# 2019

# Bat Assessment


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NPWS licence C30/2017 (Licence to handle bats, expires 31st December 2019)

NPWS licence 33/2017 (Licence to photograph/film bats, expires 31st December 2019)

NPWS licence DER/BAT 2017-09 (Licence to disturb a roost, expires 29th March 2020)

**Client:** Cairn Homes Properties Ltd.

**Project Name & Location:** Farrankelly, Greystones, Co. Wicklow

## Report Revision History

| Date of Issue | Draft Number | Issued To |
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| 1/7/2019 | Draft 1 | Cairn Homes Properties Ltd. issued by email |
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| 13/9/19 | Draft 5b | Cairn Homes Properties Ltd. issued by email |
| 17/9/2019 | Final | Cairn Homes Properties Ltd. issued by email |

## Purpose

This document has been prepared as a Report for Cairn Homes Properties Ltd. 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:** Farrankelly, Greystones, Co. Wicklow

**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*** | | | |

* In buildings outside the proposed development site.

**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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# Contents

# 1. Introduction

Bat Eco Services was commissioned by Cairn Homes Properties Ltd. to survey lands proposed to be developed in Farrankelly, Greystones, Co. Wicklow.

## 1.1 Relevant Legislation & Bat Species Status in Ireland

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 a notifiable action and a derogation licence has to be obtained from the *National Parks and Wildlife Service* before works can commence. Any works interfering with bats and especially their roosts, may only be carried out under a licence to derogate from Regulation 23 of the Habitats Regulations 1997 and Regulation 54 of the European Communities (Birds and Natural Habitats) Regulations 2011 (which transposed the EU Habitats Directive into Irish law). The details with regards to appropriate assessments, the strict parameters within which derogation licences may be issued and the procedures by which and the order in relation to the planning and development regulations such licences should be obtained, are set out in Circular Letter NPWS 2/07 "*Guidance on Compliance with Regulation 23 of the Habitats Regulations 1997 - strict protection of certain species/applications for derogation licences*" issued on behalf of the Minister of the Environment, Heritage and Local Government on the 16th of May 2007.

There are eleven recorded bat species in Ireland, nine of which are considered resident. 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.

Irish bat species list (please see Appendices for more information in individual bat species) is presented in Table 1. The current status of the known bat species occurring in Ireland is given in the Table 1 below.

**Table 1: Status of the Irish bat fauna (Marnell *et al.,* 2009).**

| 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*** | Near threatened | 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 | Near threatened | 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.
- Kelleher, C. & Marnell, F. (2006) Bat Mitigation Guidelines for Ireland. Irish Wildlife Manuals, No. 25. National Parks and Wildlife Service, Department of Environment, Heritage and Local Government, Dublin, Ireland.
- 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.

Based on the information collected during the desktop studies and bat surveys, the bat ecologist assigns an ecological value to each bat species recorded based on its conservation status at different geographical scales (Table 2). 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 2: 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: Co. Wicklow |
| **Local** | Farrankelly, Greystones |
| **Negligible** | None, the feature is common and widespread |

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 conflict.

## 1.3 Project Description

### *1.3.1 Site Location*

The proposed development is located on the grounds to the north-west of Eden Gate and to the west of Kilcoole Road in Farrankelly, Co. Wicklow. The site is bounded by Eden Gate housing estate to the south-east, residential properties to the west, green field and industrial businesses to the north and Kilcoole Road to the east at Farrankelly, Co. Wicklow.

Lands marked for proposed residential development at Farrankelly, Greystones, Co. Wicklow consists of land associated with a farmland and with the Three Trouts Stream along the northern boundary. There is a linear woodland / treeline associated with the river. The site, while agriculturally managed, comprises of mature treelines and hedgerows in a well-connected landscape. Some of these linear habitats are intensively managed. There is a large array of buildings located adjacent to the proposed development site and located on lands in separate ownership. Figure 1 represents that red line boundary of the proposed development site on an aerial photograph. The survey area for the bat survey extended into the area of buildings adjacent to the eastern boundary of the proposed development site (Yellow hatch lines) for a wider understanding of the local bat population as part of the assessment process.


Figure 1: Aerial of proposed development area (Within Red Line, supplied by Cairn Homes Properties Ltd.) with survey area extended to include buildings adjacent to the eastern boundaries of the proposed development site (Yellow Hatch Lines).

### *1.3.2 Proposed Project*

The proposed development involves the construction of:

- The development will consist of the construction of a residential development of 426 no. dwellings, a creche (c. 599 sq. m), residential amenity building (c. 325 sq. m), active open space of 4.5 hectares, greenway of c. 2.4 hectares all on a site of c. 21.2 hectares.

### *1.3.3 Bat Survey Aims*

The aims of the bat survey at the proposed project site are as follows:

- Collect robust data following good practice guidelines to allow an assessment of the potential impacts of the proposed project on local bat populations, both on and off-site 9i.e. accumulative impacts);
- Facilitate the design of mitigation, enhancement and monitoring strategies for local bat populations recorded;
- Provide baseline information with which the results of post-construction monitoring surveys can be compared to, where appropriate;
- Provide clear information to enable NPWS and planning authorities to reach robust decisions with definitive required outcomes;
- Assist clients in meeting their statutory obligations;
- Facilitate the conservation of local bat populations.

**Surveys are comprised of many different types and may differ from site to site depending on the gaols of the survey. The following is a brief description of main types of surveys completed.**

- Emergence (dusk) surveys: surveying of buildings or structures to determine whether such building/structure is a bat roost. Undertaken from 10 minutes prior to sunset to 90 minutes after sunset.
- Walking transect: bat surveys completed on-foot where the surveyor(s) walk the survey site from 10 minutes prior to sunset to at least 110 minutes after sunset. Often this survey is completed post an emergence survey and therefore may be undertaken for a longer period of time after sunset.
- Driving transect: bat survey completed in a car and undertaken according to a strict survey protocol. Surveying is completed from 40 minutes after sunset till the end of the planned survey route. This is only undertaken for large survey area with a well-defined public road structure. Routes are planned and mapped prior to surveying.
- Dawn surveys: surveying of buildings or structures to determine whether such building/structure is a bat roost. Undertaken from 90 minutes prior to sunrise to 10 minutes after sunrise.
- Static surveys: placement of automated recording devices within the survey area. The units are set up during the daylight hours and left in place to record during the hours of darkness.
- Additional surveys required may include trapping / netting of bats. But this type of surveying is only undertaken where specific information is required (e.g. to determine if a roost is a maternity colony).

### *1.3.4 Bat Surveys - Historical*

A bat survey was undertaken in 2017 with a site visit in 2018 and re-surveying was completed in 2019. Therefore this report presents the survey results from all surveys completed. The bat surveys were completed in the appropriate summer months.

# 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. For this development proposal there are no buildings within the proposed development boundary and therefore this section refers to buildings adjacent to the proposed development site. Due to the transient nature of bats and their seasonal life cycle, there are a number of different types 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 (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*

Structures, buildings and other likely places that may provide a roosting space for bats are inspected during the daytime 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 on stonework) 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. Inspections are undertaken visually with the aid of a strong torch beam (LED Lenser P14.2) and endoscope (General DC5660A Wet / Dry Scope).

### *2.1.2 Tree Potential Bat Roost (PBRs) Inspection*

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

Trees identified as PBRs are 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 on stonework) 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 series of inspections are undertaken. Phase 1 inspections aims to make a list of trees within the proposed development site that may be suitable as roosting sites for bats. Inspections are 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, tree reports, if available, are consulted to supplement that data collected.

Phase 2 inspections are, generally, recommended once a complete list of trees that have been identified as PBRs, and are marked for felling in order for the proposed development to be undertaken. The Phase 2 inspection will generally involve a closer examination of individual trees using a strong torch beam (LED Lenser P14.2) and endoscope (General DC5660A Wet / Dry Scope) and where required (and/or possible), height surveys are completed using a ladder. If a tree is deemed to be a roost site then further surveying involving dusk and dawn surveys of the actual trees may be recommended to determine what bat species are present etc.

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

| Tree Category | Description |
|---|---|
| **1** | Trees with multiple, highly suitable features (Potential Roosting Features = PRFs) capable of supporting larger roosts |
| **2** | Trees with definite bat potential but supporting features (PRFs) suitable for use by individual bats; |
| **3** | 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** | Trees have no potential. |

### *2.1.3 Bat Habitat & Commuting Routes Mapping*

The survey site is assessed during daytime walkabout surveys, in relation to potential bat foraging habitat and potential bat commuting routes. Such habitats are classified according to Fossit, 2000 (Appendix 1, Table 1.B) while hedgerows are classified according to BATLAS 2020 classification (Bat Conservation Ireland, 2015) (Appendix 1, Table 1.A). Bat habitats and commuting routes identified are 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 surveys are generally completed from 10 minutes before sunset to at least 120 minutes post sunset (extended survey period times occur if walking transects and driving transects are included). Dawn surveys are generally completed from 90 minutes before sunrise to 10 minutes after sunrise. If the focus of this survey is to determine whether a structure is a bat roost (i.e. An Emergence Survey is deemed necessary), the surveyors then position themselves adjacent to the building / structure to be surveyed to determine if bats are roosting within, location of roost, number of bats, bat species etc. Surveying is generally completed for 100 mins, starting 10 mins before sunset.

Surveys are generally completed during mild and dry weather conditions with air temperature 8$^{o}$C or greater, where possible. All bat encounters are noted during surveys.

The following equipment is used for the 2019 surveys which were completed on 24/6/2019 (emergence survey and walking transect) and 27/6/2019 (walking transect) and 28/6/2019 (dawn survey):

Surveyor 1 (Principal surveyor): Wildlife Acoustics Echo Meter Touch (Generation 1, Apple IOS) connected to iPad 2 (32 GB storage) and Petersson D200 Heterodyne Bat Detector.

Surveyor 2: Wildlife Acoustics Echo Meter Touch2 Pro (Android) connected to Samsung Galaxy Tab S3 and Petersson D200 Heterodyne Bat Detector.

Walking transects involve the surveyor(s) walking the survey area, noting the time, location and bat species encountered. If the mapping facility is used on the Wildlife Acoustics Echo Meter Touch2 Pro (Android) connected to Samsung Galaxy Tab S3, this is mapped using Google Earth with a KLM file produced for mapping purposes. Validation of bat records is completed by the principal bat surveyor prior to mapping. Otherwise, Irish Grid references are recorded and an excel file of bat record locations is produced for mapping.

A dusk (3$^{rd}$ September 2017) survey was also completed by two surveyors using bat detectors (Wildlife Acoustics EchoMeter Touch (with an iPad 2 and iPhone 4) and Pettersson D200 and D100 Heterodyne Bat Detectors). During Dusk Survey, the entire proposed development site was walked, following the field boundaries for each field.

A small area located on the eastern edge of the greenway along the northern boundary and along the frontage on the R761 was inspected during the daytime to facilitate an additional setback for sight lines required, some tree/hedge removal is planned. A site visit was completed in September 2018 to investigate this.

### *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 various software. Recordings made by SongMeter SM2 (Unit 2) is analysed using SongScope, SongMeter SM2Bat+ (Unit 4, 5), Song Meter Bat FS (Units 1-5) and SongMeter 3 recordings are analysed using BatClassifyIreland and Wildlife Acoustics Kaleidoscope Pro. Elekon BatLogger A+ units are analysed using BatExplorer. 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 |
|---|---|---|---|
| **SM2 Unit 4 - 2018** | Wildlife Acoustics SongMeter 2 Bat+ | Passive Full Spectrum | SMX-US (connected directly to unit) |
| **SM4 Unit 3 - 2019**<br>**SM4 Unit 4 - 2019** | Wildlife Acoustics SongMeter 4 Bat FS | Passive Full Spectrum | SMM-U2, 4m cable |
| **BL Unit A – 2019 & 2019**<br>**BL Unit B – 2019 & 2018** | Elekon BatLogger A+ bat detector | Passive Full Spectrum | FG Black microphone, 2m cable |
| **SM3 Unit 1 - 2018** | Wildlife Acoustics SongMeter 3 | Passive Full Spectrum | SMM-U1, 5m cable |

## 2.3 Desktop Review

### *2.3.1 Bat Conservation Ireland Database*

A 1km and 10km search is undertaken for the central Irish grid reference of the survey site.

## 2.4 Survey Constraints

It is important to note that bat surveys are comprised of a number of surveys designed to provide as much information on the bat usage of a survey area. Each survey method has its pros and cons. Therefore, a combination of surveys is recommended to determine the importance of a survey area for local bat populations. Bat surveys are also a snap shot of the bat activity at the time of surveying. Bat activity varies greatly from season to season and in relation to weather conditions. A list of bat survey methods are ticked at the start of the report to provide an overview for the reader. Weather data is presented to provide context to the suitability of survey dates to recorded bat activity.

The following assessment has been completed in relation to Survey Constraints:

**Table 6: Survey Constraint Assessment Results.**

| Category | Discussion |
|---|---|
| **Timing of surveys** | June 2019 supplemented with data from September 2017. These surveys have been completed during the recommended survey period to record bat activity and to record potential summer roosts. |
| **Weather conditions** | June 2019 – good weather conditions<br><br>September 2017 – good weather conditions |
| **Survey effort** | June 2019 – 4 nights statics; 1 emergence survey (2 surveyors), 1 dawn survey (1 surveyor), 2 walking transects (2 surveyors).<br><br>September 2018 – daytime inspection of road frontage (R761).<br><br>September 2017 – 2 nights statics, 1 emergence surveys (2 surveyor), 1 walking transect (2 surveyors) |
| **Equipment** | All in good working order. |

The number of surveys complies with best practice as per bat guidelines and therefore it is deemed that the survey work completed is appropriate in order to complete the aims of the bat survey and that no particular survey constraints were encountered.

# 3. Bat Survey Results

## 3.1 Daytime Inspections

### *3.1.1 Building & Structure Inspection*

While there are an array of buildings within the wider survey area these buildings are not part of the proposed development Carin Homes. However, surveying was undertaken to determine if there were any roosts within the buildings to provide an a cumulative assessment of the wider area. The following buildings / structures were inspected. A general walkabout of the buildings and inspection of external walls and surfaces for evidence of bats (e.g. bat droppings on windows) was undertaken within internal inspection completed, where possible.

**Table 7: Buildings / Structures inspection results.**

| Building Code | Description | Grid Reference | Roost Type / Suitability | Bat Species |
|---|---|---|---|---|
| Stable block | Single storey buildings of mixed construction and roof types (slate and corrugated iron). One building with a loft. | O 28639 10415 | Medium | Internal and external inspection<br><br>*Pipistrellus* droppings on floors – scatter. |
| Long shed | Natural stone with slate roof in poor condition. | O 28662 10377 | Medium | Internal and external inspection<br><br>*Pipistrellus* droppings on floors – scatter. |
| Industrial buildings | Large array of modern iron / concrete buildings | O 28616 10448 | Low | External inspection only<br><br>None |
| House | 2-storey modern house with slate roof | O 28635 10388 | Medium | External inspection only<br><br>None |

A small area located on the eastern edge of the greenway along the northern boundary and along the frontage on the R761 was investigated during the daytime in September 2018 in relation to potential tree removal and their suitability as bat roosts. No trees, considered to be of PBR value were recorded.

### *3.1.2 Tree Potential Bat Roost (PBRs) Inspection*

The Landscape Report & Outline Landscape Specification report states that “The majority of the trees in the site are classed as category B and C by the Arborist with a number or U category trees. There are no Category A trees found on the site. The hedgerows are typical in their species make up being primarily Hawthorn and Blackthorn although bramble is well established. The higher quality hedgerows are found along the site boundary and running along the north-south axis as well as the east-west access through the middle of the site, intersecting at certain points. The high number of moderate value trees on site can be enhanced and strengthened along with the hedgerow species to produce healthier and longer lasting hedgerows throughout the site. The

species mix of the trees found on the site varies but consists mostly of Scots Pine, Ash, Beech and Sycamore. The larger trees are found throughout the roadside hedgerow and along the small access laneway. There a large number of moderate value Scots Pine on site which will be retained in compliance with the objectives of the Local Area Plan (LAP). The prominent hedgerow running from Farankelly House south to the site boundary contains a mix of moderate quality Beech, Ash and Scots Pine. The wooded area alongside the 'Three Trouts Stream' also contains many moderate value trees and adds biodiversity and amenity value to the local landscape".

This section is completed with reference to the Tree Constraints Plan that accompanies the report *"A condition assessment of the trees on lands at Farrenkelly, Greystones, Co. Wicklow" produced on the 22nd August 2018*. All of the tree tag numbers quoted below is those used by the tree arborist. This tree assessment is a Phase 1 assessment to categorise trees according to their PBR value. This is completed as a daytime inspections coupled with reference to the Tree Constraints Plan. The updated Tree Protection Plan (August 2019) was also consulted.

There is a high level of mature trees located within the proposed development site. There is also good landscape connectivity and the following habitats are deemed important for foraging and commuting bats: Treelines 1, Scrub woodland 1, Hedgerows 3, 7, 11, and 13 (Tree Constraints Plan – Figure 2).

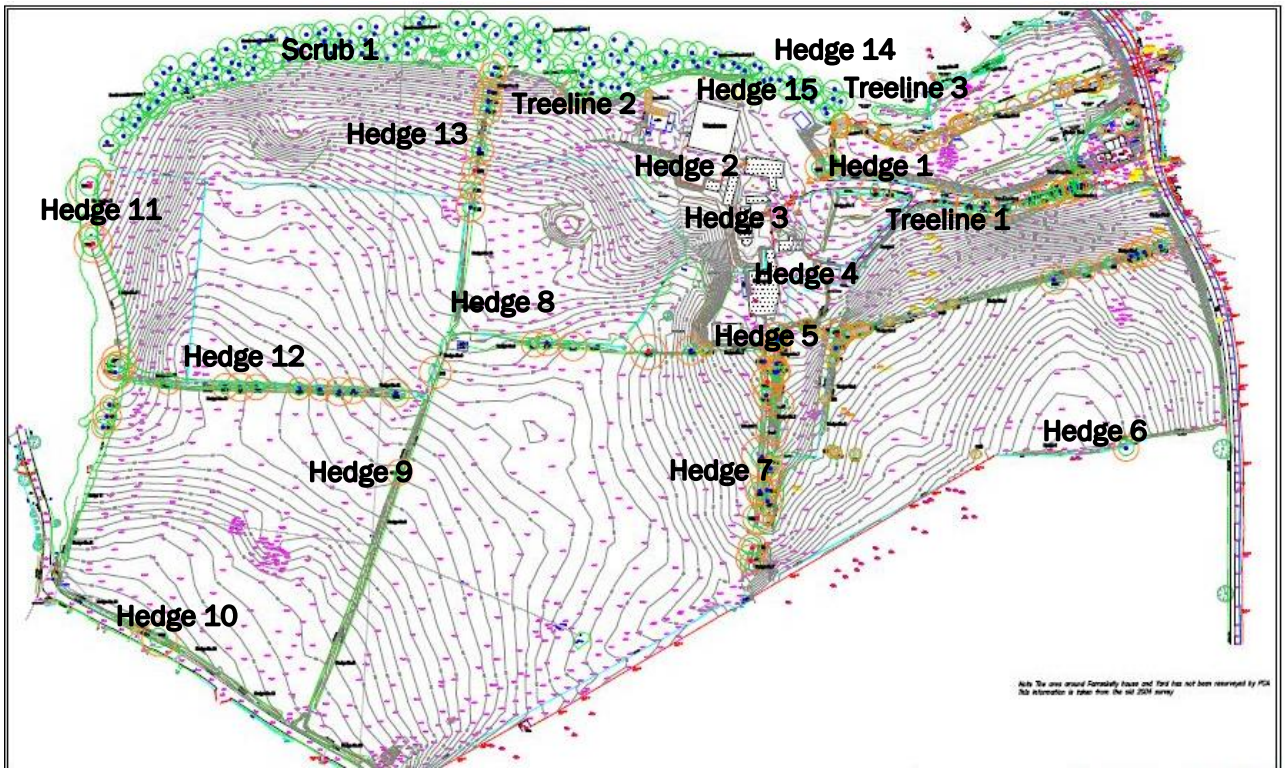



Figure 2: Screen shot of Tree Constraints Map to indicate location of hedgerows and scrub habitats referenced in the report.

There are 55 trees deemed as Tree Category 1 PBR value trees (This refers to the Potential Bat Roost (PBR) classification as presented in Table 4) trees within the survey area: 1442, 1443, 1444, 1446, 1447, 1448, 1449, 1450, 1451, 1452, 1453, 1454, 1455, 1456, 1457, 1475, 1484, 1485, 1486, 1487, 1489, 1490, 1491, 1493, 1497, 1498, 1499, 1502, 1504, 1506, 1507, 1508, 1509, 1510, 1511, 1518, 1519, 1520, 1521, 1522, 1523, 1524, 1525, 1526, 1527, 1528, 1529, 1530, 1531, 1532, 1533, 1534, 1535, 1536, 1537. These trees are all mature trees with dead wood, tree

holes and/or spilt limbs. Some have extensive ivy growth. They are a mixture of tree species: Scots pine, Ash and Beech.

Trees with heavy ivy growth (18 such trees) are assigned a Tree Category 2 trees and are number as follows on the Tree Constraints Plan: 1468, 1469, 1470, 1471, 1472, 1473, 1477, 1478, 1479, 1480, 1488, 1494, 1506, 1512, 1515, 1516, 1539, 1538. These are a mixture of Ash, Beech and Scots Pine.

The Tree Protection Plan indicates the following sections of hedge / treeline is proposed to be removed. These include 9 trees considered to be Potential bat Roosts (8 as Category 1 PBR trees and 1 as Category 2 PBR trees) and marked a Category U trees that may be recommended for removal for reasons of sound Arboricultural practice/ management and:

- Section of Hedge No. 2 to be removed which includes a Category U tree (No. 1458)
- Section of Hedge No. 6 to be removed
- Hedge No. 5 to be removed which include Category U trees (1479, 1480, 1481, 1477, 1476, 1473)
- Section of Hedge No. 7 to be removed which includes Category U trees (1488, 1490, 1489, 1486, 1487, 1502, 1497, 1485, 1484)
- Hedge No. 3 to be removed

While the following hedges contain four Category U trees. These will be retained, where possible.

- Category U tree 1506 of Hedge No. 8
- Category U trees 1519 and 1518 in Hedge No. 11
- Category U tree 1531 in Hedge No. 11

In total the 13 PBR trees potentially to be removed are as follows:

- Category 1 PBR – 1490, 1489, 1486, 1487, 1402, 1497, 1485, 1484, 1506, 1518, 1519 and 1531;
- Category 2 PBR – 1473.

As part of the PBR assessment, a 2nd phase tree survey will be undertaken prior to tree removal and tree construction.

### *3.1.3 Bat Habitat & Commuting Routes Mapping*

The survey site is characterised by woodland, hedgerows, mature treelines and sparse treeline hedges in a well-connected landscape. This is particularly important in relation the connectivity to the river valley which provides a suitable landscape for commuting and foraging bat populations.

## 3.2 Night-time Bat Detector Surveys

### *3.2.1 Dusk & Dawn Bat Survey*

The following figure summarises the results of the bat detector surveys completed on 24/6/2019 (weather conditions: overcast, calm, dry, 13$^{o}$C):

**Table 8: Buildings / Structures survey results.**

| Building Code | Roost Type & Location | Bat Species (No. of bats) | Access Points | Vegetation / Lighting arrangement |
|---|---|---|---|---|
| Long shed | Satellite roost | Common pipistrelle x2 | Open doorways | Ivy growth, lighting associated with industrial buildings. |
| Stable block | Night roost | Common pipistrelle, Natterer's bats<br>Individual bats | Open doorways | Lighting associated with industrial buildings |

The first bat encounter during the emergence survey was at 22:26 hrs and this was a common pipistrelle commuting down the existing laneway (outside the proposed development site) from the general vicinity of the R761 towards the buildings. Leisler's bats were first recorded at 22:35 hrs commuting through the area where the buildings are located, travelling in a westerly direction. Two common pipistrelles were recorded emerging from the Long Shed at 22:43 hrs and these individuals commuted to the fields east of the building to forage. Continuous activity for both Leisler's bats and common pipistrelles were recorded throughout the survey. The first soprano pipistrelle was not recorded till 23:22 hrs. Single bats were recorded night-roosting within the stable blocks during the night (resting): Natterer's bat and common pipistrelle.

The dawn survey on 27/6/2019 (weather conditions: clear sky, light breeze, dry and 15$^{o}$C) was undertaken around the buildings to determine if there were any swarming bats/returning bats to roosts. No bats were recorded swarming around the buildings in the adjacent site.

The September 2017 Survey Results are as follows:

| | | |
|---|---|---|
| Weather Conditions | Cloudy, dry, calm and 14$^{0}$C. | 3$^{rd}$ September 2017 |
| Dusk Survey | 20:00 to 23:00 hrs | 3$^{rd}$ September 2017 |

The Dusk Emergence Survey was started in vicinity of the buildings located immediate adjacent to the proposed development site (Farrankelly House and adjacent stables / agricultural sheds) and the fields within the survey site. The survey then proceeded as a walking transect into the fields of the proposed development site.

The first bat was recorded at 20:37 hrs. This was a common pipistrelle bat commuting through the stable yard (Located in the buildings adjacent to the proposed development site). The first Natterer's bat was recorded at 20:52 hours and this bat was commuting within the stable yard. The first Leisler's bat was recorded at 21:07 hours and this individual was foraging along treelines of the avenue/laneway leading to the R761. A second Leisler's bat was recorded at 21:24 hrs.

Following the track that leads to the second static unit (Blue Circle) all five species of bat were recorded foraging and commuting. Scrub Woodland 1 along with Hedgerow 11 provides an important foraging and commuting habitat for local bat populations. All five bat species recorded during the survey were recorded along these two habitats. As surveying continued towards the arable fields, bat activity was less with only the three common bat species recorded: common pipistrelle, soprano pipistrelle and Leisler's bat. The bat encounters are presented on Figure 3.

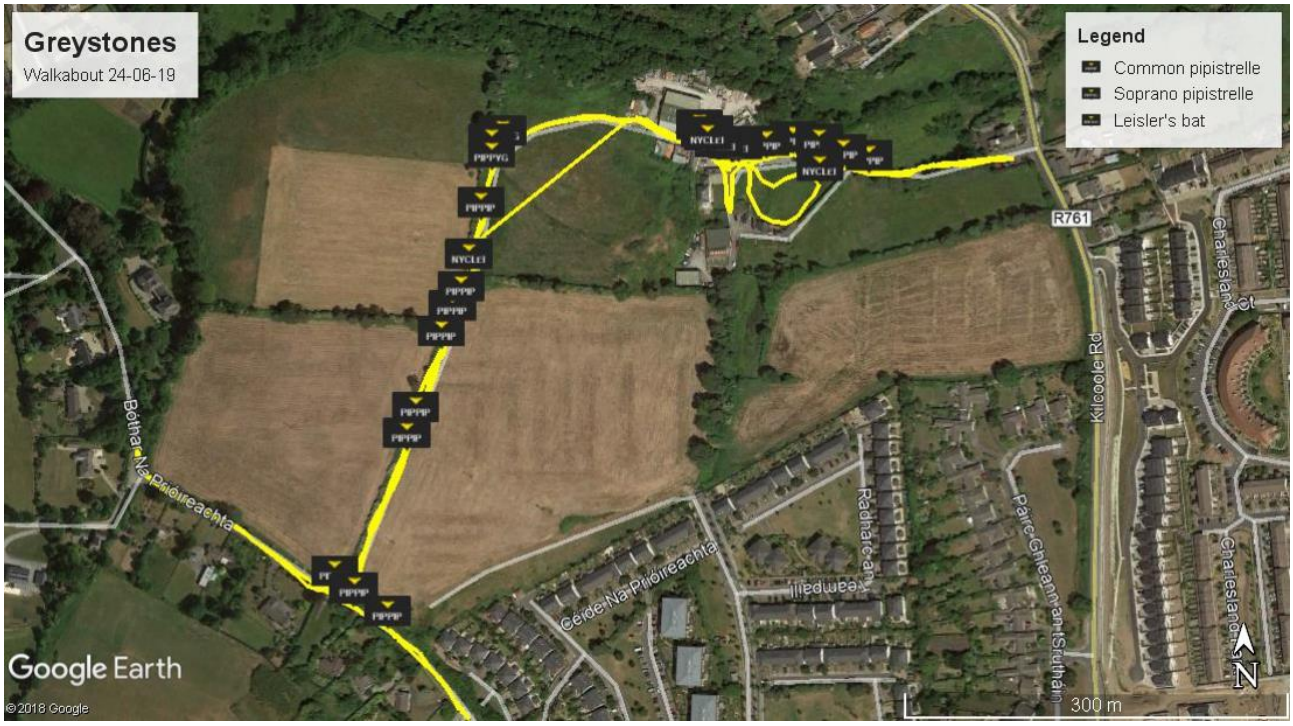

Figure 3: Bat encounters during Dusk Survey (including walking transect) (Within Red Line, supplied by CAIRN Homes.). Circles indicate the location of bat encounters and these are colour coded for each of the bat species recorded.

Green = common pipistrelles; Red = soprano pipistrelles; Blue = Leisler's bats
Orange = brown long-eared bats; Purple = Natterer's bats / *Myotis* bats

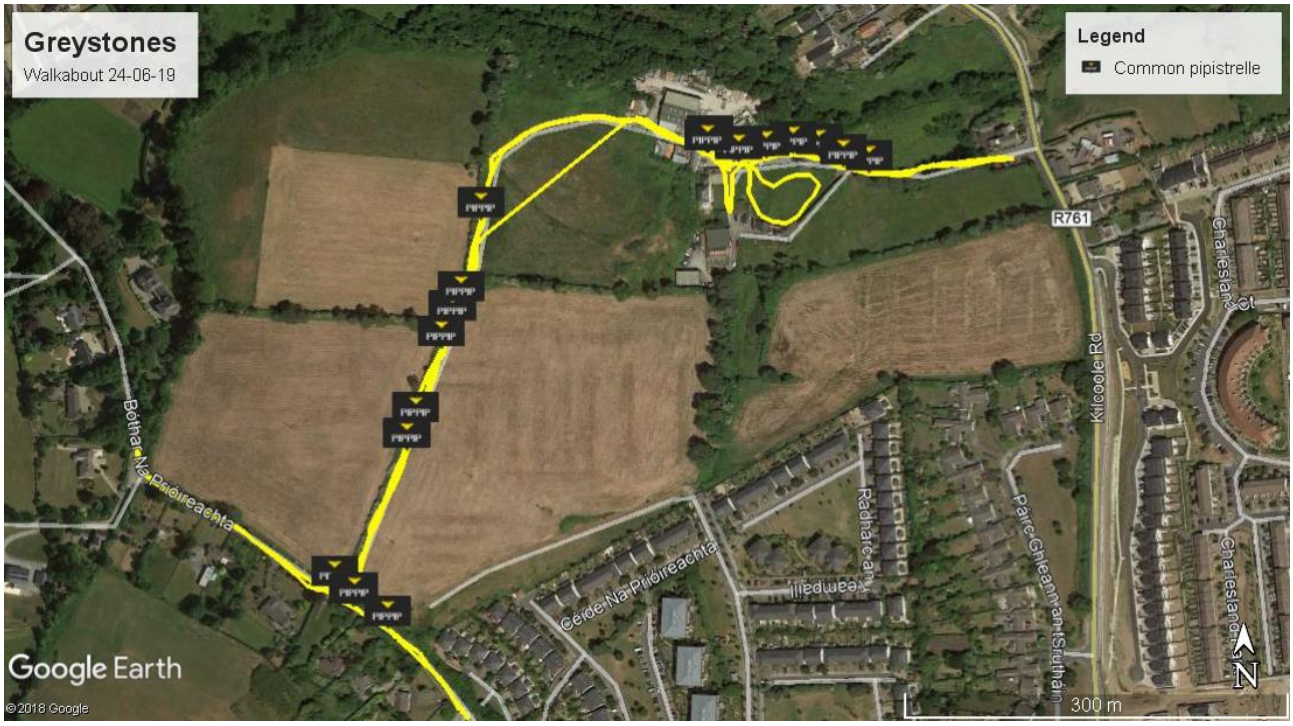
A number of walking transect bat surveys were completed in both 2017 and 2019. The 2017 results are presented above (Figure 3). The 2019 results are present below (Figures 4 and 5) as follows (please note that the maps used below are from Google Earth and mapping is facilitated by the EchoMeter Touch App. supplied by Wildlife Acoustics):

Figure 4a-d: Night 1 (June 2019) – Yellow line is walking route completed.

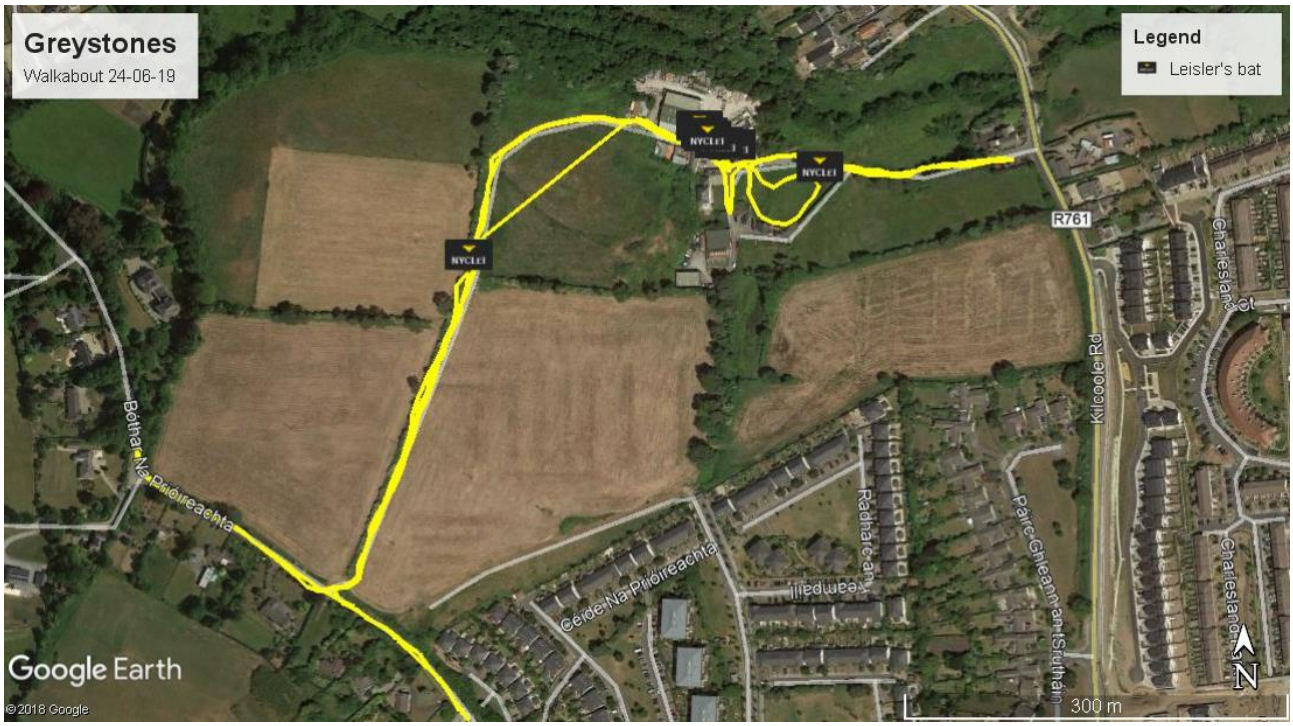
a) All bat encounters




b) Common pipistrelle encounters



c) Leisler's bat encounters




d) Soprano pipistrelle encounters


The second walking transect recorded five species of bat and increased the number of brown long-eared bat encounters. Common pipistrelles were the most frequently encountered bat species as with all other bat surveys.

Figure 5a-d: Night 2 (27th / 28th June 2019) – Green line is walking route completed.

a) All bat encounters


b) Common pipistrelles encounters

c) Soprano pipistrelle encounters


d) Leisler's bat encounters

e) Brown long-eared bat encounters


f) *Myotis* species

### *3.2.2 Passive Static Bat Detector Survey*

The following table summarises the results recorded on the static units deployed in both 2019 and 2017. The total number of bat passes recorded per night and divided by the number of hours of recording provides a figure for analysis. As a general guide activity level is determined as follows: Low = <10 bat passes/hr; Medium = >10 - <50 bat passes/hr; High = >50 bat passes/hr). Please see Appendices for more details.

*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.*

A high level of common pipistrelle bat activity was recorded on the static unit located along Hedge 13 as well as a medium level of Leisler's bat activity. Four other locations recorded a medium level of bat activity, primarily for common pipistrelles. These areas were also deemed important as a result of the walking transects too.

**Table 9: Results of Static Bat Detectors deployed during Static Bat Detector Surveys.**

Note: Unit A failed to record during surveillance period due to electronic interference. However walking transect was completed in this area to determine bat activity.

| Static Code | Details | Leis | CP | SP | BLE | Myotis |
|---|---|---|---|---|---|---|
| **2019 SM4 Unit 3**<br><br>Survey Period - 24/6/2019 to 28/6/2019 | Location: treeline (red triangle)<br><br>Hedge 9 | Night 1 – Low<br>Night 2 – Low<br>Night 3 – Low<br>Night 4 – Low | Night 1 – Low<br>Night 2 – Low<br>Night 3 – Low<br>Night 4 – Med | Night 1 – Low<br>Night 2 – Low<br>Night 3 – Low<br>Night 4 – Low | None | None |
| **2019 SM4 Unit 4**<br><br>Survey Period - 24/6/2019 to 28/6/2019 | Location; on treeline (orange triangle)<br><br>Hedge 13 | Night 1 – Low<br>Night 2 – Low<br>Night 3 – Med<br>Night 4 – Low | Night 1 – Med<br>Night 2 – High<br>Night 3 – High<br>Night 4 – Med | Night 1 – Low<br>Night 2 – Low<br>Night 3 – Low<br>Night 4 – Low | Night 1 – Low<br>Night 3 – Low | None |
| **2019 Unit B**<br><br>Survey Period - 24/6/2019 to 28/6/2019 | Location: treeline in cereal field (blue triangle)<br><br>Hedge 4 | Night 1 – Low<br>Night 2 – Low<br>Night 3 – Low<br>Night 4 – Low | Night 1 – Low<br>Night 2 – Low<br>Night 3 – Low<br>Night 4 – Low | Night 1 – Low<br>Night 2 – Low<br>Night 3 – Low<br>Night 4 – Low | Night 1 – Low | None |
| **2019 Unit A**<br><br>Survey Period - 24/6/2019 to | Location: mature tree in field adjacent to river (green | No recordings | No recordings | No recordings | No recordings | No recordings |

| | | | | | | |
|---|---|---|---|---|---|---|
| 28/6/2019 | triangle)<br><br>Hedge 14 | | | | | |
| **2017 SM3**<br><br>Survey Period – 3/9/17 to 5/9/2017 | Location: Treeline / hedgerow (red circle) | Night 1 – Low<br>Night 2 – Low | Night 2 – Low<br>Night 2 – Low | Night 1 – Low<br>Night 2 – Low | Night 2 - Low | Night 1 – Low<br>Night 2 – Low |
| **2017 SM2 Unit 4**<br><br>Survey Period – 2/5/2019 to 4/5/2018 | Location: Treeline / hedgerow (yellow circle) | Night 1 – Low<br>Night 2 – Low | Night 1 – Low<br>Night 2 – Low | Night 1 – Med<br>Night 2 – Low | Night 2 - Low | Night 1 – Low<br>Night 2 – Low |
| **2018 Unit A**<br><br>Survey Period – 2/5/2019 to 4/5/2018 | Location: Treeline / hedgerow (blue circle) | Night 2 – Low | Night 2 – Med | Night 2 – Low | Night 2 – Low | None |
| **2018 Unit B**<br><br>Survey Period – 2/5/2019 to 4/5/2018 | Location: Treeline / hedgerow (green circle) | Night 2 – Low | Night 2 – Med | Night 2 – Low | Night 2 – Low | Night 2 – Low |

During the 2017 static survey five species of bat was recorded on units: soprano pipistrelle, common pipistrelle, Leisler's bat, brown long-eared bat and *Myotis* species. During the Dusk Survey, Natterer's bats were recorded and therefore the *Myotis* species recorded is therefore likely to be this species. Both brown long-eared bats and Natterer's bats are woodland bat species and less common bat species. The remaining three species are common Irish bat species. A similar suite of bat species were also recorded in the 2019 static surveys.

Figure 6: Aerial of survey area (Within Red Line, supplied by Cairn Home Properties Ltd.) Circles indicate the location of the static units in 2017. Triangles indicate the location of static units in 2019. Ovals indicate linear habitats with High (Yellow) or Medium (Blue) level of bat activity.

## 3.3 Desktop Review

### *3.3.1 Bat Conservation Ireland Database*

A 1km and 10km search was undertaken for the central Irish grid reference of the survey site: O2854610298.

1 km level: 2 Roosts (*Pipistrellus* spp. and common pipistrelle) and 1 Ad Hoc record (Leisler's bat and common pipistrelle).

10km level: 20 Roosts (whiskered bat, soprano pipistrelle, brown long-eared bat, common pipistrelle and Leisler's bats); 8 Transects (Daubenton's bat, Leisler's bat and soprano pipistrelle) and 28 Ad Hoc records (whiskered bat, soprano pipistrelle, brown long-eared bat, common pipistrelle, Natterer's bat and Leisler's bats).

# 4. Bat Ecological Evaluation

## 4.1 Bat Species Recorded & Sensitivity

Three bat species were frequently recorded during these bat surveys: common pipistrelle, Leisler's bat and soprano pipistrelle. These three species are the three most common bat species recorded in Ireland. The additional two bat species recorded were Natterer's bat/*Myotis* species and brown long-eared bat.

The high level of bat activity of common pipistrelles and Leisler's bats, especially as the start of the night, commuting into the survey area indicates that there are important roosts, likely to be maternity roosts, located within the town of Greystones (east of the R761) due to the recorded commuting routes going from east to west..

A satellite roost of common pipistrelles was recorded both in 2018 and 2019 in the long shed within the wider survey area while a night roost was recorded in the stables for two species of bat, one of which is a less common bat species (Natterer's bat). It should be noted these buildings are outside the application area and will not be disturbed by the proposed development.

A high level of bat activity was recorded in sections of the survey area and these are discussed further in the next section.

## 4.2 Bat Foraging Habitat & Commuting Routes

A number of locations within the survey area have been identified as important foraging habitats and commuting routes for bats. These are represented on Figure 7 above. Yellow circled locations represent HIGH importance (due to high level of bat activity recorded within this area) and blue represent MEDIUM importance (due to medium level of bat activity recorded within this area).

## 4.3 Zone of Influence – Bat Landscape Connectivity

The survey area is located south of the town of Greystones, Co. Wicklow. This town has increased in size with numerous residential developments proposed for the town environs. As a consequence, it is important to ensure that for the long-term present of local bat populations that there is an overall plan to ensure landscape connectivity especially along such linear habitats as the wooded river valley.

## 4.4 Development Proposals

### *4.4.1 Greenway & Green Infrastructure*

Central to the landscape strategy for this proposed development is the proposed walking and cycling route along the existing 'Three Trouts Stream', which is located just inside of the northern site boundary. Both the stream itself and the dense woodland planting are prominent landscape features within the site. The green route proposed meanders through the existing woodland. Utilizing existing tracks and topographical features, it provides an alternative circulation route for users, which connects to footpaths and existing tracks located outside of the site boundary. The proposed route will begin at the south-west corner of the site and work its way around the site boundary up to the north-east corner.

The Landscape Report & Outline Landscape Specification report states the following: *"Pedestrian permeability throughout the site and to adjoining sites has been provided linking with the existing and future proposed footpath network and passive surveillance has been considered throughout all of the open spaces".* The pathways, including the greenway is shown on the following figure:

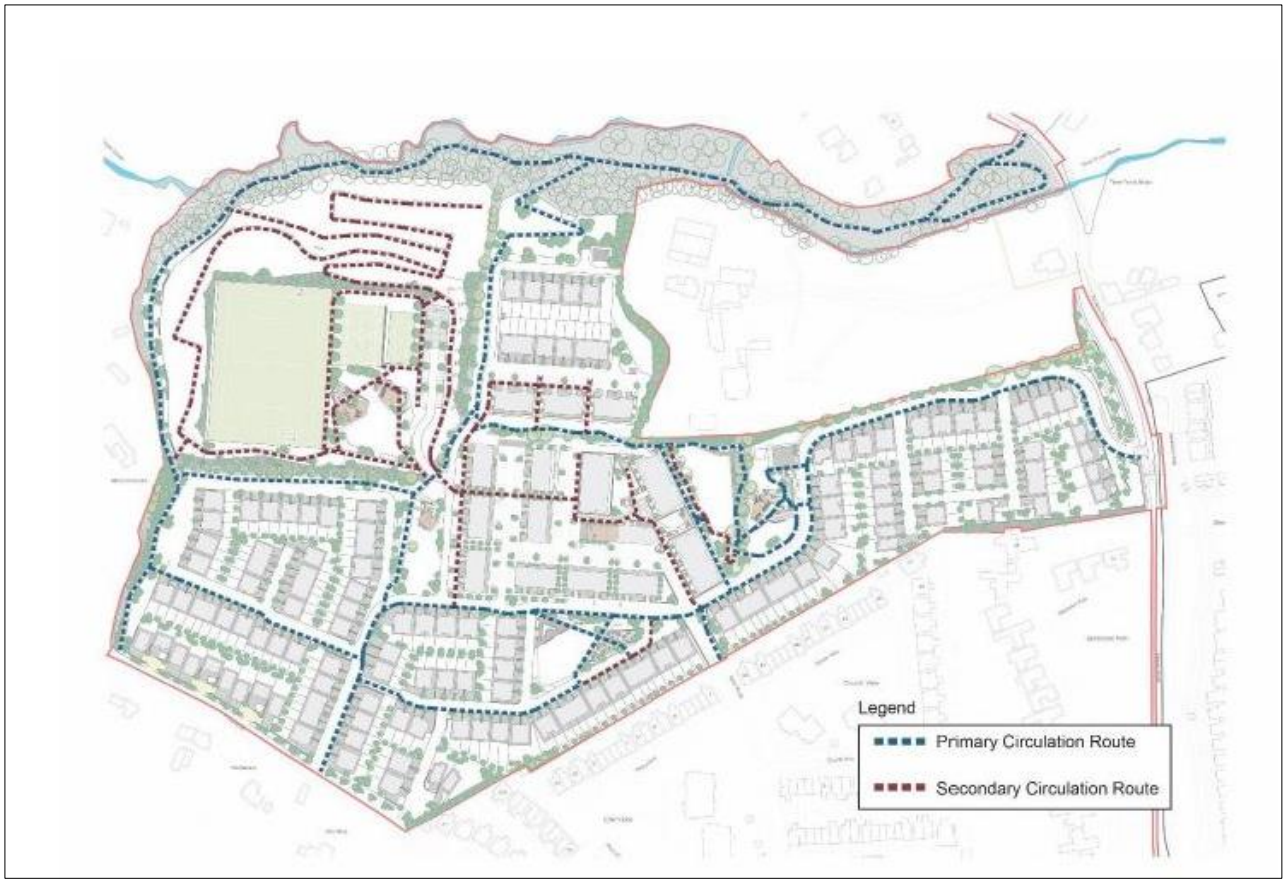



Figure 7: Pathways proposed: Source Figure 3 Circulation and Pathways permeability, Landscape Report & Outline Landscape Specification report.

The establishment of greenways is an important facility but it is also important to ensure that it is done in a manner that the dark corridors, which rivers generally provide in an urban setting. The main method proposed to be used by the landscape strategy for this proposed development is to enhance green infrastructure links is the retention and strengthening of existing hedgerows and woodland areas. Such a strategy will be of benefit to local bat populations.

The lighting plan for the greenway is designed to reduce the degree of lighting spillage. Consultation of the lighting report illustrated the horizontal luminance of the proposed lighting which aimed to have a minimum lighting of 0.47 lux along the outer edges of the spillage with a maximum of 12.66 lux recorded at the centre of the lighting.

As there is lighting planned along the greenway, this will also require a “buffer” landscaping plan to reduce potential impact from both noise and lighting on the wooded river valley. It is recommended that that the minimum number of trees etc. are removed to facilitate the greenway.

## Horizontal Illuminance (lux)

Grid 4


**Results**

| | |
|---|---|
| Eav | 2.83 |
| Emin | 0.49 |
| Emax | 7.19 |
| Emin/Emax | 0.07 |
| Emin/Eav | 0.17 |

## Horizontal Illuminance (lux)

Grid 5


**Results**

| | |
|---|---|
| Eav | 3.09 |
| Emin | 0.47 |
| Emax | 12.66 |
| Emin/Emax | 0.04 |
| Emin/Eav | 0.15 |

Figure 8: Horizontal illuminance (lux) maps for the proposed greenway (Lighting Report).

Plate 1: Example of lighting proposed for greenway.

### *4.4.2 Active Open Space*

The active open space covers a large portion of the north-western corner of the site and links up with the proposed green route. It consists of three main spaces: the sports pitches, the neighbourhood park and the fitness trail. Various sports pitches are proposed, including a large playing field, a multi-use games pitch and a tennis court. Screening will be implemented around all of the pitches using a combination of native woodland planting, formal hedge planting and large avenue trees. A vehicular access has been provided around the pitches for both maintenance and emergency access and vehicular parking is also located at the eastern edge of the overall space.

This active open space is proposed to be located in vicinity of the wooded river valley. Flood lighting is not proposed for the sports pitches. Street lighting will be required for car parking areas as part of its operation. Such lighting may have an impact on local bat populations and therefore sensitive mitigation measures will be required to reduce the potential impact of such on bats. The screening proposals, in the form of native woodland planting, formal hedge planting and large avenue trees, will mitigate for this potential impact.

### *4.4.3 Landscape Plan*

The Landscape Report & Outline Landscape Specification report states the following *"The landscape strategy aims to integrate the proposed residential development with the existing landscape and create a network of attractive and useable open spaces while contributing to local biodiversity. The public green areas are designed as landscape spaces that offer the opportunity for meeting, walking and formal and informal play. The protection and enhancement of existing landscape features, notably woodland belts, the existing stream and native hedgerows is an important aspect of the overall strategy, providing a structure for circulation and the connection of proposed open spaces, while continuing to develop green infrastructure links in the area. The development of a green route along the 'The Three Trouts Stream' will also be an integral part of the overall landscape strategy. The long-term development and maintenance of the landscape is*

*an integral part of the design strategy".* This strategy is a positive one in relation to retention of local bat populations.

The Landscape Plan shows those existing habitat features to be retained post-development area while a number of existing trees will also be retained. The woodland along the Three Trouts Stream is also being retained. Additional planting is also planned. The linear features are shown on the figure below:

- Red Lines: exiting internal native hedgerow to be retained and enhanced;
- Blue Lines – existing boundary to be retained and enhanced;
- Orange Lines – new native linear habitats/new native woodland to be planed;
- Purple Lines – linear features to be removed.

This proposed landscaping ensures commuting and foraging habitat for the local bat population with continued landscape connectivity. Retention of mature trees will also ensure roosting sites in such features for bats.

There are also additional open spaces that will feature additional planting all of which will link in with the treeline / woodland / hedgerow network of the landscape plan.

Four exiting linear habitat features will be removed to make way for the proposed development and this is shown, approximately, as the Purple Lines in the figure above, one of which had a Medium level of bat activity while the remaining ones had little or no bat activity.

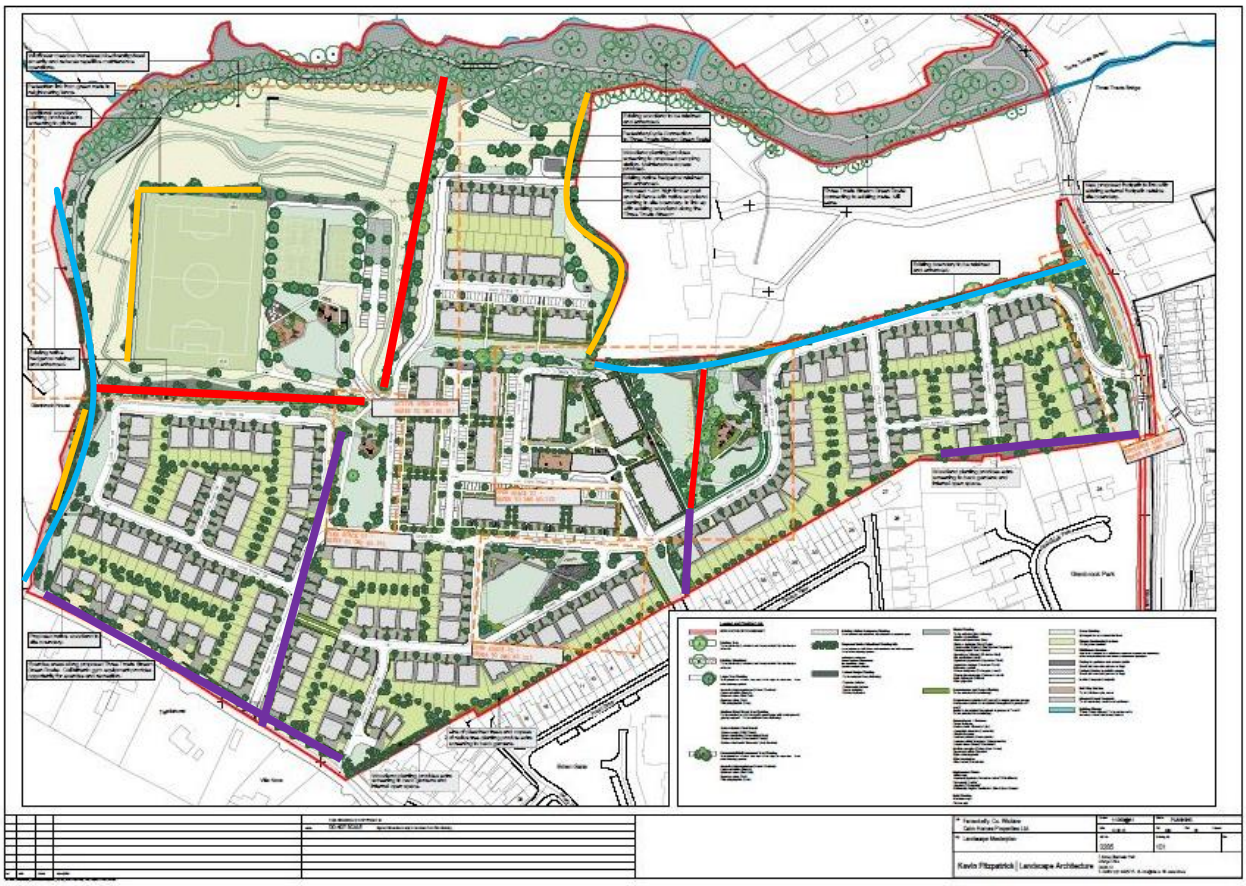


Figure 9: Landscape Plan overlaid with existing and proposed linear habitat features.

# 5. Impact Assessment & Mitigation

The following bat species have been recorded during this bat survey: common pipistrelle, soprano pipistrelle, Leisler's bat, brown long-eared bat and Natterer's / *Myotis* bats. This represents five of the nine residence bat species known to Ireland.

All bat species recorded during this Bat Survey are Annex IV species under the EU Habitats Directive and all have a Favourable Status in Ireland.

The presence of bats was given consideration at the design phases of the proposed development. For this ecological assessment, the habitats adjacent to the proposed development may be considered in terms of extent, diversity, naturalness, rarity, fragility, typicalness, recorded history, position, potential value and intrinsic appeal (Regini, 2000). The potential of these habitats for bat fauna is considered in this framework also.

- Bats may use trees with heavy ivy growth as occasional roosts. Bats may use mature trees with tree holes etc., as roosting sites all year around. A tree assessment in relation to Potential Bat Roosts was undertaken and this was compared to the Landscape plan to determine which trees will be felled. While a large number of trees were identified as PBRs, only 9 trees will be felled as a result of the removal of hedgerow removal while an additional 4 Category U trees may be felled for healthy and safety. Overall, extensive retention and enhancement of linear habitat features are proposed as part of the landscape strategy for the proposed development site.

- Foraging and commuting areas were primarily recorded along hedgerows and treelines and the wooded valley of the Three Trouts Stream located within the proposed development site, particularly for common and soprano pipistrelles, brown long-eared bats and Natterer's bats / *Myotis* species. The exception to this is Leisler's bats, which is a bat species that fly high over the landscape. They are not a reliant on linear habitats to traverse through the landscape.

- An extensive array of buildings is located adjacent to the survey area. A selection of buildings adjacent to the proposed development area have been surveyed as part of this bat survey, two of which have been recorded as a bat roost (satellite).

1 *agricultural grasslands/arable fields*.

This habitat is present within the survey area as agricultural blocks surrounded by linear habitats. These agricultural blocks and associated hedgerows/treeline boundaries provides foraging habitat for all of the bat species recorded. May be considered as Medium ecological value.

2 *hedgerow and treeline boundaries, access tracks*.

These habitat types are present around agricultural blocks, boundaries of the survey area and roadways. Such provide wildlife corridors and foraging areas for many bat species. Bat roosts may be present in mature trees or larger ivy-covered trees. However, these linear habitats are essential for commuting bats. May be considered as High ecological value.

3 *Woodland / Three Trouts Stream*

Native woodland is located along the Three Trouts Stream to the north of the proposed development site and this provides foraging and commuting habitat for the suite of bat species recorded. May be considered as of High ecological value for bats.

Bat fauna within the survey area will be affected by both the construction phase and operational phase of the proposed development. The impact assessment and mitigation will be undertaken in relation to the five bat species recorded within the proposed development area: common pipistrelle, soprano pipistrelle, Natterer's bat, Leisler's bat and brown long-eared bat.

Principal impacts of the proposed development, in general, on bat fauna may be summarised as follows:

1. A variety of habitats occur within the proposed development area, which vary in their importance for bats. The loss of areas of agricultural grassland/arable land within the proposed development area will have a negligible or minor impact on bats. The main impact on bats arises through the loss of hedgerows and treelines within the proposed development area which are widely used by all bat species recorded. Loss of bat habitats such as treelines, hedgerows as a result of construction will impact on commuting bats. Without mitigation measures and a Landscape Plan, the potential impact is considered as Moderate Negative Impact.

2. Loss or fragmentation of foraging habitats may diminish the available insect prey species and reduce feeding area for bats in some locations. This is considered as a Moderate Negative impact.

3. Bats will often use trees as roosting sites. Potential Bat Roosts in trees is also an important area to address and the proposed road route will be assessed for PBRs. There are 55 trees deemed to have roosting potential, however, many of these are located within treelines / hedgerows to be retained. Five linear habitats are proposed to be removed or partially which will results in 13 trees identified as a PBR to be removed. One of these hedgerows was deemed to have Medium important for commuting and foraging bats (hedgerow 7, but this will only be partially removed). All other linear habitats deemed important for local bat populations are marked to be retained on the landscape plan.

   The loss of trees in the landscape as a result of proposed development is likely to be Moderate Negative impact.

The Landscape Report & Outline Landscape Specification report states the following *"The landscape strategy aims to integrate the proposed residential development with the existing landscape and create a network of attractive and useable open spaces while contributing to local biodiversity. The public green areas are designed as landscape spaces that offer the opportunity for meeting, walking and formal and informal play. The protection and enhancement of existing landscape features, notably woodland belts, the existing stream and native hedgerows is an important aspect of the overall strategy, providing a structure for circulation and the connection of proposed open spaces, while continuing to develop green infrastructure links in the area. The development of a green route along the 'The Three Trouts Stream' will also be an integral part of the overall landscape strategy. The long-term development and maintenance of the landscape is*

*an integral part of the design strategy".* This strategy is a positive one in relation to retention of local bat populations.

The proposed works is likely to entail the following:

a) Lighting of the general area.

Proposed lighting of the proposed development post works may impact on all bat species in relation to commuting, roosting and foraging potential. But the degree of impact is dependent on how sensitive the particular bat species is to lighting as some bats are tolerant of lighting. It is also dependent on the type of lighting installed and the location of such lighting.

Leisler's bats are tolerant of street lighting. Common pipistrelles and soprano pipistrelles will tolerate low levels of lighting while brown long-eared bats and *Myotis* species (Natterer's bat) are lighting sensitive bat species.

Lighting on relation to the Greenway and Active Open Space are of particular importance in relation to local bat populations. Therefore, ensuring that such a directional and that there are buffer zones to reduce light spillage onto the nearby wooded river valley will be important. The lighting of the greenway in a bat friendly manner will also be important as well as a monitoring programme to determine if proposed lighting is suitable to allow local bat populations to continue to move through the landscape.

a) Removal of Linear habitats

There is large number of trees deemed to have roosting potential for bats as well as extensive treeline/hedgerow network within the proposed development site. This is connected to the woodland along the Tree Trouts River. As a consequence, many of the linear habitat features had bat activity recorded along their length. Particular linear habitats were deemed important for local bat populations.

The proposed development plan will require five linear habitats to be removed or partially removed to make way for the development along with at least 9 mature trees deemed to have a PBR value (additional 4 PBR trees may be felled for Health & Safety). One of these linear habitats was deemed to be of Medium important for local bat populations.

It is recommended that as much existing woodland, treelines and hedgerows is retained as part of the proposed development to ensure that there is foraging, roosting and commuting habitat for local bat populations and that newly planted hedgerows are planted using Irish native tree and shrub species to retain connectivity post development.

b) Infrastructure

The construction and operation of infrastructure to support the proposed development (e.g. roads and street lighting etc.) will impact on linear habitats. This will result in the loss of some treelines/hedgerows and as a consequence commuting and foraging habitats. The proposed development will require five linear habitats to be removed or partially removed to make way for the development along with at least 9 mature trees deemed to have a PBR value. One of these linear habitats was deemed to be of Medium important for local bat populations (Hedgerow 7, but this will only be partially affected).

The lighting of infrastructure will also potentially impact on foraging and commuting bats as mentioned above.

c) Operational post-development

The operation of the proposed development site as a residential development with open spaces will increase human usage of the site and as a consequence potential disturbance due to increased noise levels and lighting. However, as the proposed development site is primarily used as a commuting and foraging area for three common bat species, landscaping and lighting controls will reduce this impact. The two additional bat species recorded are considered to be light-sensitive bat species and will be impacted by the operation of the proposed development site. However, the location of the records of these two species were on the external treelines / hedgerows and therefore landscaping and retention of the boundary linear habitats is likely to reduce the impact of the operation of the proposed development on these bat species.

In the absence of mitigation the proposed development is considered to have an overall potential Moderate negative impact on location bat populations.

**Table 10: Potential impact of the proposed development on the different bat species recorded during survey work.**

| Works | SP | CP | Leis | BLE | Myotis |
|---|---|---|---|---|---|
| **Lighting of development area**<br>- **Reduced foraging**<br>- **Reduced commuting** | Moderate | Moderate | Moderate | Moderate | Moderate |
| **Removal of linear habitats** | Moderate | Moderate | Minor | Moderate | Moderate |
| **Removal of trees** | Moderate | Moderate | Moderate | Moderate | Moderate |
| **Operation of the development site** | Moderate | Moderate | Minor | Moderate | Moderate |
| **Infrastructure** | Moderate | Moderate | Minor | Moderate | Moderate |

SP = soprano pipistrelle, CP = common pipistrelle, Leis = Leisler's bat, BLE = brown long-eared bat, Myotis: *Myotis* species (Incl. Natterer's bat).

## 5.1 Mitigation Measures

The following mitigation measures are recommended to reduce the potential impact of the proposed development on local bat populations:

### *5.1.1 Lighting plan*

Nocturnal mammals are impacted by lighting. Therefore it is important that lighting installed within the proposed development site is completed with sensitivity for local wildlife while still providing the necessary lighting for human usage. The principal areas of concern are the wooded river valley and treelines/hedgerows remaining within the proposed development area. The following principles will be followed especially in relation to the general residential area and will also be implemented for the greenway and the active open area:

- Artificial lights shining on bat roosts, their access points and the flight paths away from the roost **must always be avoided**. This includes alternative roosting sites such as bat boxes.

- Lighting design should be flexible and be able to fully take into account the presence of protected species. Therefore, appropriate lighting should be used within a proposed development and adjacent areas with more sensitive lighting regimes deployed in wildlife sensitive areas.

- Dark buffer zones can be used as a good way to separate habitats or features from lighting by forming a dark perimeter around them. This should be used for habitat features noted as foraging areas for bats.

- Buffer zones can be used to protect Dark buffer zones and rely on ensuring light levels (levels of illuminance measured in lux) within a certain distance of a feature do not exceed certain defined limits. The buffer zone can be further subdivided in to zones of increasing illuminance limit radiating away from the feature or habitat that requires to be protected.

- 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 should be considered 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 should be carefully considered to minimise light spill. The shortest column height allowed should 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.

Planting of screening will also be effectively used to prevent lighting spillage areas where bat foraging is recorded. In particular, lighting will not shine onto important commuting and foraging areas identified for local bat populations.

The current operational greenway lighting, located to the east (on the opposite side of the R761) is bat friendly lighting on a sensor mechanism. This form of bat friendly lighting will be replicated within the greenway proposal for this development. The lighting plan will ensure that horizontal illuminance is at a 0.47 lux at the outer edges of the lighting spillage and this light spillage will be kept to a minimum due to directional luminaries.

The lighting plan will also ensure that minimal lighting spillage will occur in the active zone and throughout the development.

### *5.1.2 Landscaping plan*

The protection and enhancement of the majority of the existing landscape features, notably woodland belts, the existing stream and native hedgerows/treelines, will be retained and will form part the green infrastructure links in the area. This will ensure that the existing linear habitat features will form part of the existing green infrastructure links within the site and surrounding area. The three primary open spaces are located centrally within the overall site and each space is easily accessible from the surrounding properties.

The KFLA Landscape Plan provides extensive information on the woodland and linear features to be retained as well as individual trees. In addition, new native planting is proposed to reconnect the features being retained to the woodland along the Three Trouts Stream. Additional landscaping of open spaces will also increase connectivity and potential foraging areas for bats.

It is important to ensure that as much treelines / hedgerows are retained within the survey area, particularly on the boundary and in connection with the wooded river valley. The landscaping plan will incorporate:

- Retention and enhancement of the majority of internal existing treelines / hedgerows, particularly those connected in the landscape to the wooded valley of the Three Trouts Stream.
- Retention and enhancement of boundary habitats.
- Retention of woodland along the Three Trouts Stream
- Retention of a number of mature trees in linear habitats proposed to be retained.
- Planting of new native hedgerow around the playing pitches
- Planting of new native hedgerow along two sections of the site boundary

In addition, the Landscape Plan proposes:

- Three open spaces with additional planting are proposed. This will potentially provide additional foraging areas for local bat populations.

In general, the following will also be followed:

- Any semi-natural habitats will be protected from potential damage 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 the woodland and Three Trouts Stream.

Figure 10: Proposed landscape plan for the proposed development area (Source: KFLA).

### *5.1.3 Removal of trees*

a) Minimise the removal of mature trees, where possible. Fifty-five trees were identified as PBRs and the majority of these will be retained (42-46 PBR trees depending on Health & Safety conditions).

b) A total of 9 trees, deemed as PBRs, are proposed to be removed (Additional 4 PBR trees may be removed for Health & Safety). If the trees are to be removed, planting will be undertaken to mitigate for tree removal and landscaping plans will planted "like for like" in relation to tree and shrub species removed. Consideration will be given towards hawthorn, blackthorn mix with individual ash, alder and birch to form a native tree hedge) and deciduous trees (native tree species include ash, oak, alder, birch).

c) A 2nd assessment of the trees proposed to be removed will be undertaken prior to tree removal to determine total number of trees to be felled and the tree felling procedure to be undertaken. This will be undertaken in consultation with the tree surgeons.

Where possible, trees, which are to be removed, should be felled on mild days during the autumn months of September, October or November or Spring months of February and March (felling during the spring or autumn months avoids the periods when the bats are most active).

An assessment of trees according to their PBR value determines the methodology of felling. Trees with PBR Category 1 are highly suitable for roosting bats and require more intensive procedures prior to felling. The trees identified within the survey area are PBR Category 1 and 2. The procedure to fell these is as follows:

- Category 1: Trees with roosting features (dead wood, tree holes etc.) should be checked prior to felling. It is recommended that they are physically checked (using an endoscope and high power torch) or a dusk/dawn surveys are completed to determine if bats are roosting within. A tree felling plan will be required in consultation with the tree surgeons. A bat box scheme will need to be erected prior to felling and in consultation with the bat specialist. Any trees showing crevices, hollows, *etc*., should be removed while a bat specialist is present to deal with any bats found. Such animals should be retained in a box until dusk and released on-site. Large mature trees will be felled carefully, essentially by gradual dismantling by tree surgeons, under supervision of a bat specialist. Care will be taken when removing branches as removal of loads may cause cracks or crevices to close, crushing any animals within.
- Category 2: Any ivy covered trees which require felling will be left to lie for 24 hours after cutting to allow any bats beneath the cover to escape.
- A bat box scheme is required to be erected prior to any tree felling. The number of bat boxes will be determined by the category and number of trees proposed to be felled. In principle this will follow the following:

  For every Category 1 trees to be felled – one bat box is required
  For every three Category 2 trees to be felled – one bat box is required

  **Standard woodstone bat boxes:**


Plate 2

Bat boxes scheme will be provide and to ensure that bats use the bat boxes, they will be sited carefully and this will be undertaken by a bat specialist. Bat boxes will be erected prior to tree felling. Some general points that will be follow include:

- Straight limb trees (or telegraph pole) with no crowding branches or other obstructions for at least 3 metres 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.

- It is recommended to erect a number of bat boxes on one tree at an array of aspects. South facing boxes will receive the warmth of the sun, which is necessary for maternity colonies. In large bat box scheme it is generally recommended to have three bat boxes arranged at the same height facing North, South-East and South-West. This ensures a range of temperatures are available all day. If the South facing boxes become warm, bats can safely remove to the cooler North facing box.
- Locations for bat boxes should be selected to ensure that the lighting plan for the proposed site does not impact on the bat boxes.

### *5.1.4 Monitoring*

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

- Inspection of bat boxes within one year of erection of bat box scheme/rocket box and inspection of current bat box scheme. Register bat box scheme with Bat Conservation Ireland. This should be undertaken for a minimum of 2 years.
- Monitoring of any bat mitigation measures. All mitigation measures should be checked to determine that they were successful. A full summer bat survey is recommended post-works. This is especially important in relation to lighting plans for the greenway and the active open zone.

**Table 11: Potential impact of the proposed development on the different bat species recorded during survey work if bat mitigation measures are fully implemented.**

| Works | SP | CP | Leis | BLE | Myotis |
|---|---|---|---|---|---|
| **Lighting of development area**<br>- **Reduced foraging**<br>- **Reduced commuting** | Minor | Minor | Minor | Minor to Moderate | Minor to Moderate |
| **Removal of linear habitats / retention / replanting** | Minor | Minor | Minor | Minor to Moderate | Minor to Moderate |
| **Removal of trees in a manner as prescribed** | Minor | Minor | Minor to Moderate | Minor to Moderate | Minor to Moderate |
| **Operation of the development site** | Minor | Minor | Minor | Minor | Minor |
| **Infrastructure** | Minor | Minor | Minor | Minor | Minor |

SP = soprano pipistrelle, CP = common pipistrelle, Leis = Leisler's bat, BLE = brown long-eared bat, Myotis: *Myotis* species (Incl. Natterer's bat).

# 6. Survey Conclusions

This report provides information on the bat usage of the proposed development site. Three bat species were frequently recorded during these bat surveys: common pipistrelle, Leisler's bat and soprano pipistrelle. The additional two bat species recorded were Natterer's bat bat and brown long-eared bat within the survey area.

The medium level of bat activity of common pipistrelles, soprano pipistrelles and Leisler's bats was recorded, while a low level of bat activity was recorded for Natterer's bat and brown long-eared bat. Overall, the level of bat activity could be considered as Medium level. A satellite roost of common pipistrelles and Natterer's bats was recorded in two buildings outside the proposed development site and adjoining lands.

In relation to the bat evidence collected by this report, it is deemed that the bat populations recorded within the survey area are of Local Importance.

In the absence of mitigation the proposed development will likely have a Moderate Negative impact on local bat populations.

A number of mitigation measures have been provided and incorporated into the design of the proposed development, and strict adherence to these will reduce the overall impact level to Minor-Moderate Negative impact.

The proposed development area will result in the loss of a small number of commuting hedgerows/treelines. However the Landscape Plan will retain the majority of the important bat commuting linear habitat features and new planting and enhancement planting will ensure connectivity of same to the woodland area of the Three Trouts Stream. Additional open spaces will create potentially further foraging areas for bats which will also be connected as part of the green infrastructure.

The proposed development will increase the degree of lighting. However, the lighting plan is designed to reduce lighting spillage onto external hedgerows/treelines which will allow their continued usage by commuting and foraging bats. A sensor lighting plan is proposed for the greenway to reduce potential impact on local bat populations.

The proposed development will result in the felling of mature trees but this will be undertaken in a manner to ensure that no bats are harmed and alternative roosting will be provided in the form of bat boxes.

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# 8. Appendices

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.<br>  |

**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 | |

# 9. Static Unit Results

2017 Surveillance

Table 1: Songmeter SM3 (Red Circle, Figure 2 – located between Hedgerow 4 and Hedgerow 7 according to Tree Constraints Plan, Figure 4)

*NOTE: This detector was interfered with which may account for the lack of recordings from 00:00 hrs to 07:00 hrs on the first night of surveillance.*

| Time (hrs) | Leis | SP | CP | BLE | Myotis |
|---|---|---|---|---|---|
| **3rd September to 4th September 2017** | | | | | |
| 20:00-21:00 | 11 passes | 20 passes | 13 passes | 0 passes | 0 passes |
| 21:00-22:00 | 3 passes | 0 passes | 1 pass | 0 passes | 0 passes |
| 22:00-23:00 | 0 passes | 1 pass | 0 passes | 0 passes | 0 passes |
| 23:00-00:00 | 4 passes | 20 passes | 4 passes | 0 passes | 1 pass |
| 00:00-01:00 | 0 passes | 0 passes | 0 passes | 0 passes | 0 passes |
| 01:00-02:00 | 0 passes | 0 passes | 0 passes | 0 passes | 0 passes |
| 02:00-03:00 | 0 passes | 0 passes | 0 passes | 0 passes | 0 passes |
| 03:00-04:00 | 0 passes | 0 passes | 0 passes | 0 passes | 0 passes |
| 04:00-05:00 | 0 passes | 0 passes | 0 passes | 0 passes | 0 passes |
| 05:00-06:00 | 0 passes | 0 passes | 0 passes | 0 passes | 0 passes |
| 06:00-07:00 | 0 passes | 0 passes | 0 passes | 0 passes | 0 passes |
| **4th September to 5th September 2017** | | | | | |
| 20:00-21:00 | 2 passes | 10 passes | 6 passes | 0 passes | 0 passes |
| 21:00-22:00 | 1 pass | 0 passes | 0 passes | 0 passes | 1 pass |
| 22:00-23:00 | 1 pass | 0 passes | 1 pass | 0 passes | 0 passes |
| 23:00-00:00 | 1 pass | 0 passes | 1 pass | 0 passes | 0 passes |
| 00:00-01:00 | 0 passes | 0 passes | 0 passes | 1 pass | 0 passes |
| 01:00-02:00 | 5 passes | 1 pass | 3 passes | 1 pass | 0 passes |
| 02:00-03:00 | 1 pass | 0 passes | 3 passes | 0 passes | 0 passes |
| 03:00-04:00 | 7 passes | 2 passes | 2 passes | 0 passes | 0 passes |
| 04:00-05:00 | 2 passes | 1 pass | 2 passes | 0 passes | 0 passes |
| 05:00-06:00 | 3 passes | 9 passes | 15 passes | 0 passes | 0 passes |
| 06:00-07:00 | 9 pass | 0 passes | 7 passes | 0 passes | 0 passes |

Table 2: Songmeter 4 (Located along the river – Yellow Circle, Figure 2 – Scrub Woodland 1 according to Tree Constraints Plan, Figure 4)

| Time (hrs) | Leis | SP | CP | BLE | Myotis |
|---|---|---|---|---|---|
| **3rd September to 4th September 2017** | | | | | |
| 20:00-21:00 | 5 passes | 88 passes | 18 passes | 0 passes | 0 passes |
| 21:00-22:00 | 1 pass | 16 passes | 13 passes | 0 passes | 2 passes |
| 22:00-23:00 | 2 passes | 11 pass | 10 passes | 0 passes | 0 passes |
| 23:00-00:00 | 3 passes | 0 passes | 0 passes | 0 passes | 0 passes |
| 00:00-01:00 | 0 passes | 0 passes | 0 passes | 0 passes | 0 passes |
| 01:00-02:00 | 0 passes | 1 pass | 1 pass | 0 passes | 0 passes |
| 02:00-03:00 | 0 passes | 0 passes | 0 passes | 0 passes | 0 passes |
| 03:00-04:00 | 0 passes | 0 passes | 0 passes | 0 passes | 0 passes |
| 04:00-05:00 | 0 passes | 0 passes | 0 passes | 0 passes | 0 passes |
| 05:00-06:00 | 0 passes | 0 passes | 0 passes | 0 passes | 0 passes |
| 06:00-07:00 | 0 passes | 0 passes | 0 passes | 0 passes | 0 passes |
| **4th September to 5th September 2017** | | | | | |

| | | | | | |
|---|---|---|---|---|---|
| 20:00-21:00 | 3 passes | 23 passes | 15 passes | 0 passes | 2 passes |
| 21:00-22:00 | 1 pass | 25 passes | 11 pass | 0 passes | 0 passes |
| 22:00-23:00 | 1 pass | 10 passes | 11 pass | 0 passes | 0 passes |
| 23:00-00:00 | 0 passes | 0 passes | 1 pass | 0 passes | 0 passes |
| 00:00-01:00 | 0 passes | 0 passes | 3 passes | 1 pass | 0 passes |
| 01:00-02:00 | 5 passes | 1 pass | 3 passes | 1 pass | 0 passes |
| 02:00-03:00 | 1 pass | 0 passes | 3 passes | 0 passes | 0 passes |
| 03:00-04:00 | 1 pass | 10 passes | 2 passes | 0 passes | 0 passes |
| 04:00-05:00 | 2 passes | 11 pass | 12 passes | 0 passes | 0 passes |
| 05:00-06:00 | 0 passes | 14 passes | 14 passes | 0 passes | 0 passes |
| 06:00-07:00 | 2 passes | 10 passes | 13 passes | 0 passes | 0 passes |

Table 3: BatLogger A+ Unit A (Located along treeline – Blue Circle, Figure 2)

| Time (hrs) | Leis | SP | CP | BLE | Myotis |
|---|---|---|---|---|---|
| **4th September to 5th September 2017** | | | | | |
| 20:00-21:00 | 43 passes | 7 passes | 37 passes | 0 passes | 0 passes |
| 21:00-22:00 | 3 passes | 4 passes | 85 pass | 0 passes | 0 passes |
| 22:00-23:00 | 0 passes | 0 passes | 3 passes | 0 passes | 0 passes |
| 23:00-00:00 | 0 passes | 0 passes | 54 passes | 0 passes | 0 passes |
| 00:00-01:00 | 2 passes | 0 passes | 14 passes | 0 passes | 0 passes |
| 01:00-02:00 | 5 passes | 1 pass | 3 passes | 0 passes | 0 passes |
| 02:00-03:00 | 0 passes | 0 passes | 0 passes | 0 passes | 0 passes |
| 03:00-04:00 | 2 passes | 0 passes | 14 passes | 0 passes | 0 passes |
| 04:00-05:00 | 11 passes | 2 passes | 28 passes | 2 passes | 0 passes |
| 05:00-06:00 | 9 passes | 7 passes | 52 passes | 0 passes | 0 passes |
| 06:00-07:00 | 34 passes | 0 passes | 1 pass | 0 passes | 0 passes |

Table 4: BatLogger A+ Unit B (Located along treeline – Green Circle, Figure 2)

| Time (hrs) | Leis | SP | CP | BLE | Myotis |
|---|---|---|---|---|---|
| **4th September to 5th September 2017** | | | | | |
| 20:00-21:00 | 57 passes | 12 passes | 59 passes | 0 passes | 0 passes |
| 21:00-22:00 | 4 passes | 9 passes | 22 passes | 0 passes | 0 passes |
| 22:00-23:00 | 2 passes | 2 passes | 2 passes | 0 passes | 0 passes |
| 23:00-00:00 | 0 passes | 2 passes | 5 passes | 1 pass | 0 passes |
| 00:00-01:00 | 0 passes | 0 passes | 9 passes | 0 passes | 0 passes |
| 01:00-02:00 | 5 passes | 1 pass | 2 passes | 0 passes | 0 passes |
| 02:00-03:00 | 0 passes | 2 passes | 4 passes | 0 passes | 0 passes |
| 03:00-04:00 | 4 passes | 13 passes | 4 passes | 0 passes | 1 pass |
| 04:00-05:00 | 9 passes | 0 passes | 3 passes | 1 pass | 0 passes |
| 05:00-06:00 | 4 passes | 3 passes | 10 passes | 1 pass | 0 passes |
| 06:00-07:00 | 13 passes | 1 pass | 5 passes | 0 passes | 1 pass |

2019 Surveillance results

| Static Unit | Date | Leis | passes/hr | SP | passes/hr | CP | passes/hr | BLE | passes/hr | Myotis | passes/hr |
|---|---|---|---|---|---|---|---|---|---|---|---|
| SM4 Unit 3 | 24/06/2019 | 67 | 9.5714286 | 12 | 1.7142857 | 63 | 9 | 0 | 0 | 0 | 0 |
| | 25/06/2019 | 69 | 9.8571429 | 40 | 5.7142857 | 40 | 5.7142857 | 0 | 0 | 0 | 0 |
| | 26/06/2019 | 29 | 4.1428571 | 7 | 1 | 46 | 6.5714286 | 0 | 0 | 0 | 0 |
| | 27/06/2019 | 18 | 2.5714286 | 22 | 3.1428571 | 134 | 19.142857 | 0 | 0 | 0 | 0 |
| SM4 Unit 4 | 24/06/2019 | 30 | 4.2857143 | 20 | 2.8571429 | 246 | 35.142857 | 2 | 0.2857143 | 0 | 0 |
| | 25/06/2019 | 42 | 6 | 67 | 9.5714286 | 546 | 78 | 0 | 0 | 0 | 0 |
| | 26/06/2019 | 108 | 15.428571 | 48 | 6.8571429 | 736 | 105.14286 | 3 | 0.4285714 | 0 | 0 |
| | 27/06/2019 | 6 | 0.8571429 | 16 | 2.2857143 | 188 | 26.857143 | 0 | 0 | 0 | 0 |
| Unit B | 24/06/2019 | 16 | 2.2857143 | 16 | 2.2857143 | 25 | 3.5714286 | 1 | 0.1428571 | 0 | 0 |
| | 25/06/2019 | 53 | 7.5714286 | 17 | 2.4285714 | 24 | 3.4285714 | 0 | 0 | 0 | 0 |
| | 26/06/2019 | 21 | 3 | 14 | 2 | 33 | 4.7142857 | 0 | 0 | 0 | 0 |
| | 27/06/2019 | 56 | 8 | 10 | 1.4285714 | 31 | 4.4285714 | 0 | 0 | 0 | 0 |