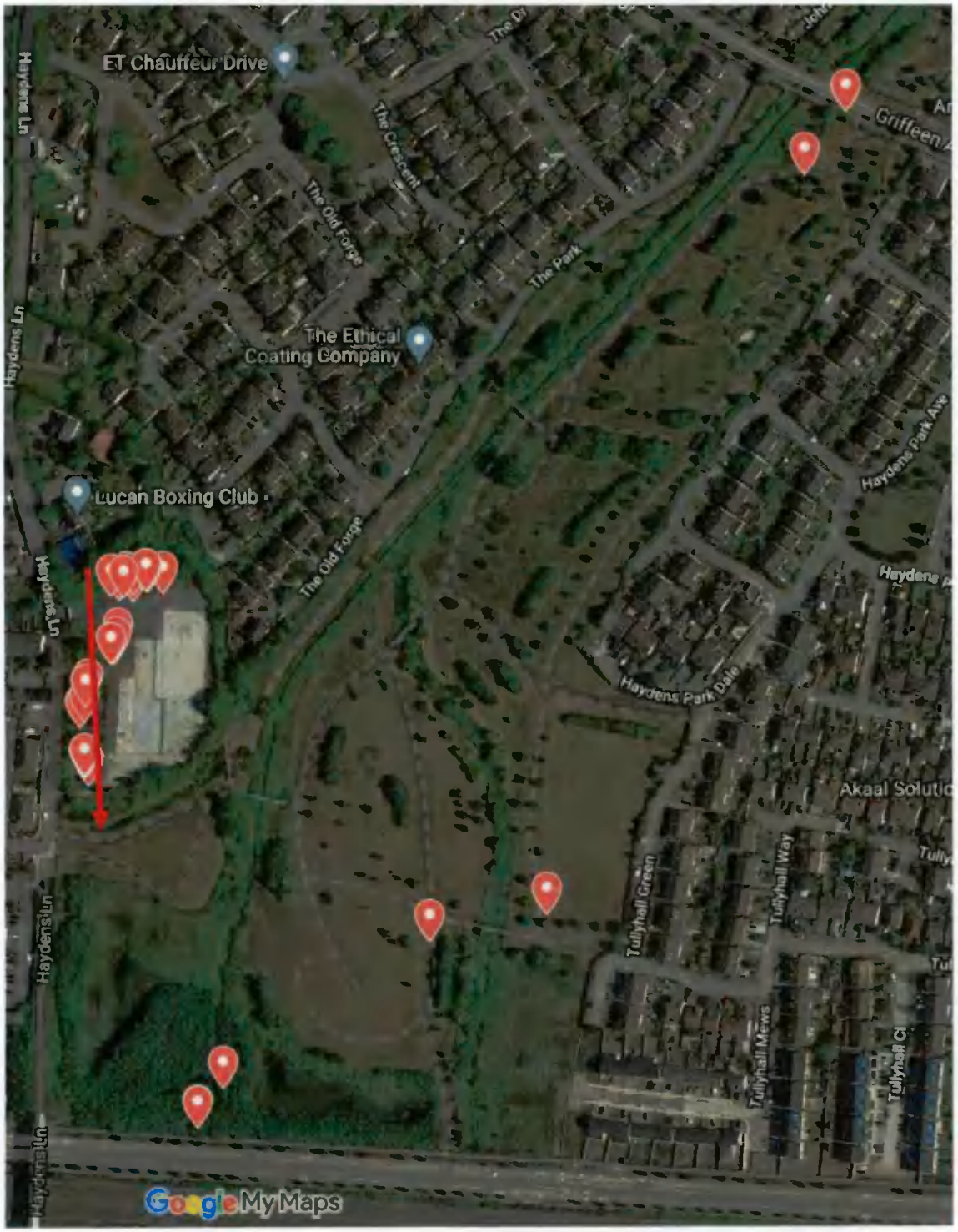

Figure 4a: Common pipistrelle bat encounters during dusk bat survey and walking transect.

Figure 4b: Soprano pipistrelle bat encounters during dusk bat survey and walking transect.

Figure 4c: Leisler's bat encounters during dusk bat survey and walking transect.

3.2.2 Passive Static Bat Detector Survey

The following tables summarises the results recorded on the static units deployed (Please see Figure 5). Three static units were deployed for 15 nights of surveillance. This is a long static surveillance period but this was completed in order to compensate for the cold nights recorded in April 2021 and for the early static surveillance (i.e. bat activity surveys are recommend to be undertaken from May to September). A total of five species of bat was recorded during the static surveillance: common pipistrelle, soprano pipistrelle, Leisler's bat, Daubenton's bat and brown long-eared bat.

Figure 5: Location of static units during passive surveillance.

Table 8a: Results of Static Bat Detectors deployed during Static Bat Detector Surveys.

Static Code	Location Description	Grid Reference	Survey Period
Mini Bat 1	On tree along northern boundary of proposed development site.	O0347733072	31/3/2021 to 15/4/2021
Mini Bat 2	On tree along northern boundary of proposed development site.	O0344232958	31/3/2021 to 15/4/2021
Mini Bat 3	On tree within park woodland.	O0351032808	31/3/2021 to 15/4/2021

The highest bat activity level was recorded on the static unit deployed in the adjacent park compared to the two static units located within the proposed development site while a higher bat species diversity was recorded on the static units within the proposed development site (total of five bat species, Figure 6a). While bat activity was recorded on the static units located within the proposed development site, as observed during the dusk survey, thee are individual bats commuting through and travelling towards the adjacent park.

Table 8b: Results of Static Bat Detectors deployed during Static Bat Detector Surveys.

Date	Common pipistrelle	Soprano pipistrelle	Leisler's bat	Daubenton's bat	Brown long-eared bat
Mini Bat 1	169	131	19	1	0
Mini Bat 2	185	122	25	0	4
Mini Bat 3	465	489	17	1	0

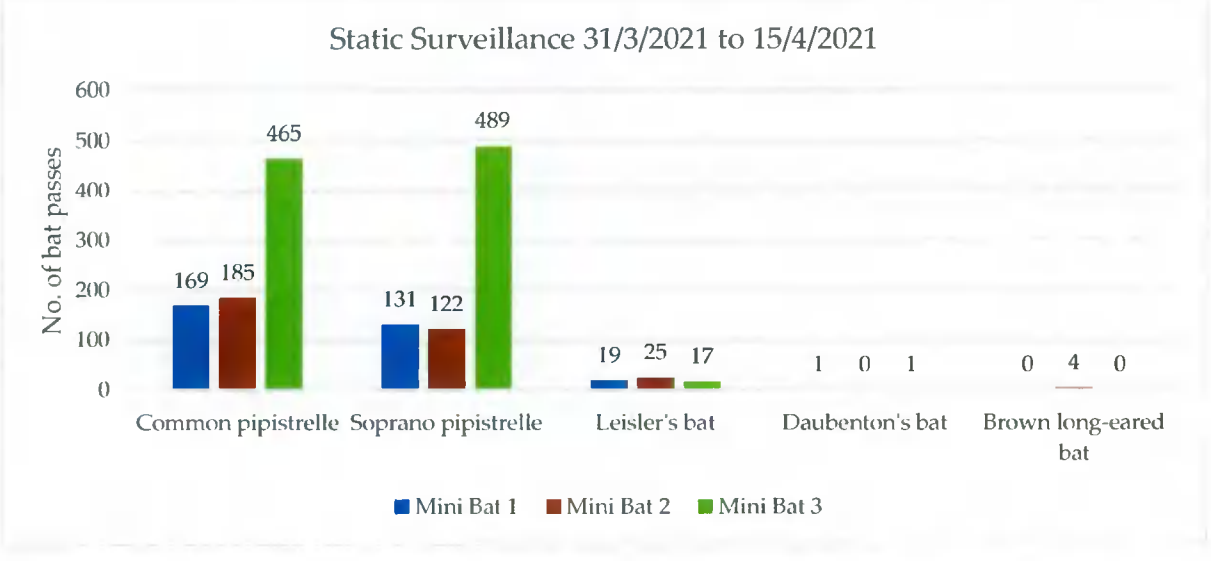

Figure 6a: Total bat passes for each of the bat species recorded during the static surveillance.

In relation to the nightly activity on the static units, the majority of the bat passes were recorded from 20:00 hrs to 23:00 hrs and this reflects the temperatures of the surveillance nights. Insects tend to fly in mild weather conditions and, therefore, bats are active when their prey items are active. As a consequence, there is little bat activity once the air temperature drop below 6°C. indeed, on nights where air temperatures were low, no bat activity was recorded (Figure 6b). The brown long-eared bats recorded on mini Bat 1 (Table 8b) were four passes recorded on three separate nights and were

recorded between the hours of 00:00 hrs to 04:00 hrs and therefore are likely to be foraging individuals.

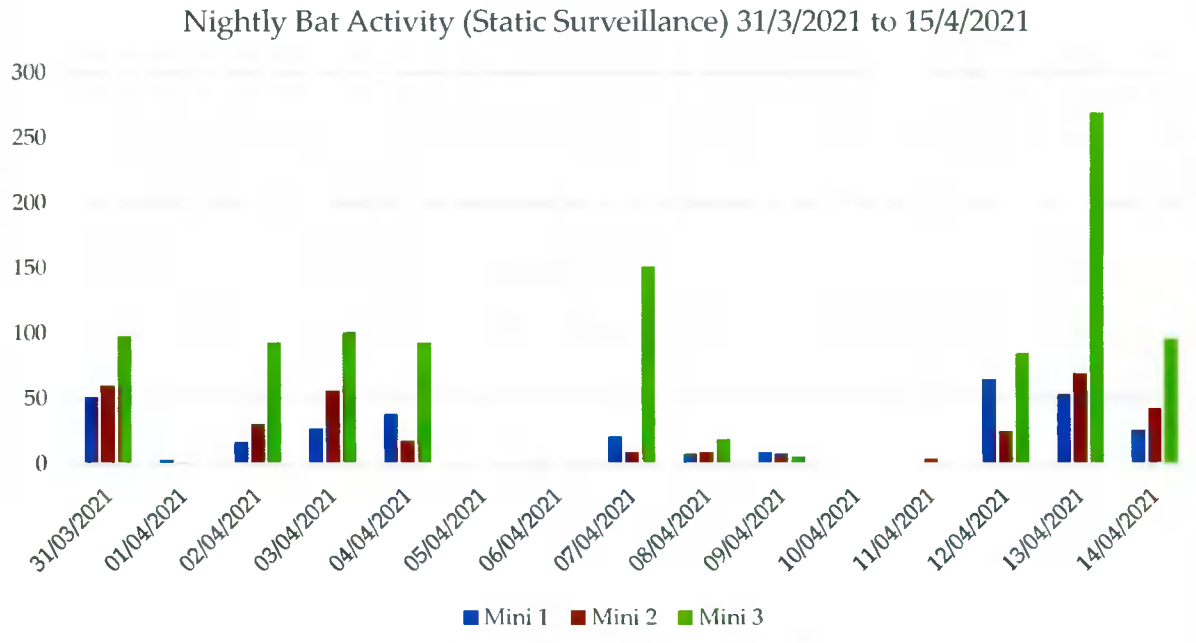

Figure 5b: Nightly total bat passes for each of the static units deployed during static surveillance.

As a general guide, activity level is determined by the author as follows: Low = <10 bat passes/hr; Medium = >10 - <50 bat passes/hr; High = >50 bat passes/hr). The static units recorded for approximately 8 hours per night. However, as the nightly temperature tended to drop too low for bat activity after midnight, just taking 4 hours as the nightly bat activity period the nightly data was examined (Please see tables in Appendices for nightly breakdown of activity). Therefore the activity levels for each bat species is presented in the Table 8b for the entire 15 days of surveillance indicates a Low level of bat activity for each bat species at each static unit locations within the proposed development site. In relation to the static located in the park, occasionally a Medium level of bat activity for common and soprano pipistrelles was recorded but a low level for all other bat species.

NOTE: The behaviour of bats during commuting and foraging greatly influences the level of bat passes recorded on static units. The number of bat passes do not equate to the number of bats flying past the static unit. Pipistrellus species tended to foraging as they commute and therefore are regularly observed flying up and down a treeline or hedgerow before moving on in the landscape. Leisler's bats fly high in the sky and therefore can be observed flying fast through the landscape, occasionally foraging over treetops as they commute. As a consequence, Pipistrellus species bat activity tends to result in a higher number of bat passes recorded on static units compared to Leisler's bats. In relation to other bat species recorded, as they tend to be less common in the landscape compared to common pipistrelles, soprano pipistrelles and Leisler's bats, their recorded presence is notable. Exceptions to this would include Daubenton's bats on a waterway or a static located adjacent to a known bat roost.

3.3 Lighting

Lighting was noted in Griffeen Valley Park (low level along walking tracks) and extensively street lighting was note along Hayden's Lane.

3.4 Desktop Review

3.4.1 Bat Conservation Ireland Database

The bat records within a 1km radius of the proposed development on the BCIreland database. The returned records are as follows:

Roost – 1 record (brown long-eared roost)
Transect – 1 record (Daubenton's bat on Grand Canal at 12th Lock)
Ad Hoc – 4 records (Daubenton's bats, common pipistrelle, soprano pipistrelle, Leisler's bat and brown long-eared bat).

The current bat survey recorded the same bat species list as already known for a 1km radius data search of the BCIreland database of the proposed development site.

An updated database search was undertaken and no additional records are available for the search area.

3.4.2 Bat Conservation Landscape Favourability

Figure 6 depicts the BCIreland Landscape Favourability Model (Lundy *et al.*, 2011). The county is divided into 5km squares and the different colouring of the square, indicates the favourability of the 5km square for bats. This GIS layer is hosted on the NBDC website www.biodiversityireland.ie. The proposed development site is approximately located in the Red Box. This 5km square has an overall medium favourability for bats, in general. The percentage favourability for each bat species is presented in the table below. The 5km square only has a Medium to High favourability for the three species of bat recorded during the surveys: common pipistrelle, brown long-eared bat and Leisler's bat.

Table 9: 5km Square Landscape Favourability value for individual bat species.

Bat species	5km Square
Common pipistrelle	41% (Medium to High)
Soprano pipistrelle	35% (Medium)
Nathusius' pipistrelle	19% (Low to Medium)
Leisler's bat	41% (Medium to High)
Brown long-eared bat	40% (Medium to High)
Daubenton's bat	19% (Low to Medium)
Natterer's bat	26% (Low to Medium)
Whiskered bat	19% (Low to Medium)
Lesser horseshoe bat	0% (Not suitable)

Figure 6: BCIreland Landscape Favourability Model 5km square – proposed development site location is marked with a Red Square (Source: www.biodiversityireland.ie).

3.5 Survey Effort, Constraints & Survey Assessment

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

Table 10: Survey Effort, Constraints & Survey Assessment Results.

Category	Discussion
Timing of surveys	April 2021 – these is outside the preferred survey months of May to September. However, to compensate for this early survey, a longer static surveillance was undertaken.
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 ○
Weather conditions	Cool weather conditions during static surveillance period.
Survey Constraints	Early survey period
Survey effort	Dusk Survey & Walking Transect = 3 hrs Static Surveillance – 3 units, 15 night = 360 hrs **TOTAL = 363 hrs**
Extent of survey area	Proposed development site and adjacent Griffeen Valley Park
Equipment	All in good working order

The extent of the surveys undertaken has achieved to determine:

- Presence / absence of bat within the survey area;
- A bat species list for the survey area;
- Extent and pattern of usage by bats within the survey area.

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

4. Bat Ecological Evaluation

4.1 Bat Species Recorded & Sensitivity

Five species of bat were recorded foraging and commuting within the proposed development area. No bats roosts were recorded. For a small survey area, this is a high level of bat biodiversity but this reflects that fact that the proposed development site is located adjacent to Griffeen Valley Park.

Three of the bat species recorded were common pipistrelle, Leisler's bat and soprano pipistrelle and these are the three most common bat species in Ireland (Roche *et al.*, 2014). The remaining two bat species are considered to be less common but widespread. Overall a low level of bat activity was recorded within and adjacent to the proposed development area. A low-medium level of bat activity was recorded within the adjacent park and this reflects the wider array of bat habitats available for local bat populations.

Two trees were identified as have a Potential Bat Roosts (PBR) value but not bats were recorded roosting within.

4.2 Bat Foraging Habitat & Commuting Routes

As the proposed development site is a small area and the bat activity recorded is more associated with commuting individuals with some foraging recorded. Bats commuted through the proposed development site to such areas as the Griffeen Valley Park.

The proposed development area is located in a primarily urban area with some green parklands and vegetation associated with local Griffeen Valley Park which provide bat foraging and commuting habitat in the immediate area.

4.3 Zone of Influence – Bat Landscape Connectivity

The proposed development area is located in a primarily urban area with some green parklands and vegetation associated with local Griffeen Valley Park which provide bat foraging and commuting habitat in the immediate area. Other potential bat habitats located in the local area include Finnstown Castle to the west and Vesey Park to the north.

5. Impact Assessment & Mitigation

The level of bat activity within the proposed development site is considered to be Low for all bat species recorded.

The proposed development would result in the following:

- Removal of tall vegetation / trees along sections of the boundaries (Construction Impacts)
- Increase in human activity (noise and light levels) (Operational Impacts)

As there are no confirmed bat roosts within the proposed development site, there is no assessment made in relation to potential Scale of Impact according to Figure 20 of Marnell *et al.* (2022).

Two trees were identified as Potential Bat Roosts (PBRs) and both of these will be retained. Therefore there will be no impact on PBRs within the proposed development site.

The proposed development presented in this updated report has been reassessed according to the bat survey information gathered in 2021 and on reflection of information gathered in 2015. The proposed development is a more compact proposal coupled with reduced infrastructure that is considered to have less of an impact on local bat populations. There is also a greater retention of exiting trees within the proposed development site which will benefit local bat populations in relation to commuting and foraging individuals. This is reflected in the assessment completed in the table below.

There is a Low level of bat activity within the proposed development area. The potential impact of the proposed development is considered to have a scale of impact of Slight Negative on named bat species if no bat mitigation measures are implemented. This has been considered in relation to the increased lighting for the proposed development. The operational impacts of the proposed development will likely be Permanent.

Table 11: Potential Negative scale of impact of the proposed development on the different bat species recorded during survey work.

Works	SP	CP	Leis	BLE	Daub
Lighting of development area	Slight	Slight	Not-Significant	Slight	Slight
Removal of trees etc.	Slight	Slight	Slight	Slight	Slight
Operation of the development site	Slight	Slight	Not-Significant	Slight	Slight
Infrastructure	Slight	Slight	Not-Significant	Slight	Slight

SP = soprano pipistrelle, CP = common pipistrelle, Leis = Leisler's bat, BLE = brown long-eared bat, Daub = Daubenton's bat.

5.1 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 (2018). 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. Please see Section 1.2.3 for more information.

In order to reduce the potential negative impact of the proposed development on local bat populations, the following mitigation measures are recommended to be fully implemented.

5.1.1 PBR Trees

The two trees identified as PBRs will be retained, protected during construction works and incorporate into landscape plans. As these trees are being retained, there are no mitigation measures required in relation to additional tree surveys and tree felling procedure.

5.1.2 Bat Box Scheme

A bat box scheme will be erected as part of general conservation measures for local bat populations and the bat boxes chosen are for the bat species recorded within and adjacent to the proposed development site.

- 6 summer bat boxes (Schwegler Woodcrete 1FF (x4 units) and 1F (x2 units) bat box designs) to be erected within Griffeen Valley Park under consultation with the park's management team and local authority.

Bat boxes scheme will be sited carefully and this will be undertaken by a bat specialist. Bat boxes will be erected prior to construction works. The bat specialist will erect the bat boxes with assistance from the contractor. Some general points that will be follow include:

- Straight limb trees (or telegraph pole) with no crowding branches or other obstructions for at least 1 metre above and below position of bat box.
- Diameter of tree should be wide and strong enough to hold the required number of boxes.
- Locate bat boxes in areas where bats are known to forage or adjacent to suitable foraging areas. Locations should be sheltered from prevailing winds.
- Bat boxes should be erected at a height of 4-5 metres to reduce the potential of vandalism and predation of resident bats.
- Locations for bat boxes should be selected to ensure that the lighting plan for the proposed site does not impact on the bat boxes.

5.1.3 Lighting Plan

Bats are light sensitive bats species, hence their nocturnal activities. Of the three bat species recorded foraging and commuting within the survey area, two species are Semi-tolerant and the third species if Tolerant. The remaining two species recorded on the static surveillance are Light Sensitive. Artificial lighting is a barrier to nocturnal wildlife and therefore there are strict lighting guidelines to reduce the potential impact of the proposed development on local bat populations.

Luminaire design is extremely important to achieve an appropriate lighting regime. Luminaires come in a myriad of different styles, applications and specifications which a lighting professional can help to select. The following will be following when choosing luminaires. This is taken from the most recent BCT Lighting Guidelines (BCT, 2018).

- All luminaires used will lack UV/IR elements to reduce impact.
- LED luminaires will be used due to the fact that they are highly directional, lower intensity, good colour rendition and dimming capability.
- A warm white spectrum (<2700 Kelvins will be used to reduce the blue light component of the LED spectrum).

- Luminaires will feature peak wavelengths higher than 550nm to avoid the component of light most disturbing to bats.
- Column heights will be carefully considered to minimise light spill. The shortest column height allowed will be used where possible.
- Only luminaires with an upward light ratio of 0% and with good optical control will be used.
- Luminaires will be mounted on the horizontal, i.e. no upward tilt.
- Any external security lighting will be set on motion-sensors and short (1min) timers.
- As a last resort, accessories such as baffles, hoods or louvres will be used to reduce light spill and direct it only to where it is needed.

It was confirmed that the lighting plan for the proposed development will strictly follow the above guidelines. It is also confirmed that lighting will lighting stands will positioned to ensure no conflict with proposed tree planting.

5.1.4 Landscaping plan

It is important to ensure that there is boundary landscape planting to provide suitable bat commuting and foraging habitat. The planting will include native deciduous trees and shrubs which will provide foraging and commuting habitat for bats post construction. The proposed planting will consist of different native tree species depending on the type of planting (i.e. feature trees, parkland trees etc.). Please consult the proposed landscape plan for more details.

In general, the following will also be followed:

- Existing semi-natural habitats and trees will be protected from potential damage during the construction phase and post-construction.
- The use of chemicals (weed killers, *etc.*) will be kept to a minimum within the development zone and will not be used in near woodlands.

5.1.5 Monitoring

Monitoring is recommended post-construction works. This monitoring should involve the following aspects:

- Inspection of bat boxes will be undertaken within one year of erection of bat box scheme/rocket box and will be undertaken for a minimum of 2 years. It will be register with Bat Conservation Ireland.
- A full summer bat survey will be undertaken post-works to check the level of success of the bat mitigation measures.

6. Survey Conclusions

Five species of bat were recorded foraging and commuting within the proposed development area. No bats roosts were recorded within the proposed development area. For a small survey area, this is a high level of bat biodiversity but this reflects that fact that the proposed development site is located adjacent to Griffeen Valley Park.

Three of the bat species recorded were common pipistrelle, Leisler's bat and soprano pipistrelle and these are the three most common bat species in Ireland (Roche *et al.,* 2014). The remaining two bat species are considered to be less common but widespread. Overall a low level of bat activity was recorded within and adjacent to the proposed development area. A low-medium level of bat activity was recorded within the adjacent park and this reflects the wider array of bat habitats available for local bat populations.

Two trees were identified as have a Potential Bat Roosts (PBR) value but not bats were recorded roosting within. Both of these trees will be retained as part of the landscape plan.

Overall in consideration of the level of bat activity and presence of suitable bat habitats in the immediate area, the potential impact quality and significance of the proposed development is considered to be Permanent Slight Negative impact if no bat mitigation measures are implemented.

Mitigation measures are provided to reduce this this potential impact by retaining PBR trees, designing the outdoor lighting according to guidelines, incorporating native tree and shrub planting to provided commuting and foraging habitat and erecting a bat box scheme to provide roosting sites in the adjacent park.

The implementation of the bat mitigation measures will reduce the impact of the proposed development to Permanent Not Significant Negative impact. Therefore the residual impact of the proposed development will be Permanent Not Significant Negative impact.

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8. Appendices

8.1 Appendix 1 Bat Habitat & Commuting Route Classifications

Table 1.A: Hedgerow Category (Bat Conservation Ireland, 2015)

Type of Hedgerow / Treeline	Code	Description / Bat Potential
Small Hedgerow	**SH**	Hedgerow is less than approximately 1.5 m high, there are no, or very few, protruding bushes or trees. This type of hedgerow would provide little shelter to bats. 
Medium Hedgerow	**MH**	Hedgerow is approximately 1.5 to 3 m high. This type of hedgerow will provide foraging and commuting potential for bats. 
Sparse Treeline Hedgerow	**ST**	Hedgerow, low or medium in height, with individuals trees (where tree canopies, for the most part, do not touch).

		
Dense Treeline Hedgerow	**DT**	Large uncut hedgerows or treelines, dominated by mainly large tree or very tall scrub species (e.g. tall hawthorn, blackthorn or hazel), where the canopies are mostly touching. 

Table 1.B: Habitat Classification (Bat Conservation Ireland, 2015, based on Fossit, 2000)

Cultivated land		Salt marshes		Exposed rock		Fens/flushes	
Built land		Brackish waters		Caves		Grasslands	
Coastal structures		Springs		Freshwater marsh		Scrub	
Shingle/gravel		Swamps		Lakes/ponds		Hedges/treelines	
Sea cliffs/islets		Disturbed ground		Heath		Conifer plantation	
Sand dunes		Watercourse		Bog		Woodland	

8.2 Appendix 2 Light Treatments

Lighting, including street lights come in an array of different types. The Information Box provided below is taken from BCT, 2018 and provides an comprehensive summary of lighting types.

INFORMATION BOX – Type of Lights used in exterior lighting applications, (Taken directly from BCT, 2018)

Low-pressure sodium lamps (SOX) (orange lamps seen along roadsides). Light is emitted predominantly at one wavelength, contains no ultraviolet (UV) light, and has a low attraction to insects. The lamps tend to be large which makes it more difficult to focus the light from these lamps. These are in the gradual process of being removed or replaced, in part due to their poor colour rendition, and will not be available past 2019.

2. **High-pressure sodium lamps (SON)** (brighter pinkish-yellow lamps). Commonly used as road lighting. Light is emitted over a moderate band of long wavelengths giving little, if any, UV component, except for the version of the lamp used in horticulture. Insects are attracted to the brighter light. The lamp is of medium size and the light can be more easily directed than low pressure sodium. This lamp is still used for some main road lighting but this is being reduced; these lamps are expected to be phased out in the future.

3. **Mercury lamps (MBF)** (bluish-white lamps). These emit light over a moderate spectrum, including a larger component of UV light to which insects are particularly sensitive. Insects are attracted in large numbers along with high densities of certain tolerant bat species (Rydell & Racey 1993). They ceased to be available in the EU in 2015 and are rare now.

4. **White SON**. This is a reddish white light source. It is based on high pressure sodium technology and has the same UV component as SON. This source is no longer used and is not available now.

5. **Metal halide.** A small lamp and therefore more easy to focus light and make directional. Emits a small UV content. The light source is available in three forms a) quartz arc tube (HQI); b) ceramic arc tube (CDM-T) and c) CosmoPolis which is the newest of the ceramic forms. Still used by some for some exterior lighting applications.

6. **Light emitting diodes (LEDs).** This is the light source of choice for most local authorities. The light emitted is more directional and normally controlled by lenses or sometimes reflectors. The light is produced in a narrow beam. It is an instant light source. LED is available in a number of colour temperatures. Older installations tend to use 'cool white' (blueish colour) at >5700° Kelvin. More recently, 4000°K has become more commonly used. 'Warm white' (more yellow/orange colour) at around 3000°K and as low as 2700°K can now be used with little reduction in lumen output. LED typically features no UV component and research indicates that while lower UV components attract fewer invertebrates, warmer colour temperatures with peak wavelengths greater than 550nm(~3000°K) cause less impacts on bats (Stone, 2012, 2015a, 2015b).

7. **Tungsten halogen**. Is not used in new lighting schemes but may be encountered as security light on a private household.

8. **Compact fluorescent.** Mostly in use in residential street lighting. It produces a white light; variants are available with minimal UV output. It can be used at a low wattage and therefore on a low output to achieve low levels of illuminance (measured in lux).

8.3 Appendix 3 Static Surveillance Results

Mini 1					
Date	Common pipistrelle	Soprano pipistrelle	Leisler's bat	Daubenton's bat	TOTAL
31/03/2021	21	25	5	0	**51**
01/04/2021	3	0	0	0	**3**
02/04/2021	8	9	0	0	**17**
03/04/2021	12	12	3	0	**27**
04/04/2021	27	11	0	0	**38**
05/04/2021	0	0	0	0	**0**
06/04/2021	0	0	0	0	**0**
07/04/2021	13	8	0	0	**21**
08/04/2021	4	4	0	0	**8**
09/04/2021	9	0	0	0	**9**
10/04/2021	0	0	0	0	**0**
11/04/2021	0	0	0	0	**0**
12/04/2021	35	29	1	0	**65**
13/04/2021	18	27	8	0	**53**
14/04/2021	18	6	1	1	**26**
Mini 2					
Date	Common pipistrelle	Soprano pipistrelle	Leisler's bat	Brown long-eared bat	TOTAL
31/03/2021	25	29	5	1	**60**
01/04/2021	1	0	0	0	**1**
02/04/2021	22	7	1	1	**31**
03/04/2021	29	21	6	0	**56**
04/04/2021	10	8	0	0	**18**
05/04/2021	0	0	0	0	**0**
06/04/2021	0	0	0	0	**0**
07/04/2021	8	1	0	0	**9**
08/04/2021	6	3	0	0	**9**
09/04/2021	4	3	1	0	**8**
10/04/2021	0	0	0	0	**0**
11/04/2021	1	3	0	0	**4**
12/04/2021	18	5	2	0	**25**
13/04/2021	33	25	9	2	**69**
14/04/2021	27	15	1	0	**43**
Mini 3					
Date	Common pipistrelle	Soprano pipistrelle	Leisler's bat	Daubenton's bat	TOTAL
31/03/2021	82	14	2	0	**98**
01/04/2021	0	0	0	0	**0**
02/04/2021	74	18	1	0	**93**
03/04/2021	71	26	4	0	**101**
04/04/2021	48	45	0	0	**93**
05/04/2021	0	0	0	0	**0**
06/04/2021	0	0	0	0	**0**
07/04/2021	10	141	0	0	**151**
08/04/2021	12	7	0	0	**19**
09/04/2021	1	5	0	0	**6**
10/04/2021	0	0	0	0	**0**
11/04/2021	1	0	0	0	**1**

12/04/2021	33	49	2	1	**85**
13/04/2021	98	164	7	0	**269**
14/04/2021	35	60	1	0	**96**

8.4 Appendix 4 Bat Assessment Tables

Table 4.1 Guidelines for assessing the potential suitability of proposed development sites for bats, based on the presence of habitat features within the landscape, to be applied using professional judgement.

Suitability	Description Roosting habitats	Commuting and foraging habitats
Negligible	Negligible habitat features on site likely to be used by roosting bats.	Negligible habitat features on site likely to be used by commuting or foraging bats.
Low	A structure with one or more potential roost sites that could be used by individual bats opportunistically. However, these potential roost sites do not provide enough space, shelter, protection, appropriate conditions[a] and/or suitable surrounding habitat to be used on a regular basis or by larger numbers of bats (i.e. unlikely to be suitable for maternity or hibernation[b]). A tree of sufficient size and age to contain PRFs but with none seen from the ground or features seen with only very limited roosting potential.[c]	Habitat that could be used by small numbers of commuting bats such as a gappy hedgerow or unvegetated stream, but isolated, i.e. not very well connected to the surrounding landscape by other habitat. Suitable, but isolated habitat that could be used by small numbers of foraging bats such as a lone tree (not in a parkland situation) or a patch of scrub.
Moderate	A structure or tree with one or more potential roost sites that could be used by bats due to their size, shelter, protection, conditions[a] and surrounding habitat but unlikely to support a roost of high conservation status (with respect to roost type only – the assessments in this table are made irrespective of species conservation status, which is established after presence is confirmed).	Continuous habitat connected to the wider landscape that could be used by bats for commuting such as lines of trees and scrub or linked back gardens. Habitat that is connected to the wider landscape that could be used by bats for foraging such as trees, scrub, grassland or water.
High	A structure or tree with one or more potential roost sites that are obviously suitable for use by larger numbers of bats on a more regular basis and potentially for longer periods of time due to their size, shelter, protection, conditions[a] and surrounding habitat.	Continuous, high-quality habitat that is well connected to the wider landscape that is likely to be used regularly by commuting bats such as river valleys, streams, hedgerows, lines of trees and woodland edge. High-quality habitat that is well connected to the wider landscape that is likely to be used regularly by foraging bats such as broadleaved woodland, tree-lined watercourses and grazed parkland. Site is close to and connected to known roosts.

[a] For example, in terms of temperature, humidity, height above ground level, light levels or levels of disturbance.
[b] Evidence from the Netherlands shows mass swarming events of common pipistrelle bats in the autumn followed by mass hibernation in a diverse range of building types in urban environments (Korsten *et al.*, 2015). This phenomenon requires some research in the UK but ecologists should be aware of the potential for larger numbers of this species to be present during the autumn and winter in large buildings in highly urbanised environments.
[c] This system of categorisation aligns with BS 8596:2015 Surveying for bats in trees and woodland (BSI, 2015).

Figure A: Table 4.1 (p 35) Reproduced from Collins (2016).

(1) Conversion, modification, demolition or removal of buildings (including hotels, schools, hospitals, churches, commercial premises and derelict buildings) which are:

- agricultural buildings (e.g. farmhouses, barns and outbuildings) of traditional brick or stone construction and/or with exposed wooden beams;
- buildings with weather boarding and/or hanging tiles that are within 200m of woodland and/or water;
- pre-1960 detached buildings and structures within 200m of woodland and/or water;
- pre-1914 buildings within 400m of woodland and/or water;
- pre-1914 buildings with gable ends or slate roofs, regardless of location;
- located within, or immediately adjacent to woodland and/or immediately adjacent to water;
- Dutch barns or livestock buildings with a single skin roof and board-and-gap or Yorkshire boarding if, following a preliminary roost assessment, the site appears to be particularly suited to bats.

(2) Development affecting built structures:

- tunnels, mines, kilns, ice-houses, adits, military fortifications, air-raid shelters, cellars and similar underground ducts and structures; unused industrial chimneys that are unlined and brick/stone construction;
- bridge structures, aqueducts and viaducts (especially over water and wet ground).

(3) Floodlighting of:

- churches and listed buildings, green space (e.g. sports pitches) within 50m of woodland, water, field hedgerows or lines of trees with connectivity to woodland or water;
- any building meeting the criteria listed in (1) above.

(4) Felling, removal or lopping of:

- woodland;
- field hedgerows and/or lines of trees with connectivity to woodland or water bodies;
- old and veteran trees that are more than 100 years old;
- mature trees with obvious holes, cracks or cavities, or that are covered with mature ivy (including large dead trees).

(5) Proposals affecting water bodies:

- in or within 200m of rivers, streams, canals, lakes, reed beds or other aquatic habitats.

(6) Proposals located in or immediately adjacent to:

- quarries or gravel pits;
- natural cliff faces and rock outcrops with crevices or caves and swallets.

(7) Proposals for wind farm developments of multiple wind turbines and single wind turbines (depending on the size and location) (NE TIN 051 – undergoing updates at the time of writing).

(8) All proposals in sites where bats are known to be present[1]

This may include proposed development affecting any type of buildings, structures, feature or location.

Notes:

1. Where sites are of international importance to bats, they may be designated as SACs. Developers of large sites 5–10km away from such SACs may be required to undertake a HRA.

Figure B: Reproduced from Collins (2016) – page 13.

Table 2 Factors affecting the probability of bats being present.

Factors affecting the probability of a building being used by bats in summer	
Increased probability	Disused or little used; largely undisturbed
	Large roof void with unobstructed flying spaces
	Large dimension roof timbers with cracks, joints and holes
	Uneven roof covering with gaps, though not too draughty
	Entrances that bats can fly in through
	Hanging tiles or wood cladding, especially on south-facing walls
	Rural setting
	Close to woodland and/or water
	Pre-20th century or early 20th century construction
	Roof warmed by the sun
	Within the distribution area of horseshoe bats
Decreased probability	Highly urbanised area with few feeding places
	Small or cluttered roof void (esp. for brown long-eared bat)
	Heavily disturbed
	Modern construction with few gaps around soffits or eaves (but be aware these may be used by pipistrelles in particular)
	Prefabricated with steel and sheet materials
	Active industrial premises
	Roof shaded from the sun
Factors affecting the probability of trees being used by roosting bats	
Increased probability	In ancient woodland or parkland
	Large trees with complex growth form
	Species that typically form cavities, such as beech, willow, oak or ash
	Visible damage caused by rot, wind, lightning strike *etc.*
	Loose bark providing cavities
Decreased probability	Coniferous plantation with no specimen trees
	Young trees with simple growth form and little damage
Factors affecting the probability of underground sites being used by roosting bats	
Increased probability	Large enough to develop stable temperature in winter
	High humidity
	Undisturbed
	Close to woodland or water (but note that bats will also use upland sites)
	Many cracks and crevices suitable for bats
Decreased probability	Small and draughty
	Heavily disturbed
	In urbanised areas
	Smooth surfaces with few roosting opportunities

Figure C: Table 2 Reproduced from Marnell *et al.* (2022).

8.5 Appendix 5 Alternative Bat Roosts

Bat Boxes

Examples of bat box design (self-cleaning boxes i.e. opened at the bottom to allow bat droppings to fall out).

a) Woodcrete 1FF (Potential supplier - www.nhbs.com)

9. Photograph Catalogue

Plate 1: Example of PBR located within the proposed development site.

10. Bat Species Profile

10.1 Leisler's bat

Ireland's population is deemed of international importance and the paucity of knowledge of roosting sites, makes this species vulnerable. However, it is considered to be widespread across the island. The modelled Core Area for Leisler's bats is a relatively large area that covers much of the island of Ireland (52,820km^2). The Bat Conservation Ireland Irish Landscape Model indicated that the Leisler's bat habitat preference has been difficult to define in Ireland. Habitat modelling for Ireland shows an association with riparian habitats and woodlands (Roche *et al.*, 2014). The landscape model emphasised that this is a species that cannot be defined by habitats preference at a local scale compared to other Irish bat species but that it is a landscape species and has a habitat preference at a scale of 20.5km. In addition, of all Irish bat species, Leisler's bats have the most specific roosting requirements. It tends to select roosting habitat with areas of woodland and freshwater.

Irish Status	Near Threatened
European Status	Least Concern
Global Status	Least Concern
Irish Population Trend	2003-2013 ↑
Estimated Irish Population Size	73,000 to 130,000 (2007-2013) Ireland is considered the world stronghold for this species
Estimate Core Area (Lundy *et al. 2011)*	52,820 km^2

Taken from Roche *et al.*, 2014, Lysaght & Marnell, 2016 & Marnell *et al.*, 2019

The principal concerns for Leisler's bats are poorly known in Ireland but those that are relevant for this survey area are as follows:

- Selection of maternity sites is limited to specific habitats;
- Relative to the population estimates, the number of roost sites is poorly recorded;
- Tree felling, especially during autumn and winter months; and
- Increasing urbanisation.

10.2 Common pipistrelle

This species is generally considered to be the most common bat species in Ireland. The species is widespread and is found in all provinces. The modelled Core Area for common pipistrelles is a large area that covers much of the island of Ireland (56,485km^2) which covers primarily the east and south east of the area (Roche *et al.*, 2014). The Bat Conservation Ireland Irish Landscape Model indicated that the Common pipistrelle selects areas with broadleaf woodland, riparian habitats and low density urbanization (<30%) (Roche *et al.*, 2014).

Irish Status	Least Concern
European Status	Least Concern
Global Status	Least Concern
Irish Population Trend	2003-2013 ↑
Estimated Irish Population Size	1.2 to 2.8 million (2007-2012)
Estimate Core Area (km^2) (Lundy *et al. 2011)*	56,485

Taken from Roche *et al.*, 2014, Lysaght & Marnell, 2016 & Marnell *et al.*, 2019

Principal concerns for Common pipistrelles in Ireland that are relevant for this survey area are as follows:

- Lack of knowledge of roosting requirements
- This species has complex habitat requirements in the immediate vicinity of roosts. Therefore, careful site specific planning for this species is required in order to ensure all elements are maintained.
- Renovation or demolition of derelict buildings.
- Tree felling
- Increasing urbanisation (e.g. increase in lighting)

10.3 Soprano pipistrelle

This species is generally considered to be the second most common bat species in Ireland. The species is widespread and is found in all provinces, with particular concentration along the western seaboard. The modelled Core Area for soprano pipistrelle is a large area that covers much of the island of Ireland (62,020km^2). The Bat Conservation Ireland Irish Landscape Model indicated that the soprano pipistrelle selects areas with broadleaf woodland, riparian habitats and low density urbanisation (Roche *et al.*, 2014).

Irish Status	Least Concern
European Status	Least Concern
Global Status	Least Concern
Irish Population Trend	2003-2013 ↑
Estimated Irish Population Size	0.54 to 1.2 million (2007-2012)
Estimate Core Area (km^2) (Lundy *et al. 2011)*	62,020

Taken from Roche *et al.*, 2014, Lysaght & Marnell, 2016 & Marnell *et al.*, 2019

Principal concerns for Soprano pipistrelles in Ireland that are relevant for this survey area are as follows:

- Lack of knowledge of roosts;
- Renovation or demolition of structures;
- Tree felling; and
- Increasing urbanisation (e.g. increase in lighting).

10.4 Brown long-eared Bat

This species is generally considered to be widespread across the island. The modelled Core Area for Brown long-eared bats is a relatively large area that covers much of the island of Ireland (52,820km^2) with preference suitable areas in the southern half of the island. The Bat Conservation Ireland Irish Landscape Model indicated that the Brown long-eared bat habitat preference is for areas with broadleaf woodland and riparian habitats on a small scale of 0.5km emphasising the importance of local landscape features for this species (Roche *et al.*, 2014).

Irish Status	Least Concern
European Status	Least Concern
Global Status	Least Concern
Irish Population Trend	2008-2013 Stable
Biographical Range	km^2
Estimate Core Area (Lundy *et al. 2011)*	49,929 km^2

Taken from Roche *et al.*, 2014, Lysaght & Marnell, 2016 & Marnell *et al.*, 2019

Principal concerns for brown long-eared bats are poorly known in Ireland, but those that are relevant for this survey area are as follows:

- Selection of maternity sites is limited to specific habitats;
- Lack of knowledge of winter roosts;
- Loss of woodland, scrub and hedgerows;
- Tree surgery and felling;
- Increasing urbanisation; and
- Light pollution.

10.5 Daubenton's bat

The modelled Core Area for Daubenton's bats is a relatively large area that covers much of the island of Ireland (41,285km^2) reflecting the distribution of sizeable river catchments. The Irish Landscape Model indicated that the Daubenton's bat habitat preference is for areas with broadleaf woodland, riparian habitats and low density urbanisation (Roche *et al.*, 2014).

Irish Status	Least Concern
European Status	Least Concern
Global Status	Least Concern
Irish Population Trend	2008-2013 Stable
Estimated Irish Population Size	81,000 to 103,000 (2007-2012)
Estimate Core Area (km^2) (Lundy *et al. 2011)*	41,285

Taken from Roche *et al.*, 2014, Lysaght & Marnell, 2016 & Marnell *et al.*, 2019

Principal concerns for Daubenton's bats are poorly known in Ireland but those that are relevant for this survey area are as follows:

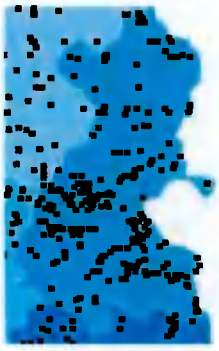
- Potential roost loss due to bridge maintenance;
- Loss of woodland and forest clearance;
- Loss of woodland, scrub and hedgerows;
- Tree surgery and felling;
- Increasing urbanisation; and
- Light pollution.

10.6 Bat Conservation Ireland Bat Species Maps

Bat records for County Dublin (Source: www.batconservationireland.org)

Common pipistrelle

Nathusius' pipistrelle



Soprano pipistrelle

Leisler's bat

Brown long-eared bat

Daubenton's bat

Natterer's bat

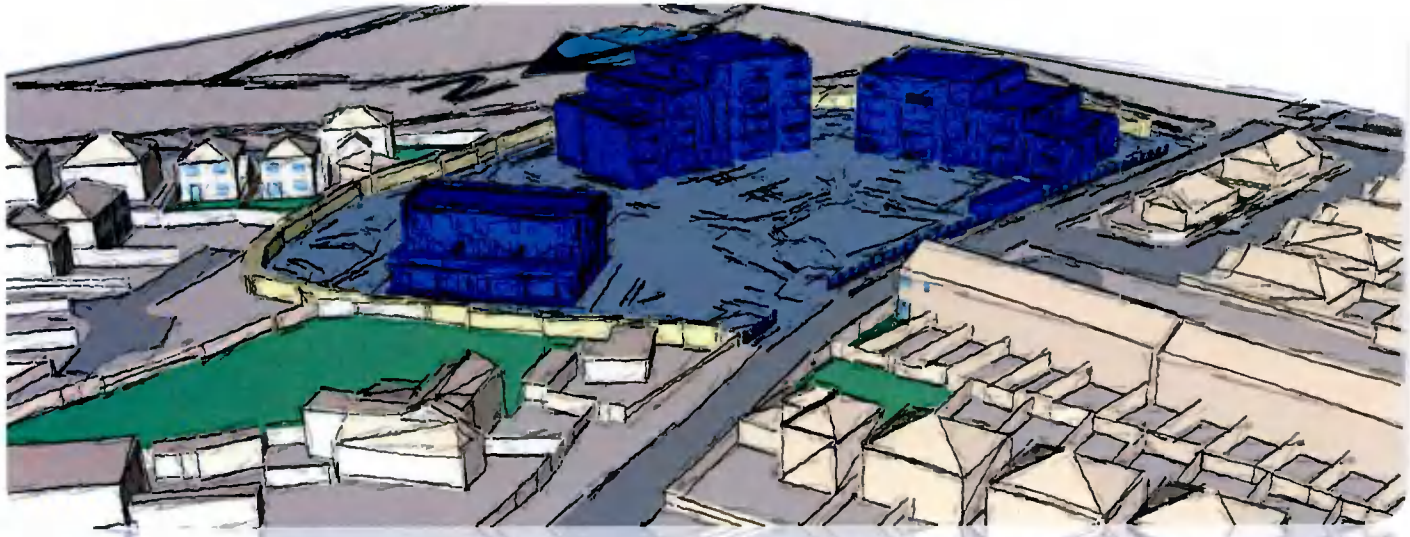
Whiskered bat

Lesser horseshoe bat

HAYDEN'S LANE

Sunlight, Daylight & Shadow Assessment (Impact Neighbours)

V1



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Executive Summary

This report examines the impact the proposed Development will have on neighbours in terms of daylight, sunlight & shadow. We will also examine how the proposed development performs in terms of light.

The report is, in accordance with "Site Layout Planning for Daylight and Sunlight: A Guide to Good Practice" and BS 8206 Lighting for Buildings, Part 2: Code of Practice for Daylighting.

It should be noted at the outset that the BRE document sets out in its introduction that:

> *"Summary Page . . . It is purely advisory and the numerical target values within it may be varied to meet the needs of the development and its location."*
>
> *" 1.6 . . . The advice given here is not mandatory and the guide should not be seen as an instrument of planning policy; its aim is to help rather than constrain the designer. Although it gives numerical guidelines, these should be interpreted flexibly since natural lighting is only one of many factors in site layout design. . . . "*

Change/Impact to neighbouring buildings in the adjoining residential areas.

- **Skylight- VSC**
  - **100%** of the tested windows comply with the 27%, 0.8 ratio requirements for habitable rooms.
  - The average change ratio for VSC is **0.96**
- **Sunlight APSH & WPSH**
  - **100%** of tested windows comply with the annual APSH and
  - **100%** with the winter WPSH requirements for sunlight or overall requirement.
  - The average change ratio for sunlight is APSH:**0.96** and WPSH: **0.94**
- **Shadow**
  - **100%** of tested neighbouring amenity spaces pass the 2-hour test requirements for the 21st March.
  - The average change ratio for shadow/sunlight is **0.99**

The application complies with the recommendations and guidelines of Site Layout Planning for Daylight and Sunlight: A Guide to Good Practice (BRE 2011) and BS 8206 Lighting for Buildings and Part 2: Code of Practice for Daylighting.

This development has been successfully designed to limit the impact on existing buildings. As such the design has used the guidelines in the spirit they have been written and balanced the requirements of this report with other constraints to arrive at this design.

Introduction

Chris Shackleton Consulting (CSC) have been asked to examine the impact that the proposed development will have on the existing neighbouring properties in terms of sunlight, daylight & shadow. The proposed development consists of a residential development comprising 3 no. 2-5 storey blocks of 66 no. apartments on a former industrial unit (now demolished).

This analysis has been carried out in accordance with the recommendations of Site Layout Planning for Daylight and Sunlight: A Guide to Good Practice (BRE 2011) and BS 8206 Lighting for Buildings and Part 2: Code of Practice for Daylighting.

> ***All references quoted in this report are from BRE document "Site Layout Planning for Daylight and Sunlight: A Guide to Good Practice – Second Edition – 2011 (BR 209) by Paul Littlefair" unless specifically noted otherwise.***

Preliminary Overview

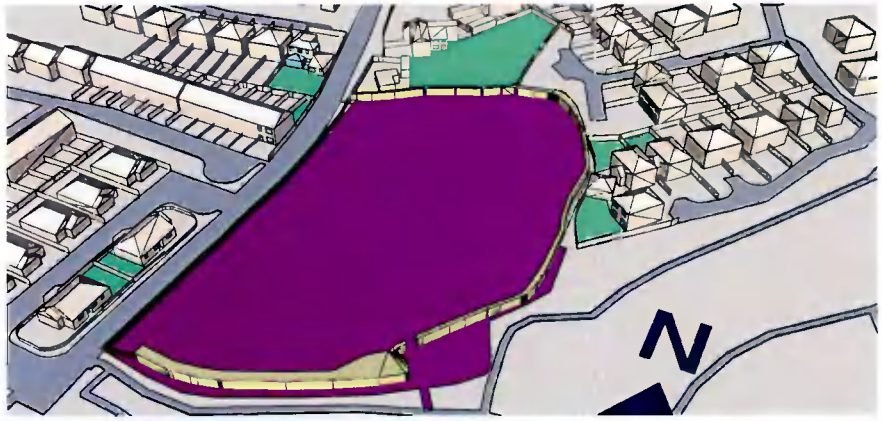
The aerial view shows the context for the site and the closest neighbouring window groups.

Google Earth extract © Google 2022

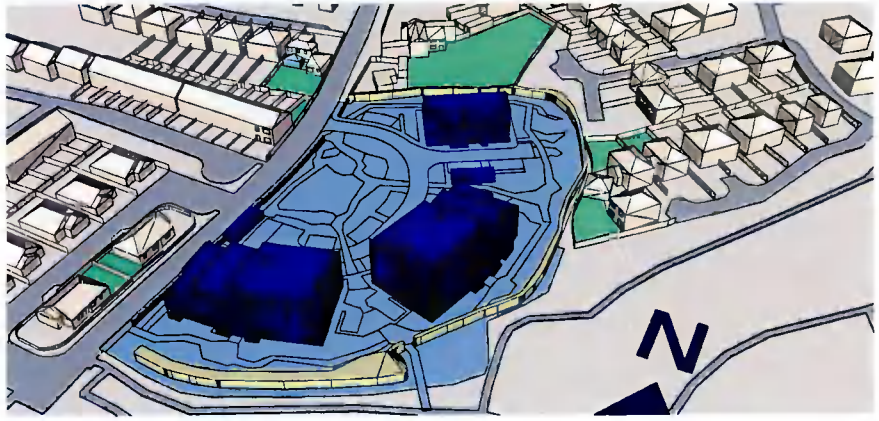
Design Model

A 3D model of the proposed development and the surrounding neighbouring properties was provided by the Architect. These had been modelled from survey information and drawings provided in plan, elevation and section formats. The model was geo-referenced to its correct location and an accurate solar daylight system was introduced. Here "Cream" indicates surrounding environment, "Purple" the existing site, "Blue" this proposal.

The analysis is based on the information provided.



Existing Model



Proposed Model

Scope of this Report

We have been asked to address the following specific items in this report and our scope is limited to the same:

Impact on Existing Neighbours

In this document we will assess the potential impact of the proposed development on the neighbouring residential houses. We will test for the following in relation to impact:

- Existing facing windows for:
  - Impact/Change for Skylight – Vertical Sky Component - VSC
  - Impact/Change for Probable Sunlight Hours – Annual APSH and Winter WPSH
- Existing amenity spaces for impact/change on Sunlight/Shadow

The former industrial unit (now demolished) is not considered in the baseline condition in this analysis. This is the more onerous condition.

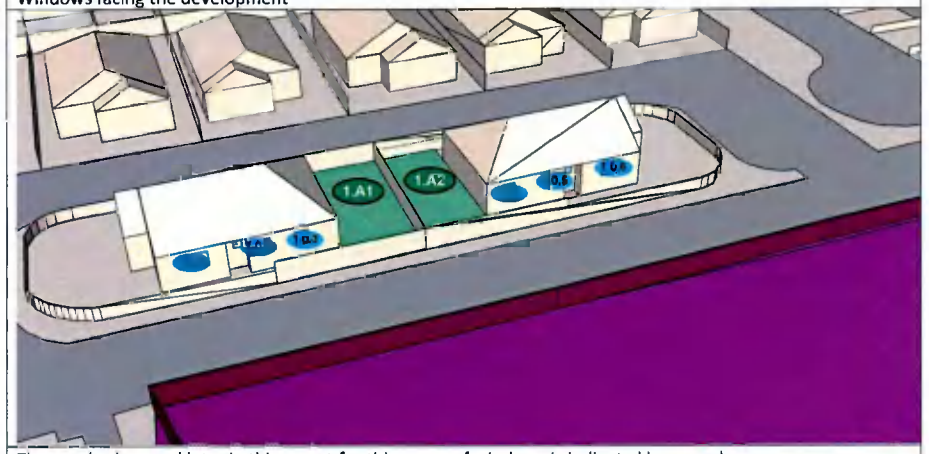
Adjacent Properties Details

The numbering used later for windows in each of the blocks is detailed below.

Neighbours – Window Group B1

Oblique imagery © Google 2021

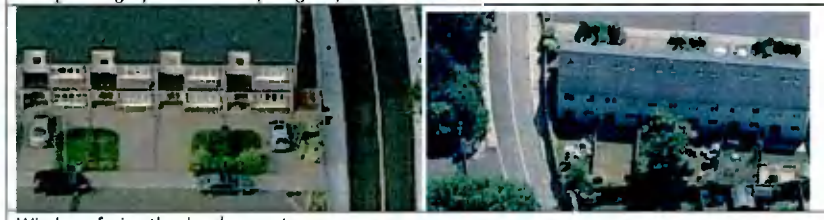
Windows facing the development



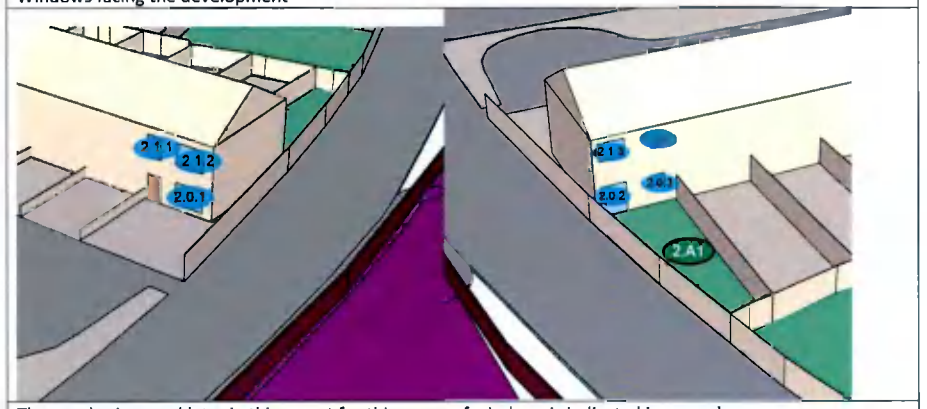
The numbering used later in this report for this group of windows is indicated in cyan above.
Amenity spaces (gardens) are noted in green

Neighbours – Window Group B2

Oblique imagery © Microsoft / Bing Maps 2022



Windows facing the development



The numbering used later in this report for this group of windows is indicated in cyan above.
Amenity spaces (gardens) are noted in green

Neighbours – Window Group B3

Oblique imagery © Microsoft / Bing Maps 2022

Windows facing the development

The numbering used later in this report for this group of windows is indicated in cyan above.
Amenity spaces (gardens) are noted in green

Neighbours – Window Group B4

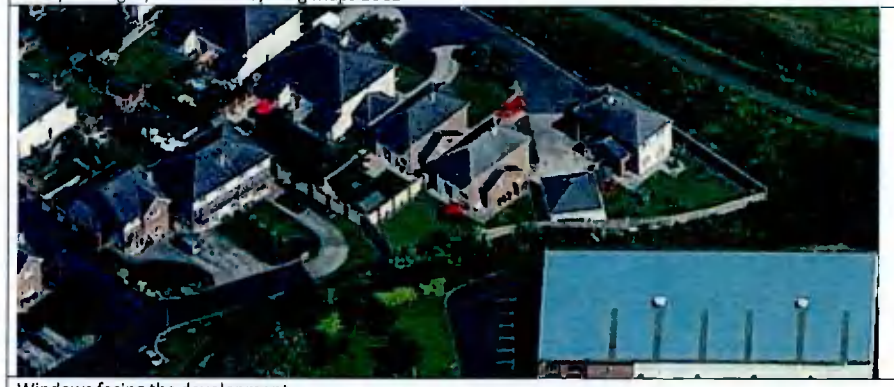
Oblique imagery © Microsoft / Bing Maps 2022

Windows facing the development

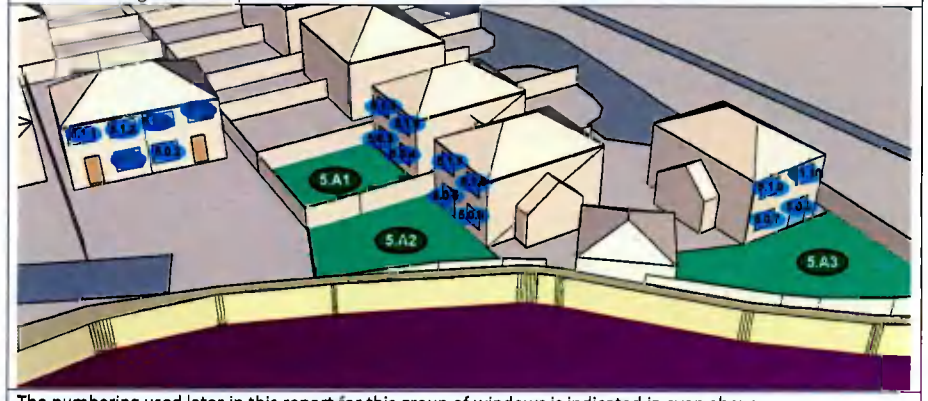
The numbering used later in this report for this group of windows is indicated in cyan above.
First floor windows assumed and tested.
Amenity spaces (gardens) are noted in green

Neighbours – Window Group B5

Oblique imagery © Microsoft / Bing Maps 2022



Windows facing the development



The numbering used later in this report for this group of windows is indicated in cyan above.
Amenity spaces (gardens) are noted in green

Impact on neighbours

Adjacent Properties - Light from the Sky impact on neighbouring properties

Tests were carried out to establish the quantity and quality of skylight (daylight) available to a room's windows. Locations tested are based on guideline recommendations for the closest facades which have windows with potential for impact.

We have investigated this impact under clause 2.2.7

> ***2.2.7 If this VSC is greater than 27% then enough skylight should still be reaching the window of the existing building. Any reduction below this level should be kept to a minimum. If the VSC, with the new development in place, is both less than 27% and less than 0.8 times its former value, occupants of the existing building will notice the reduction in the amount of skylight. The area lit by the window is likely to appear more gloomy, and electric lighting will be needed more of the time.***

> ***2.2.6 Any reduction in the total amount of skylight can be calculated by finding the VSC at the centre of each main window. In the case of a floor-to-ceiling window such as a patio door, a point 1.6 m above ground (or balcony level for an upper storey) on the centre line of the window may be used. For a bay window, the centre window facing directly outwards can be taken as the main window. If a room has two or more windows of equal size, the mean of their VSCs may be taken. The reference point is in the external plane of the window wall. Windows to bathrooms, toilets, storerooms, circulation areas and garages need not be analysed. . . .***

CUNNANE STRATTON REYNOLDS
LAND PLANNING & DESIGN

Drawing Number	Drawing Title	Scale
21503-1-105	Landscape Masterplan	1:250 @ A1
21503-1-108	Play Area – Play Equipment	1:100 @ A3
21503-1-203	Landscape Sections Section C	1:100 @ A1
21503-1-901	Tree Pit	1:20 @ A1
21503A-T-101	Classification & Constraints	1:250 @ A1
21503A-T-102	Arboricultural Impact Assessment	1:250 @ A1
21503A-T-103	Tree Protection	1:250 @ A1