Bat Survey Report

Ardderroo Wind Farm

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Table of Contents

Figures

Appendices

1 INTRODUCTION

McCarthy Keville O'Sullivan (MKO) was commissioned by Ardderroo Windfarm Ltd. to complete a comprehensive assessment of the potential effects on bats of a proposed wind farm at Ardderroo, Co. Galway (Figure 1.1). This report provides details of the bat surveys undertaken, including survey design, methods and results, and the assessment of potential effects of the development on bats. Where necessary, mitigation is prescribed to minimise any identified significant effects.

Bat surveys were undertaken at the site in 2013 and 2014 as part of a previous planning application (ABP Ref: PA0036). Previous reports and survey data were reviewed as part of the current assessment. In addition, a series of bat surveys, designed in accordance with the Bat Conservation Trust's guidelines for wind turbine developments (Hundt, 2012), were also undertaken in 2016 and 2017.

Bat surveys adopted a four-season approach and employed a combination of methods, including desktop study, habitat and landscape assessments, roost inspections, manual activity surveys and static detector surveys at ground level and at height. The aim of these surveys was to determine how bats are using the proposed development site and surrounding landscape. Specifically, to:

- identify the species present and their abundance
- locate any roosts, foraging areas or commuting routes
- determine seasonal variation in bat species assemblages and habitat use

1.1 Statement of Authority

Bat surveys undertaken in 2016 and 2017 were conducted by MKO ecologists; Chris Peppiatt (BSc, PhD) and Úna Nealon (BSc, PhD). Staff have relevant academic qualifications and are competent experts in undertaking bat surveys to this level.

Bat activity surveys were carried out and results compiled by Chris Peppiatt (BSc, PhD). Chris is a bat expert with over 12 years' professional experience, including echolocation survey work, demolition and tree felling supervision, bat box monitoring, roost counts, etc. He has previously undertaken bat surveys for wind energy developments in Clare, Cork, Donegal, Galway, Kerry, Limerick, Longford, Mayo, Roscommon and Tipperary. In addition, Chris is a member of the Heritage Council Bat Panel and has held an NPWS bat handling licence since 2005.

Scope development, surveys at height, impact assessment and reporting was undertaken by Úna Nealon (BSc, PhD). Úna's primary expertise lies in bat ecology, particularly in relation to wind farm EIA. Building on previous consultancy experience, she completed her PhD with the Centre for Irish Bat Research, examining the impacts of wind farms on Irish bat species. Her unique background leaves her ideally suited to undertake scope development for wind energy bat surveys, including the practical application of bat survey guidelines at Irish wind energy sites. She is also practiced in bat survey methods at potential development sites using multiple techniques. Furthermore, she is skilled in bat impact assessment and the design of mitigation measures where she applies scientific and technical knowledge to produce practical solutions.

This bat survey report was reviewed by Pat Roberts (BSc, MCIEEM). Pat has over 10 years' experience in management and ecological assessment. He has supervised the majority of ecological assessments (300+) completed by the company, including more recently, over 200 assessments required in accordance with Article 6(3) of the Habitats Directive.

1.2 Proposed Development Site

The proposed wind farm is located in the townlands of Letter, Ardderroo and Finnaun, near Roscahill, County Galway (Figure 1.1). The towns of Oughterard and Moycullen are located approximately 6.6 km north and 6.9 km east of the proposed wind farm respectively. Access to the site is gained by a network of forestry tracks, connected via tertiary and local roads to the N59 National Road.

The proposed development site is located in an upland site. The primary land use in the area is commercial forestry and the remainder is occupied by marginal farmland and peatland habitats. The proposed development site is drained by two rivers, the Owenboliska River to the west and the Ardderroo River to the east. Within the wider landscape, agriculture and renewable energy comprise the main land uses. Existing and permitted wind farms are located to the north-west, west and south of the proposed development.

The proposed development comprises:

(i) Construction of up to 25 No. wind turbines with a maximum overall blade tip height of up to 178.5 m
(ii) 1 no. permanent meteorological mast with a maximum height of up to 112 m
(iii) 1 no. 110kV electrical substation with 2 no. control buildings with welfare facilities, 6 no. battery containers, all associated electrical plant and equipment, all associated underground cabling, waste water holding tank and all ancillary works
(iv) Underground cabling connecting the turbines to the proposed substation and connection from the proposed substation to the national grid at the existing Eirgrid substation in the townland of Letter
(v) Upgrade of existing and provision of new internal access roads and all associated drainage control systems
(vi) 3 no. borrow pits
(vii) 2 no. temporary construction compounds
(viii) Recreation and amenity works, including marked trails, conversion of one temporary construction compound into a permanent amenity car park, provision of a toilet/shelter building and associated waste water holding tank, and associated recreation and amenity signage
(ix) All associated site development works
(x) A ten year planning permission and 30 year operational life from the date of commissioning of the entire wind farm.

The provision of an alternative access road from the N59 does not form part of the application but is considered in this impact assessment. The alternative construction access junction, off the N59, would be located in the townland of Knockaunranny and the alternative construction access road would run northwest for approximately 830m before emerging on to the local road, west of the residential area, in the townland of Doon.

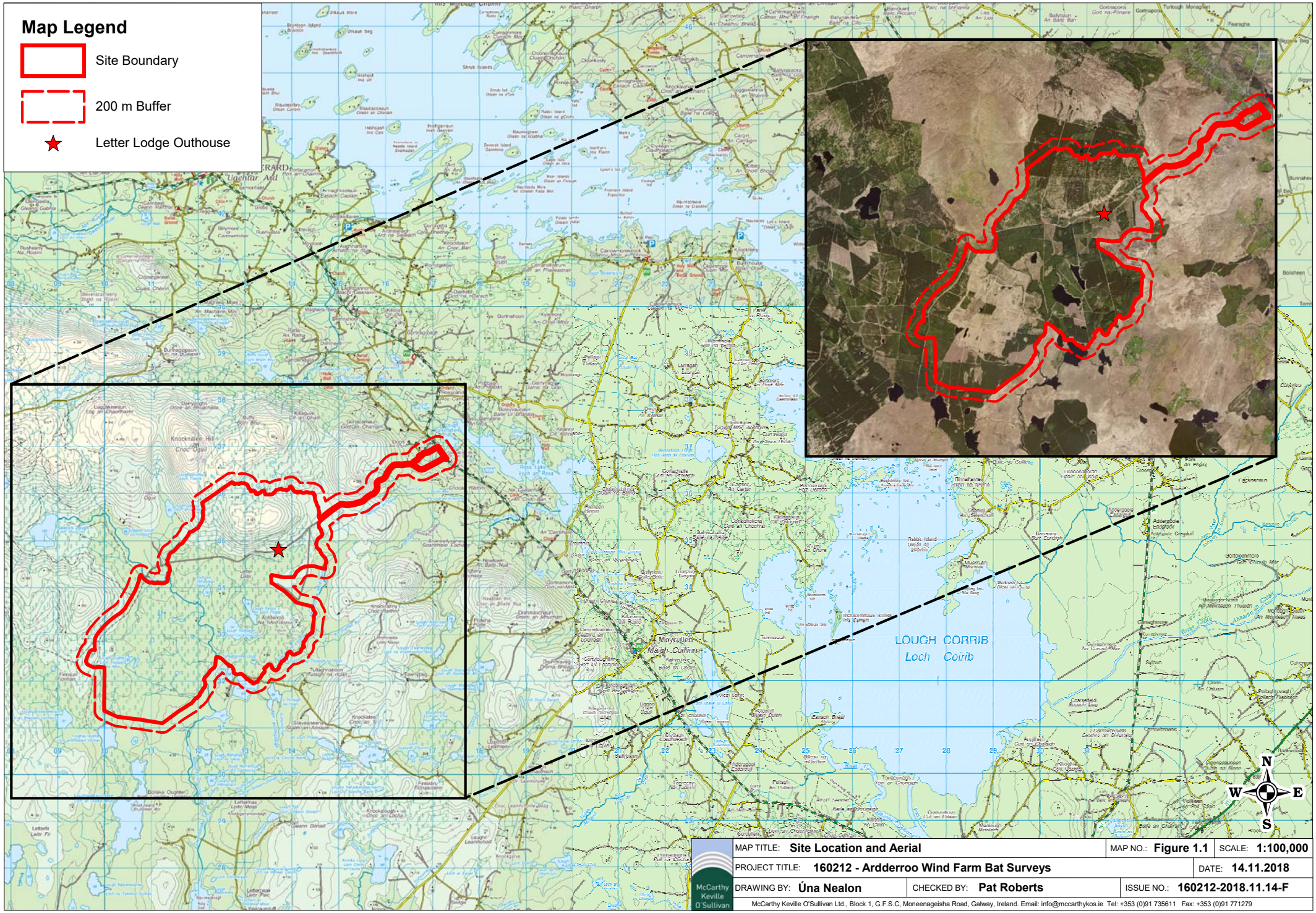
The Study Area was defined by the developable area and a 200m buffer (Figure 1.1) (Hundt, 2012). A map of the proposed site layout is provided in Figure 1.2.

1.3 Site History

In September 2014, Ardderroo Windfarm Ltd. applied to An Bord Pleanála (ABP) for planning permission for a 29 no. turbine wind farm and associated works (ABP Ref. 07.PA0036).

In February 2014, ABP requested further information to satisfy items identified by the Inspector. One of these items related to the proposed demolition of an existing agricultural structure to facilitate the proposed substation and its potential for adverse effects on roosting bats. In May 2015, MKO submitted an EIAR/EIS Addendum which proposed the relocation of the substation, eliminating the requirement to demolish the existing agricultural structure and the potential for adverse effects as a result.

In December 2015, ABP refused planning permission for the proposed wind farm. One of the reasons for refusal concluded there was insufficient information on which to base a robust assessment on bats. Since the Board's decision, MKO have taken steps to address the issues that gave rise to this decision. This included a substantial widening of the scope and duration of bat surveys.



MAP TITLE: **Site Location and Aerial**		MAP NO.: **Figure 1.1**	SCALE: **1:100,000**
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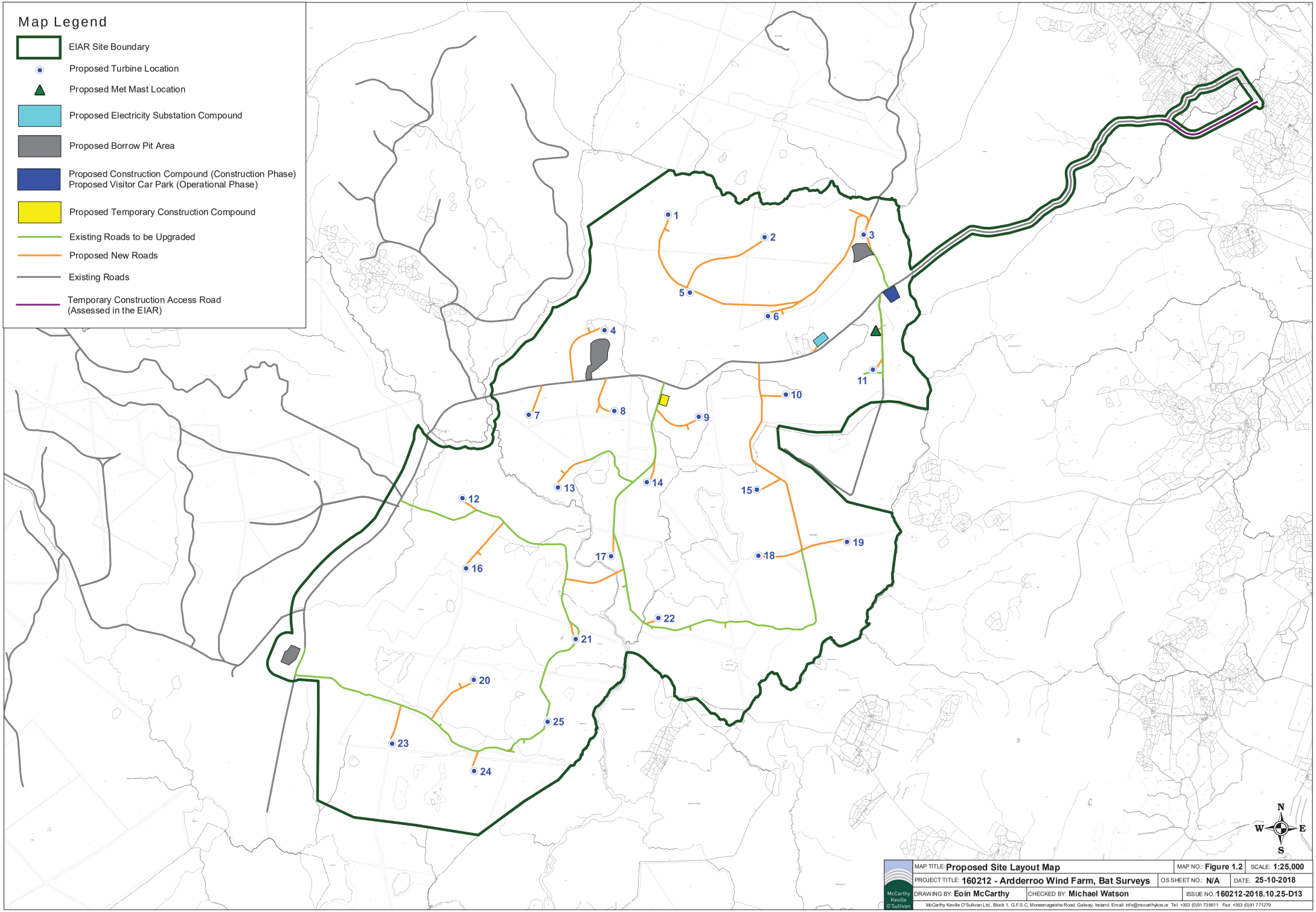

MAP TITLE: **Proposed Site Layout Map** | MAP NO.: **Figure 1.2** | SCALE: **1:25,000**

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2 BACKGROUND

2.1 Introduction

Wind energy provides a clean, sustainable alternative to fossil fuels in generating electricity. However, wind energy development can impact wildlife, directly through mortality and indirectly through disturbance and habitat loss. Bat fatalities have been reported at wind energy facilities around the world, raising concern about the cumulative impacts of such developments on bat populations (Arnett et al. 2016). No large scale studies have been undertaken in Ireland to date. However, a study from the UK estimated bat fatalities at 0 – 5.25 bats per turbine per month (Mathews et al. 2016). While these results are not directly applicable to Ireland due to differences in bat species and behaviour, Ireland shares more similarities with bat assemblages of Great Britain, compared to those of mainland Europe.

Investigative research in North America and mainland Europe have revealed the mechanisms for bat mortality at wind turbines. Fatalities arise from direct collision with moving turbine blades (Horn et al. 2008, Cryan et al. 2014) and barotrauma (Baerwald et al. 2008), i.e. internal injuries caused by air pressure changes. Why bats fly in the vicinity of wind turbines has been attributed to several different behavioural and environmental factors, e.g. habitat associations, weather conditions, species ecology, etc.

Pre-construction bat surveys are undertaken to gain an insight into bat activity in the absence of turbines and to predict and mitigate against any future risks identified. Survey design and analyses of results at the proposed development site was undertaken with reference to the latest policy and legislation, scientific literature and industry guidelines. Any spatial, temporal or behavioural factors that may put bats at risk were fully considered.

2.2 Irish Bats: Legislation, Policy and Status

Ireland has nine resident bat species, comprising more than half of Ireland's native terrestrial mammals (Montgomery et al., 2014). This is considerably less than the 53 bat species found in mainland Europe (Rodrigues, 2015) and 17 in Great Britain (Hundt, 2012).

All Irish bats are protected under European legislation, namely the Habitats Directive (92/43/EEC). All Irish species are listed under Annex IV of the Directive, requiring strict protection for individuals, their breeding sites and resting places. The lesser horseshoe bat (*Rhinolophus hipposideros*) is further listed under Annex II of the Directive, requiring the designation of conservation areas for the species. Under this Directive, Ireland is obliged to maintain the favourable conservation status of Annex-listed species. This Directive has been transposed into Irish law through the European Communities (Birds and Natural Habitats) Regulations 2011.

In addition, Irish species are further protected by national legislation (Wildlife Acts 1976-2017). Under these legislation, it is an offence to intentionally disturb, injure or kill a bat, or disturb its roost. Any work at a roost site must be carried out with the agreement of the National Parks and Wildlife Service (NPWS).

The NPWS monitors the conservation status of European protected habitats and species and reports their findings to the European Commission every 6 years. The most recent report for the Republic of Ireland was submitted in 2013. Table 2.1 summarises

the current conservation status of Irish bat species and identified threats to Irish bat populations.

Table 2.1: Irish bat species conservation status and threats

Bat Species	Conservation Status	Principal Threats
Common pipistrelle *Pipistrellus pipistrellus*	Favourable	▪ Urbanised areas (e.g. light pollution) ▪ Bridge/viaduct repairs ▪ Pesticides usage ▪ Removal of hedges, scrub, forestry ▪ Water pollution ▪ Other pollution and human impacts (e.g. renovation of dwellings with roosts) ▪ Infillings of ditches, dykes, ponds, pools and marshes ▪ Management of aquatic and bank vegetation for drainage purposes ▪ Abandonment of pastoral systems ▪ Spieleology and vandalism ▪ Communication routes: roads - forestry management
Soprano pipistrelle *Pipistrellus pygmaeus*	Favourable	
Nathusius' pipistrelle *Pipistrellus nathusii*	Favourable	
Leisler's bat *Nyctalus leisleri*	Favourable	
Daubenton's bat *Myotis daubentoni*	Favourable	
Natterer's bat *Myotis nattereri*	Favourable	
Whiskered bat *Myotis mystacinus*	Favourable	
Brown long-eared bat *Plecotus auritus*	Favourable	
Lesser horseshoe bat *Rhinolophus hipposideros*	Favourable	

2.3 Collision Risk for Irish Species

Bat species at high risk of wind turbine collision share several morphological and ecological similarities. Species at high risk tend to be open-air foragers with long narrow wings and use high-intensity, narrow-band echolocation calls (Schuster, 2015). This pattern is consistent in North America, Europe and Australia.

Guidance provided by Natural England (2014) utilised this information to provide a collision risk assessment for British bat species. Table 2.2 summarises the results of this risk assessment with respect to species that occur in Ireland. Four species are identified as high or medium risk. They are common pipistrelle (*Pipistrellus pipistrellus*), soprano pipistrelle (*Pipistrellus pygmaeus*), Nathusius' pipistrelle (*Pipistrellus nathusii*) and Leisler's bat (*Nyctalus leisleri*). These four species have also displayed significant mortality at wind energy facilities in mainland Europe (EUROBATS, 2016).

Table 2.2: Collision risk level for Irish bat species (Natural England, 2014)

Low Risk	Medium Risk	High Risk
Myotis species	Common pipistrelle	Leisler's bat
Brown long-eared bat	Soprano pipistrelle	Nathusius pipistrelle
Lesser horseshoe bat		

No systematic fatality studies have been undertaken at Irish wind farms to date. However, there are isolated reports of a small number of Irish bat fatalities. These include pipistrelle bats (n=8) and Leisler's bat (n=1) (Nealon, 2016).

2.4 Guidance

A number of guidelines for surveying bats at wind energy developments have been produced in Europe, the UK and Ireland. These guidelines aid in designing bat surveys at potential wind energy sites, assessing risk and developing mitigation and compensation strategies to minimise negative effects. The various guidelines differ in their level of technical detail and reference to published research findings. It is important that every assessment considers the scale of any likely impacts and takes a proportionate approach, with reference to published advice and guidelines.

2.4.1 EUROBATS

At a European level, the Advisory Committee to the EUROBATS Agreement, to which Ireland is a signatory, have produced *Guidelines for Consideration of Bats in Wind Farm Projects* which outlines an approach for assessing the potential impacts of wind turbines on bats during planning, construction and operation phases (Rodrigues, 2015). However, these guidelines are based on continental scenarios and include more diverse species and behaviours than those typical of Ireland. As such, EUROBATS guidance may recommend a level of survey that may prove inappropriate in Irish scenarios. Nevertheless, the guidance is evidence-based and provides a useful European context, within which Member States are encouraged to produce specific national guidance, focusing on local circumstances.

2.4.2 Bat Conservation Trust (BCT)

The second edition of the BCT's *Bat Survey Good Practice Guidelines* (Hundt, 2012) includes a chapter on survey methodologies for assessing the potential impacts of wind turbines on bats. The document provides technical guidance for consultants carrying out impact assessments. However, the recommendations are not based on any research findings specific to the UK.

A third edition to the guidelines, published in early 2016, removed the chapter on surveying wind turbine developments. New wind farm guidance is being drafted in partnership with relevant organisations and with regard to recent research findings in the UK. This new guidance was due for publication in late 2016 but has not yet been made available. Until this new guidance is published, the chapter in the 2nd edition is still applicable.

2.4.3 Bat Conservation Ireland (BCI)

BCI produced *Wind Turbine/Wind Farm Development Bat Survey Guidelines* (BCI, 2012a). This document provides advice to practitioners and decision makers in Ireland on necessary qualifications for surveyors, health and safety considerations, pre-construction and post-construction survey methodologies and information to be included in a report. In the absence of comprehensive Irish research, these guidelines provide generalised methodology rather than detailed technical advice.

2.4.4 Other Useful Publications

Prior to the publication of the BCT guidelines, *Natural England's Bat and Onshore Wind Turbines: Interim Guidance* provided a pragmatic interpretation of the EUROBATS recommendations, as applied to onshore wind energy facilities in the UK (Natural England, 2014). In addition, the Chartered Institute of Ecology and Environmental Management (CIEEM) publishes advice on best practice as well as updates on the current state of knowledge in the *Technical Guidance Series* and in the quarterly publication *In Practice*.

In addition to specific wind farm guidance documents, other sources on bat survey, assessment and mitigation were consulted. Conservatively, these included:

- Bat Surveys for Professional Ecologists: Good Practice Guidelines (3rd edn) (Collins, 2016)
- The Bat Worker's Manual, 3rd Edition (Mitchell-Jones and McLeish, 2004).
- Ecological and Behavioral Methods for the Study of Bats, 2nd Edition (Kunz and Parsons, 2009).
- Irish Bats in the 21st Century (Roche et al., 2014)
- British Bat Calls: A guide to species identification (Russ, 2012)
- Handbook of Biodiversity Methods: Survey, Evaluation and Monitoring (Hill, 2005)
- The Lesser Horseshoe Bat: Conservation Handbook (Schofield, 2008).
- Bats and Appropriate Assessment Guidelines, Version 1 (BCI, 2012b)
- Bat Mitigation Guidelines (Mitchell-Jones, 2004).
- Bat Mitigation Guidelines for Ireland. (Kelleher and Marnell, 2006)
- Bat Conservation: Global evidence for the effects of interventions (Berthinussen et al., 2014)
- Best practice guidelines for the conservation of bats in the planning of national road schemes (NRA, 2006a)
- Guidelines for the treatment of bats during the construction of national road schemes (NRA, 2006b)
- Bat Survey – Specific Requirements for Wind Farm Proposals (Northern Ireland Environment Agency, 2011)
- Wildlife and Wind Farms – Conflicts and Solutions, Volumes 1 and 2 (Perrow, 2017)

3 METHODS

3.1 Consultation

A consultation exercise was undertaken as part of the EIAR for the proposed development. A Scoping Document, comprising a description of the site and the proposed development, was circulated to consultees in December 2016. As part of this exercise, prominent Irish conservation groups were contacted and BCI were specifically invited to comment on the potential of the proposed development to affect bats.

In addition, a meeting was held between project ecologists and an NPWS representative (Dr. Julie Fossitt) at the NPWS Regional Offices in Galway on the 20th February 2017. During the meeting, issues raised by the NPWS and ABP (under ABP Ref: PA0036) were addressed. This included an outline of all additional surveys undertaken (including additional bat surveys) and a summary of results to date. Discussions that followed covered the interpretation of survey results, assessment of effects and proposed mitigation.

A copy of the agreed minutes from this meeting is included within Appendix 2-1 of the main EIAR.

3.2 Desktop Study

A desktop review of published and unpublished material was undertaken prior to conducting field surveys. The aim of the desktop review was to identify the presence of species of interest or designated sites within the Study Area and surrounding region.

3.2.1 Bat Survey Reports 2013-2014

Previous bat survey reports, prepared for a planning application (ABP Ref: PA0036), were reviewed as part of the desktop study. MKO ecologists undertook bat surveys at the site between April and September 2013, and in August 2014. These surveys included a combination of methods including desktop studies, roost surveys, walked transects and static detector surveys at ground level. All previous survey data and reporting were considered in the current assessment.

3.2.2 National Bat Database of Ireland

The National Bat Database of Ireland holds records of bat observations received and maintained by BCI. These records include results of national monitoring schemes, roost records as well as ad-hoc observations. A search of the National Bat Database of Ireland was last carried out on the 14th February 2018 and examined bat presence and roost records within a 10 km radius of the Study Area (BCI 2012a, Hundt 2012).

In addition, the following BCI monitoring reports were reviewed:

- All Ireland Daubenton's Bat Waterway Monitoring Scheme 2006-2011. Irish Wildlife Manuals, No. 61 (Aughney et al., 2012)
- Car-based bat monitoring in Ireland 2003-2011. Irish Wildlife Manuals, No. 60. (Roche et al., 2012)
- Brown Long-eared Bat roost monitoring scheme for the Republic of Ireland: synthesis report 2007-2010. Irish Wildlife Manuals, No.56. (Aughney et al., 2011)
- BATLAS 2020 Pilot Project Report (Abbott et al., 2015)

- Irish Bat Monitoring Schemes. BATLAS Republic of Ireland Report for 2008-2009 (Carden et al., 2010)
- An investigation of the impact of development projects on bat populations: Comparing pre- and post-development bat faunas (Aughney, 2008)
- Lesser horseshoe bat: population trends and status of its roosting resource. Irish Wildlife Manuals, No 85 (Roche et al., 2015)

3.2.3 Designated Sites

The National Parks and Wildlife Service (NPWS) map viewer and website provides information on rare and protected species, sites designated for nature conservation and their conservation objectives. A search was undertaken of sites, specifically designated for the conservation of bats, within a 10 km radius of the Study Area (Hundt, 2012). This included European designated sites, i.e. SACs, and nationally designated sites, i.e. NHAs and pNHAs.

3.2.4 Habitat and Landscape

Ordnance survey maps (OSI 1:5,000 and 1:50,000) and aerial imagery (ortho-based maps) were reviewed to identify any habitats and features likely to be used by bats. Maps and images of the Study Area and general landscape were examined for suitable foraging or commuting habitats including woodlands and forestry, hedgerows, treelines and watercourses. In addition, any potential roost sites, such as buildings and bridges, were noted for further investigation.

In addition, the Geological Survey Ireland (GSI) online mapping tool and UBSS Cave Database for the Republic of Ireland were consulted for any indication of natural subterranean bat sites, such as caves, within 10 km of the Study Area (BCI, 2012a) (last searched on the 14th Febraury 2018). Furthermore, the archaeological database of national monuments was also reviewed for any evidence of manmade underground structures, e.g. souterrains, that may be used by bats (last searched on the 14th Febraury 2018).

3.3 Habitat Suitability Assessment

Bat walkover surveys were carried out throughout 2013 (April – September), 2014 (August), 2016 (April – October) and 2017 (January). During these surveys, habitat types within the Study Area were recorded and assessed for their suitability to support bats. Suitability was assessed according to Collins (2016) which provides a grading protocol for roosting habitats and for commuting and foraging areas. Suitability categories, divided into *High*, *Moderate*, *Low* and *Negligible*, are described fully in Appendix 1.

3.4 2016-2017 Field Surveys

3.4.1 Survey Design

The likely impact of a proposed development on bats is related to the size of the development, the extent and quality of the habitat and the availability of buildings or other features that may support roosting bats. The scale of impacts is likely to increase in relation to the number and quality of such features. The BCT guidelines provide recommendations for assessing site characteristics and determining the potential risk level of a development (Hundt, 2012). All BCT site assessment criteria are provided in Appendix 2.

Table 3.1 describes the criteria and site characteristics used to determine the potential risk level for the Study Area. Desk study results and initial habitat assessments were

reviewed in relation to all BCT site assessment criteria and the Study Area was conservatively assigned a *Medium* value.

Table 3.1: Assessment of potential risk level within the Study Area (as determined from Hundt, 2012)

Item	Assessment of Site	Evidence at Site	Risk Level
Quality of habitat, number of features likely to contribute to potential mortality rates	Buildings, trees or other structures with moderate-high potential as roost sites on or near the site	A night roost for lesser horseshoe bat was previously identified within the site	Medium
	Habitat could be used extensively by foraging bats	Woodland, forestry, lakes & watercourses within the site may provide good habitat	Medium
	Isolated site, not connected to the wider landscape by prominent linear features	Site is surrounded by wide expanses of open peatland habitats	Low
Species likely to use the site	High number, medium risk species Low number, single high risk species	Likely used by at least moderate numbers of pipistrelle bats and some Leisler's bats	Medium
Importance of roosts, of species likely to use site, which may be affected.	District	A night roost for lesser horseshoe bat was previously identified No other valuable roosts identified	Medium
Overall assessment			**Medium**

The assigned risk level was then used to determine the scope and extent of survey work required to fully and comprehensively assess impacts on bat species. A description of survey standards for all risk levels is included in Appendix 3 and further detail is available in the BCT guidelines (Collins 2016, Hundt 2012). Briefly, for a *Medium* value site:

- Roost surveys are recommended within 200 m of the developable area, including an assessment of roosting potential, an inspection of all potential roost sites and activity surveys of roosts of high/medium risk species and roosts of district importance and above (Wray et al 2010).

- For manual surveys, transect routes should be representative of all habitats and turbine locations. The guidelines recommend a minimum survey effort of one visit per transect per month between April and October.

- For static detector surveys, detectors should be deployed in sufficient numbers so as to represent the extent of the site and the range of habitats present. At least 5 consecutive nights recording per detector per month is recommended between April and October.

- The need for bat monitoring at height should be assessed on a site by site basis. It is recommended when key-holing wind turbines in small clearings of woodland.

The results of the desktop study, including previous survey results and initial habitat assessments, were used to determine any outstanding bat survey requirements with reference to BCT guidance (Hundt, 2012). Bat surveys in 2016 and 2017 employed a combination of methods including roost surveys, manual activity surveys along fixed transects, static activity surveys at ground level and at height. The resulting data were combined with previous survey results to provide a comprehensive impact assessment using spatial and temporal bat activity data, and roost surveys across all seasons and over multiple years.

3.4.2 Roost Surveys 2016/2017

A search for bat roosts was undertaken within the Study Area across all seasons in 2016/2017. The aim was to determine the presence of roosting bats and the need for further survey work or mitigation.

The site was visited in spring (April and May 2016), summer (June, July and August 2016), autumn (September and October 2016) and winter (January 2017). A walkover was carried out and all structures and trees were assessed for their potential to support roosting bats (see Appendix 1 for criteria in assessing roosting habitats).

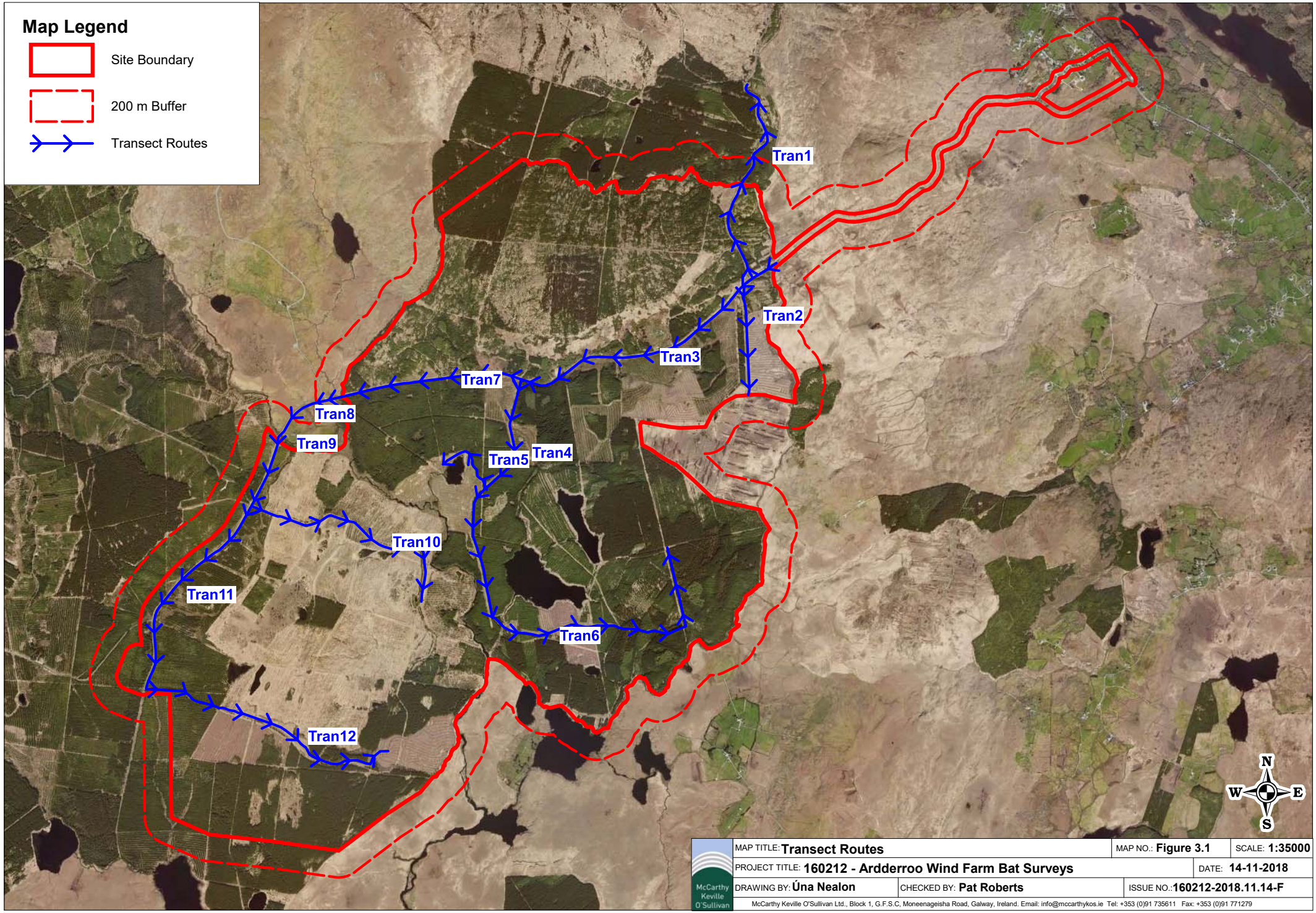
Any potential roost sites were subject to a preliminary roost assessment. This comprised a detailed inspection of the exterior and interior (if accessible) to look for evidence of bat use, including live and dead specimens, droppings, feeding remains, urine splashes, fur oil staining and noises. Trees were examined for the presence of rot holes, hazard beams, cracks and splits, partially detached bark, knot holes, gaps between overlapping branches and any other potential tree roost features identified by Andrews (2013).

The night roost previously identified at Letter Lodge Outhouse was subject to monthly inspections and activity monitoring using automated detector systems (See Section 3.4.4).

3.4.3 Manual Transects 2016

Manual activity surveys comprised walked and driven transects between dusk and dawn. The aim of these surveys was to identify bat species using the site and gather any information on bat behaviour and important features used by bats.

A series of representative transect routes were chosen throughout the proposed wind farm site. Transect routes were prepared with reference to the proposed layout, desktop and walkover survey results as well as any health and safety considerations and access limitations. As such, transect routes generally followed existing roads and tracks. Transect descriptions are provided in Table 3.2 and transect routes are shown in Figure 3.1. Further information on transect routes and habitats sampled are available in Appendix 4.



MAP TITLE: **Transect Routes**		MAP NO.: **Figure 3.1**	SCALE: **1:35000**
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Table 3.2: Description of manual transect routes in 2016

Transect No.	Start Point	End Point	Length	Habitats present
Tran 1	E114434 N235334	E114422 N236781	1.65 km	Borders Conifer plantation (WD4), Scrub (WS1), Drainage ditch (FW4), Wet heath (HH3), Lowland blanket bog (PB3), Intersects Eroding Upland River (FW1) at one location.
Tran 2	E114367 N235279	E114386 N234471	0.82 km	Borders Conifer plantation (WD4), Drainage ditches (FW4), Lowland blanket bog (PB3), Cutover bog (PB4), Intersects Eroding Upland River (FW1) at one location
Tran 3	E114618 N235449	E112688 N234600	2.22 km	Borders Conifer plantation (WD4), Scrub (WS1), Wet heath (HH3), Immature woodland (WS2), Wet willow-alder-ash woodland (WN6), Wet grassland (GS4), Recently felled woodland (WS5), Intersects Eroding Upland River (FW1) at one location
Tran 4	E112688 N234600	E112395 N233781	0.93 km	Borders Conifer plantation (WD4), Treelines (WL2), Immature woodland, Drainage ditch (FW4). Intersects Eroding Upland River (FW1) at one location.
Tran 5	E112395 N233781	E112093 N233991	0.54 km	Borders Conifer plantation (WD4), Immature woodland (WS2), Scrub (WS1), Wet heath (HH3). Also noteworthy, within 50 m are Acid oligotrophic lake (FL2), Reed & large sedge swamps (FS1), Transition mire & quaking bog (PF3).
Tran 6	E112395 N233781	E113755 N233324	3.13 km	Borders Conifer plantation (WD4), Recently felled woodland (WS5). Intersects Eroding Upland River (FW1) at one location
Tran 7	E112688 N234600	E111239 N234470	1.47 km	Borders Conifer plantation (WD4), Wet heath (HH3), Scrub (WS1), Treelines (WL2), Dense bracken (HD1), Lowland blanket bog (PB3), Wet grassland (GS4). Intersects Eroding Upland River (FW1) at two locations.
Tran 8	E111239 N234470	E110888 N234223	0.45 km	Borders Wet grassland (GS4), Lowland blanket bog (PB3). Ends with Eroding Upland River (FW1) at two locations.
Tran 9	E110888 N234223	E110650 N233688	0.59 km	Borders Conifer plantation (WD4), Immature woodland (WS2).

Transect No.	Start Point	End Point	Length	Habitats present
				Starts at intersection with Eroding Upland River (FW1).
Tran 10	E110650 N233688	E111909 N232968	1.79 km	Borders Conifer plantation (WD4), Recently felled woodland (WS5). Intersects Eroding Upland River (FW1) at three locations. Also noteworthy, within 50m of Dystrophic lake (FL1), Lowland blanket bog (PB3), Wet heath (HH3).
Tran 11	E110650 N233688	E109833 N232332	1.67 km	Borders Conifer plantation (WD4), Scrub (WS1). Intersects Eroding Upland River (FW1) at one location.
Tran 12	E109833 N232332	E111609 N231832	2.03 km	Borders Conifer plantation (WD4), Recently felled woodland (WS5), Scrub (WS1), Treelines (WL2) Intersects Eroding Upland River (FW1) at two locations

During each manual survey, transects were walked or driven by one surveyor, recording bats in real time. Driven transects followed the methodology described by Roche et al. (2012). The surveyor was equipped with a dual heterodyne/time expansion bat detector, the D240X Ultrasound Detector (Pettersson Elektronik AB, Uppsala, Sweden). Stereo headphones were used to hear the heterodyne signal on one channel and the time expansion signal on the other.

Where possible, species identification was made in the field and any other relevant information was also noted, e.g. numbers, behavior, features used, etc. All bat echolocation was recorded on a Roland digital recorder for subsequent analysis to confirm species identifications (Section 3.4.6).

Manual surveys commenced 30 minutes before sunset and were completed at sunrise (Hundt, 2012). The order of transects as well as the start and finish points were alternated between survey nights across the season, to allow for varying emergence times of different bat species.

Manual transects were undertaken monthly between April and October 2016. Transects were completed over two or three consecutive nights per month. A total of 340.33 km were surveyed over 88.27 survey hours in 2016. Table 3.3 describes survey effort with regard to manual transects. A detailed breakdown of survey effort per transect per month is provided in Appendix 5.

Table 3.3: Summary of manual transects survey effort in 2016

Dates	Start Time – Finish Time	Sunset - Sunrise	Effort (km)	Effort (h)
22nd – 23rd April 2016	20:50 – 05:52	20:48 – 06:18	25.74	6.08
23rd – 24th April 2016	20:50 – 00:06	20:50 – 06:16	12.16	3.20
21st – 22nd May 2016	21:07 – 05:34	21:37 – 05:25	25.38	6.27
22nd – 23rd May 2016	21:10 – 05:13	21:39 – 05:24	20.04	5.17
26th – 27th June 2016	22:00 – 04:56	22:07 – 05:10	19.66	6.38
27th – 28th June 2016	22:00 – 05:00	22:07 – 05:10	19.88	05.12
22nd – 23rd July 2016	21:47 – 05:14	21:47 – 05:38	23.92	06.93
23rd – 24th July 2016	21:46 – 06:15	21:46 – 05:40	30.38	07.03
22nd – 23rd August 2016	20:46 – 00:39	20:49 – 06:30	18.58	03.52
23rd – 24th August 2016	20:45 – 06:30	20:47 – 06:31	24.32	07.93
17th – 18th September 2016	20:00 – 01:38	19:47 – 07:14	24.66	05.05
18th – 19th September 2016	19:45 – 07:06	19:45 – 07:16	30.74	09.07
10th – 11th October 2016	19:20 – 08:25	18:52 – 07:55	36.40	09.57
11th – 12th October 2016	19:00 – 08:10	18:49 – 07:57	28.47	06.95
Total Manual Transect Effort			**340.33 km**	**88.27 hours**

3.4.4 Static Detector Surveys at Ground Level 2016

Manual bat activity surveys provide a snapshot of activity across a site. Automated bat detector systems deployed at ground level were used to record activity in fixed locations over prolonged periods of time. The aim of static detector surveys in 2016 was to identify bat fidelity to particular foraging, commuting and roosting habitats.

3.4.4.1 Letter Lodge Outhouse

Inspection and monitoring of an outhouse at Letter Lodge (IG Ref: E113720 N234820; Figure 1.1) in 2013 and 2014 concluded the shed was used as a night roost for a small number of lesser horseshoe bats. In 2016, automated detector surveys were employed throughout the bat activity season in order to confirm the status of this roost.

During monthly manual survey visits, the shed was inspected for signs of bats and one Anabat Express (Titley Scientific, Brendale, Australia) passive bat detector was installed within the Letter Lodge Outhouse. The detector was set to record from 30 minutes before sunset until 30 minutes after sunrise. In total, two nights recording per month was completed between April and October 2016, resulting in a total 14 nights recording bat activity within the Letter Lodge Outhouse.

Table 3.4 provides a summary of all static detector deployments at Letter Lodge Outhouse, including the total number of nights surveyed and total number of hours surveyed (accounting for varying sunset and sunrise times).

Table 3.4: Description of monitoring at Letter Lodge outhouse in 2016

ID	Survey Period	No. Nights	No. hours (h)
Outhouse (Apr)	22nd – 24th April 2016	2	18.85
Outhouse (May)	21st – 23rd May 2016	2	15.47
Outhouse (Jun)	26th – 28th June 2016	2	14.07
Outhouse (Jul)	22nd – 24th July 2016	2	15.77
Outhouse (Aug)	22nd – 24th August 2016	2	19.48
Outhouse (Sep)	17th – 19th September 2016	2	23.05
Outhouse (Oct)	10th – 12th October 2016	2	26.25
Total Survey Effort at Letter Lodge Outhouse		**14 nights**	**132.94 hours**

3.4.4.2 Other Static Detector Locations

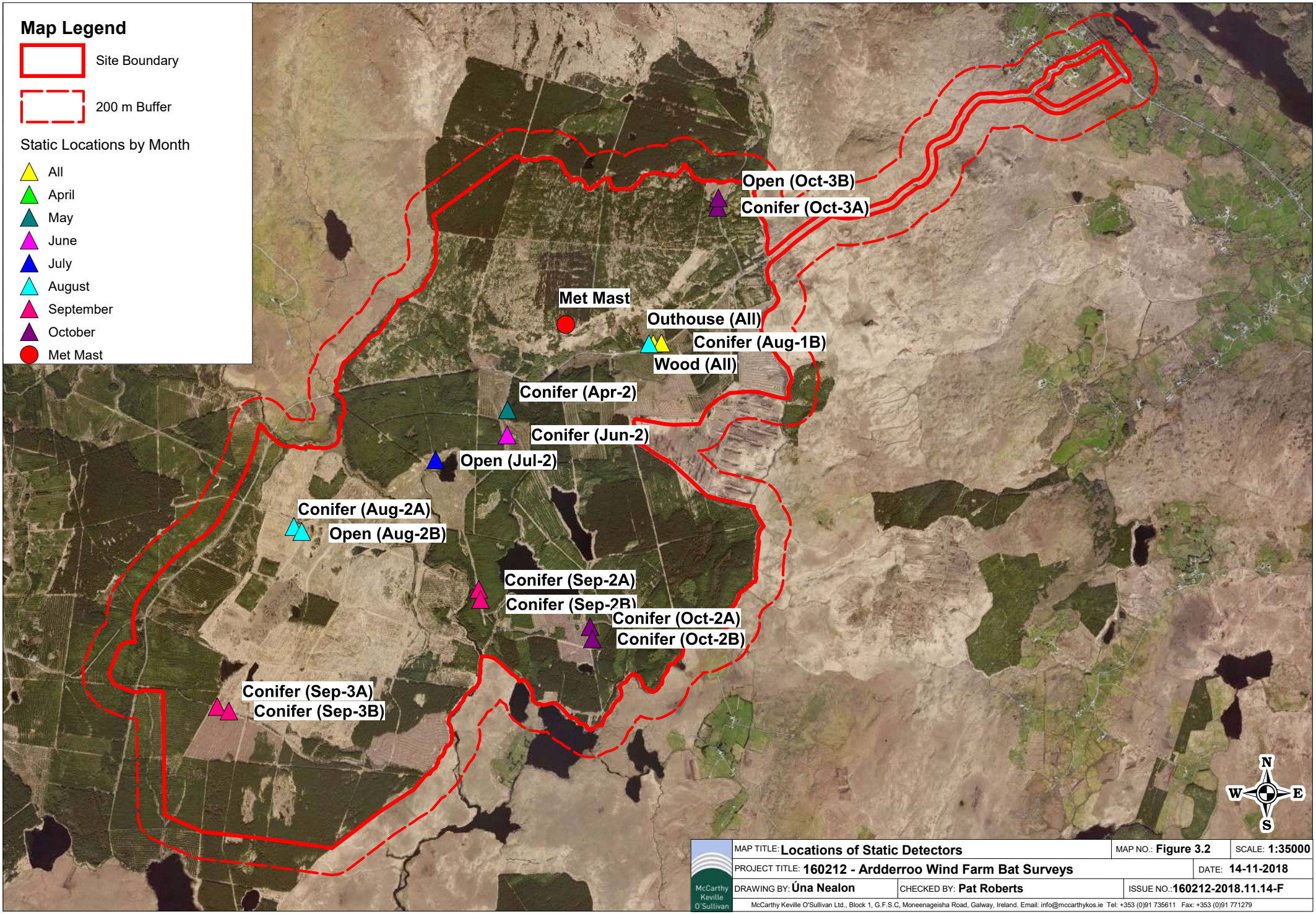
Automated bat detectors were also used to sample temporal variations in bat activity at other locations throughout the Study Area. Locations of static detectors were selected to represent the range of habitats present within the site, including favourable bat habitats and turbine locations.

Models employed included the Song Meter SM3BAT and SM4BAT (Wildlife Acoustics, Maynard, MA, USA). Settings used were those recommended by the manufacturer for bats, with minor adjustments in gain settings and band pass filters to reduce background noise when recording. Detectors were set to record from 30 minutes before sunset until 30 minutes after sunrise. The Song Meter automatically adjusts sunset and sunrise times using the Solar Calculation Method when provided with GPS coordinates. Detectors were left in place for at least 5 consecutive nights per month between April and October 2016 (Hundt, 2012).

Each month detectors were deployed in pairs. The wet woodland present at Letter Lodge (measuring approx. 0.3 ha) was considered the most favourable bat habitat and was surveyed every month. Other detector locations and habitats sampled were varied month to month. This allowed an assessment of temporal variation across the survey season and a direct comparison between different habitat types.

The autumn migration period has been previously identified as a high risk period for bats at wind energy sites (Arnett et al. 2008, Rydell et al 2010). As such, additional detectors and twinned microphones were employed in order to sample additional habitats between August and October 2016. Each SM3BAT bat detector was equipped with two microphones separated by 100 m of extension cables.

A total of 22 deployments were achieved throughout the Study Area between April and October 2016. Table 3.5 describes all static detector deployments including the total number of nights surveyed and total number of hours surveyed (accounting for varying sunset and sunrise times). The locations of all static detectors are displayed in Figure 3.2.



McCarthy Keville O'Sullivan	MAP TITLE: **Locations of Static Detectors**	MAP NO.: **Figure 3.2**	SCALE: **1:35000**
	PROJECT TITLE: **160212 - Ardderroo Wind Farm Bat Surveys**		DATE: **14-11-2018**
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Table 3.5: Description of other static detector locations in 2016

ID	Survey Period	Grid Reference	Habitat	No. Nights	No. Hours
Wood (Apr-1)	22nd – 30th April 2016	E113781 N234823	Alder woodland by Letter Lodge.	8	73.87
Conifer (Apr-2)	22nd – 30th April 2016	E112619 N234343	Closed canopy Sitka Spruce plantation.	8	73.87
Wood (May-1)	20th – 25th May 2016	E113781 N234823	Alder woodland by Letter Lodge.	5	38.57
Conifer (May-2)	20th – 25th May 2016	E112619 N234343	Closed canopy Sitka Spruce plantation.	5	38.57
Wood (Jun-1)	26th June – 3rd July 2016	E113781 N234823	Alder woodland by Letter Lodge.	7	49.52
Conifer (Jun-2)	26th June – 3rd July 2016	E112613 N234155	Pre-thicket Sitka Spruce plantation.	7	49.52
Wood (Jul-1)	22nd – 31st July 2016	E113781 N234823	Alder woodland by Letter Lodge.	9	72.60
Open (Jul-2)	22nd – 31st July 2016	E112074 N233979	Downy Birch tree in open.	9	72.60
Wood (Aug-1A)	21st – 26th August 2016	E113781 N234823	Alder woodland by Letter Lodge.	5	48.88
Conifer (Aug-1B)	21st – 26th August 2016	E113688 N234819	Edge of semi-mature closed canopy conifers.	5	48.88
Conifer (Aug-2A)	21st – 26th August 2016	E111004 N233498	Young pre-thicket conifer plantation.	5	48.88
Open (Aug-2B)	21st – 26th August 2016	E111063 N233460	Open regenerating bog & old felled forestry.	5	48.88
Wood (Sep-1)	17th – 22nd September 2016	E113781 N234823	Alder woodland by Letter Lodge.	5	58.15
Conifer (Sep-2A)	17th – 22nd September 2016	E112377 N233004	Young pre-thicket conifer plantation & brash piles.	5	58.15
Conifer (Sep-2B)	17th – 22nd September 2016	E112389 N232927	Young pre-thicket conifer plantation & brash piles.	5	58.15
Conifer (Sep-3A)	17th – 22nd September 2016	E110403 N232161	Conifer treeline by track near young pre-thicket conifer plantation.	5	58.15
Conifer (Sep-3B)	17th – 22nd September 2016	E110490 N232126	Treeline by track near pre-thicket conifers.	5	58.15
Wood (Oct-1)	10th – 15th October 2016	E113781 N234823	Alder woodland by Letter Lodge.	5	66.15
Conifer (Oct-2A)	10th – 15th October 2016	E113204 N232710	Edge of sub-mature closed canopy forestry & wide blanket bog ride. Very young pre-thicket forestry on other side.	5	66.15
Conifer (Oct-2B)	10th – 15th October 2016	E113219 N232618	Edge of sub-mature closed canopy forestry & wide blanket bog ride. Very young pre-thicket forestry on other side.	5	66.15
Conifer (Oct-3A)	10th – 15th October 2016	E114221 N235831	Edge of mature forestry & bog/heath.	5	66.15
Open (Oct-3B)	10th – 15th October 2016	E114229 N235901	Open bog/heath.	5	66.15
Total Survey Effort at Other Static Detector Locations				**128 nights**	**1286.14 hours**

3.4.5 Static Detector Surveys at Ground Level and at Height 2017

Studies have shown activity levels recorded at ground level may differ to those recorded at height and assessing bat activity levels from only ground level data may overestimate activity levels experienced at height for certain species, e.g. pipistrelle bats and may underestimate those for high-flying species, e.g. Leisler's bat (Collins and Jones, 2009). Therefore, simultaneous surveying at ground level and at height was also undertaken using static detectors throughout 2017.

One SM3BAT detector was installed on a meteorological mast within the Study Area (IG Ref: E113069 N234974). The detector was equipped with two microphones; one at ground level and one at height (approx. 75 m above ground level). Table 3.6 describes survey effort and the location of the met mast is illustrated in Figure 3.2.

Table 3.6: Summary of met mast survey effort in 2017

ID	Survey Period	Habitat	No. Nights	No. Hours
Mar - A	28th March – 1st April 2017	Met Mast – Low Mic	4	44.38
		Met Mast – High Mic	4	44.38
Apr – A	1st April – 4th April 2017	Met Mast – Low Mic	3	32.55
		Met Mast – High Mic	3	32.55
Apr – B	26th April – 1st May 2017	Met Mast – Low Mic	5	45.43
		Met Mast – High Mic	5	45.43
May – A	1st May – 8th May 2017	Met Mast – Low Mic	7	60.97
		Met Mast – High Mic	7	60.97
May – B	24th May – 1st June 2017	Met Mast – Low Mic	8	59.93
		Met Mast – High Mic	8	59.93
Jun – A	1st June – 5th June 2017	Met Mast – Low Mic	4	29.10
		Met Mast – High Mic	4	29.10
Aug – A	9th August – 13th August 2017	Met Mast – Low Mic	4	35.80
		Met Mast – High Mic	4	35.80
Survey Effort at Ground Level			*35*	*308.16*
Survey Effort at Height			*35*	*308.16*
Total Met Mast Survey Effort			**70**	**616.32**

3.4.6 Bat Call Analysis

All recordings were later analysed using bat call analysis software, BatSound (Pettersson Elektronik AB, Uppsala, Sweden), Kaleidoscope Converter and Viewer, v.3.1.7 (Wildlife Acoustics, Maynard, MA, USA) or AnalookW 4.1 (Titley Scientific, Brendale, Australia). Bat species were identified using established call parameters, to identify individual species or genera. In addition, any information on bat behavior contained within echolocation calls, e.g. social calls, feeding buzzes, were noted.

Individual bats of the same species cannot be distinguished by their echolocation alone. Thus, 'bat passes' was used as a measure of activity (Collins, 2016).

- For the purposes of the manual activity survey, a bat pass was defined as one to several calls of a single species/species group, separated by an interval.
- For the purposes of the static detector study, a bat pass is defined as a recording of an individual species/species group's echolocation containing at least two echolocation pulses and separated by a 2s gap.

3.4.7 Assessment of Bat Activity Levels

The use of bat passes is the most commonly used tool for quantifying bat activity. However, interpretation of these data is subjective and may vary considerably between surveyors, depending on their knowledge and experience.

In the interpretation of static detector monitoring results at the proposed development site, the online tool Ecobat was employed (ecobat.org.uk). This web-based interface, launched in August 2016, allows users to upload activity data and to contrast results with a comparable reference range, allowing objective interpretation. Uploaded data then contributes to the overall dataset to provide increasingly robust outputs.

Static dectector at ground level results for the proposed wind farm were uploaded on the 8th February 2017. Database records used in analyses were limited to those within a similar geographic region (100 km), using Wildlife Acoustic detectors and the same bat pass definition. Filters on season or date prohibitively restricted the dataset and so were not applied.

4 SURVEY LIMITATIONS

Survey design and effort was created in accordance with the latest best practice guidelines for surveying bats and wind farms (Hundt, 2012). The survey design was continually assessed to determine its appropriateness to the bat species diversity and level of activity encountered at the proposed site. Bat surveys carried out in 2016 and 2017, in combination with previous bat survey results from 2013 and 2014, exceed the guideline standards (Hundt, 2012).

No seasonal limitations have been identified with this bat assessment. Activity monitoring concentrated on the main activity season from April to October (Hundt, 2012). In addition, the site was visited in spring, summer and autumn 2016 and in winter 2017. Habitats were assessed for their potential to support bats throughout all aspects of their yearly cycle.

In general, manual transects were undertaken in optimal survey conditions i.e. no heavy rain or strong winds with dusk temperatures above 7 °C (BCI, 2012a). Where rain was encountered, bat surveys were paused and resumed when rain stopped. Dawn temperatures dropped below 7 °C during surveys in April and May 2016. However, dusk temperatures were sufficiently high. Lower morning temperatures are considered representative of site conditions at that time of year.

Onsite weather monitoring was not undertaken as part of bat surveys for the proposed site. However, weather conditions for the nearest Met Éireann weather station (Mace Head) were considered in the analyses of statuc detector results. High winds and moderate to heavy rain were occasionally recorded during monitoring periods. However, this is considered normal for the site and does not present a significant limitation to the survey work. In addition, it should be noted that the Mace Head weather station lies in a more exposed location than the proposed development site.

It should be noted that detection distances can vary between species. For example, Leisler's bat has a much larger detection distance of 80 m compared to 25 m for pipistrelle species (Barataud and Tupinier, 2012). This may lead to an overestimation of Leisler's activity when compared to pipistrelles. Detector selection may also influence results, where automatic detectors have a larger detection distance than manual detectors.

The analysis of bat data is subject to experience. All survey data collected in the course of this study was analysed by Chris Peppiatt (BSc, PhD) and Úna Nealon (BSc, PhD). Both have extensive experience in bat call analyses. Species were identified according to Russ (2012). Where reliable identifications were not possible, bat calls were identified to genus level and not to species level. Criteria for species identification are described fully in Section 3.4.6.

5 SURVEY RESULTS

5.1 Consultation

A scoping and consultation exercise was undertaken as part of EIA for Ardderroo Wind Farm. These results are described fully in the main EIAR and no specific recommendations were made in relation to bats. BCI were invited to comment on the proposed development and potential effects on bats. However, no response was received as of 8th March 2017.

A meeting was held between project ecologists and an NPWS representative on the 20th February 2017. A summary of survey work was provided, followed by a discussion. The main points raised in relation to bats were as follows:

- Additional bat surveys completed in line with BCT guidelines revealed low levels of bat activity. Nonetheless, vegetative connectivity should be maintained in the development.
- Lesser horseshoe bat was only occasionally recorded on the site and the previously recorded night roost was not in regular use. The night roost should be retained along with connectivity to it.
- The development site is located within the lesser horseshoe bat's range of two European Sites designated for this species' conservation. However, the population for which Lough Corrib SAC was designated are not located within this distance and such factors should be taken into account in the NIS.

A copy of the agreed minutes from this meeting is included within Appendix 2-1 of the main EIAR.

5.2 Desktop Study

5.2.1 Bat Survey Reports 2013 - 2014

As part of a previous planning application (ABP Ref: PA0036), MKO ecologists undertook bat surveys at the site in April - September 2013 and in August 2014. These surveys included a combination of methods including roost surveys, walked transects and static detector surveys.

5.2.1.1 Roost Surveys

A daytime inspection was carried out at Letter Lodge Outhouse where the shed was thoroughly searched for any evidence of roosting bats. The inspection found no roosting bats but did find a small number of bat droppings.

In order to determine roost usage, a static bat detector (SM3BAT) was installed within the shed and set to record from sunset on the 14th August 2014 until sunrise on the 15th August 2014. In total, 43 bat passes were recorded. All bat passes were of a single species, lesser horseshoe bat. The surveyor concluded the building was used as a night roost. It was not possible to determine how many individuals were involved from the data recorded, potentially as few as one.

The location and nature of the associated day roost was not determined. However, there are known roosts of this species approx. 3.3 km at Ross Lake and 4.7 km at Knockbane. No other signs of roosting bats were recorded in any other buildings at Letter Lodge.

5.2.1.2 Manual Transects

Walked transects were undertaken at dusk and at dawn over four nights between May and September 2013. During manual transect surveys, the surveyor walked set routes, covering a total distance of 13.24 km each night (Figure 5.1). Bats were recorded in real time using an Echo Meter EM3 full spectrum bat detector (Wildlife Acoustics, Maynard, MA, USA) or a D240X dual heterodyne/time expansion bat detector (Pettersson Elektronik AB, Uppsala, Sweden). Conditions were favourable for bats on all survey nights, i.e. no heavy rain or strong winds with dusk temperatures above 7 ˚C (Table 5.1) (BCI, 2012a)

Table 5.1: Conditions during manual transects in 2013

Date	Sunset	Sunrise	Temp	Rain	Wind	Cloud
28th-29th May 2013	21:47	05:20	7.5-9˚C	Dry	0-3.6ms^{-1} (NW)	50%
15th-16th June 2013	22:06	05:08	8.5-11˚C	Some short showers	0-3.1ms^{-1} (W)	30–100%
27th-28th July 2013	21:44	05:45	10-15˚C	Dry, some fog early on	0 ms^{-1}	30-60%
23rd-24th September 2013	19:30	07:30	15-17˚C	Dry	0-1.5ms^{-1} (E)	80%

In total, 65 bat passes were recorded across a total 58.88 km of manual transects between May and September 2013. At least 4 bat species were recorded, with common and soprano pipistrelles showing the highest activity. Table 5.2 and Table 5.3 present manual transect results as total bat passes and bat passes per kilometre surveyed respectively.

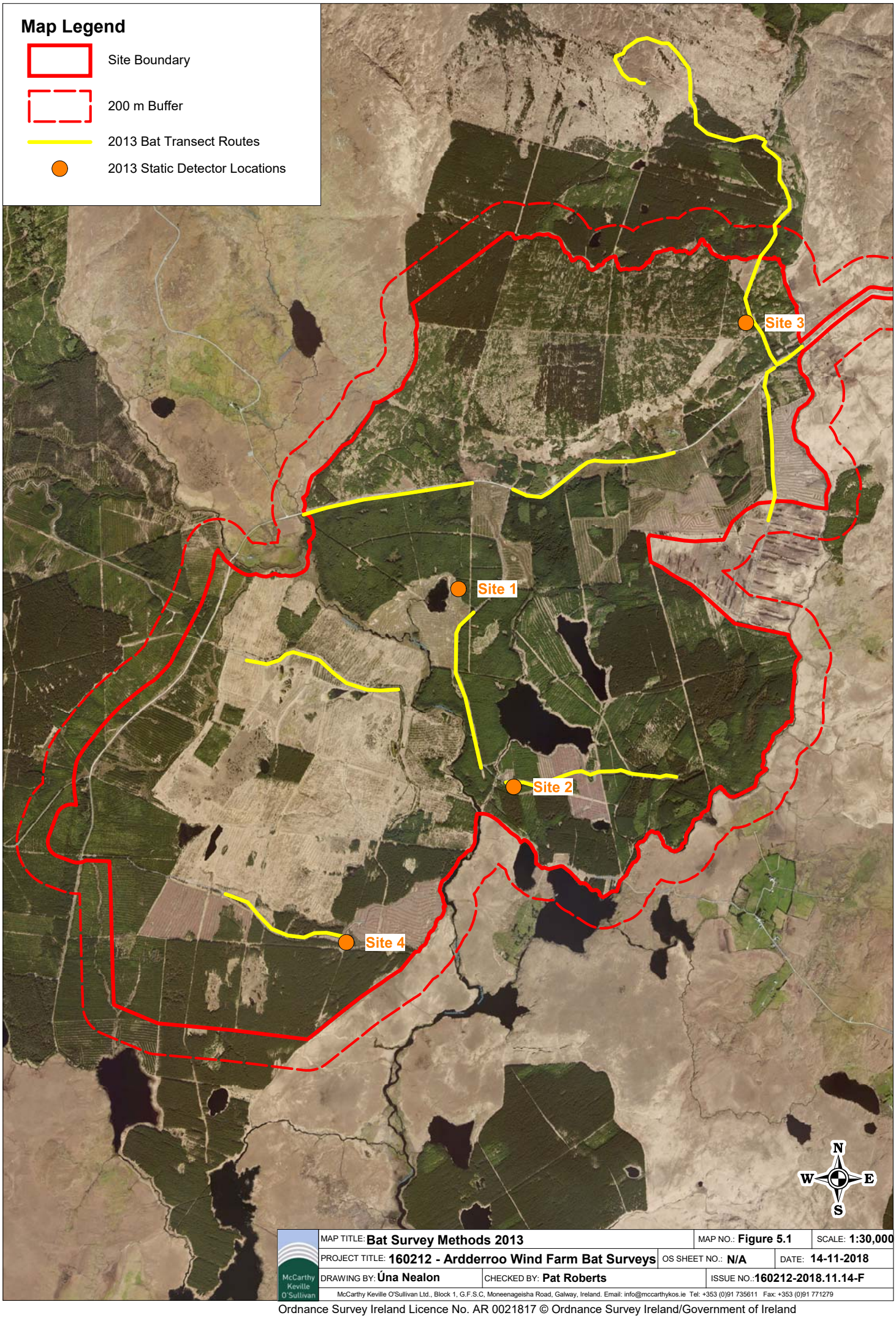
Table 5.2: Manual transect results in 2013 (total bat passes)

Species	May 2013	Jun 2013	Jul 2013	Sep 2013	Total
Common pipistrelle	10	3	0	5	**18**
Soprano pipistrelle	4	1	11	21	**37**
Myotis sp.	2	2	1	2	**7**
Leisler's bat	0	0	1	0	**1**
Unidentified pipistrelle	1	0	0	1	**2**
Total	**17**	**6**	**13**	**29**	**65**

Table 5.3: Manual transect results in 2013 (bat passes per km)

Species	May 2013	Jun 2013	Jul 2013	Sep 2013	Total
Total Distance	*11.03 km*	*16.64 km*	*17.97 km*	*13.24 km*	***58.88 km***
Common pipistrelle	0.91	0.18	0.00	0.38	**0.31**
Soprano pipistrelle	0.36	0.06	0.61	1.59	**0.63**
Myotis sp.	0.18	0.12	0.06	0.15	**0.12**
Leisler's bat	0.00	0.00	0.06	0.00	**0.02**
Unidentified pipistrelle	0.09	0.00	0.00	0.08	**0.03**
Total	**1.54**	**0.36**	**0.72**	**2.19**	**1.10**

Manual transect results (0.36-2.19 bat passes per km) were compared to results from similar studies. Studies at similar upland conifer sites were slightly higher but comparable (2.5 bat passes per km), while those at lowland sites were significantly higher (3.0 – 6.1 bat passes per km). In addition, a national monitoring scheme using driven car transects in a variety of habitats recorded averages of 11.0-52.7 bat passes per km. Therefore, the surveyor concluded that recorded bat activity at the proposed site was low.



MAP TITLE: **Bat Survey Methods 2013**		MAP NO.: **Figure 5.1**	SCALE: **1:30,000**
PROJECT TITLE: **160212 - Ardderroo Wind Farm Bat Surveys**		OS SHEET NO.: **N/A**	DATE: **14-11-2018**
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5.2.1.3 Static Detector Surveys

Static monitoring was undertaken at four locations between April and July 2013. All monitoring locations were situated within or on the edge of conifer plantations. Each month, one Anabat SD2 frequency division bat detector was installed and left in place for a period of 7 days. Table 5.4 and Figure 5.1 presents a summary of static survey effort in 2013.

Table 5.4: Summary of static detector monitoring effort in 2013

ID	Survey Period	Grid Ref.	No. Night	No. hours (h)
Site 1	20th - 27th April 2013	E112324 N233958	7	75.25
Site 2	22nd – 29th May 2013	E112635 N232669	7	61.25
Site 3	10th – 17th June 2013	E114247 N235608	7	56.00
Site 4	23rd – 30th July 2013	E111515 N231705	7	59.50
Total Survey Effort			**28**	**252.00**

In total, 194 bat passes were recorded over 252 survey hours. At least 5 bat species were recorded, with common pipistrelle and soprano pipistrelle showing the highest activity. Table 5.5 and Table 5.6 provide a summary of static monitoring results in 2013, presented as total bat passes and bat passes per survey hour respectively.

Table 5.5: Static detector monitoring results in 2013 (total bat passes)

Species	Location 1 (Apr 2013)	Location 2 (May 2013)	Location 3 (Jun 2013)	Location 4 (Jul 2013)	Total
Common pipistrelle	0	12	23	38	**73**
Soprano pipistrelle	1	8	17	50	**76**
Myotis sp.	2	2	3	8	**15**
Leisler's bat	0	1	12	9	**22**
Unidentified pipistrelle	0	0	6	1	**7**
Brown long-eared bat	0	0	0	1	**1**
Total	**3**	**23**	**61**	**107**	**194**

Table 5.6: Static detector monitoring results in 2013 (bat passes per hour)

Species	Location 1 (Apr 2013)	Location 2 (May 2013)	Location 3 (Jun 2013)	Location 4 (Jul 2013)	Total
Common pipistrelle	0.00	0.2	0.41	0.64	**0.29**
Soprano pipistrelle	0.01	0.13	0.3	0.84	**0.30**
Myotis sp.	0.03	0.03	0.05	0.13	**0.06**
Leisler's bat	0.00	0.02	0.21	0.15	**0.09**
Unidentified pipistrelle	0.00	0.00	0.11	0.02	**0.03**
Brown long-eared bat	0.00	0.00	0.00	0.02	**0.004**
Total	**0.04**	**0.38**	**1.09**	**1.79**	**0.77**

Static detector results were compared to results from similar studies. Previous studies at similar upland sites with conifer plantations showed comparable results, while those at lowland sites, with various pasture, woodland and bog habitats, found significantly higher activity levels.

5.2.2 National Bat Database of Ireland

The National Bat Database of Ireland was searched for records of bat activity and roosts within a 10 km radius of the central point of the Study Area (IG Ref: E112000, N234000). A number of observations have been recorded including roosts (n=7),

transects (n=12) and ad-hoc observations (n=18). At least eight of Ireland's nine resident bat species were recorded within 10 km of the proposed works including common pipistrelle, soprano pipistrelle, Nathusius' pipistrelle, Leisler's bat, Daubenton's bat, Natterer's bat, brown long-eared bat, lesser horseshoe bat and several records of unidentified bats. All roosts were recorded in the lowland areas to the west of the proposed site, along the N59 national road. The results of the database search are provided in Table 6.7.

Table 5.7: BCI data within 10km radius of Study Area (Grid Ref: E112000 N234000)

Survey Type	Location	Species	Survey	Designation
Roost	Moycullen Cave, Moycullen	**Roost type**: Natural cave or possible mine **Species**: Lesser horseshoe bat	Unknown	Annex II, Annex IV
	Knockbane, Moycullen	**Roost type**: Building **Species**: Lesser horseshoe bat	Unknown	Annex II, Annex IV
	Ross Demesne, Oughterard	**Roost type**: Building **Species**: Lesser horseshoe bat	Unknown	Annex II, Annex IV
	Oughterard Catholic Church, Oughterard	**Roost type**: Building **Species**: Leisler's bat	Unknown	Annex IV
	Oughterard National School, Oughterard	**Roost type**: Building **Species**: Leisler's bat	Unknown	Annex IV
	Tonwee, Oughterard	**Roost type**: Bridge **Species**: Unidentified bat	Unknown	Annex IV
	Ross House, Ross Demesne, Oughterard, Co. Galway	**Roost type**: Building **Species**: Lesser horseshoe bat	Unknown	Annex II, Annex IV
Transect	Owenriff River	Daubenton's bat, unidentified bat	Waterways Survey	Annex IV
	Owenriff River	Daubenton's bat, unidentified bat	Waterways Survey	Annex IV
	Owenriff River	Daubenton's bat, unidentified bat	Waterways Survey	Annex IV
	Owenriff River	Daubenton's bat, unidentified bat	Waterways Survey	Annex IV
	Owenriff River	Daubenton's bat, unidentified bat	Waterways Survey	Annex IV
	Owenriff River	Daubenton's bat, Leisler's bat, unidentified bat	Waterways Survey	Annex IV
	Owenriff River	Daubenton's bat, unidentified bat	Waterways Survey	Annex IV
	Owenriff River	Daubenton's bat, unidentified bat	Waterways Survey	Annex IV
	Owenriff River	Daubenton's bat, unidentified bat	Waterways Survey	Annex IV

Survey Type	Location	Species	Survey	Designation
	Owenriff River	Daubenton's bat, unidentified bat	Waterways Survey	Annex IV
	Owenriff River	Daubenton's bat, unidentified bat	Waterways Survey	Annex IV
	River Knock	Daubenton's bat, unidentified bat	Waterways Survey	Annex IV
Ad-hoc Observation	Knockadrehid	Common pipistrelle, soprano pipistrelle	BATLAS 2010	Annex IV
	Co. Galway	Daubenton's bat, Leisler's bat, common pipistrelle, soprano pipistrelle	BATLAS 2010	Annex IV
	Moyvoon	Daubenton's bat, common pipistrelle, soprano pipistrelle	BATLAS 2010	Annex IV
	Co. Galway	Daubenton's bat, Leisler's bat, common pipistrelle, soprano pipistrelle	BATLAS 2010	Annex IV
	Ballynacregga	Soprano pipistrelle	BATLAS 2010	Annex IV
	Knockatee	Leisler's bat	BATLAS 2010	Annex IV
	Co. Galway	*Myotis* sp., Leisler's bat, common pipistrelle, soprano pipistrelle	BATLAS 2010	Annex IV
	Co, Galway	Common pipistrelle, unidentified bat	BATLAS 2010	Annex IV
	Co. Galway	Daubenton's bat, Natterer's bat, Leisler's bat, soprano pipistrelle	BATLAS 2010	Annex IV
	Oughterard	Daubenton's bat, Leisler's bat, soprano pipistrelle	BATLAS 2010	Annex IV
	Co. Galway	*Myotis* sp. , Leisler's bat, common pipistrelle, soprano pipistrelle, unidentified bat	BATLAS 2010	Annex IV
	Owenriff River, Oughterard	Nathusius' pipistrelle	Consultant Ecologist	Annex IV
	Oughterard	*Myotis* sp. , Leisler's bat, soprano pipistrelle, pipistrelle spp.	EIA Survey	Annex IV
	Kylebroghlan, Moycullen	Natterer's bat, soprano pipistrelle	EIA Survey	Annex IV
	Kylebroghlan, Moycullen	Natterer's bat, Leisler's bat, soprano pipistrelle	EIA Survey	Annex IV
	Moyaille	Soprano pipistrelle, brown long-eared bat	EIA Survey	Annex IV

Survey Type	Location	Species	Survey	Designation
	Knockalough	*Myotis* sp., Leisler's bat, common pipistrelle, soprano pipistrelle, brown long-eared bat	Consultant Ecologist	Annex IV
	Knockalough	*Myotis* sp., common pipistrelle, soprano pipistrelle	Consultant Ecologist	Annex IV

5.2.3 Designated Sites

Within Ireland, the lesser horseshoe bat is the only bat species requiring the designation of Special Areas of Conservation (SACs) and the Study Area is situated within the known range of this species. Natural Heritage Areas (NHAs) and proposed Natural Heritage Areas (pNHAs) may be designated for any bat species.

A search of all SACs, NHAs and pNHAs within a 10 km radius of the Study Area found four sites designated for the conservation of bats. Two of these sites were also identified in the search of the National Bat Database of Ireland (Ross Lake and Woods SAC and pNHA, and Oughterard National School pNHA). A brief description of these designated sites is provided in Table 5.8.

Table 5.8: Sites designated for the conservation of bats within 10km

Designated Site	Bat Species of Interest	Description	Distance
Lough Corrib SAC and pNHA (000297)	Lesser horseshoe bat	Summer roost with approx. 100 individuals recorded in 1999.	2.9 km from wind farm 2.9 km from access road
Ross Lake and Woods SAC and pNHA (001312)	Lesser horseshoe bat	Breeding colony. Woodland & lakeside vegetation also provides good foraging habitat.	2.9 km from wind farm 0.1 km from access road
Oughterard National School pNHA (002082)	Leisler's bat	Nursery colony of approx. 300 individuals.	6.5 km from wind farm 6.5 km from access road
Killarainy Lodge, Moycullen pNHA (002083)	Natterer's bat	Nursery colony of approx. 70 individuals within a stone building.	6.9 km from wind farm 5.8 km from access road

Detailed conservation objectives for Lough Corrib SAC and Ross Lake and Woods SAC were also reviewed in the preparation of this report:

- Lough Corrib SAC is situated outside the foraging range for lesser horseshoe bat (i.e. 2.5 km) and over 15 km from the summer roost for which the site was selected.
- Ross Lake and Woods SAC is also separated from the proposed wind farm by a distance greater than the foraging range for the species. However, the proposed temporary construction access road is located within 100 m of this SAC. The proposed access road is not located in any potential foraging grounds identified in the Conservation Objectives. In addition, the proposed works will not result in a significant loss of linear features or a significant increase in artificial light intensity.

5.2.4 Habitat and Landscape

A review of mapping, photography and previous survey reports provided insight into the habitats and landscape features present at the proposed development site. In

summary, the primary land use within the Study Area is commercial forestry, while the remainder supports marginal farmland and peatland habitats. There are a number of lakes and streams within the Study Area. A bat habitat assessment for the site is described in Section 5.3.1 and a full assessment of flora and habitats is included in the main EIAR.

A review of the GSI online mapper did not indicate the possible presence of any subterranean sites within the Study Area and a search of the National Monuments Database did not reveal the presence of any manmade subterranean sites within the Study Area.

A search of the UBSS Cave Database for the Republic of Ireland found one cave within a 10km radius (also identified in the search of the National Bat Database of Ireland). The cave Rhinolophus Retreat is situated approximately 5 km northwest of the proposed development site. The site is described as a 34 m long rift passage with previous records of bat and human activity.

5.3 2016 Field Survey

5.3.1 Habitat Suitability Assessment

The Study Area is dominated by commercial forestry at various stages of the rotational cycle and a number of tracks and roadways provide access. In addition, a small area of wet woodland is present in the center of the site. The remainder of the site comprises marginal farmland and peatland habitats. Much of the peatland on the site has been damaged by disturbance and drainage. However, some relatively intact examples of wet heath and blanket bog exist within the site. Several lakes are present within the Study Area and the site is drained by two rivers, namely the Owenboliska River to the west and the Ardderroo River to the east. In addition, several smaller streams and drainage ditches are found throughout.

Results from the desktop review and walkover surveys were used to assess habitats for their suitability to support foraging and commuting bats, and roosting bats, according to Collins (2016). Suitability categories, divided into *High*, *Moderate, Low* and *Negligible*, are described fully in Appendix 1.

With regard to foraging and commuting bats, areas of closed canopy forestry as well as exposed areas of grassland and peatland habitats were considered *Negligible* suitability, i.e. negligible habitat features on site likely to be used by commuting or foraging bats (Collins, 2016).

Areas of wet woodland and edge habitats, created by commercial forestry and roadways/watercourses, may provide greater foraging and commuting opportunities. However, these habitats are surrounded by wide expanses of peatland habitats and thus, are not very well connected to the surrounding landscape. As such, these habitats were classified as *Low* suitability, i.e. suitable but isolated habitat that could be used by small numbers of commuting or foraging bats (Collins, 2016).

With regard to roosting bats, a targeted roost survey of every tree within the site was considered unnecessary. However, an assessment of the various woodland and forestry habitats was undertaken. The majority of trees present are commercial coniferous species with negligible or low roosting potential. Many of the trees are replanted and immature. In addition, much of the forestry was planted on thin or very wet peat, presenting stunted growth in mature trees. As a result, coniferous trees were generally not of sufficient size or age to contain roost features.

Broadleaved tree species are present within treelines, areas of scrub and the wet woodland on site. These trees were generally described as shrub-like or spindly and so were also not of sufficient size or age to contain potential roost features.

Several broadleaved trees surrounding Letter Lodge were of sufficient size and age to contain potential roost features and so were subject to a preliminary roost assessments, described in the following Section 5.3.2.

Several structures were identified within the Study Area and were subjected to preliminary roost assessments, described in the following Section 5.3.2.

5.3.2 Roost Surveys

The site was visited in spring, summer and autumn 2016 and winter 2017. All structures and trees were assessed for their potential to support roosting bats, throughout the various stages of their yearly cycle.

Several trees surrounding the main house and sheds at Letter Lodge were examined for potential roost features as described by Andrews (2013). However, no potential features were observed from ground level and these trees were assessed as *Low* roosting potential.

Several structures identified within the Study Area were subject to a preliminary roost assessment where the exterior and interior (if accessible) was inspected for potential access points, roosting locations and any evidence of bats. The main house and surrounding sheds at Letter Lodge showed *Moderate* roosting potential. One confirmed roost within an outhouse was subject to additional activity monitoring. All other structures surveyed showed *Negligible* or *Low* roosting potential. Appendix 6 provides details of individual results for all structures surveyed.

5.3.3 Manual Transects 2016

Manual transects were undertaken over several consecutive nights each month between April and October 2016, totaling 88.27 hours of survey time (Table 3.3).

Table 5.9 presents weather conditions recorded during all manual transects. Surveys were undertaken during favourable conditions with dusk temperatures above 7 ˚C and no strong winds (BCI, 2012). Where rain was encountered, surveys were paused and resumed once the rain had stopped. Dawn temperatures were low during surveys in April and May 2016. Lower morning temperatures are considered representative of site conditions at that time of year.

Table 5.9: Conditions during manual transects in 2016

Date	Temp (Start – End)	Rain	Wind (Beaufort)	Cloud %
22nd-23rd April 2016	12.0 – 3.3 °C	Dry	2-3 NW	0-100%
23rd-24th April 2016	7.0 – 1.4 °C	Dry	0	25%
21st-22nd May 2016	11.0 – 4.0 °C	Dry	0	10-20%
22nd-23rd May 2016	11.0 – 3.0 °C	Dry	0-1 W	10-20%
26th-27th June 2016	13.0 – 10.0 °C	Light showers at sunrise*	1-2 NW	25%
27th-28th June 2016	12.0 – 11.0 °C	Heavy rain between 02:25 – 03:45*	0-2 W	40-50%
22nd-23rd July 2016	15.0 – 14.0 °C	Dry	0-1 S/SE	100%
23rd-24th July 2016	15.0 – 12.0 °C	Some drizzle at 03:00 & 04:45	0	50-100%
22nd-23rd August 2016	14.0 – 12.5 °C	Dry	0-2 S	100%
23rd-24th August 2016	14.0 – 9.0 °C	Rain from 2:00 to sunrise*	0-2 SW	20%
17th-18th September 2016	15.0 – 14.0 °C	Dry	1-2 SW	100%
18th-19th September 2016	12.0 – 10.0 °C	Dry	0-1 W	10-100%
10th-11th October 2016	12.0 – 6.0 °C	Dry	1-2 E/NE	0-100%
11th-12th October 2016	10.0 – 8.0 °C	Dry	0-1 NE	20-75%

*Surveys were paused during periods of rain and resumed once stopped.

In total, 304 bat contacts were recorded during manual transect surveys in 2016. Common pipistrelle, soprano pipistrelle and unidentified pipistrelle were encountered most frequently, followed by *Myotis* sp., Leisler's bat and brown long-eared bat (Figure 5.2). Table 5.10 presents manual transect results for individual bat species per survey period (i.e. per month). Detailed manual transect results are available in Appendix 7.

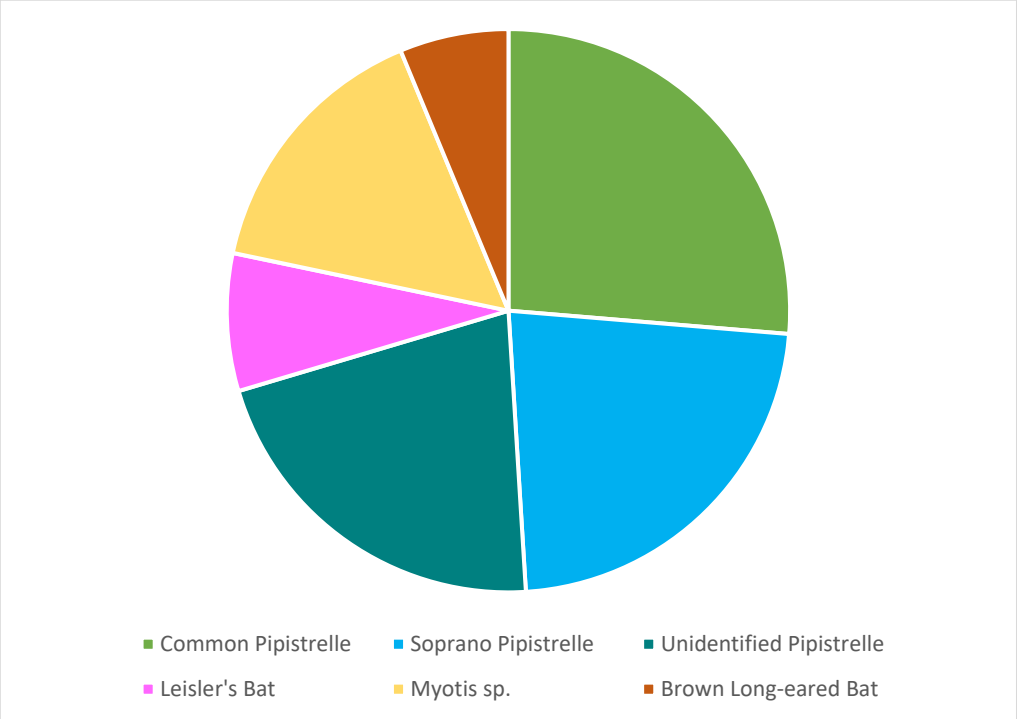


Figure 5.2: Manual transect results: Species composition (total bat contacts)

Table 5.10: Summary of manual transect results in 2016 (total bat contacts)

	Apr 2016	May 2016	Jun 2016	Jul 2016	Aug 2016	Sep 2016	Oct 2016	Total
Common pipistrelle		4	21	23	16	12	4	80
Soprano pipistrelle	2	1	4	21	21	17	3	69
Unidentified pipistrelle	3	3	8	13	8	25	5	65
Leisler's bat	0	0	3	14	6	1	0	24
Myotis sp.	4	8	5	14	9	6	1	47
Brown long-eared bat	1	2	4	6	1	4	1	19
Total	**10**	**18**	**45**	**91**	**61**	**65**	**14**	**304**

In addition, transect survey results were calculated as bat passes per km surveyed. Figure 5.3 and Table 5.11 presents these results for individual species per survey period. Common pipistrelle, soprano pipistrelle and unidentified pipistrelle showed the greatest activity levels. In addition, bat activity was significantly greater in the period June to September, peaking in July.

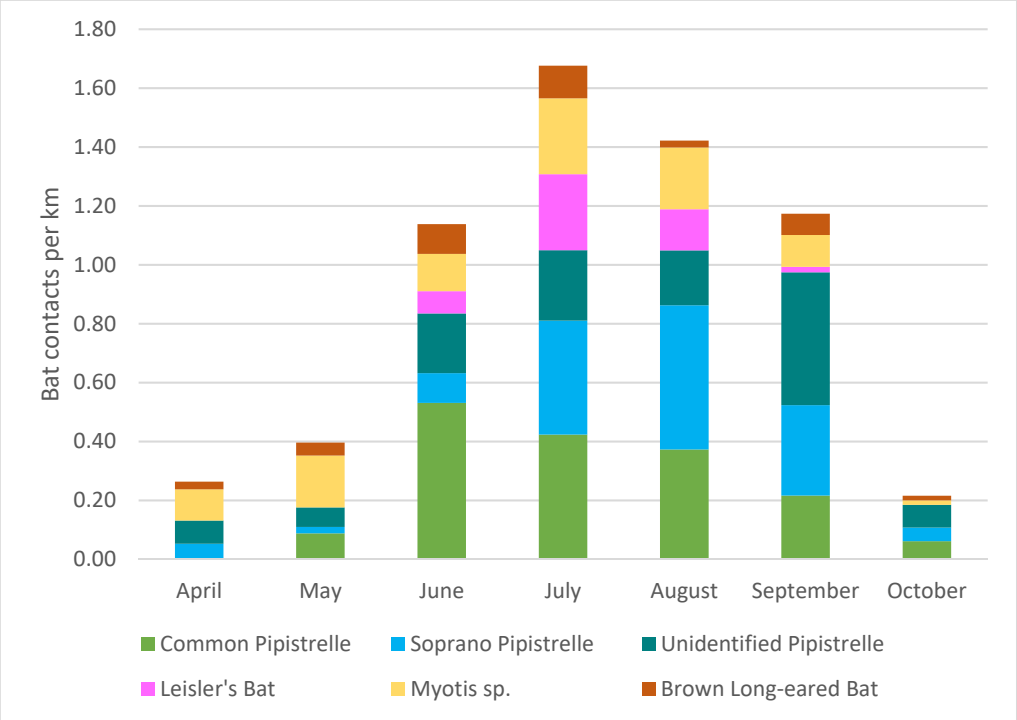


Figure 5.3: Manual transect results: Bat contacts per km in 2016

Table 5.11: Manual transect results in 2016 (bat contacts per survey km)

	Apr 2016	May 2016	Jun 2016	Jul 2016	Aug 2016	Sep 2016	Oct 2016	Total
Survey length (km)	37.90	45.42	39.54	54.30	42.90	55.40	64.87	340.33
Common pipistrelle	0.00	0.09	0.53	0.42	0.37	0.22	0.06	0.24
Soprano pipistrelle	0.05	0.02	0.10	0.39	0.49	0.31	0.05	0.20
Unidentified pipistrelle	0.08	0.07	0.20	0.24	0.19	0.45	0.08	0.19
Leisler's bat	0.00	0.00	0.08	0.26	0.14	0.02	0.00	0.07
Myotis sp.	0.11	0.18	0.13	0.26	0.21	0.11	0.02	0.14
Brown long-eared bat	0.03	0.04	0.10	0.11	0.02	0.07	0.02	0.06
Total	**0.26**	**0.40**	**1.14**	**1.68**	**1.42**	**1.17**	**0.22**	**0.89**

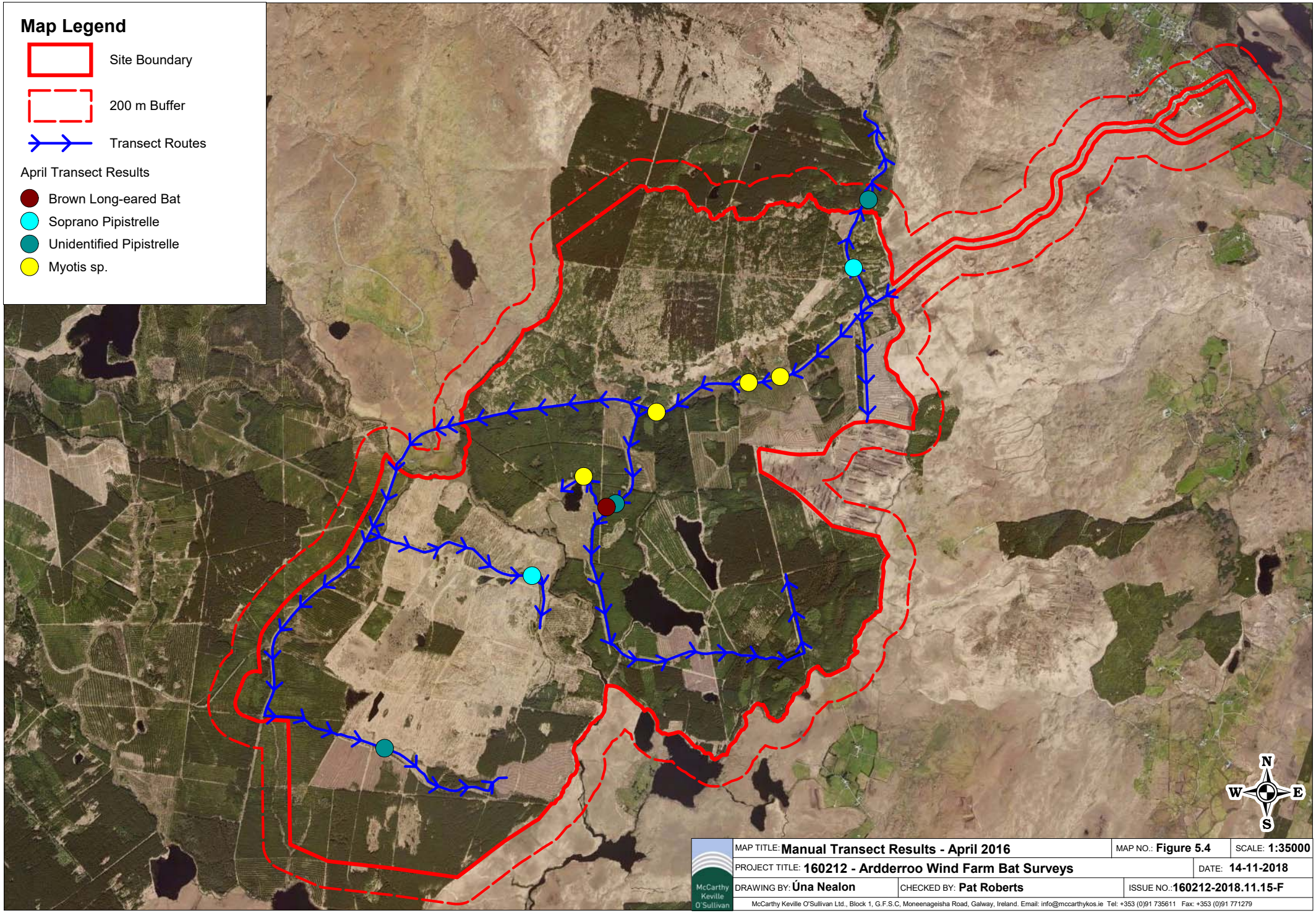
Figures 5.4 – 5.10 present the spatial distribution of bat activity across all survey months. Bat activity was recorded on all transects surveyed in 2016. In general, bats were recorded most frequently in broadleaved woodland habitats (Transect 3) as well as edge habitats along small forestry tracks (Transects 1, 4, 6 and 12). Likewise, bats tended to avoid open areas and edge habitats beside wide access roads.

5.3.4 Static Detector Surveys at Ground Level 2016

5.3.4.1 Letter Lodge Outhouse

In total, two nights recording per month was completed at Letter Lodge Outhouse between April and October 2016, resulting in a total 14 nights or 132.94 hours of recorded bat activity. Weather conditions encountered were the same as those recorded for manual transects (Table 5.9).

In total, 379 bat passes were recorded. Leisler's bat was encountered most frequently, followed by brown long-eared bat, *Myotis* sp., soprano pipistrelle, lesser horseshoe bat, common pipistrelle and unidentified pipistrelle (Figure 5.11). Table 5.12 presents manual transect results for individual bat species per survey period. Detailed results are available in Appendix 8.



MAP TITLE: **Manual Transect Results - April 2016**		MAP NO.: **Figure 5.4**	SCALE: **1:35000**
PROJECT TITLE: **160212 - Ardderroo Wind Farm Bat Surveys**			DATE: **14-11-2018**
DRAWING BY: **Úna Nealon**	CHECKED BY: **Pat Roberts**	ISSUE NO.:**160212-2018.11.15-F**	

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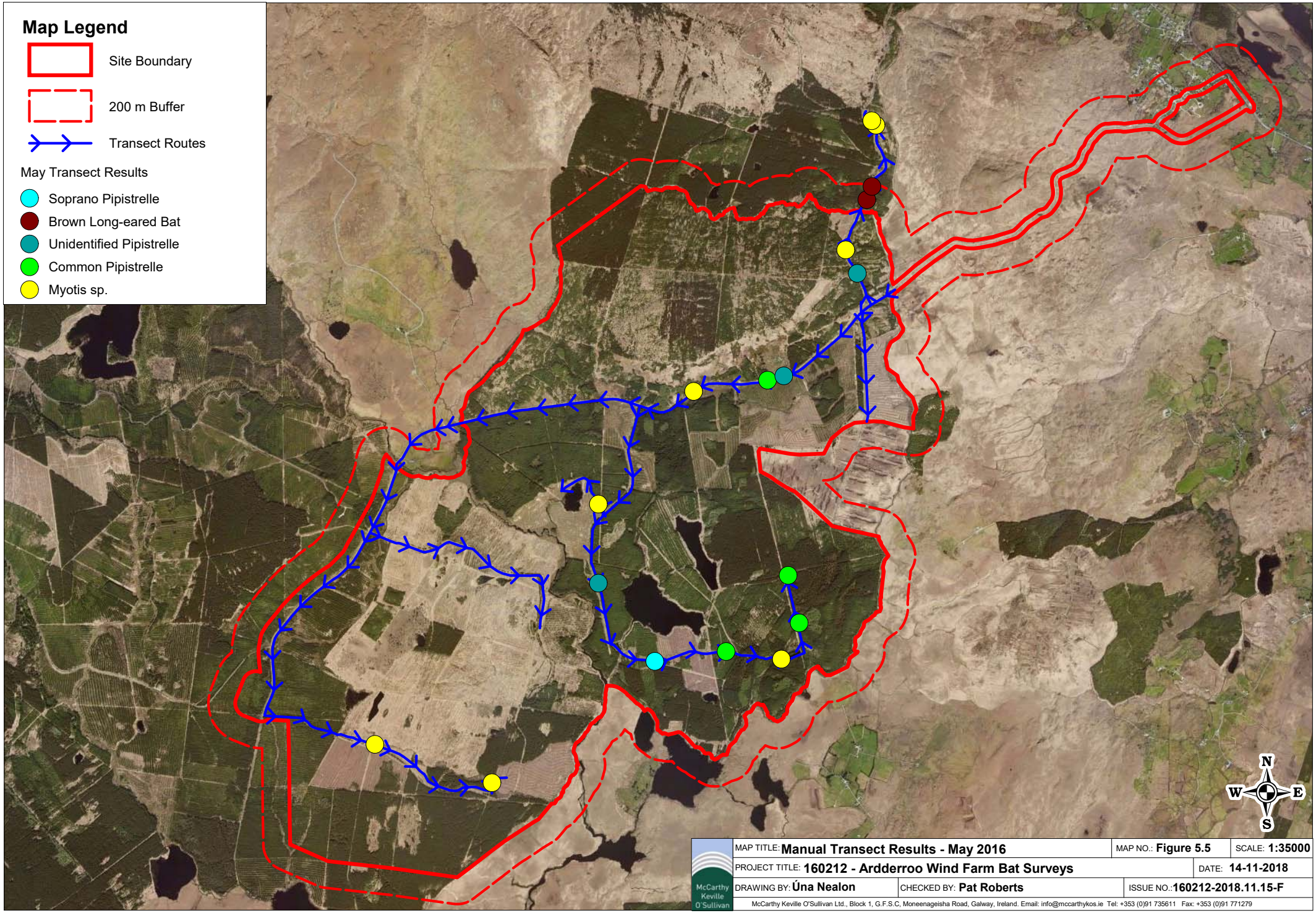

MAP TITLE: **Manual Transect Results - May 2016**		MAP NO.: **Figure 5.5**	SCALE: **1:35000**
PROJECT TITLE: **160212 - Ardderroo Wind Farm Bat Surveys**			DATE: **14-11-2018**
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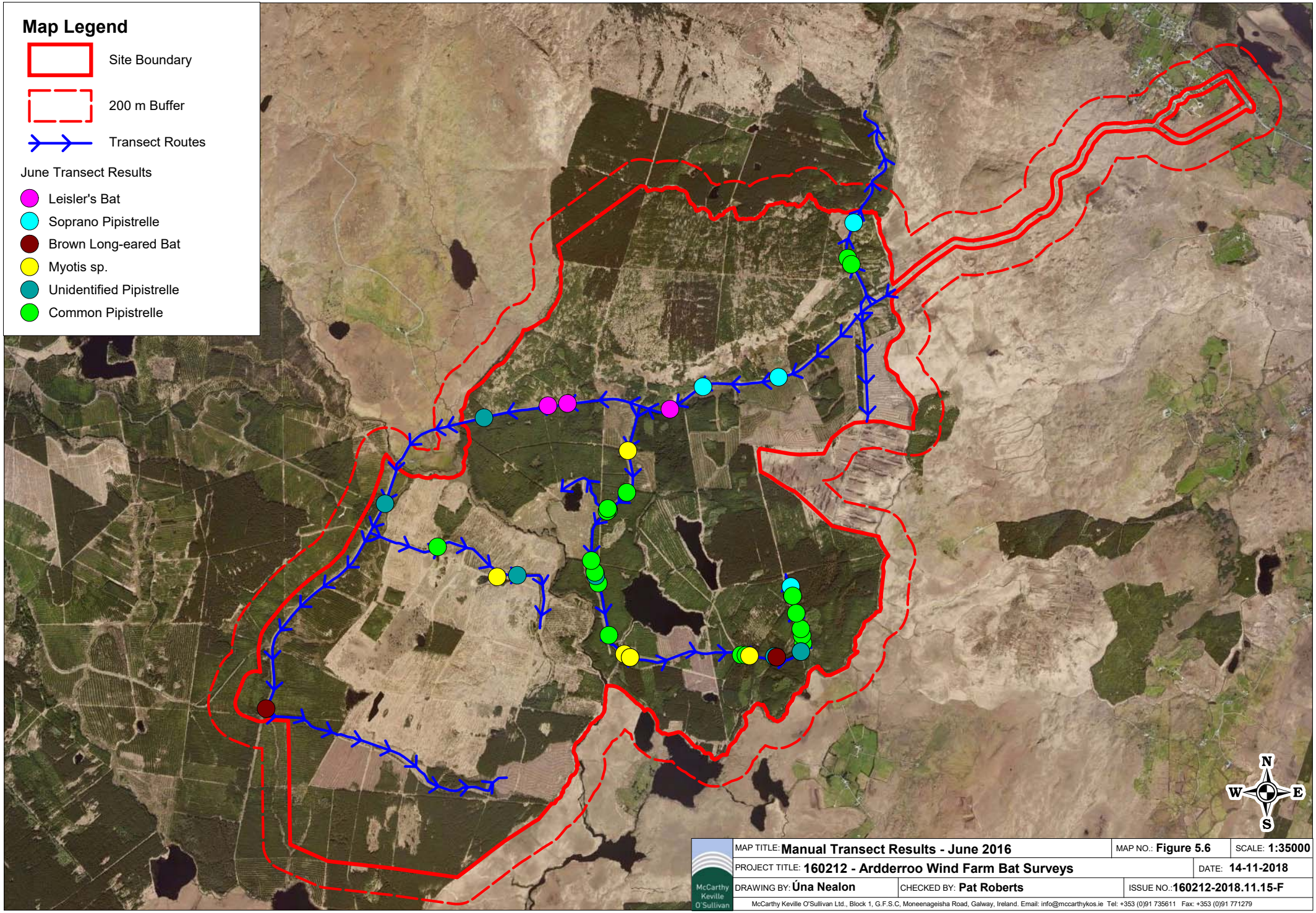

MAP TITLE: **Manual Transect Results - June 2016**		MAP NO.: **Figure 5.6**	SCALE: **1:35000**
PROJECT TITLE: **160212 - Ardderroo Wind Farm Bat Surveys**			DATE: **14-11-2018**
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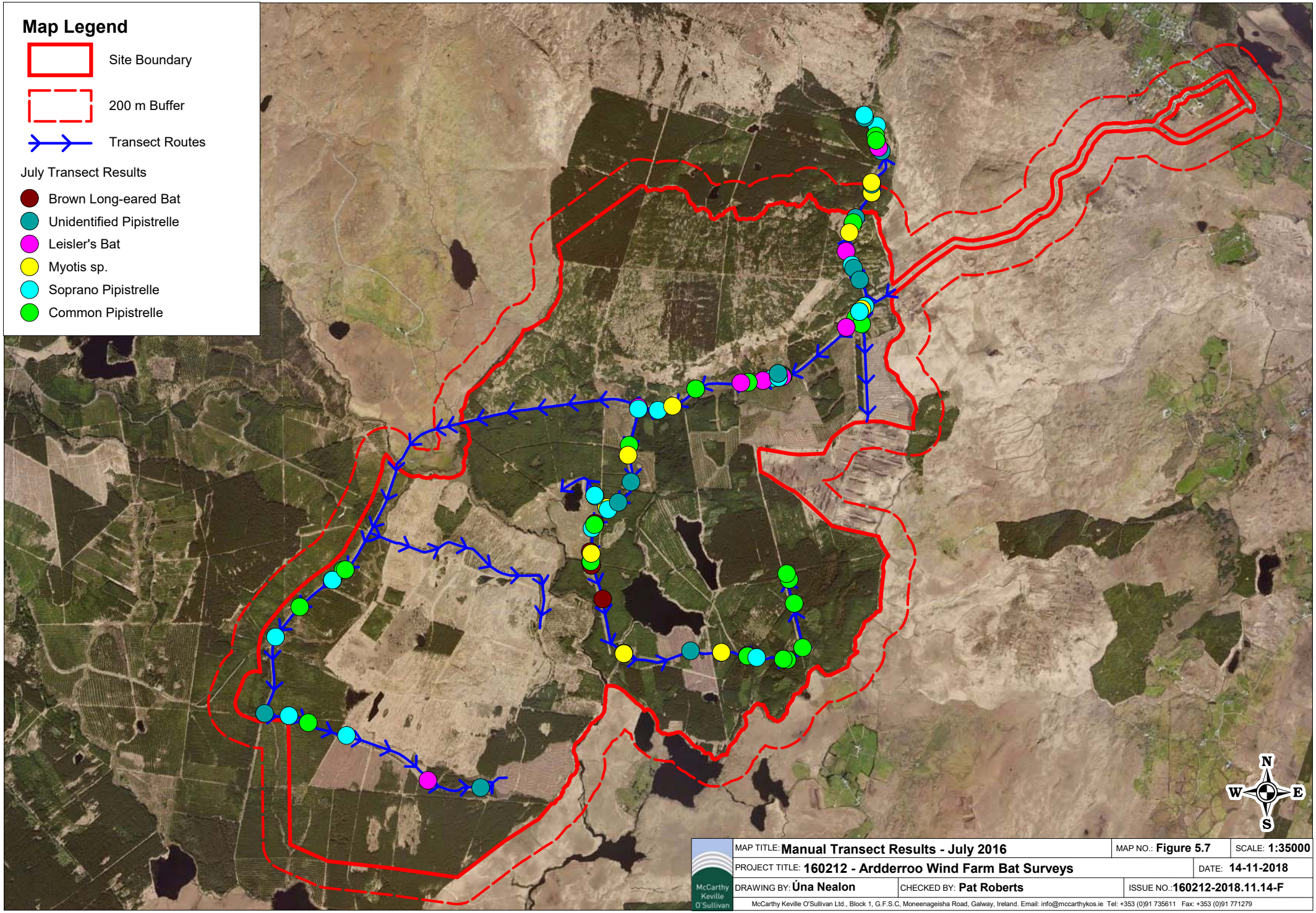

MAP TITLE: **Manual Transect Results - July 2016**		MAP NO.: **Figure 5.7**	SCALE: **1:35000**
PROJECT TITLE: **160212 - Ardderroo Wind Farm Bat Surveys**			DATE: **14-11-2018**
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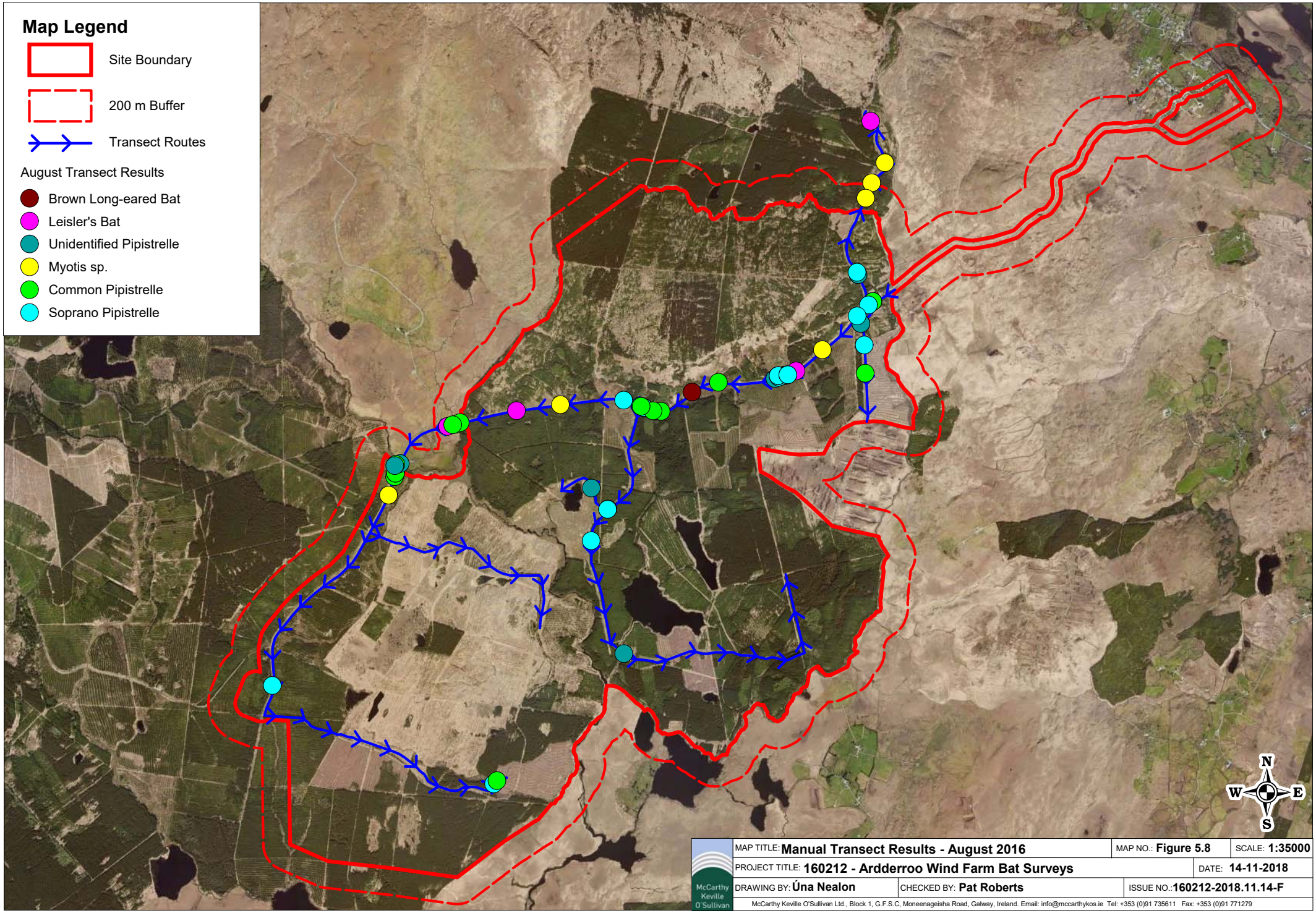

MAP TITLE: **Manual Transect Results - August 2016**		MAP NO.: **Figure 5.8**	SCALE: **1:35000**
PROJECT TITLE: **160212 - Ardderroo Wind Farm Bat Surveys**			DATE: **14-11-2018**
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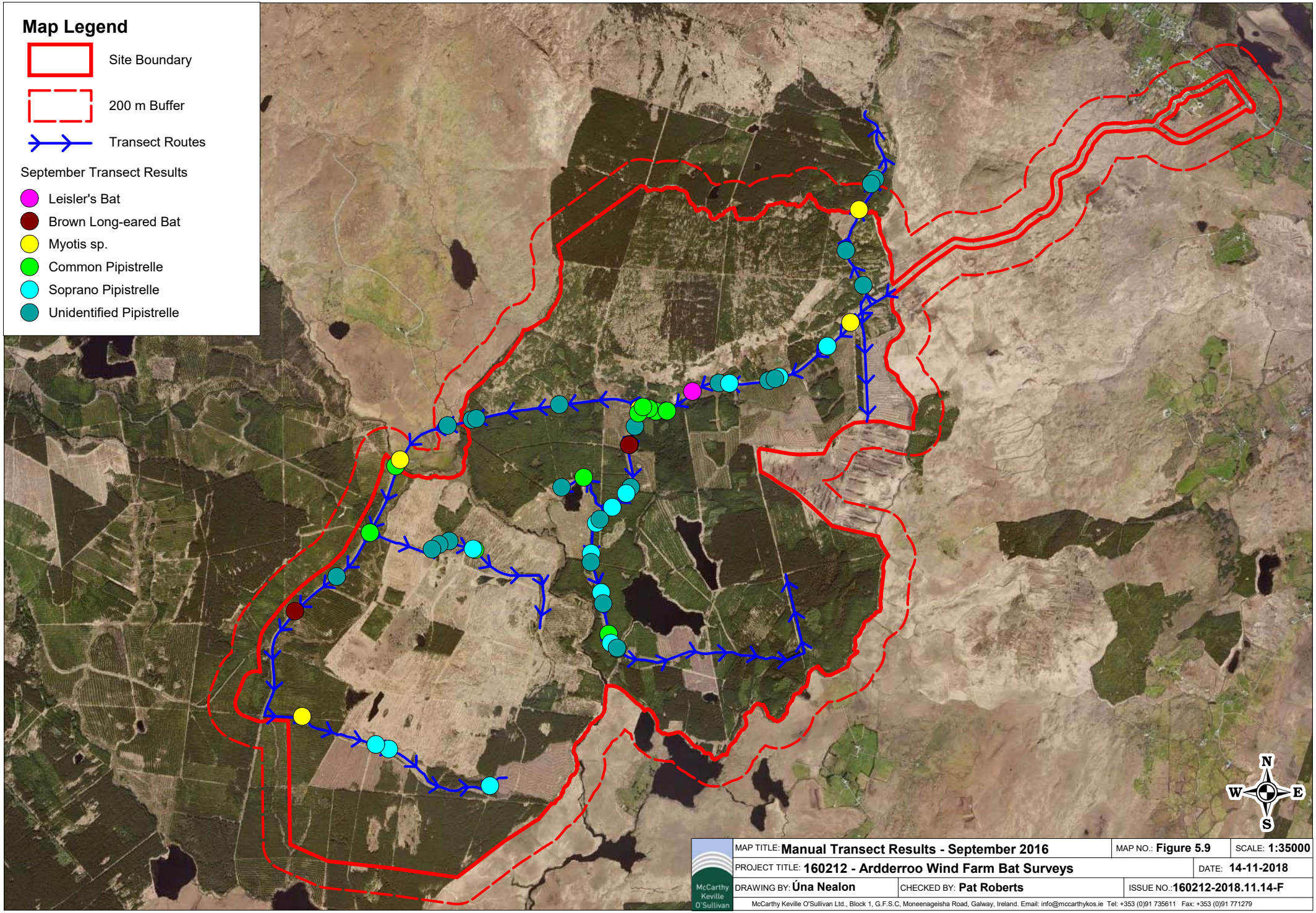

MAP TITLE: **Manual Transect Results - September 2016**		MAP NO.: **Figure 5.9**	SCALE: **1:35000**
PROJECT TITLE: **160212 - Ardderroo Wind Farm Bat Surveys**			DATE: **14-11-2018**
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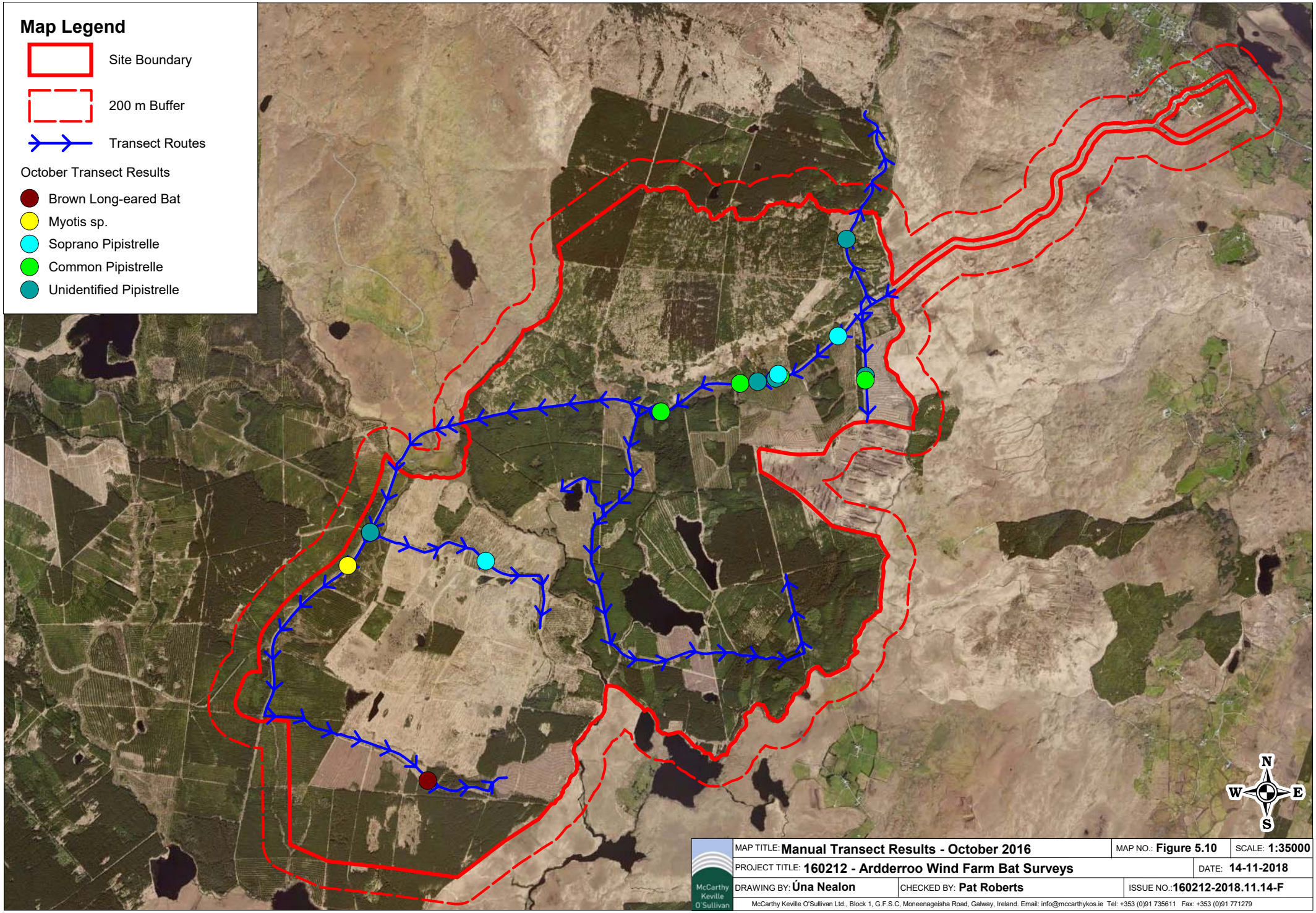

MAP TITLE: **Manual Transect Results - October 2016**		MAP NO.: **Figure 5.10**	SCALE: **1:35000**
PROJECT TITLE: **160212 - Ardderroo Wind Farm Bat Surveys**			DATE: **14-11-2018**
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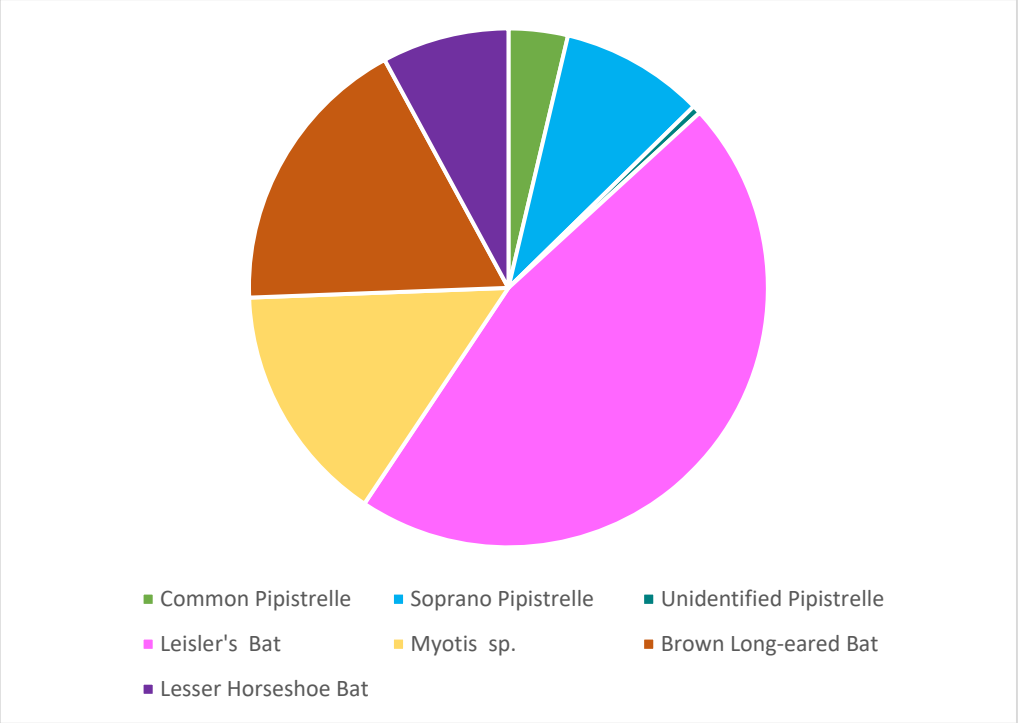

Figure 5.11: Letter Lodge static detector results: species composition (total bat passes)

Table 5.12: Letter Lodge outhouse static detector results in 2016 (total bat contacts)

	Apr 2016	May 2016	Jun 2016	Jul 2016	Aug 2016	Sep 2016	Oct 2016	Total
Common pipistrelle	3	0	0	5	6	0	0	14
Soprano pipistrelle	0	1	2	5	15	1	10	34
Unidentified pipistrelle	0	0	2	0	0	0	0	2
Leisler's bat	4	1	71	17	59	18	5	175
Myotis sp.	4	2	0	4	30	4	13	57
Brown long-eared bat	5	0	1	7	34	20	0	67
Lesser horseshoe bat	0	0	2	0	27	0	1	30
Total	**16**	**4**	**78**	**38**	**171**	**43**	**29**	**379**

The time at which bats are recorded can provide some indication of roosting behaviour. Bats recorded around sunset may indicate they have just left a roost, whereas bats recorded much later, are more likely to have travelled farther.

Emergence times, i.e. the time at which a bat will leave a roost to begin feeding, vary between species. In general, Leisler's bat and the pipistrelle species emerge earlier (approx. 0-20 min after sunset) while *Myotis* species emerge later (approx. 20-40 min after sunset) (Russ 2012, Collins, 2016). However, it should be noted that emergence and re-entry times may be influenced by a host of other factors including the availability of protective cover around the roost, the bats' reproductive status, ambient weather conditions on the night in question and on previous nights, etc.

Figures 5.12 and 5.13 display total bat passes recorded over 15 min time intervals after sunset and before sunrise respectively. In general, bat activity was greatest within the

first 30 minutes after sunset and the last 30 minutes before sunrise, indicating that the building may be used as a day roost, at least some of the time.

Figure 5.14 presents the species composition of potential roosting species. Leisler's bat showed the highest activity in the first hour after sunset and last hour before sunrise, in mid to late summer. While it is not possible to determine the exact numbers of individuals, the low number of recorded bat passes indicates that this is unlikely to be an important roost site.

In addition, lower levels of bat activity were recorded throughout survey nights, indicating the possible use of the outhouse as a night or feeding roost.

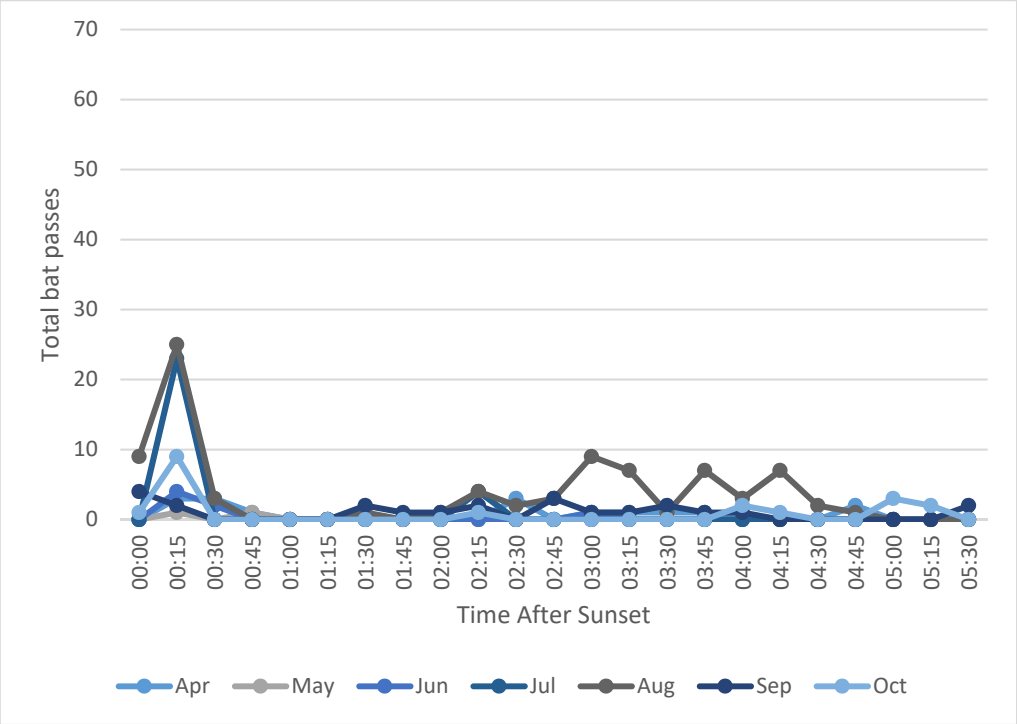

Figure 5.12: Bat activity at Letter Lodge outhouse over 15-minute time intervals after sunset

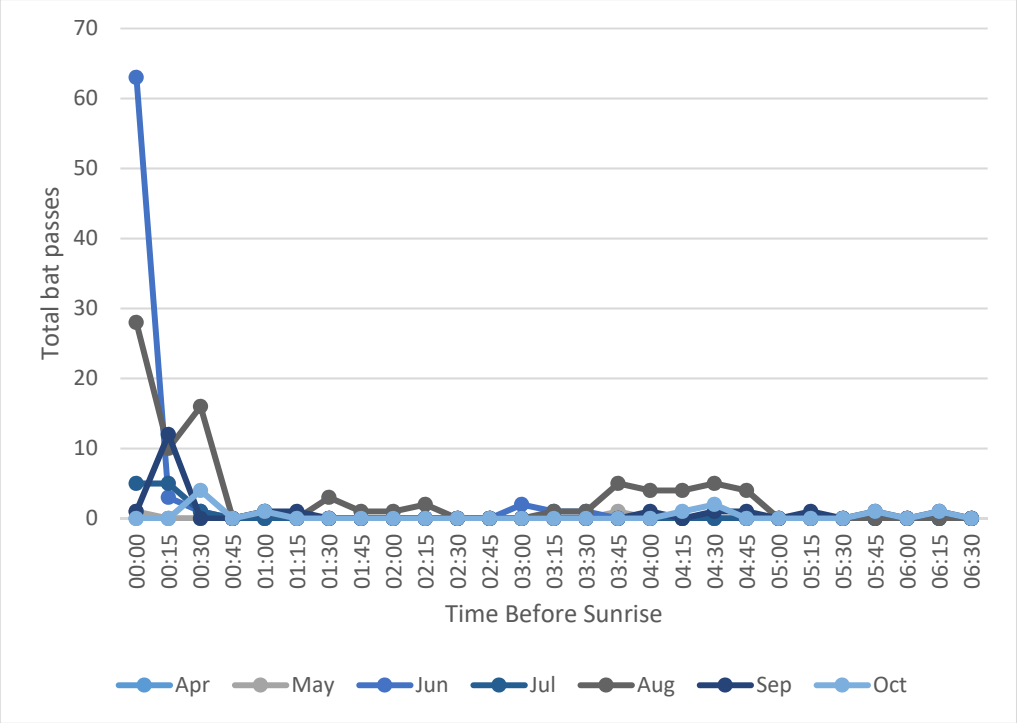

Figure 5.13: Bat activity at Letter Lodge outhouse over 15-minute time intervals before sunrise

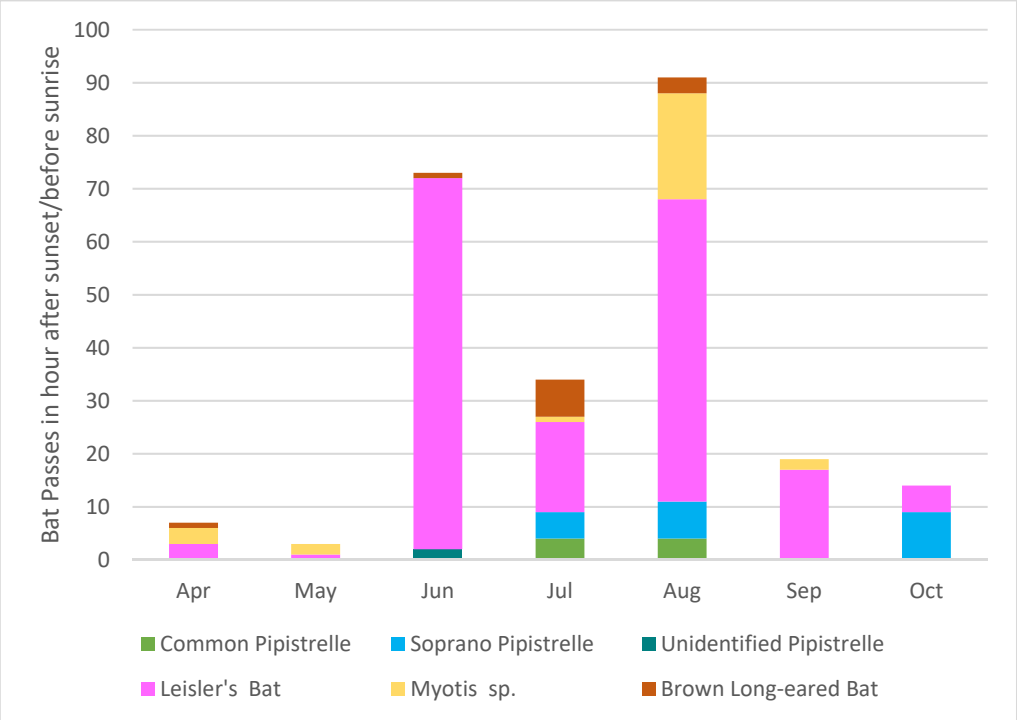

Figure 5.14: Bat species composition within 1st hour after sunset/before sunrise at Letter Lodge outhouse.

Thirty bat passes attributed to lesser horseshoe bat were recorded at Letter Lodge outhouse in 2016. Twenty-five of these were recorded on a single night in August, while the others were recorded in June, August and October. Similar to previous surveys in 2013, this indicates that the outhouse is used as a night roost. However, greater survey effort in 2016 has revealed the roost is not in regular use.

5.3.4.2 Other Static Detector Locations

In total, 6,602 bat passes were recorded over 128 nights of static detector monitoring, comprising 1,286.14 survey hours. Most of this activity was attributed to soprano pipistrelle, followed by common pipistrelle. Unidentified pipistrelle, *Myotis* sp. and Leisler's bat were recorded less frequently. Brown long-eared bat, lesser horseshoe bat and Nathusius' pipistrelle were recorded rarely (Figure 5.15). Table 5.13 provides a summary of these results.

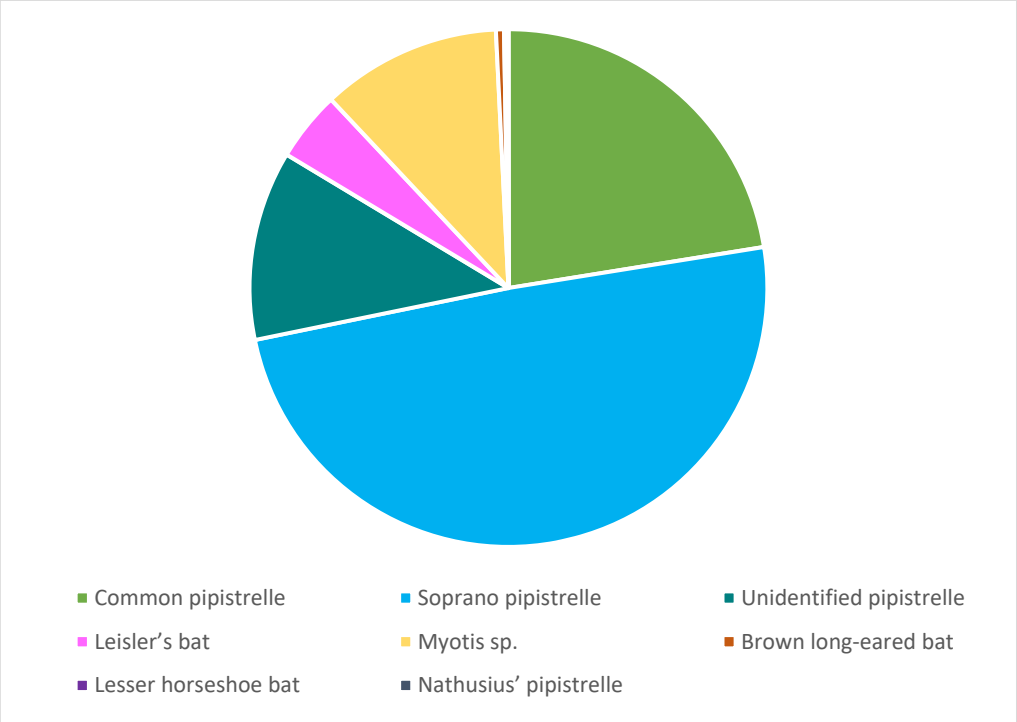

Figure 5.15: Static detector survey results: Species composition (total bat passes)

Bat activity was also calculated as total bat passes per hour (bpph) to account for any bias in survey effort, resulting from varying night lengths throughout the survey season (Table 3.5). Table 5.14 presents these results for each static detector location. Bat activity totaled 5.12 bat passes per survey hour. However, significant differences were observed between different species and survey locations (Figure 5.16 – 5.19).

In general, bat activity was consistently higher within the wet woodland habitat surveyed throughout the bat activity season. In comparison, activity was significantly less within conifer and open habitats throughout paired surveys.

The exception was in September where two conifer monitoring points (one detector with two microphones separated by 100m) recorded significantly more activity than woodland or other conifer habitats (Figure 5.17). Most of this activity was attributed to pipistrelle species. However, static bat detectors are not designed to distinguish between individual bats. Therefore, it is not possible to determine the number of individuals involved. Manual transect results in September recorded a small number of pipistrelles in this area (11 contacts along Transect 6), with several records of feeding buzzes and social calls. Given the low levels of activity recorded during static monitoring in similar habitats in September and the observed feeding behaviour of a small number of individuals during manual transects, this higher level of activity is likely due to a number of individuals foraging along the forestry track and repeatedly passing the microphone and is therefore, not considered typical.

In addition, in August a conifer monitoring point recorded levels of activity comparable to that of the woodland (Figure 5.16). However, this conifer habitat was located next to the woodland habitat (one detector with two microphones separated by 100m).

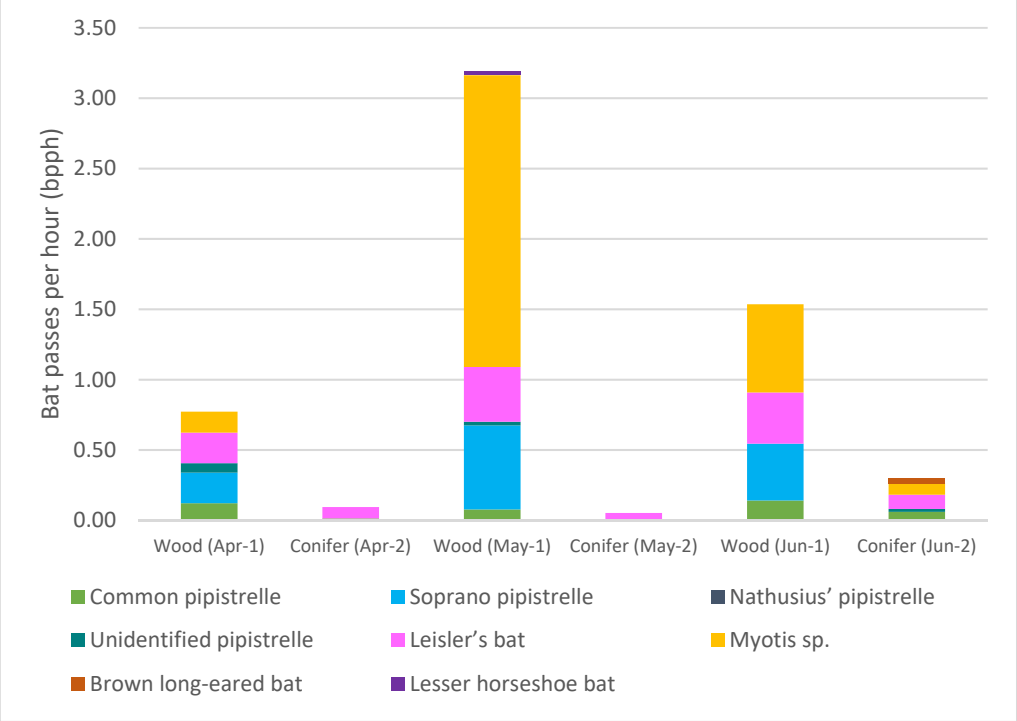

Figure 5.16: Static detector survey results April – May 2016: Species composition per location (bpph)

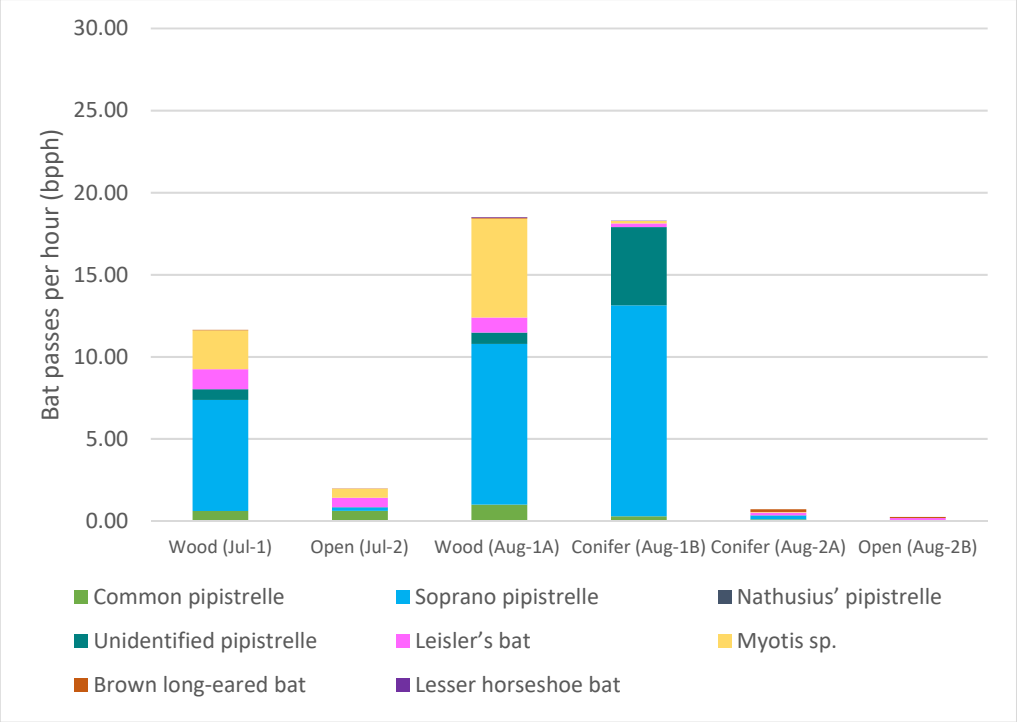

Figure 5.17: Static detector results Jul - Aug 2016: Species composition per location (bpph)

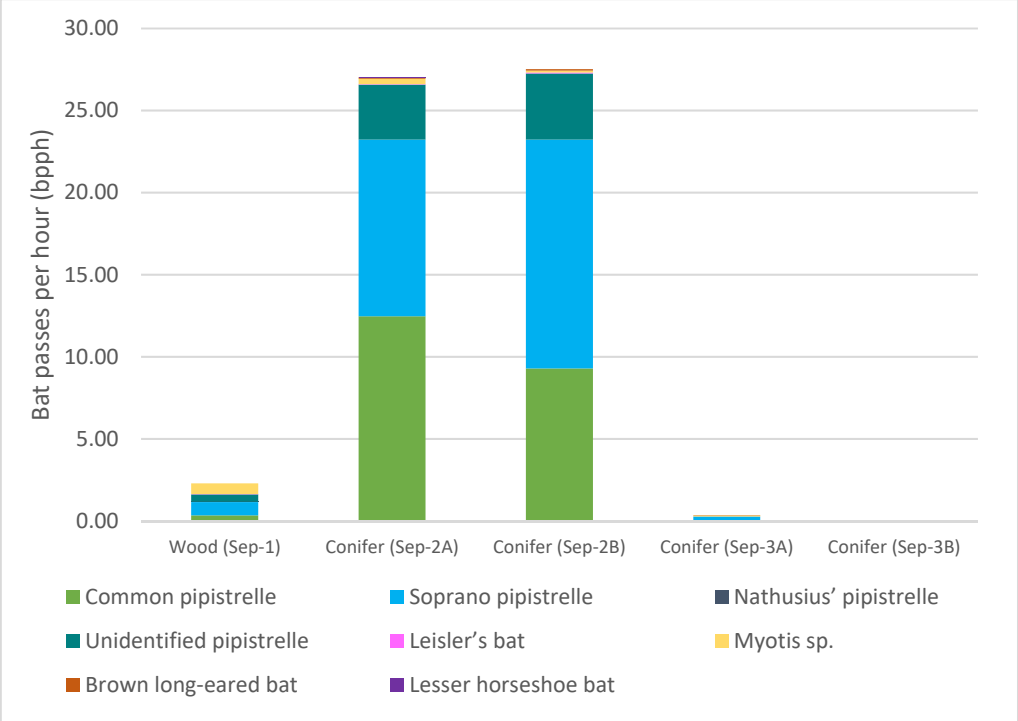

Figure 5.18: Static detector survey results September 2016: Species composition per location (bpph)

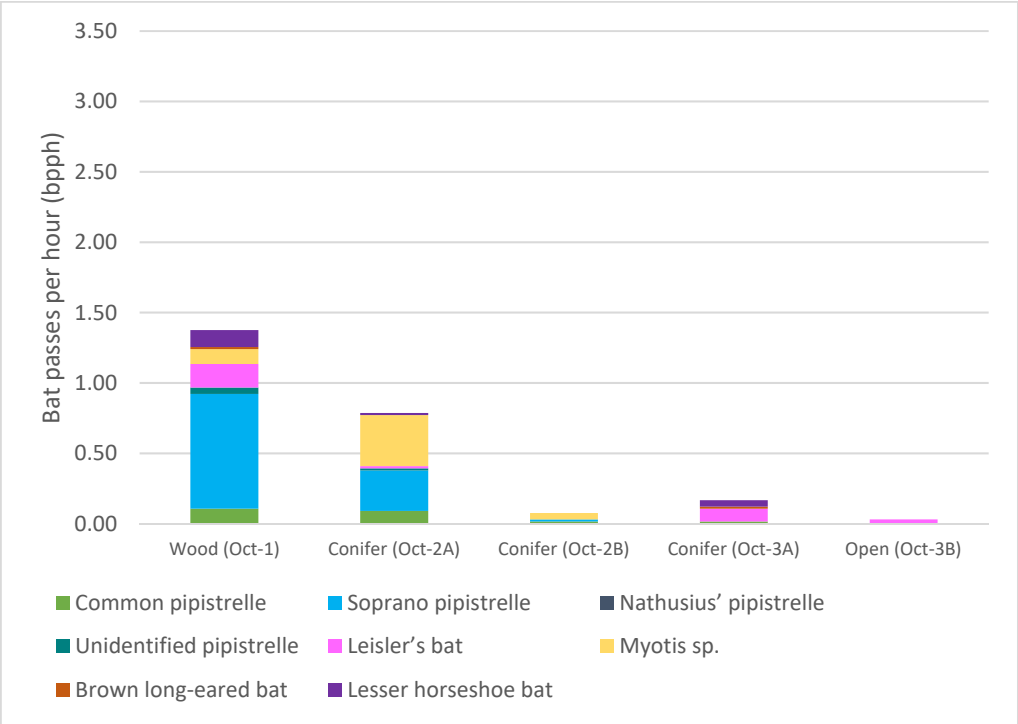

Figure 5.19: Static detector survey results October 2016: Species composition per location (bpph)

Table 5.13: Static detector results per species per location (total bat passes)

Location ID	Common pipistrelle	Soprano pipistrelle	Nathusius' pipistrelle	Unidentified pipistrelle	Leisler's bat	*Myotis* sp.	Brown long-eared bat	Lesser horseshoe bat	Total
Wood (Apr-1)	9	16	0	5	16	11	0	0	57
Conifer (Apr-2)	1	0	0	0	6	0	0	0	7
Wood (May-1)	3	23	0	1	15	80	0	1	123
Conifer (May-2)	0	0	0	0	2	0	0	0	2
Wood (Jun-1)	7	20	0	0	18	31	0	0	76
Conifer (Jun-2)	3	0	0	1	5	4	2	0	15
Wood (Jul-1)	44	491	0	48	88	172	2	0	845
Open (Jul-2)	45	15	0	1	42	39	1	0	143
Wood (Aug-1A)	49	478	0	34	45	294	3	2	905
Conifer (Aug-1B)	14	628	0	233	11	7	0	1	894
Conifer (Aug-2A)	5	11	0	1	8	2	8	0	35
Open (Aug-2B)	0	3	0	0	6	0	3	0	12
Wood (Sep-1)	20	47	1	26	1	38	0	0	133
Conifer (Sep-2A)	725	626	0	194	2	19	6	1	1573
Conifer (Sep-2B)	540	811	0	234	3	7	5	0	1600
Conifer (Sep-3A)	3	13	0	0	0	4	1	0	21
Conifer (Sep-3B)	0	0	0	0	0	0	0	0	0
Wood (Oct-1)	7	54	0	3	11	7	1	8	91
Conifer (Oct-2A)	6	19	0	1	1	24	0	1	52
Conifer (Oct-2B)	1	1	0	0	0	3	0	0	5
Conifer (Oct-3A)	1	0	0	0	6	0	1	3	11
Open (Oct-3B)	0	0	0	0	2	0	0	0	2
Total	**1483**	**3256**	**1**	**782**	**288**	**742**	**33**	**17**	**6602**

Table 5.14: Statoc detector survey results per species per location, calculated as total bat passes per survey hour (bpph)

Location ID	Effort (h)	Common pipistrelle	Soprano pipistrelle	Nathusius' pipistrelle	Unidentified pipistrelle	Leisler's bat	*Myotis* sp.	Brown long-eared bat	Lesser horseshoe bat	Total
Wood (Apr-1)	*73.87*	0.12	0.22	0.00	0.07	0.22	0.15	0.00	0.00	0.77
Conifer (Apr-2)	*73.87*	0.01	0.00	0.00	0.00	0.08	0.00	0.00	0.00	0.09
Wood (May-1)	*38.57*	0.08	0.60	0.00	0.03	0.39	2.07	0.00	0.03	3.19
Conifer (May-2)	*38.57*	0.00	0.00	0.00	0.00	0.05	0.00	0.00	0.00	0.05
Wood (Jun-1)	*49.52*	0.14	0.40	0.00	0.00	0.36	0.63	0.00	0.00	1.53
Conifer (Jun-2)	*49.52*	0.06	0.00	0.00	0.02	0.10	0.08	0.04	0.00	0.30
Wood (Jul-1)	*72.6*	0.61	6.76	0.00	0.66	1.21	2.37	0.03	0.00	11.64
Open (Jul-2)	*72.6*	0.62	0.21	0.00	0.01	0.58	0.54	0.01	0.00	1.97
Wood (Aug-1A)	*48.88*	1.00	9.78	0.00	0.70	0.92	6.01	0.06	0.04	18.51
Conifer (Aug-1B)	*48.88*	0.29	12.85	0.00	4.77	0.23	0.14	0.00	0.02	18.29
Conifer (Aug-2A)	*48.88*	0.10	0.23	0.00	0.02	0.16	0.04	0.16	0.00	0.72
Open (Aug-2B)	*48.88*	0.00	0.06	0.00	0.00	0.12	0.00	0.06	0.00	0.25
Wood (Sep-1)	*58.15*	0.34	0.81	0.02	0.45	0.02	0.65	0.00	0.00	2.29
Conifer (Sep-2A)	*58.15*	12.47	10.77	0.00	3.34	0.03	0.33	0.10	0.02	27.05
Conifer (Sep-2B)	*58.15*	9.29	13.95	0.00	4.02	0.05	0.12	0.09	0.00	27.52
Conifer (Sep-3A)	*58.15*	0.05	0.22	0.00	0.00	0.00	0.07	0.02	0.00	0.36
Conifer (Sep-3B)	*58.15*	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Wood (Oct-1)	*66.15*	0.11	0.82	0.00	0.05	0.17	0.11	0.02	0.12	1.38
Conifer (Oct-2A)	*66.15*	0.09	0.29	0.00	0.02	0.02	0.36	0.00	0.02	0.79
Conifer (Oct-2B)	*66.15*	0.02	0.02	0.00	0.00	0.00	0.05	0.00	0.00	0.08
Conifer (Oct-3A)	*66.15*	0.02	0.00	0.00	0.00	0.09	0.00	0.02	0.05	0.17
Open (Oct-3B)	*66.15*	0.00	0.00	0.00	0.00	0.03	0.00	0.00	0.00	0.03
Total	***1286.14***	**1.15**	**2.53**	**0.00**	**0.61**	**0.22**	**0.58**	**0.03**	**0.01**	**5.13**

5.3.4.3 Assessment of Bat Activity Levels

Static monitoring results for 2016 were uploaded to Ecobat. This online tool allows the comparison of bat activity data to a reference dataset allowing the objective interpretation of activity levels.

Ecobat assesses activity levels using percentiles. Percentiles provide a numerical indicator of the relative importance of a night's worth of activity. Ecobat provide the following cut-off levels between activity categories.

- Low activity <20th percentile
- Low/moderate activity 20-30th percentiles
- Moderate activity 30-70th percentiles
- Moderate/high activity 70-80th percentiles
- High activity >80th percentile

Table 5.15 presents the results of Ecobat analyses. All recorded bat species displayed relatively high activity on at least some nights. However, in general bat activity was low. Using the median percentile value, activity levels at the site were assessed as low for common pipistrelle, Leisler's bat, brown long-eared bat and lesser horseshoe bat. Activity levels were assessed as moderate for soprano pipistrelle, unidentified pipistrelle and *Myotis* sp.

5.3.5 Static Detetecor Surveys at Ground Level and at Height 2017

In 2017, 35 nights of simultaneous bat monitoring at ground level and at height was achieved. In total, 221 bat passes were recorded with bat activity significantly higher at ground level (97%) compared to at height (3%). Leisler's bat (n=3), soprano pipistrelle (n=2) and pipistrelle sp. (n=2) were recorded at height.

Tables 5.16 and 5.17 present met mast monitoring as total bat passes and as bat passes per survey hour. Figure 5.20 provides a summary of these results. All individual bat records arising from static detector monitoring are appended to this report as Appendix 9.

Table 5.15: Assessment of bat activity levels: Ecobat results

Location ID	Total Survey Nights	Activity Levels (Nights)					Median Percentile	95% Confidence Interval	No. Database Records Compared	Overall Activity Assessment
		High	High-Moderate	Moderate	Moderate-Low	Low				
Common pipistrelle	128	31	32	-	-	65	0	0 - 62	510	**Low**
Soprano pipistrelle	128	55	18	-	-	55	62	0 - 80	512	**Moderate**
Unidentified pipistrelle	128	64	18	-	-	46	77	62 - 85	512	**Moderate/High**
Leisler's bat	128	27	32	-	-	69	0	0 - 62	510	**Low**
Myotis sp.	128	42	25	-	-	61	62	0 - 74	508	**Moderate**
Brown long-eared bat	128	3	17	-	-	108	0	0 - 0	502	**Low**
Lesser horseshoe bat	128	2	10	-	-	116	0	0 - 0	504	**Low**

Table 5.16: Summary of met mast static detector results in 2017 (total bat passes)

	Mar – A		Apr – A		Apr – B		May – A		May – B		Jun – A		Aug – A		Total
	Low	High	Low	High	Low	High	Low	High	Low	High	Low	High	Low	High	
Effort (h)	*44.38*	*44.38*	*32.55*	*32.55*	*45.43*	*45.43*	*60.97*	*60.97*	*59.93*	*59.93*	*29.1*	*29.1*	*35.8*	*35.8*	*616.32*
Soprano pipistrelle	5	-	1	-	1	-	13	-	52	1	2	-	10	1	86
Common pipistrelle	-	-	-	-	1	-	19	-	16	-	1	-	20	-	47
Nathusius' pipistrelle	-	-	-	-	-	-	-	-	2	-	-	-	-	-	2
Unidentified pipistrelle	1	-	-	-	-	-	-	-	11	1	-	1	1	-	15
Leisler's bat	-	-	-	-	-	1	16	-	1	-	1	1	23	1	44
Brown long-eared bat	2	-	-	-	-	-	2	-	5	-	2	-	3	-	14
Myotis sp.	-	-	-	-	-	-	1	-	4	-	2	-	3	-	10
Lesser horseshoe bat	1	-	-	-	-	-	1	-	-	-	1	-	-	-	3
Total	9	0	0	0	2	1	52	0	91	2	9	2	50	2	221

Table 5.17: Summary of met mast static detector results in 2017 (bpph)

	Mar – A		Apr – A		Apr – B		May – A		May – B		Jun – A		Aug – A		Total
	Low	High	Low	High	Low	High	Low	High	Low	High	Low	High	Low	High	
Effort (h)	*44.38*	*44.38*	*32.55*	*32.55*	*45.43*	*45.43*	*60.97*	*60.97*	*59.93*	*59.93*	*29.1*	*29.1*	*35.8*	*35.8*	*616.32*
Soprano pipistrelle	5	-	1	-	1	-	13	-	52	1	2	-	10	1	86
Common pipistrelle	-	-	-	-	1	-	19	-	16	-	1	-	20	-	47
Nathusius' pipistrelle	-	-	-	-	-	-	-	-	2	-	-	-	-	-	2
Unidentified pipistrelle	1	-	-	-	-	-	-	-	11	1	-	1	1	-	15
Leisler's bat	-	-	-	-	-	1	16	-	1	-	1	1	23	1	44
Brown long-eared bat	2	-	-	-	-	-	2	-	5	-	2	-	3	-	14
Myotis sp.	-	-	-	-	-	-	1	-	4	-	2	-	3	-	10
Lesser horseshoe bat	1	-	-	-	-	-	1	-	-	-	1	-	-	-	3
Total	9	0	0	0	2	1	52	0	91	2	9	2	50	2	221

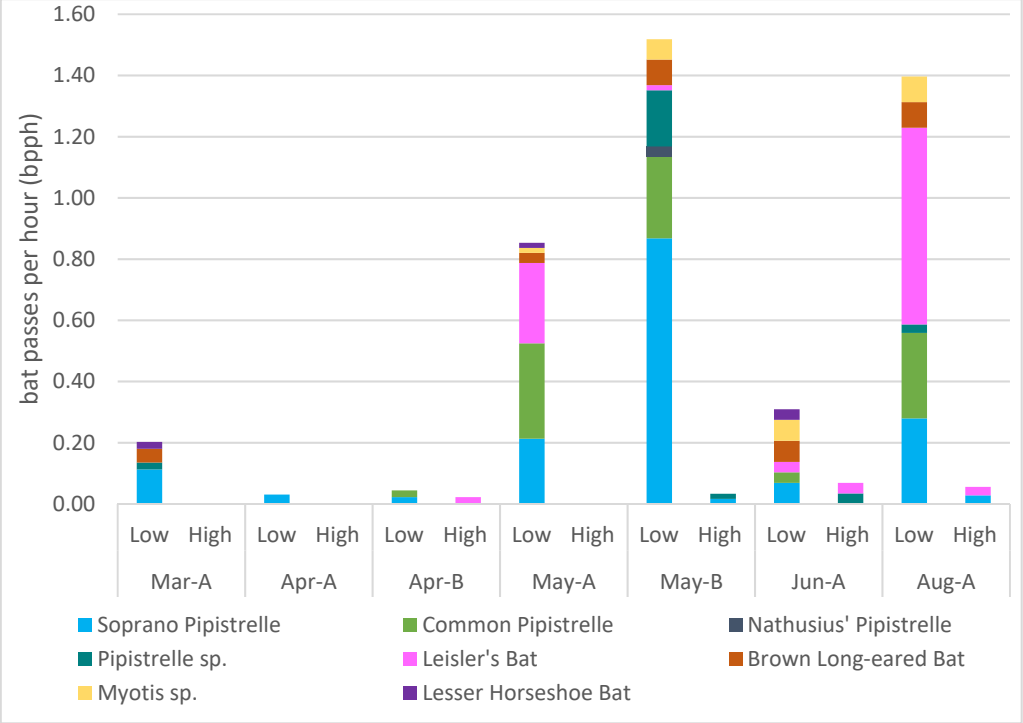

Figure 5.20: Static detectors at met mast 2017: Species composition per mic & per deployment (bpph)

5.4 Summary of Results

Bat surveys were designed in accordance with survey standards for medium risk sites, in accordance with the Bat Conservation Trust's guidelines for wind turbine developments (Hundt, 2012). Surveys adopted a four-season approach and employed a combination of methods between 2013 and 2017, including desktop study, habitat and landscape assessments, roost inspections, manual activity surveys and static detector surveys at ground level and at height.

The landscape surrounding the proposed site contains a range of habitats suitable for most bat species occurring in Ireland. In particular, lowland areas to the west containing a mosaic of farmland, hedgerows and freshwater habitats, present good foraging and commuting opportunities as well as roosts of national and international importance.

Habitats within the Study Area are dominated by commercial forestry. The remainder of the site comprises marginal farmland, peatland and freshwater habitats, as well as some wet woodland. Areas of wet woodland and forestry edge habitats, created by commercial forestry and roadways/watercourses show potential for foraging and commuting bats. However, these habitats are isolated from the wider landscape, particularly the valuable lowland habitats to the west, by wide expanses of open peatland habitats. Woodland and forestry edge habitats were thus assigned a *Low* potential value for foraging and commuting bats. All other habitats present were assigned a *Negligible* value. The results of manual transects and static detector monitoring in 2016 confirmed a preference for woodland and edge habitats along smaller forestry tracks as well as a tendency to avoid open areas and edge habitats along wider access roads.

Overall, activity levels for soprano pipistrelle, unidentified pipistrelle and *Myotis* sp. were considered *Moderate* using Ecobat analyses. Activity levels for common

pipistrelle, Leisler's bat, brown long-eared bat and lesser horseshoe bat were assessed as *Low*. In addition, a single Nathusius' pipistrelle pass was recorded, indicating that the presence of this species within the site is exceptionally rare. Manual transect results showed bat activity gradually increased from April, peaked in July and gradually tapered off into October. Static detector results reflect this trend, with significantly higher activity recorded in July and August (excluding atypical recordings in September). This trend is typical of bat activity in Ireland where increased activity levels in late summer are generally attributed to young bats on the wing.

Static detector surveys at the site's met mast, simultaneously monitoring at ground level and at height in 2017, found extremely low levels of bat activity at height, compared to activity at ground level over the same time period.

A search for roosts was undertaken within 200m of the site boundary, using a four-season approach. Trees within the Study Area were not of sufficient size or age to contain potential roost features and were assigned a *Low* suitability value. The main house and surrounding sheds at Letter Lodge showed *Moderate* roosting potential, in addition to one confirmed roost within an outhouse. Additional structures identified within the Study Area were assigned *Negligible* or *Low* potential values. Habitat assessments and roost surveys did not find any suitable sites for maternity colonies, swarming activity or hibernation within the Study Area.

One night of unattended monitoring at Letter Lodge Outhouse in August 2014 concluded the building was likely used as a night roost by lesser horseshoe bat. However, substantially increased survey effort in 2016 determined the roost may occasionally be used by lesser horseshoe bat as a night roost but it is not subject to regular use as was previously assumed.

Roost monitoring at Letter Lodge Outhouse in 2016 recorded Leisler's bat most frequently, followed by brown long-eared bat, *Myotis* sp. , soprano pipistrelle, lesser horseshoe bat, common pipistrelle and unidentified pipistrelle. It is likely only used by a small number of individuals as a day, feeding or night roost. Due to its structure, design and surrounding habitat, it is unlikely to support important roosts, e.g. maternity colonies or large roosts of lesser horseshoe bat, whiskered bat or Natterer's bat (NRA, 2006).

6 LIKELY AND SIGNIFICANT EFFECTS ON BATS

6.1 Assessment of Potential Effects

Potential effects on bats of the proposed wind farm at Ardderroo, Co. Galway is presented in Table 6.1.

Table 6.1: Assessment of potential effects on bats

Analysis of potential effects during construction, operation and decommissioning phases of the proposed development		Unmitigated significance of potential effect (EPA 2002)
Construction Phase		
Habitat loss/ degradation	Loss or degradation of commuting/foraging habitat has potential to reduce feeding opportunities and/or displace bat populations. However, there will be no net loss of bat foraging/commuting habitat associated with the proposed wind farm development.	**Long-term Neutral Effect**
	Loss or degradation of roosting habitat has potential to displace bat populations and/ or impact breeding success. No sites suitable for maternity colonies, swarming or hibernation were identified. The bat roost at Letter Lodge outhouse will be retained as part of the development proposal. In addition, the development has been designed to retain linear landscape connectivity and maintain connectivity to this roost.	**No Effect**
Disturbance/ Displacement	Bats may be disturbed by increased human presence and increased noise during construction, leading to avoidance of the area. However, the Study Area is not utilised by large populations of bats. No sites suitable for maternity colonies, swarming or hibernation were identified. Bat activity levels were also assessed as *Low-Moderate*, with a preference for woodland and edge habitats. In addition, construction works will be temporary.	**Short-term Slight Negative Effect**
Mortality	The potential for bats to be killed during removal of trees or structures was considered in this assessment. All trees and structures were assessed for roosting potential. The bat roost at Letter Lodge outhouse will be retained as part of the development proposal and no other roosts were identified.	**No Effect**

Analysis of potential effects during construction, operation and decommissioning phases of the proposed development		Unmitigated significance of potential effect (EPA 2002)
Operational Phase		
Disturbance/ Displacement	Bats may be disturbed by noise and/or movement of operational wind turbines, leading to avoidance of the area. However, the Study Area is not utilised by large populations of bats. It is unlikely there will be any significant disturbance or displacement during the operational phase.	**Long-term Imperceptible Negative Effect**
Mortality	Death may occur through collision with turbine blades or as a result of barotrauma. Significant fatalities may negatively affect local and national bat populations. To date, no studies have conclusively linked pre-construction activity surveys to post-construction fatality rates (Hein etal. 2013). However, there is a strong positive correlation between post-construction activity and fatality at wind farms (Kunz et al. 2007, Baerwald and Barclay 2009, Amorim et al. 2012, Korner-Nievergelt et al. 2013). Activity levels for species at high and medium risk of collision was assessed as low (Leisler's bat, Nathusius' pipistrelle and common pipistrelle). In addition, bat activity at height (within the potential risk zone) was significantly less than that at ground level. Therefore, provided there is no significant change in activity as a result of the proposed development, a significant negative effect is not predicted. Post-construction activity monitoring and fatality searches will be undertaken to monitor for any changes.	**Long-term Slight Negative Effect**
	Activity levels for soprano pipistrelle and unidentified pipistrelle, species at medium risk of collision, was moderate. In addition, bat activity at height (within the potential risk zone) was significantly less than that at ground level. Therefore, provided there is no significant change in activity as a result of the proposed development, there is some potential for negative effects. Post-construction activity monitoring and fatality searches will be undertaken to monitor any changes.	**Long-term Moderate Negative Effect**
	All other recorded species are low collision risk species and no negative effect arising from collisions is predicted.	**No Effect**

Analysis of potential effects during construction, operation and decommissioning phases of the proposed development		Unmitigated significance of potential effect (EPA 2002)
	Wind turbines located close to roosts present a greater risk of collision. Proposed turbine locations are located at least 370m from the one identified roost. Therefore, no increased risk of collision is anticipated due to proximity to roost sites.	**No Effect**
Decommissioning Phase		
Habitat loss/ degradation	Activities during the decommissioning phase are similar to those during the construction phase. No significant negative effects are predicted during the decommissioning phase.	**No Effect**
Disturbance/ Displacement	Activities during the decommissioning phase are similar to those during the construction phase. No significant negative effects are predicted during the decommissioning phase.	**Short-term Slight Negative Effect**
Mortality	Activities during the decommissioning phase are similar to those during the construction phase. No significant negative effects are predicted during the decommissioning phase.	**No Effect**

7 MITIGATION MEASURES

7.1 Derogation Licence

It is illegal to damage or destroy a bat roost in Ireland. One roost was identified within the Study Area. However, proposed works will have no direct effect on this roost. No other roosts in trees, buildings or other structures were identified within the developable area. Therefore, there is no requirement for a derogation licence

7.2 Buffer Distances

Habitats within the Study Area have limited value for bats at present. However, wind farm construction creates linear features and spaces around each turbine, which may provide favourable conditions for flying insects and foraging bats. Forest clearing will, at a minimum, observe a 50m buffer distance as recommended by Natural England (2014). These vegetation-free areas will be maintained during the operational life of the development.

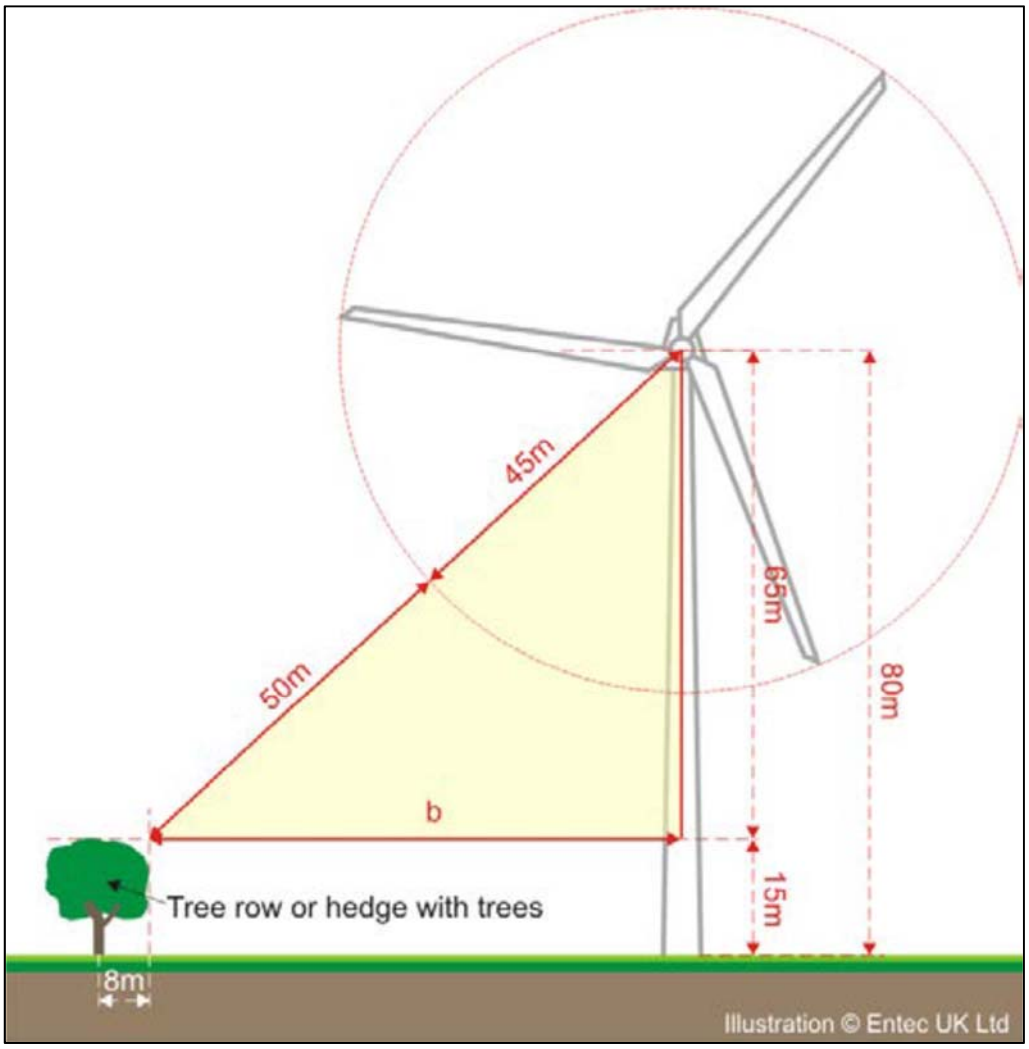

Figure 7.1: Calculation of buffer distances (from Natural England, 2014)

To minimise risk to bat populations our advice is to maintain a 50 m buffer around any feature (trees, hedges) into which no part of the turbine intrudes. This means the edge

of the rotor-swept area needs to be at least 50 m from the nearest part of the habitat feature. Therefore, 50m should be the minimum stand-off distance from blade tip to the nearest feature.

It is incorrect to measure 50 m from the turbine base to habitat feature at ground level as this would bring the blade tips very close to the canopy of a tall hedgerow tree and potentially put bat populations at risk. Instead, it is necessary to calculate the distance between the edge of the feature and the center of the tower (b) using the formula:

$$b = \sqrt{(50 + bl)^2 - (hh - fh)^2}$$

where: bl = blade length, hh = hub height, fh = feature height (all in metres). For the example above, b = 69.3 m (Figure 7.1).

7.3 Habitat Management

The bat roost at Letter lodge will be maintained. In addition, the linear landscape connecting the roost to the wider landscape will be retained throughout construction, operational and decommissioning phases of the development. Protected treelines will be fenced off during construction.

Where wind turbine construction will result in the loss of forestry habitat, re-planting will be undertaken so that there is no net loss. Planting schemes will connect to existing wildlife corridors to provide continuity and facilitate foraging and commuting bats.

7.4 Noise Restrictions

During the construction phase, noise limits, noise control measures, hours of operation and selection of plant items will be considered in relation to disturbance of bats. In addition, plant machinery will be turned off when not in use and all plant and equipment for use will comply with the Construction Plant and Equipment Permissible Noise Levels Regulations (SI 359/1996).

7.5 Lighting Restrictions

Lighting will not be permitted at Letter Lodge and will be avoided elsewhere wherever possible. Where lighting is required, directional lighting will be used to prevent overspill on to woodland/forestry edges. This will be achieved through the use of lighting accessories, such as hoods, cowls, louvers and shields, to direct the light to the intended area only.

7.6 Post-construction Monitoring & Fatality Searches

Post-construction monitoring and fatality searches will be undertaken during the operational phase of the development. The aim of these surveys is to monitor changes in foraging, commuting and roosting behaviour within the site, the effectiveness of prescribed buffer distances and to record any fatalities.

In accordance with best practice guidelines, a minimum of three years post-construction monitoring will be undertaken (BCI 2012a, Rodrigues et al. 2015). Late summer and autumn has been previously identified as the highest collision risk period for bats (Mathews et al. 2016). In addition, survey results have shown bat activity at the Ardderroo site is significantly higher between June and September. Therefore, 4 searches will be undertaken at monthly intervals between June and September in

Years 1, 2 and 3 of the lifetime of the wind farm. Bat corpse searches can be conducted in conjunction with any bird corpse searches and will follow methods outlined by Rodrigues et al. (2015).

Bat corpses, due to their small size and dark colouring, are exceptionally difficult for humans to detect in the field (Mathews et al 2013, Arnett 2006). Therefore, trained sniffer dogs will be employed in fatality searches. In keeping with best practice guidance, all fatality estimates will incorporate searcher efficiency and scavenger removal trials, specific to the site, as well as the impact of search plot size (BCI 2012a, Hundt 2012, Rodrigues 2015).

In accordance with best practice, post-construction activity surveys will be carried out in conjunction with fatality searches (BCI 2012a, Hundt 2012, Rodrigues 2015). A dusk and a dawn survey will be carried out on the night preceding any bat fatality search. Activity surveys will comprise walked transects. The aim of post-construction activity surveys is to assess any changes in bat activity and habitat use on site, monitor the effectiveness of prescribed buffer distances and to provide context to fatality search results.

Results from post-construction monitoring, fatality searches and efficiency trials will be compiled for each year and reported to relevant bodies including NPWS. Reporting will provide an estimate of overall fatality rates for all turbines, taking into consideration any identified search biases. In addition, fatality estimates will consider any cumulative effects that may arise from adjacent wind farm developments. If a negative effect on bats is observed, a plan of action will be determined with the NPWS without delay.

7.7 Residual Impacts

Taking into consideration the proposed mitigation measures; significant residual effects on bats with regard to habitat loss/degradation, disturbance/displacement or mortality are not anticipated.

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Appendix 1

Criteria for Habitat Suitability Assessment

Guidelines for assessing the potential suitability of a site for bats, based on the presence of habitat features (taken from Collins, 2016)

Suitability	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[1] 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[2]. A tree of sufficient size and age to contain potential roost features but with none seen from the ground or features seen with only very limited roosting potential[3].	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 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 potential roost sites that are obviously suitable for use by larger numbers of bats on a more regular basis and potentially for longer periods of time due to their size, shelter, protection, conditions and surrounding habitat.	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.

[1] For example, in terms of temperature, humidity, height above ground, light levels or levels of disturbance.

[2] Larger numbers of Common pipistrelle may be present during autumn and winter in large buildings in highly urbanised areas, based on evidence from the Netherlands (Korsten et al. 2015).

[3] Categorisation aligns with BS 8596:2015 Surveying for bats in trees and woodland (BSI, 2015).

Appendix 2

Determining Survey Effort & Site Risk

Factors to consider when determining survey effort & site risk (taken from Hundt, 2012)

Quality of habitat & number of habitat features likely to affect bat mortality rates if altered by development*	Species likely to use the site*	Importance of roosts, of species likely to use site, which may be affected	Potential risk level of development
No potential habitat for roosting, foraging or commuting bats	None	Local	Lowest
Small number of potential roost features, of low quality Low quality foraging habitat that could be used by small numbers of foraging bats Isolated site, not connected to the wider landscape by prominent linear features	Low number, single low risk species High number, several low risk species	Parish	Low
Buildings, trees or other structures with moderate-high potential as roost sites on or near the site Habitat could be used extensively by foraging bats Site is connected to the wider landscape by linear features such as scrub tree lines and streams	Low number, medium risk species High number, medium risk species	District County	Medium
Numerous suitable buildings, trees (particularly mature ancient woodland) or other structures with moderate/high potential on or near the site and/or confirmed roosts present close to or on the site Extensive and diverse habitat mosaic of high quality for foraging bats Site is connected to the wider landscape by a network of strong linear features such as rivers, blocks of woodland and mature hedgerows	High number, single high risk species High number, several high risk species High number, all high risk species	National International	High

Appendix 3

Minimum standards for bat surveys at onshore wind farms

Minimum standards for bat surveys at proposed onshore wind turbine developments (taken from Hundt, 2012)

Survey criteria	Site risk level		
	Low	Medium	High
	Roost surveys		
Selection of roosts requiring further survey	If evidence of roosting by medium or high-risk species and or roosts of district importance and above is found, further survey should follow SNCO guidance & guidelines available in Chapter 8 (Hundt, 2012)		
	Activity surveys		
Survey period	Surveys should provide data for one survey as a minimum		
Survey area [1]	Up to 200 m + rotor radius from turbine locations or potential turbine locations		
Ground level transects	One visit per transect each season (spring, summer & autumn)	One visit per transect each month (April -October)	Up to two visits per transect each month (April – October)
Automated surveys at ground level	5 consecutive nights for each single[2] or pair of locations within the survey area, per season	5 consecutive nights for each single or pair of locations within the survey area, per month	Up to 2 sets of 5 consecutive nights for each single or pair of locations within the survey area, per month
Automated surveys at height	Situations where at-height survey may be appropriate are outlined in Chapter 10 (Hundt, 2012) For surveys undertaken from masts, survey effort is as outlined above for surveys at ground level.		

[1] Should include potential turbine locations plus the nearest habitat features likely to be used by bats.

[2] Single locations will be at potential turbine locations. It may not be necessary to survey potential turbine locations without suitable habitat for bats located within 100 m plus the rotor radius. See Chapter 10 in Hundt (2012) for further details.

Appendix 4

Transect Route Descriptions

ANNEX 4 TRANSECT DESCRIPTIONS

Habitats sampled were classified to broad groups (Level 1) according to Fossitt (2000). The lengths and relative proportions of these groups are provided in Table 3.3. Two or more habitat groups are listed where transect routes followed a track with different habitats on either side. The majority of transects sampled various woodland and scrub habitats.

Transect Lengths (km) found within various Habitat Groups

Habitat Group	Tran 1 (km)	Tran 2 (km)	Tran 3 (km)	Tran 4 (km)	Tran 5 (km)	Tran 6 (km)	Tran 7 (km)	Tran 8 (km)	Tran 9 (km)	Tran1 0 (km)	Tran1 1 (km)	Tran1 2 (km)	Total (km)	Total %
Woodland & Scrub	1.03	0.24	1.93	0.64	0.45	3.13	1.21	-	0.59	1.79	1.67	2.03	14.71	85.0%
Woodland & Scrub / Freshwater	0.36	0.52	-	0.29	-	-	-	-	-	-	-	-	1.17	6.8%
Peatland	-	0.06	-	-	-	-	0.096	0.4	-	-	-	-	0.56	3.2%
Woodland & Scrub / Heath & Dense Bracken	0.002	-	0.25	-	0.09	-	0.07	-	-	-	-	-	0.41	2.4%
Woodland & Scrub / Peatland/ Freshwater	0.26	-	-	-	-	-	-	-	-	-	-	-	0.26	1.5%
Grassland	-	-	-	-	-	-	0.03	0.05	-	-	-	-	0.08	0.5%
Heath	-	-	-	-	-	-	0.07	-	-	-	-	-	0.07	0.4%
Woodland & Scrub / Grassland	-	-	0.04	-	-	-	-	-	-	-	-	-	0.04	0.2%
Total Length	**1.65**	**0.82**	**2.22**	**0.93**	**0.54**	**3.13**	**1.48**	**0.45**	**0.59**	**1.79**	**1.67**	**2.03**	**17.3**	**100%**

Appendix 5

Manual Transect Survey Effort (April – October 2016)

Manual Transect Survey Effort (April – October 2016)

Date	Transect No.	Direction	Method	Start Time	Finish Time
22-04-16	11	Reverse	Walked	00:01	00:27
22-04-16	10	Forward	Walked	00:27	00:57
22-04-16	10	Reverse	Walked	00:57	01:21
22-04-16	9	Reverse	Walked	01:21	01:29
22-04-16	2	Forward	Walked	02:00	02:15
22-04-16	2	Reverse	Walked	02:15	02:25
22-04-16	3	Forward	Walked	03:46	04:16
22-04-16	3	Reverse	Walked	04:16	04:48
22-04-16	2	Forward	Walked	04:48	04:53
22-04-16	2	Reverse	Walked	04:53	05:00
22-04-16	6	Forward	Walked	00:00	01:08
22-04-16	6	Reverse	Walked	01:08	02:00
23-04-16	4	Reverse	Walked	02:00	02:11
23-04-16	7	Forward	Walked	02:12	02:32
23-04-16	8	Forward	Walked	02:32	02:40
23-04-16	1	Forward	Walked	04:00	04:36
23-04-16	1	Reverse	Walked	04:37	04:56
23-04-16	9	Forward	Walked	22:00	22:38
23-04-16	11	Forward	Walked	22:39	23:00
23-04-16	12	Forward	Walked	23:00	23:31
23-04-16	12	Reverse	Walked	23:31	00:01
23-04-16	1	Forward	Walked	22:00	22:25
23-04-16	1	Reverse	Walked	22:25	23:59
23-04-16	8	Reverse	Walked	23:10	23:21
23-04-16	7	Reverse	Walked	23:21	23:37
23-04-16	4	Forward	Walked	23:37	23:48
21-05-16	5	Forward	Walked	23:48	23:56
21-05-16	5	Reverse	Walked	23:56	00:00
21-05-16	8	Reverse	Walked	00:10	00:27
21-05-16	7	Reverse	Walked	00:27	00:44
21-05-16	7	Forward	Walked	00:45	01:14
21-05-16	8	Forward	Walked	01:14	01:27
21-05-16	3	Reverse	Walked	03:09	03:51
21-05-16	2	Forward	Walked	03:53	04:06
21-05-16	2	Reverse	Walked	04:06	04:22
22-05-16	3	Forward	Walked	04:22	05:08
22-05-16	3	Reverse	Walked	05:08	06:30
22-05-16	11	Reverse	Walked	00:31	01:00
22-05-16	9	Reverse	Walked	01:00	01:09
22-05-16	8	Reverse	Driven	01:40	01:46
22-05-16	7	Reverse	Driven	01:46	01:58
22-05-16	3	Reverse	Driven	01:59	02:06
22-05-16	3	Forward	Driven	02:08	02:23
22-05-16	7	Forward	Driven	02:24	02:33
22-05-16	8	Forward	Driven	02:33	02:41
22-05-16	9	Forward	Walked	03:02	03:14
22-05-16	10	Forward	Walked	03:14	03:39
22-05-16	10	Reverse	Walked	03:39	04:02
22-05-16	9	Reverse	Walked	04:03	04:13
22-05-16	4	Forward	Walked	04:33	04:51
22-05-16	5	Forward	Walked	04:51	05:02
22-05-16	5	Reverse	Walked	05:03	05:14
22-05-16	4	Reverse	Walked	05:14	05:30
23-05-16	3	Roost shed on Transect 3		05:35	06:15
23-05-16	4	Reverse	Walked	00:09	00:22
23-05-16	3	Reverse	Driven	00:23	00:39
23-05-16	9	Forward	Walked	20:45	21:20
23-05-16	10	Forward	Walked	21:21	21:39
23-05-16	10	Reverse	Walked	21:39	21:57
23-05-16	11	Forward	Walked	21:58	22:22
23-05-16	12	Forward	Walked	22:23	22:54
23-05-16	12	Reverse	Walked	22:54	23:23
26-06-16	11	Reverse	Walked	23:23	23:49
26-06-16	9	Reverse	Walked	23:50	00:10
26-06-16	3	Forward	Walked	00:20	01:02
26-06-16	4	Forward	Walked	01:18	01:35
26-06-16	5	Forward	Walked	01:36	01:47
26-06-16	5	Reverse	Walked	01:48	01:58
26-06-16	6	Forward	Walked	01:58	03:19
27-06-16	6	Reverse	Walked	03:19	04:24
27-06-16	4	Reverse	Walked	04:24	04:41
27-06-16	7	Forward	Driven	04:41	04:55
27-06-16	8	Forward	Driven	04:55	05:00
27-06-16	8	Reverse	Driven	05:01	05:05
27-06-16	7	Reverse	Driven	05:06	05:14
27-06-16	9	Forward	Walked	21:46	21:58
27-06-16	10	Forward	Walked	21:58	22:25
27-06-16	10	Reverse	Walked	22:25	22:52
27-06-16	11	Forward	Walked	22:53	23:21
27-06-16	12	Forward	Walked	23:22	23:54
28-06-16	12	Reverse	Walked	23:55	00:30
28-06-16	9	Reverse	Walked	00:19	00:26

Manual Transect Survey Effort (April – October 2016)

Date	Transect No.	Direction	Method	Start Time	Finish Time	Date	Transect No.	Direction	Method	Start Time	Finish Time
28-06-16	1	Forward	Walked	02:55	03:35	24-07-16	8	Forward	Walked	04:07	04:17
28-06-16	1	Reverse	Walked	03:35	04:03	24-07-16	8	Reverse	Walked	04:18	04:28
28-06-16	2	Forward	Walked	04:07	04:11	24-07-16	7	Reverse	Walked	04:28	04:47
28-06-16	2	Reverse	Walked	04:12	04:16	24-07-16	4	Forward	Walked	04:47	05:01
28-06-16	4	Forward	Walked	04:30	04:44	24-07-16	5	Forward	Walked	05:02	05:11
28-06-16	5	Forward	Walked	04:45	04:53	24-07-16	5	Reverse	Walked	05:11	05:20
28-06-16	5	Reverse	Walked	04:53	05:01	22-08-16	4	Reverse	Walked	05:20	05:34
28-06-16	4	Reverse	Walked	05:01	05:13	22-08-16	9	Forward	Walked	21:10	21:34
22-07-16	7	Forward	Walked	03:00	03:36	22-08-16	10	Forward	Walked	21:35	21:58
22-07-16	8	Forward	Walked	03:41	04:09	22-08-16	10	Reverse	Walked	21:59	22:24
22-07-16	8	Reverse	Walked	04:09	04:26	22-08-16	11	Forward	Walked	22:25	22:52
22-07-16	7	Reverse	Walked	04:26	04:48	22-08-16	12	Forward	Walked	22:52	23:23
22-07-16	1	Forward	Walked	05:00	05:27	22-08-16	12	Reverse	Walked	23:24	23:56
22-07-16	1	Reverse	Walked	05:28	05:52	22-08-16	11	Reverse	Walked	23:56	00:19
23-07-16	9	Forward	Walked	20:50	21:18	22-08-16	1	Forward	Walked	20:50	21:17
23-07-16	10	Forward	Walked	21:18	21:44	22-08-16	1	Reverse	Walked	21:17	21:45
23-07-16	10	Reverse	Walked	21:45	22:12	23-08-16	2	Forward	Walked	21:48	21:53
23-07-16	11	Forward	Walked	22:12	22:41	23-08-16	2	Reverse	Walked	21:54	21:58
23-07-16	12	Forward	Walked	22:42	23:08	23-08-16	3	Forward	Walked	21:59	22:31
23-07-16	12	Reverse	Walked	23:08	23:36	23-08-16	4	Forward	Walked	22:31	22:46
23-07-16	11	Reverse	Walked	23:37	23:58	23-08-16	5	Forward	Walked	22:47	22:59
23-07-16	9	Reverse	Walked	23:59	00:06	23-08-16	5	Reverse	Walked	22:59	23:07
23-07-16	2	Forward	Walked	20:46	21:24	23-08-16	6	Forward	Walked	23:09	23:28
23-07-16	2	Reverse	Walked	21:24	21:37	23-08-16	6	Reverse	Walked	23:28	23:46
23-07-16	1	Forward	Walked	21:39	22:10	23-08-16	4	Reverse	Walked	23:47	00:00
23-07-16	1	Reverse	Walked	22:11	22:37	23-08-16	3	Reverse	Walked	00:00	00:30
23-07-16	3	Forward	Driven	22:48	22:59	24-08-16	1	Forward	Walked	21:07	21:33
23-07-16	4	Forward	Walked	23:03	23:17	24-08-16	1	Reverse	Walked	21:39	22:02
23-07-16	5	Forward	Walked	23:17	23:25	24-08-16	2	Forward	Walked	22:04	22:08
23-07-16	5	Reverse	Walked	23:26	23:34	24-08-16	2	Reverse	Walked	22:09	22:13
23-07-16	6	Forward	Walked	23:35	23:54	24-08-16	3	Reverse	Walked	22:13	22:49
24-07-16	6	Reverse	Walked	23:55	00:09	24-08-16	4	Forward	Walked	22:49	23:01
24-07-16	7	Reverse	Driven	21:47	22:15	24-08-16	5	Forward	Walked	23:02	23:14
24-07-16	3	Reverse	Walked	22:22	22:51	24-08-16	5	Reverse	Walked	23:14	23:24
24-07-16	2	Forward	Walked	22:51	22:56	24-08-16	6	Forward	Walked	23:24	00:16
24-07-16	2	Reverse	Walked	22:56	23:00	17-09-16	9	Forward	Walked	02:05	02:20
24-07-16	1	Forward	Walked	23:02	23:43	17-09-16	11	Forward	Walked	02:20	02:46
24-07-16	1	Reverse	Walked	23:44	00:19	17-09-16	12	Forward	Walked	02:47	03:19
24-07-16	6	Reverse	Walked	00:16	01:08	17-09-16	12	Reverse	Walked	03:19	03:49
24-07-16	4	Reverse	Walked	01:08	01:19	17-09-16	11	Reverse	Walked	03:49	04:14
24-07-16	3	Reverse	Walked	01:20	01:47	17-09-16	10	Forward	Walked	04:14	04:36
24-07-16	7	Forward	Walked	03:45	04:07	17-09-16	10	Reverse	Walked	04:37	04:58

Manual Transect Survey Effort (April – October 2016)

Date	Transect No.	Direction	Method	Start Time	Finish Time
17-09-16	9	Reverse	Walked	04:58	05:10
17-09-16	3	Reverse	Walked	05:22	05:57
17-09-16	1	Forward	Walked	06:00	06:39
17-09-16	1	Reverse	Walked	06:40	07:06
17-09-16	6	Reverse	Walked	00:20	00:42
17-09-16	4	Reverse	Walked	00:43	00:58
17-09-16	3	Reverse	Walked	00:58	01:38
18-09-16	9	Forward	Walked	19:45	20:20
18-09-16	10	Forward	Walked	20:20	20:46
18-09-16	10	Reverse	Walked	20:46	21:15
18-09-16	11	Forward	Walked	21:15	21:45
18-09-16	12	Forward	Walked	21:45	22:23
18-09-16	12	Reverse	Walked	22:24	23:05
18-09-16	11	Reverse	Walked	23:05	23:34
18-09-16	9	Reverse	Walked	23:35	23:44
18-09-16	8	Reverse	Walked	23:46	23:59
18-09-16	8	Forward	Walked	23:59	00:10
18-09-16	7	Forward	Driven	20:00	20:06
18-09-16	8	Forward	Driven	20:07	20:15
18-09-16	8	Reverse	Driven	20:35	20:40
19-09-16	7	Reverse	Driven	20:40	20:54
19-09-16	3	Reverse	Driven	20:56	21:07
19-09-16	1	Forward	Walked	21:11	21:46
19-09-16	1	Reverse	Walked	21:47	22:15
19-09-16	2	Forward	Walked	22:18	22:27
19-09-16	2	Reverse	Walked	22:27	22:37
19-09-16	3	Forward	Walked	22:37	23:12
19-09-16	4	Forward	Walked	23:13	23:33
19-09-16	5	Forward	Walked	23:34	23:43
19-09-16	5	Reverse	Walked	23:44	23:53
19-09-16	6	Forward	Walked	23:53	00:20
10-10-16	9	Forward	Walked	05:00	05:10
10-10-16	11	Forward	Walked	05:10	05:36
10-10-16	12	Forward	Walked	05:37	06:20
10-10-16	12	Reverse	Walked	06:20	06:50
10-10-16	11	Reverse	Walked	06:50	07:13
10-10-16	10	Forward	Walked	07:14	07:34
10-10-16	10	Reverse	Walked	07:34	07:55
10-10-16	9	Reverse	Walked	07:55	08:10
10-10-16	4	Reverse	Walked	00:40	00:53
10-10-16	7	Forward	Walked	00:53	01:16
10-10-16	8	Forward	Walked	01:16	01:27

Date	Transect No.	Direction	Method	Start Time	Finish Time
11-10-16	8	Reverse	Walked	01:28	01:38
11-10-16	7	Reverse	Walked	01:39	01:59
11-10-16	8	Reverse	Walked	04:35	04:49
11-10-16	7	Reverse	Walked	04:49	05:08
11-10-16	7	Forward	Walked	05:09	05:30
11-10-16	8	Forward	Walked	05:31	05:42
11-10-16	4	Forward	Walked	05:54	06:06
11-10-16	5	Forward	Walked	06:06	06:16
11-10-16	5	Reverse	Walked	06:16	06:25
11-10-16	4	Reverse	Walked	06:25	06:36
11-10-16	2	Forward	Walked	06:41	06:52
11-10-16	2	Reverse	Walked	06:52	07:03
11-10-16	1	Forward	Walked	07:05	07:34
11-10-16	1	Reverse	Walked	07:34	08:02
11-10-16	3	Roost shed on Transect 3		08:11	08:25
11-10-16	9	Forward	Walked	19:00	19:42
11-10-16	10	Forward	Walked	19:42	20:01
11-10-16	10	Reverse	Walked	20:01	20:19
11-10-16	11	Forward	Walked	20:20	20:48
11-10-16	12	Forward	Walked	20:48	21:20
11-10-16	12	Reverse	Walked	21:21	21:54
11-10-16	11	Reverse	Walked	21:54	22:20
11-10-16	9	Reverse	Walked	22:20	22:27
11-10-16	8	Reverse	Driven	22:35	22:40
11-10-16	7	Reverse	Driven	22:40	22:46
11-10-16	3	Reverse	Driven	22:47	23:00
11-10-16	2	Forward	Walked	19:20	19:41
11-10-16	2	Reverse	Walked	19:41	19:50
11-10-16	3	Forward	Walked	19:50	20:21
12-10-16	3	Reverse	Walked	20:21	20:58
12-10-16	1	Forward	Walked	20:59	21:29
12-10-16	1	Reverse	Walked	21:29	21:58
12-10-16	4	Forward	Walked	22:17	22:30
12-10-16	5	Forward	Walked	22:30	22:39
12-10-16	5	Reverse	Walked	22:40	22:49
12-10-16	6	Forward	Walked	22:50	23:48
12-10-16	6	Reverse	Walked	23:48	00:39

Appendix 6

Roost Inspection Results 2016

Results of Roost Inspections 2016

Roost Type	Grid Ref	Description	Assessment of Roosting Potential
Structure	E 113724 N 234820	Letter Lodge Outhouse. Agricultural block shed with corrugated sheet roof. Lacks an attic space and insulation. Contains multiple potential access points and roosting locations. Surrounded by broadleaved habitats. No bats present during inspections. However, droppings present throughout the activity period.	Confirmed night roost
Structure	E 113743 N 234936	Letter Lodge main house is occupied. Constructed of stone with a slate roof. Converted attic with skylights. Contains several potential access points and roosting locations, Moderate roosting potential. Long stone building with slate roof comprising 3 sheds. Several potential access points and roosting locations, Moderate roosting potential. Block building under construction. No roof. Negligible potential. Two sheds, constructed of corrugated sheets and timber. Several potential access points and roosting locations. Very bright in daytime. Low potential.	No evidence of bats found. Negligible, low & moderate potential roost sites recorded.
Structure	E 110998 N 234215	Large farm shed constructed of structural steel. Numerous potential access points & some poor quality roosting locations. Subject to regular disturbance and open to large amounts of daylight. Surrounding habitat provides no cover.	Low potential
Structures	E 110910 N 235209	House & sheds. Cottage with slate roof. Several stone and block sheds surrounding. Several potential access points and roosting locations. Numerous semi-mature trees provide cover. However, no connectivity with wider landscape (peatland habitats).	Low potential
Structure	E 113024 N 234678	Derelict stone house. Bad state of repair. Partial walls and no roof.	Low potential
Structure	E 114282 N 235206	110kV electricity substation of constructed steel.	Negligible potential
Structure	E 111199 N 234475	Newly constructed wind farm sub-station. Concrete block & stone, slate roof. No potential access points recorded. Surrounded by open habitats.	Low potential
Structures	E 111019 N 234883	Construction compound. A number of temporary pre-fabricated buildings installed for the duration of nearby wind farm construction.	Negligible potential
Structure	E 113404 N 234758	Gate security office Temporary pre- fabricated building installed for the duration of nearby wind farm construction.	Negligible potential
Bridge	E 110888 N 234224	Concrete slab bridge ~3m tall. No suitable crevices available. Supported by banks constructed of boulders.	Negligible potential
Bridge	E 111308 N 234486	Concrete culvert ~2m tall. No suitable crevices available. Supported by banks constructed of boulders.	Negligible potential

Appendix 7

Manual Transect Results 2016

Manual Transect Results 2016

Date	Time	Species	No.	X	Y	Tran	Notes
22-04-16	21:20:34	Unidentified Pipistrelle	1	114423	236109	1R	One pass
22-04-16	21:40:43	Soprano Pipistrelle	1	114301	235601	1R	One pass
22-04-16	22:11:50	*Myotis sp.*	1	113735	234795	3F	Two passes
22-04-16	22:17:00	*Myotis sp.*	1	113498	234755	3F	One pass
22-04-16	22:44:00	Unidentified Pipistrelle	1	112484	233866	4F	One pass
22-04-16	22:48:15	Brown Long-eared Bat	1	112415	233841	5F	Two passes
22-04-16	22:55:00	*Myotis sp.*	1	112249	234074	5F	Two passes
23-04-16	00:03:00	*Myotis sp.*	1	112804	234546	3R	One pass
23-04-16	21:39:24	Soprano Pipistrelle	1	111847	233337	10F	One pass.
23-04-16	23:30:00	Unidentified Pipistrelle	1	110717	232064	12R	One pass.
21-05-16	22:29:08	Common Pipistrelle	1	113640	234770	3F	Two passes.
21-05-16	23:04:00	*Myotis sp.*	1	112355	233864	5F	Two passes.
21-05-16	23:45:35	Soprano Pipistrelle	2	112753	232679	6F	Echolocation and type D social calls.
22-05-16	00:06:47	Common Pipistrelle	1	113840	232948	6F	Four passes.
22-05-16	00:19:00	Common Pipistrelle	1	113764	233306	6R	Two passes.
22-05-16	00:32:00	*Myotis sp.*	1	113701	232679	6R	One pass.
22-05-16	00:40:00	Common Pipistrelle	1	113288	232743	6R	One pass.
22-05-16	01:00:00	Unidentified Pipistrelle	1	112343	233272	6R	One pass.
22-05-16	01:26:51	*Myotis sp.*	1	113085	234696	3R	One pass.
22-05-16	01:36:00	Unidentified Pipistrelle	1	113762	234801	3R	One pass.
22-05-16	23:07:30	*Myotis sp.*	2	110645	232094	12F	Considered Daubenton's at time of observation. One pass only.
22-05-16	23:26:02	*Myotis sp.*	1	111516	231791	12R	One pass.
23-05-16	03:02:00	Unidentified Pipistrelle	1	114328	235559	1F	One pass.
23-05-16	03:15:45	Brown Long-eared Bat	1	114411	236109	1F	Three passes.
23-05-16	03:19:56	Brown Long-eared Bat	1	114451	236208	1F	One pass.
23-05-16	03:30:00	*Myotis sp.*	1	114491	236666	1F	One pass.
23-05-16	03:39:07	*Myotis sp.*	1	114460	236700	1R	One pass.
23-05-16	03:56:00	*Myotis sp.*	1	114245	235736	1R	One pass
26-06-16	23:28:00	Unidentified Pipistrelle	1	111512	234526	7R	One pass
26-06-16	23:42:00	*Myotis sp.*	1	112584	234261	4F	One pass
26-06-16	23:59:20	Common Pipistrelle	1	112431	233819	5R	Four passes.
27-06-16	00:00:27	Common Pipistrelle	1	112418	233810	6F	Four passes.
27-06-16	00:10:35	Common Pipistrelle	1	112321	233343	6F	Four passes.
27-06-16	00:18:07	Common Pipistrelle	1	112413	232881	6F	One pass.
27-06-16	00:28:41	*Myotis sp.*	1	112526	232738	6F	Bat IDed as Daubenton's by observer on behaviour. Multiple passes over river by bridge.
27-06-16	00:42:00	Common Pipistrelle	1	113400	232716	6F	Two passes.
27-06-16	00:43:49	Common Pipistrelle	1	113436	232713	6F	One pass.
27-06-16	00:45:00	*Myotis sp.*	1	113463	232708	6F	One pass.

Manual Transect Results 2016

Date	Time	Species	No.	X	Y	Tran	Notes
27-06-16	00:48:00	Unidentified Pipistrelle	1	113648	232701	6F	One pass.
27-06-16	00:49:00	Unidentified Pipistrelle	1	113666	232695	6F	Type D social calls
27-06-16	00:49:28	Brown Long-eared Bat	1	113666	232695	6F	One pass.
27-06-16	00:54:00	Common Pipistrelle	1	113865	232796	6F	Two passes.
27-06-16	00:56:29	Common Pipistrelle	1	113859	232855	6F	Two passes.
27-06-16	00:57:51	Common Pipistrelle	1	113851	232903	6F	One pass.
27-06-16	01:02:00	Common Pipistrelle	1	113793	233152	6F	Two passes.
27-06-16	01:03:16	Common Pipistrelle	1	113790	233175	6F	Three passes.
27-06-16	01:11:46	Soprano Pipistrelle	1	113782	233221	6R	One pass.
27-06-16	01:13:35	Common Pipistrelle	1	113795	233151	6R	Two passes.
27-06-16	01:15:46	Common Pipistrelle	1	113819	233021	6R	Two passes.
27-06-16	01:20:21	Unidentified Pipistrelle	1	113848	232733	6R	One pass.
27-06-16	01:20:21	Brown Long-eared Bat	1	113848	232733	6R	One pass.
27-06-16	01:39:26	Brown Long-eared Bat	1	112569	232711	6R	Three passes.
27-06-16	01:41:56	*Myotis sp.*	1	112569	232711	6R	Eight passes. Sounded Daubies.
27-06-16	01:50:46	Common Pipistrelle	1	112342	233272	6R	Three passes.
27-06-16	01:52:13	Unidentified Pipistrelle	1	112324	233327	6R	One pass.
27-06-16	01:53:09	Common Pipistrelle	1	112318	233353	6R	Two passes.
27-06-16	01:54:44	Common Pipistrelle	1	112293	233442	6R	One pass.
27-06-16	02:00:06	Unidentified Pipistrelle	1	112425	233830	6R	One pass.
27-06-16	02:00:26	Common Pipistrelle	1	112425	233830	6R	Echolocation and feeding buzzes.
27-06-16	02:02:58	Common Pipistrelle	1	112569	233948	4R	One pass.
27-06-16	02:21:47	Leisler's Bat	1	112139	234622	7F	Three passes.
27-06-16	02:23:54	Leisler's Bat	1	111993	234608	7F	One pass.
27-06-16	04:19:06	Common Pipistrelle	1	114285	235627	1F	One pass.
27-06-16	04:20:25	Common Pipistrelle	1	114259	235674	1F	Two passes.
27-06-16	04:24:00	Soprano Pipistrelle	1	114309	235939	1F	One pass.
28-06-16	00:03:00	Brown Long-eared Bat	1	109837	232376	11R	One pass.
28-06-16	00:47:08	*Myotis sp.*	1	111586	233333	10F	One pass. Possibly Daubenton's.
28-06-16	01:00:00	Unidentified Pipistrelle	1	111737	233342	10R	One pass.
28-06-16	01:12:00	Common Pipistrelle	1	111145	233565	10R	Two passes.
28-06-16	01:24:00	Unidentified Pipistrelle	1	110758	233895	9R	One pass.
28-06-16	04:07:00	Soprano Pipistrelle	1	113156	234730	3F	One pass. Actually 21.85 minutes (21:52) after recording started.
28-06-16	04:12:00	Leisler's Bat	1	112905	234566	3F	One pass.
28-06-16	04:34:00	Soprano Pipistrelle	1	113723	234792	3R	Three passes.
22-07-16	22:49:31	Common Pipistrelle	1	114310	235227	3R	One pass.
22-07-16	22:53:00	Common Pipistrelle	1	114353	235179	2F	One pass.
22-07-16	23:08:56	Leisler's Bat	1	114247	235726	1F	One pass.
22-07-16	23:15:00	*Myotis sp.*	1	114302	235923	1F	One pass.
22-07-16	23:23:00	*Myotis sp.*	1	114449	236160	1F	Possibly Daubenton's. One pass.

Manual Transect Results 2016

Date	Time	Species	No.	X	Y	Tran	Notes
22-07-16	23:26:00	Unidentified Pipistrelle	1	114450	236225	1F	One pass.
22-07-16	23:28:00	*Myotis sp.*	1	114449	236238	1F	One pass.
22-07-16	23:34:00	Unidentified Pipistrelle	1	114528	236472	1F	One pass.
22-07-16	23:35:52	Leisler's Bat	1	114507	236499	1F	One pass.
22-07-16	23:39:09	Soprano Pipistrelle	1	114497	236662	1F	One pass.
22-07-16	23:41:00	Unidentified Pipistrelle	1	114408	236722	1F	One pass.
22-07-16	23:42:42	Soprano Pipistrelle	1	114404	236743	1F	One pass.
22-07-16	23:50:38	Common Pipistrelle	1	114487	236586	1R	Two passes. Echolocation and type D social calls.
22-07-16	23:52:43	Common Pipistrelle	1	114490	236552	1R	One pass.
23-07-16	00:04:00	Unidentified Pipistrelle	1	114325	235976	1R	Two passes.
23-07-16	00:05:27	Common Pipistrelle	1	114305	235940	1R	Two passes.
23-07-16	00:08:09	*Myotis sp.*	1	114275	235866	1R	One pass.
23-07-16	00:12:00	Soprano Pipistrelle	1	114289	235622	1R	One pass.
23-07-16	00:14:10	Unidentified Pipistrelle	1	114301	235599	1R	Type D social calls (probably Soprano)
23-07-16	00:16:12	Unidentified Pipistrelle	1	114345	235510	1R	Five passes; feeding along path.
23-07-16	00:20:00	Leisler's Bat	1	114381	235312	3F	One pass.
23-07-16	00:20:30	Soprano Pipistrelle	1	114381	235312	3F	One pass.
23-07-16	00:21:00	*Myotis sp.*	1	114358	235291	3F	One pass.
23-07-16	00:23:13	Soprano Pipistrelle	1	114339	235272	3F	One pass.
23-07-16	00:23:13	Leisler's Bat	1	114339	235272	3F	One pass.
23-07-16	00:27:00	Leisler's Bat	1	114237	235156	3F	Feeding by new substation. Five passes.
23-07-16	00:28:28	Leisler's Bat	1	114237	235156	3F	Feeding by new substation. One pass.
23-07-16	00:36:00	Unidentified Pipistrelle	1	113760	234803	3F	Type D social calls.
23-07-16	00:37:51	*Myotis sp.*	1	113752	234802	3F	Three passes.
23-07-16	00:39:11	Soprano Pipistrelle	1	113721	234800	3F	Three passes. Feeding near night roost shed.
23-07-16	00:39:11	*Myotis sp.*	1	113721	234800	3F	One pass. Feeding near night roost shed.
23-07-16	00:41:37	Soprano Pipistrelle	1	113682	234786	3F	Feeding buzzes.
23-07-16	00:43:00	Leisler's Bat	1	113606	234768	3F	One pass.
23-07-16	00:43:21	Common Pipistrelle	1	113496	234757	3F	One pass.
23-07-16	00:47:00	Leisler's Bat	1	113440	234754	3F	One pass.
23-07-16	00:52:57	Brown Long-eared Bat	1	113101	234714	3F	One pass.
23-07-16	00:52:57	Common Pipistrelle	1	113101	234714	3F	One pass.
23-07-16	00:57:02	*Myotis sp.*	1	112925	234589	3F	One pass.
23-07-16	00:59:29	Soprano Pipistrelle	2	112815	234559	3F	Echolocation and feeding buzzes.
23-07-16	01:18:19	Leisler's Bat	1	112670	234585	4F	One pass.
23-07-16	01:19:00	Soprano Pipistrelle	1	112669	234572	4F	One pass.
23-07-16	01:25:51	*Myotis sp.*	1	112585	234227	4F	One pass.
23-07-16	01:29:44	Unidentified Pipistrelle	1	112602	234026	4F	Two passes.

Manual Transect Results 2016

Date	Time	Species	No.	X	Y	Tran	Notes
23-07-16	01:37:00	*Myotis sp.*	1	112415	233838	5F	One pass.
23-07-16	01:41:32	Soprano Pipistrelle	1	112332	233924	5F	Five passes.
23-07-16	01:58:00	Soprano Pipistrelle	1	112426	233822	6F	One pass.
23-07-16	02:01:00	Brown Long-eared Bat	1	112326	233722	6F	One pass.
23-07-16	02:03:00	Soprano Pipistrelle	1	112304	233684	6F	One pass.
23-07-16	02:09:12	Brown Long-eared Bat	1	112286	233509	6F	One pass.
23-07-16	02:11:00	Brown Long-eared Bat	1	112286	233432	6F	One pass.
23-07-16	02:12:18	Brown Long-eared Bat	1	112295	233406	6F	Four passes up and down the path.
23-07-16	02:18:19	Brown Long-eared Bat	1	112373	233152	6F	Two passes
23-07-16	02:29:51	*Myotis sp.*	1	112523	232744	6F	Considered to Daubenton's; at bridge.
23-07-16	02:30:46	Soprano Pipistrelle	1	112523	232744	6F	At bridge.
23-07-16	02:42:00	Unidentified Pipistrelle	1	113022	232753	6F	Two passes.
23-07-16	02:47:13	*Myotis sp.*	1	113253	232738	6F	One pass.
23-07-16	02:51:00	Leisler's Bat	1	113447	232712	6F	One pass.
23-07-16	02:52:07	Common Pipistrelle	1	113447	232707	6F	One pass.
23-07-16	02:58:04	Common Pipistrelle	1	113723	232675	6F	One pass.
23-07-16	02:59:07	Common Pipistrelle	1	113744	232674	6F	Four passes.
23-07-16	03:09:00	Common Pipistrelle	1	113805	233095	6F	Three passes.
23-07-16	03:14:16	Common Pipistrelle	1	113771	233275	6F	Five passes.
23-07-16	03:23:22	Common Pipistrelle	1	113753	233319	6R	Three passes.
23-07-16	03:33:39	Common Pipistrelle	1	113861	232762	6R	Two passes.
23-07-16	03:37:48	Common Pipistrelle	1	113715	232679	6R	Two passes. Echolocation and type D social calls.
23-07-16	03:41:56	Soprano Pipistrelle	2	113516	232695	6R	Four passes.
23-07-16	03:59:06	*Myotis sp.*	1	112522	232741	6R	Two passes. Flying above bridge
23-07-16	04:12:43	Common Pipistrelle	1	112290	233435	6R	One pass.
23-07-16	04:15:00	*Myotis sp.*	1	112294	233496	6R	One pass.
23-07-16	04:20:45	Common Pipistrelle	1	112322	233711	6R	One pass.
23-07-16	04:25:15	Unidentified Pipistrelle	1	112504	233875	4R	One pass.
23-07-16	04:35:08	Common Pipistrelle	2	112595	234302	4R	One pass.
23-07-16	22:59:00	Common Pipistrelle	1	110435	233404	11F	One pass.
23-07-16	23:28:07	Common Pipistrelle	1	110150	232265	12F	One pass.
24-07-16	00:00:00	Unidentified Pipistrelle	1	111430	231756	12R	One pass.
24-07-16	00:07:13	Leisler's Bat	1	111037	231817	12R	One pass.
24-07-16	00:19:00	Soprano Pipistrelle	1	110434	232164	12R	One pass.
24-07-16	00:27:28	Soprano Pipistrelle	1	110006	232320	12R	One pass.
24-07-16	00:31:00	Unidentified Pipistrelle	1	109825	232340	11R	One pass.
24-07-16	00:42:00	Soprano Pipistrelle	1	109918	232911	11R	One pass.
24-07-16	00:47:06	Common Pipistrelle	1	110104	233133	11R	One pass.
24-07-16	00:52:49	Soprano Pipistrelle	1	110353	233330	11R	One pass.
24-07-16	00:52:49	Common Pipistrelle	1	110353	233330	11R	One pass.

Manual Transect Results 2016

Date	Time	Species	No.	X	Y	Tran	Notes
24-07-16	00:55:00	Common Pipistrelle	1	110451	233406	11R	One pass.
24-07-16	02:13:51	Soprano Pipistrelle	1	113752	234795	3F	One pass.
24-07-16	02:14:00	Leisler's Bat	1	113752	234795	3F	One pass.
24-07-16	02:15:00	Leisler's Bat	1	113723	234789	3F	One pass.
24-07-16	02:15:22	Soprano Pipistrelle	1	113723	234789	3F	One pass.
24-07-16	05:10:28	Soprano Pipistrelle	1	112328	233931	5R	Three passes.
24-07-16	05:46:02	Unidentified Pipistrelle	1	113720	234820	3	Flying around near the roost shed.
24-07-16	05:46:02	Leisler's Bat	1	113720	234820	3	Inspected roost shed and left.
22-08-16	21:29:00	Common Pipistrelle	1	114372	234810	2R	One pass.
22-08-16	21:35:00	Leisler's Bat	1	114347	235183	2R	One pass.
22-08-16	21:35:35	Unidentified Pipistrelle	1	114347	235183	2R	One pass.
22-08-16	21:46:00	Unidentified Pipistrelle	1	114334	235549	1F	One pass.
22-08-16	21:58:00	*Myotis sp.*	1	114450	236235	1F	One pass.
22-08-16	22:02:06	*Myotis sp.*	1	114551	236384	1F	One pass.
22-08-16	22:13:06	Leisler's Bat	1	114452	236697	1R	One pass.
22-08-16	22:22:54	*Myotis sp.*	1	114403	236121	1R	One pass.
22-08-16	22:32:01	Soprano Pipistrelle	1	114326	235567	1R	One pass.
22-08-16	22:36:24	Soprano Pipistrelle	1	114440	235346	1R	One pass.
22-08-16	22:36:27	Common Pipistrelle	1	114440	235346	1R	One pass.
22-08-16	22:49:03	Soprano Pipistrelle	1	114407	235321	3F	Three passes.
22-08-16	23:16:00	Soprano Pipistrelle	1	112426	233827	4F	One pass.
22-08-16	23:30:00	Unidentified Pipistrelle	1	112305	233985	5R	One pass.
22-08-16	23:35:02	Soprano Pipistrelle	1	112423	233824	5R	One pass.
22-08-16	23:35:02	*Myotis sp.*	1	112423	233824	5R	Echolocation and feeding buzzes.
22-08-16	23:39:51	Soprano Pipistrelle	1	112295	233591	6F	One pass.
22-08-16	23:53:00	Unidentified Pipistrelle	1	112522	232741	6F	One pass.
23-08-16	22:50:59	Soprano Pipistrelle	1	111528	231783	12F	Continuous activity, echolocation and type D social calls.
23-08-16	22:52:25	Common Pipistrelle	1	111553	231806	12F	One pass.
23-08-16	23:27:21	Soprano Pipistrelle	1	109886	232548	11R	One pass.
23-08-16	23:56:00	*Myotis sp.*	1	110786	233959	9R	One pass.
24-08-16	00:00:00	Common Pipistrelle	1	110834	234096	9R	One pass.
24-08-16	00:01:23	Unidentified Pipistrelle	1	110841	234122	9R	Three passes.
24-08-16	00:02:26	Common Pipistrelle	1	110841	234122	9R	One pass.
24-08-16	00:11:14	Unidentified Pipistrelle	1	110878	234194	8R	One pass.
24-08-16	00:12:00	Common Pipistrelle	1	110845	234188	8R	One pass.
24-08-16	00:12:13	Leisler's Bat	1	111237	234466	8R	One pass.
24-08-16	00:25:19	Common Pipistrelle	1	111302	234481	8R	One pass.
24-08-16	00:35:00	Leisler's Bat	1	111757	234575	7R	One pass.
24-08-16	00:45:58	Soprano Pipistrelle	1	112560	234639	7F	One pass.
24-08-16	01:03:00	*Myotis sp.*	1	112086	234614	7F	One pass.
24-08-16	01:14:57	Common Pipistrelle	1	111333	234493	8F	Two passes.

Manual Transect Results 2016

Date	Time	Species	No.	X	Y	Tran	Notes
24-08-16	01:16:26	Common Pipistrelle	1	111277	234478	8F	One pass.
24-08-16	01:26:00	Unidentified Pipistrelle	1	110837	234179	8F	One pass.
24-08-16	03:09:59	Common Pipistrelle	1	112685	234594	3R	Echolocation and type D social calls.
24-08-16	03:09:59	Soprano Pipistrelle	1	112685	234594	3R	One pass.
24-08-16	03:11:47	Common Pipistrelle	1	112709	234582	3R	One pass.
24-08-16	03:11:47	Soprano Pipistrelle	1	112709	234582	3R	One pass.
24-08-16	03:30:18	Unidentified Pipistrelle	1	113695	234782	3R	Type D social calls
24-08-16	03:32:37	Soprano Pipistrelle	1	113770	234803	3R	One pass.
24-08-16	03:35:35	Leisler's Bat	1	113855	234836	3R	One pass.
24-08-16	03:48:06	Soprano Pipistrelle	1	114320	235240	3R	One pass.
24-08-16	04:16:04	Soprano Pipistrelle	1	114369	235021	2R	One pass.
24-08-16	04:31:00	*Myotis sp.*	1	114055	234991	3F	One pass.
24-08-16	04:38:40	Leisler's Bat	1	113763	234804	3F	By Alder wood.
24-08-16	04:38:40	*Myotis sp.*	1	113763	234804	3F	By Alder wood.
24-08-16	04:39:39	Soprano Pipistrelle	1	113763	234804	3F	By Alder wood.
24-08-16	04:42:03	Soprano Pipistrelle	1	113724	234792	3F	In front of roost shed, four passes.
24-08-16	04:52:53	Common Pipistrelle	1	113272	234761	3F	One pass.
24-08-16	04:57:57	Brown Long-eared Bat	1	113073	234692	3F	One pass.
24-08-16	05:03:28	Common Pipistrelle	1	112838	234551	3F	Two passes.
24-08-16	05:04:59	Common Pipistrelle	1	112778	234556	3F	One pass.
24-08-16	05:07:00	Common Pipistrelle	1	112690	234591	3F	One pass.
24-08-16	05:31:02	Soprano Pipistrelle	1	113720	234803	3R	By roost shed. One pass.
24-08-16	05:42:29	Soprano Pipistrelle	1	113720	234803	3R	By roost shed. Multiple passes.
24-08-16	05:48:16	*Myotis sp.*	1	113720	234803	3R	One pass.
24-08-16	05:48:16	Soprano Pipistrelle	2	113720	234803	3R	Echolocation and type D social calls.
24-08-16	05:53:00	Soprano Pipistrelle	2	113720	234803	3R	Same two bats as at 05:48, multiple passes over five minutes.
24-08-16	06:02:19	Common Pipistrelle	1	113793	234808	3R	One pass.
24-08-16	06:02:19	Soprano Pipistrelle	1	113793	234808	3R	One pass.
17-09-16	20:43:00	Unidentified Pipistrelle	1	111422	234514	7R	One pass.
17-09-16	20:44:00	Unidentified Pipistrelle	1	111454	234521	7R	Type D social calls.
17-09-16	20:48:00	Unidentified Pipistrelle	1	112078	234615	7R	One pass.
17-09-16	20:56:00	Unidentified Pipistrelle	1	112769	234566	3R	Type D social calls.
17-09-16	21:05:00	*Myotis sp.*	1	114270	235192	3R	One pass.
17-09-16	21:25:02	*Myotis sp.*	1	114351	236036	1F	Four passes; at bridge over stream.
17-09-16	21:32:00	Unidentified Pipistrelle	1	114448	236233	1F	One pass.
17-09-16	21:34:02	Unidentified Pipistrelle	1	114476	236263	1F	One pass.
17-09-16	21:41:00	*Myotis sp.*	1	114488	2236559	1F	One pass.
17-09-16	21:57:00	Unidentified Pipistrelle	1	114446	236227	1R	One pass.

Manual Transect Results 2016

Date	Time	Species	No.	X	Y	Tran	Notes
17-09-16	22:08:00	Unidentified Pipistrelle	1	114247	235732	1R	One pass.
17-09-16	22:13:00	Unidentified Pipistrelle	1	114371	235469	1R	One pass.
17-09-16	22:49:48	Soprano Pipistrelle	1	113728	234793	3F	Four passes. Echolocation and type D social calls.
17-09-16	22:49:48	Common Pipistrelle	1	113728	234793	3F	One pass.
17-09-16	22:51:34	Soprano Pipistrelle	1	113685	234780	3F	Echolocation and type D social calls.
17-09-16	23:03:00	Leisler's Bat	1	113076	234696	3F	One pass.
17-09-16	23:07:00	Unidentified Pipistrelle	1	112873	234555	3F	One pass.
17-09-16	23:08:38	Common Pipistrelle	1	112799	234552	3F	Three passes.
17-09-16	23:11:07	Common Pipistrelle	1	112748	234573	3F	One pass.
17-09-16	23:13:14	*Myotis sp.*	1	112676	234573	4F	Multiple passes up and down path; jizz very suggestive of Whiskered Bat.
17-09-16	23:18:00	Unidentified Pipistrelle	1	112640	234442	4F	One pass.
17-09-16	23:21:25	Soprano Pipistrelle	1	112597	234309	4F	One pass.
17-09-16	23:27:00	Unidentified Pipistrelle	1	112600	233986	4F	One pass.
17-09-16	23:29:09	Soprano Pipistrelle	1	112565	233941	4F	One pass.
17-09-16	23:32:00	Soprano Pipistrelle	1	112458	233839	4F	One pass.
17-09-16	23:39:00	Common Pipistrelle	1	112249	234066	5F	One pass.
17-09-16	23:44:00	Unidentified Pipistrelle	1	112082	233995	5R	One pass.
18-09-16	00:01:00	Unidentified Pipistrelle	1	112290	233430	6F	One pass.
18-09-16	00:06:00	Unidentified Pipistrelle	1	112375	233119	6F	One pass.
18-09-16	00:11:00	Soprano Pipistrelle	1	112412	232888	6F	Three passes.
18-09-16	00:11:26	Brown Long-eared Bat	1	112412	232888	6F	One pass.
18-09-16	00:12:16	Common Pipistrelle	1	112412	232890	6F	One pass.
18-09-16	00:13:57	Soprano Pipistrelle	1	112428	232822	6F	One pass.
18-09-16	00:15:46	Soprano Pipistrelle	1	112475	232779	6F	Four passes.
18-09-16	00:21:00	Unidentified Pipistrelle	1	112473	232784	6R	Three passes. Echolocation and type D social calls.
18-09-16	00:29:13	Soprano Pipistrelle	1	112362	233202	6R	One pass.
18-09-16	00:34:37	Soprano Pipistrelle	1	112293	233497	6R	One pass.
18-09-16	00:39:00	Soprano Pipistrelle	1	112336	233722	6R	One pass.
18-09-16	00:40:00	Unidentified Pipistrelle	1	112363	233751	6R	One pass.
18-09-16	00:51:00	Common Pipistrelle	1	112595	234304	4R	Four passes.
18-09-16	00:52:06	Brown Long-eared Bat	1	112595	234304	4R	One pass.
18-09-16	00:56:56	Common Pipistrelle	1	112668	234540	4R	Five passes. Echolocation and type D social calls.
18-09-16	00:59:26	Common Pipistrelle	2	112703	234586	3R	Echolocation and feeding buzzes. Four passes.
18-09-16	01:04:07	Common Pipistrelle	1	112883	234553	3R	One pass.
18-09-16	01:11:19	Unidentified Pipistrelle	1	113275	234756	3R	One pass.
18-09-16	01:13:32	Soprano Pipistrelle	1	113354	234752	3R	One pass.

Manual Transect Results 2016

Date	Time	Species	No.	X	Y	Tran	Notes
18-09-16	01:18:00	Unidentified Pipistrelle	1	113647	234767	3R	Echolocation and feeding buzzes.
18-09-16	01:19:47	Unidentified Pipistrelle	1	113696	234780	3R	Echolocation and feeding buzzes.
18-09-16	01:28:20	Soprano Pipistrelle	1	114093	235018	3R	One pass.
18-09-16	20:29:00	Unidentified Pipistrelle	1	111157	233583	10F	One pass.
18-09-16	20:35:00	Common Pipistrelle	1	111425	233539	10F	One pass.
18-09-16	20:57:34	Soprano Pipistrelle	1	111410	233545	10R	One pass.
18-09-16	21:02:00	Unidentified Pipistrelle	1	111233	233607	10R	One pass.
18-09-16	21:05:00	Unidentified Pipistrelle	1	111103	233548	10R	One pass. Echolocation and feeding buzzes.
18-09-16	21:29:55	Brown Long-eared Bat	1	110067	233102	11F	One pass.
18-09-16	21:50:00	*Myotis sp.*	1	110105	232313	12F	One pass.
18-09-16	22:20:13	Soprano Pipistrelle	1	111500	231769	12F	One pass.
18-09-16	22:31:42	Brown Long-eared Bat	1	11289	231759	12R	One pass.
18-09-16	22:45:00	Soprano Pipistrelle	1	110749	232057	12R	One pass.
18-09-16	22:48:22	Soprano Pipistrelle	1	110652	232093	12R	One pass.
18-09-16	23:26:00	Unidentified Pipistrelle	1	110385	233356	11R	One pass.
18-09-16	23:34:07	Common Pipistrelle	1	110641	233680	11R	One pass.
18-09-16	23:47:00	Common Pipistrelle	1	110843	234176	8R	One pass.
18-09-16	23:49:00	*Myotis sp.*	1	110877	234222	8R	One pass.
19-09-16	00:01:00	Unidentified Pipistrelle	1	111239	234473	8F	One pass.
10-10-16	19:38:00	Unidentified Pipistrelle	1	114375	234789	2F	One pass.
10-10-16	19:39:26	Common Pipistrelle	1	114372	234758	2F	Three passes.
10-10-16	19:54:09	Soprano Pipistrelle	1	114174	235092	3F	Echolocation and feeding buzzes.
10-10-16	20:02:55	Common Pipistrelle	1	113736	234800	3F	Three passes. Echolocation and Type D social calls.
10-10-16	20:18:00	Common Pipistrelle	1	112837	234548	3F	One pass.
10-10-16	20:35:38	Common Pipistrelle	1	113434	234750	3R	One pass.
10-10-16	20:40:00	Unidentified Pipistrelle	1	113566	234760	3R	Two passes.
10-10-16	20:43:07	Unidentified Pipistrelle	1	113702	234783	3R	Type D social calls
10-10-16	21:09:00	Unidentified Pipistrelle	1	114253	235816	1F	One pass.
11-10-16	08:11:00	Soprano Pipistrelle	1	113721	234814	3	Inspected roost shed and left.
11-10-16	19:55:37	Soprano Pipistrelle	1	111503	233452	10F	One pass.
11-10-16	20:19:00	Unidentified Pipistrelle	1	110643	233683	10R	One pass.
11-10-16	20:26:05	*Myotis sp.*	1	110470	233437	11F	One pass.
11-10-16	21:30:44	Brown Long-eared Bat	1	111035	231816	12R	One pass.

Appendix 8

Survey at Letter Lodge Outhouse Results 2016

Letter Lodge Outhouse – Static Detector Results 2016

DATE	TIME	SPECIES
23/04/2016	21:09:07	Leisler's Bat
23/04/2016	21:09:20	Leisler's Bat
23/04/2016	21:09:41	Leisler's Bat
23/04/2016	21:11:09	Myotis sp.
23/04/2016	21:11:27	Myotis sp.
23/04/2016	21:11:39	Myotis sp.
23/04/2016	21:31:22	Brown Long-eared Bat
23/04/2016	23:25:28	Brown Long-eared Bat
23/04/2016	23:48:23	Brown Long-eared Bat
24/04/2016	00:01.36	Brown Long-eared Bat
24/04/2016	00:30:23	Brown Long-eared Bat
24/04/2016	01:28:47	Common Pipistrelle
24/04/2016	01:28:56	Common Pipistrelle
24/04/2016	23:15:50	Myotis sp.
24/04/2016	23:23:41	Leisler's Bat
25/04/2016	00:17:22	Common Pipistrelle
22/05/2016	22:15:49	Myotis sp.
23/05/2016	01:34:34	Soprano Pipistrelle
23/05/2016	05:53:26	Leisler's Bat
23/05/2016	21:48:25	Myotis sp.
27/06/2016	22:36:56	Unidentified Pipistrelle
27/06/2016	22:37:14	Unidentified Pipistrelle
28/06/2016	02:09:45	Lesser Horseshoe Bat
28/06/2016	04:41:18	Brown Long-eared Bat
28/06/2016	22:18:14	Leisler's Bat
28/06/2016	22:18:31	Leisler's Bat
28/06/2016	22:24:05	Leisler's Bat
28/06/2016	22:25:51	Leisler's Bat
29/06/2016	01:06:27	Soprano Pipistrelle
29/06/2016	01:40:45	Leisler's Bat
29/06/2016	01:54:44	Lesser Horseshoe Bat
29/06/2016	02:08:41	Soprano Pipistrelle
29/06/2016	04:47:32	Leisler's Bat
29/06/2016	04:47:40	Leisler's Bat
29/06/2016	04:48:12	Leisler's Bat
29/06/2016	05:09:06	Leisler's Bat
29/06/2016	05:09:14	Leisler's Bat
29/06/2016	05:09:26	Leisler's Bat
29/06/2016	05:09:35	Leisler's Bat
29/06/2016	05:09:38	Leisler's Bat
29/06/2016	05:09:48	Leisler's Bat
29/06/2016	05:09:55	Leisler's Bat

DATE	TIME	SPECIES
29/06/2016	05:10:03	Leisler's Bat
29/06/2016	05:12:09	Leisler's Bat
29/06/2016	05:12:13	Leisler's Bat
29/06/2016	05:12:19	Leisler's Bat
29/06/2016	05:12:26	Leisler's Bat
29/06/2016	05:12:33	Leisler's Bat
29/06/2016	05:12:37	Leisler's Bat
29/06/2016	05:12:44	Leisler's Bat
29/06/2016	05:12:48	Leisler's Bat
29/06/2016	05:12:52	Leisler's Bat
29/06/2016	05:12:55	Leisler's Bat
29/06/2016	05:12:59	Leisler's Bat
29/06/2016	05:13:04	Leisler's Bat
29/06/2016	05:13:09	Leisler's Bat
29/06/2016	05:13:14	Leisler's Bat
29/06/2016	05:13:19	Leisler's Bat
29/06/2016	05:13:24	Leisler's Bat
29/06/2016	05:13:28	Leisler's Bat
29/06/2016	05:13:32	Leisler's Bat
29/06/2016	05:13:36	Leisler's Bat
29/06/2016	05:13:43	Leisler's Bat
29/06/2016	05:13:48	Leisler's Bat
29/06/2016	05:13:53	Leisler's Bat
29/06/2016	05:13:59	Leisler's Bat
29/06/2016	05:14:07	Leisler's Bat
29/06/2016	05:14:16	Leisler's Bat
29/06/2016	05:14:23	Leisler's Bat
29/06/2016	05:14:30	Leisler's Bat
29/06/2016	05:14:52	Leisler's Bat
29/06/2016	05:19:08	Leisler's Bat
29/06/2016	05:19:22	Leisler's Bat
29/06/2016	05:19:25	Leisler's Bat
29/06/2016	05:19:29	Leisler's Bat
29/06/2016	05:19:35	Leisler's Bat
29/06/2016	05:19:38	Leisler's Bat
29/06/2016	05:19:42	Leisler's Bat
29/06/2016	05:19:46	Leisler's Bat
29/06/2016	05:19:50	Leisler's Bat
29/06/2016	05:19:55	Leisler's Bat
29/06/2016	05:20:01	Leisler's Bat
29/06/2016	05:20:13	Leisler's Bat
29/06/2016	05:20:23	Leisler's Bat

Letter Lodge Outhouse – Static Detector Results 2016

DATE	TIME	SPECIES
29/06/2016	05:21:19	Leisler's Bat
29/06/2016	05:22:12	Leisler's Bat
29/06/2016	05:23:12	Leisler's Bat
29/06/2016	05:23:19	Leisler's Bat
29/06/2016	05:25:25	Leisler's Bat
29/06/2016	05:26:29	Leisler's Bat
29/06/2016	05:26:34	Leisler's Bat
29/06/2016	05:27:21	Leisler's Bat
29/06/2016	05:27:36	Leisler's Bat
29/06/2016	05:27:48	Leisler's Bat
29/06/2016	05:28:00	Leisler's Bat
29/06/2016	05:28:20	Leisler's Bat
29/06/2016	05:28:34	Leisler's Bat
29/06/2016	05:30:35	Leisler's Bat
23/07/2016	21:59:19	Brown Long-eared Bat
23/07/2016	21:59:25	Brown Long-eared Bat
23/07/2016	21:59:41	Brown Long-eared Bat
23/07/2016	22:01:34	Brown Long-eared Bat
23/07/2016	22:01:37	Brown Long-eared Bat
23/07/2016	22:01:40	Brown Long-eared Bat
23/07/2016	22:01:43	Brown Long-eared Bat
23/07/2016	22:01:43	Myotis sp.
23/07/2016	22:02:09	Soprano Pipistrelle
23/07/2016	22:02:25	Soprano Pipistrelle
24/07/2016	05:21:09	Leisler's Bat
24/07/2016	05:22:07	Leisler's Bat
24/07/2016	05:33:55	Leisler's Bat
24/07/2016	05:33:59	Leisler's Bat
24/07/2016	05:34:05	Leisler's Bat
24/07/2016	21:58:22	Leisler's Bat
24/07/2016	21:58:30	Leisler's Bat
24/07/2016	21:58:33	Leisler's Bat
24/07/2016	21:58:57	Soprano Pipistrelle
24/07/2016	21:59:12	Leisler's Bat
24/07/2016	21:59:30	Leisler's Bat
24/07/2016	21:59:30	Soprano Pipistrelle
24/07/2016	21:59:42	Leisler's Bat
24/07/2016	22:00:49	Common Pipistrelle
24/07/2016	22:01:17	Soprano Pipistrelle
24/07/2016	22:01:29	Common Pipistrelle
24/07/2016	22:01:45	Common Pipistrelle
24/07/2016	22:02:00	Common Pipistrelle

DATE	TIME	SPECIES
25/07/2016	00:04:41	Common Pipistrelle
25/07/2016	00:05:01	Myotis sp.
25/07/2016	00:05:24	Myotis sp.
25/07/2016	00:08:13	Myotis sp.
25/07/2016	05:09:45	Leisler's Bat
25/07/2016	05:22:05	Leisler's Bat
25/07/2016	05:22:15	Leisler's Bat
25/07/2016	05:22:20	Leisler's Bat
25/07/2016	05:38:39	Leisler's Bat
25/07/2016	05:59:51	Leisler's Bat
23/08/2016	20:41:10	Soprano Pipistrelle
23/08/2016	20:41:27	Soprano Pipistrelle
23/08/2016	20:41:53	Soprano Pipistrelle
23/08/2016	20:41:59	Soprano Pipistrelle
23/08/2016	20:42:09	Soprano Pipistrelle
23/08/2016	20:49:27	Soprano Pipistrelle
23/08/2016	20:50:55	Soprano Pipistrelle
23/08/2016	20:52:23	Brown Long-eared Bat
23/08/2016	20:55:51	Common Pipistrelle
23/08/2016	21:05:08	Leisler's Bat
23/08/2016	22:55:52	Lesser Horseshoe Bat
23/08/2016	23:02:49	Lesser Horseshoe Bat
23/08/2016	23:03:11	Lesser Horseshoe Bat
23/08/2016	23:05:16	Lesser Horseshoe Bat
23/08/2016	23:06:17	Myotis sp.
23/08/2016	23:23:38	Lesser Horseshoe Bat
23/08/2016	23:33:56	Brown Long-eared Bat
23/08/2016	23:34:48	Brown Long-eared Bat
23/08/2016	23:38:32	Brown Long-eared Bat
23/08/2016	23:42:21	Lesser Horseshoe Bat
23/08/2016	23:43:04	Lesser Horseshoe Bat
23/08/2016	23:44:33	Lesser Horseshoe Bat
23/08/2016	23:44:53	Lesser Horseshoe Bat
23/08/2016	23:51:22	Soprano Pipistrelle
23/08/2016	23:54:00	Lesser Horseshoe Bat
23/08/2016	23:54:17	Myotis sp.
23/08/2016	23:54:50	Myotis sp.
23/08/2016	23:55:45	Lesser Horseshoe Bat
23/08/2016	23:56:33	Myotis sp.
23/08/2016	23:56:47	Myotis sp.
24/08/2016	00:08.05	Common Pipistrelle
24/08/2016	02:01.07	Brown Long-eared Bat

Letter Lodge Outhouse – Static Detector Results 2016

DATE	TIME	SPECIES
24/08/2016	02:01.21	Brown Long-eared Bat
24/08/2016	00:03:44	Lesser Horseshoe Bat
24/08/2016	00:10:51	Lesser Horseshoe Bat
24/08/2016	00:11:47	Myotis sp.
24/08/2016	00:27:53	Lesser Horseshoe Bat
24/08/2016	00:28:59	Lesser Horseshoe Bat
24/08/2016	00:32:04	Lesser Horseshoe Bat
24/08/2016	00:32:29	Lesser Horseshoe Bat
24/08/2016	00:35:02	Lesser Horseshoe Bat
24/08/2016	00:38:27	Lesser Horseshoe Bat
24/08/2016	00:42:36	Lesser Horseshoe Bat
24/08/2016	00:44:49	Lesser Horseshoe Bat
24/08/2016	00:45:06	Lesser Horseshoe Bat
24/08/2016	00:57:54	Lesser Horseshoe Bat
24/08/2016	00:58:21	Soprano Pipistrelle
24/08/2016	00:59:46	Lesser Horseshoe Bat
24/08/2016	01:06:18	Myotis sp.
24/08/2016	01:06:35	Myotis sp.
24/08/2016	01:07:56	Myotis sp.
24/08/2016	01:08:16	Myotis sp.
24/08/2016	01:12:19	Common Pipistrelle
24/08/2016	01:20:32	Brown Long-eared Bat
24/08/2016	01:30:53	Brown Long-eared Bat
24/08/2016	01:39:41	Soprano Pipistrelle
24/08/2016	01:39:54	Soprano Pipistrelle
24/08/2016	01:40:15	Soprano Pipistrelle
24/08/2016	01:48:43	Lesser Horseshoe Bat
24/08/2016	01:56:31	Soprano Pipistrelle
24/08/2016	01:56:47	Soprano Pipistrelle
24/08/2016	02:02:28	Brown Long-eared Bat
24/08/2016	02:03:17	Brown Long-eared Bat
24/08/2016	02:06:43	Brown Long-eared Bat
24/08/2016	02:07:49	Brown Long-eared Bat
24/08/2016	02:08:13	Soprano Pipistrelle
24/08/2016	02:12:25	Brown Long-eared Bat
24/08/2016	02:15:44	Brown Long-eared Bat
24/08/2016	02:23:07	Brown Long-eared Bat
24/08/2016	02:23:21	Brown Long-eared Bat
24/08/2016	02:25:39	Brown Long-eared Bat
24/08/2016	02:37:13	Brown Long-eared Bat
24/08/2016	02:37:49	Brown Long-eared Bat
24/08/2016	02:39:32	Brown Long-eared Bat

DATE	TIME	SPECIES
24/08/2016	02:39:53	Brown Long-eared Bat
24/08/2016	02:40:47	Brown Long-eared Bat
24/08/2016	02:51:48	Brown Long-eared Bat
24/08/2016	03:14:30	Brown Long-eared Bat
24/08/2016	04:13:30	Leisler's Bat
24/08/2016	04:55:27	Brown Long-eared Bat
24/08/2016	05:06:50	Brown Long-eared Bat
24/08/2016	05:07:02	Brown Long-eared Bat
24/08/2016	05:22:36	Brown Long-eared Bat
24/08/2016	06:28:29	Leisler's Bat
24/08/2016	06:28:35	Leisler's Bat
24/08/2016	06:28:41	Leisler's Bat
24/08/2016	06:28:47	Leisler's Bat
24/08/2016	06:28:53	Leisler's Bat
24/08/2016	06:28:59	Leisler's Bat
24/08/2016	06:29:03	Leisler's Bat
24/08/2016	06:29:06	Leisler's Bat
24/08/2016	06:29:10	Leisler's Bat
24/08/2016	06:32:19	Leisler's Bat
24/08/2016	06:32:45	Leisler's Bat
24/08/2016	06:34:11	Leisler's Bat
24/08/2016	20:57:18	Common Pipistrelle
24/08/2016	20:57:33	Common Pipistrelle
24/08/2016	20:57:48	Common Pipistrelle
24/08/2016	21:00:09	Myotis sp.
24/08/2016	21:00:26	Myotis sp.
24/08/2016	21:01:58	Myotis sp.
24/08/2016	21:02:13	Myotis sp.
24/08/2016	21:03:02	Leisler's Bat
24/08/2016	21:03:17	Leisler's Bat
24/08/2016	21:03:32	Leisler's Bat
24/08/2016	21:03:59	Myotis sp.
24/08/2016	21:04:15	Myotis sp.
24/08/2016	21:04:33	Myotis sp.
24/08/2016	21:04:48	Myotis sp.
24/08/2016	21:05:04	Myotis sp.
24/08/2016	21:06:17	Myotis sp.
24/08/2016	21:06:34	Myotis sp.
24/08/2016	21:07:02	Myotis sp.
24/08/2016	21:07:24	Myotis sp.
24/08/2016	21:07:43	Myotis sp.
24/08/2016	21:07:59	Myotis sp.

Letter Lodge Outhouse – Static Detector Results 2016

DATE	TIME	SPECIES
24/08/2016	21:08:20	Myotis sp.
24/08/2016	21:08:37	Myotis sp.
24/08/2016	21:09:12	Myotis sp.
24/08/2016	21:09:38	Myotis sp.
24/08/2016	21:10:29	Myotis sp.
24/08/2016	21:11:11	Leisler's Bat
24/08/2016	22:23:32	Brown Long-eared Bat
24/08/2016	23:11:35	Lesser Horseshoe Bat
25/08/2016	00:28:04	Leisler's Bat
25/08/2016	03:02:41	Lesser Horseshoe Bat
25/08/2016	04:14:27	Brown Long-eared Bat
25/08/2016	04:34:47	Brown Long-eared Bat
25/08/2016	04:39:06	Brown Long-eared Bat
25/08/2016	06:03:55	Leisler's Bat
25/08/2016	06:04:00	Brown Long-eared Bat
25/08/2016	06:04:03	Leisler's Bat
25/08/2016	06:04:06	Leisler's Bat
25/08/2016	06:04:10	Leisler's Bat
25/08/2016	06:04:14	Leisler's Bat
25/08/2016	06:04:19	Leisler's Bat
25/08/2016	06:04:26	Leisler's Bat
25/08/2016	06:04:32	Leisler's Bat
25/08/2016	06:04:40	Leisler's Bat
25/08/2016	06:04:47	Leisler's Bat
25/08/2016	06:04:53	Leisler's Bat
25/08/2016	06:04:59	Leisler's Bat
25/08/2016	06:05:55	Brown Long-eared Bat
25/08/2016	06:06:10	Leisler's Bat
25/08/2016	06:06:26	Leisler's Bat
25/08/2016	06:11:10	Leisler's Bat
25/08/2016	06:11:14	Leisler's Bat
25/08/2016	06:11:17	Leisler's Bat
25/08/2016	06:11:38	Leisler's Bat
25/08/2016	06:22:36	Leisler's Bat
25/08/2016	06:22:47	Leisler's Bat
25/08/2016	06:23:01	Leisler's Bat
25/08/2016	06:23:18	Leisler's Bat
25/08/2016	06:23:24	Leisler's Bat
25/08/2016	06:23:29	Leisler's Bat
25/08/2016	06:23:36	Leisler's Bat
25/08/2016	06:23:46	Leisler's Bat
25/08/2016	06:24:02	Leisler's Bat

DATE	TIME	SPECIES
25/08/2016	06:24:17	Leisler's Bat
25/08/2016	06:24:46	Leisler's Bat
25/08/2016	06:27:53	Leisler's Bat
25/08/2016	06:28:04	Leisler's Bat
25/08/2016	06:28:08	Leisler's Bat
25/08/2016	06:28:22	Leisler's Bat
25/08/2016	06:28:49	Leisler's Bat
25/08/2016	06:29:05	Leisler's Bat
25/08/2016	06:29:47	Leisler's Bat
25/08/2016	06:31:18	Leisler's Bat
25/08/2016	06:31:38	Leisler's Bat
25/08/2016	06:34:37	Leisler's Bat
25/08/2016	06:34:51	Leisler's Bat
18/09/2016	19:49:08	Leisler's Bat
18/09/2016	19:49:59	Leisler's Bat
18/09/2016	19:50:49	Leisler's Bat
18/09/2016	19:54:18	Leisler's Bat
18/09/2016	20:04:47	Myotis sp.
18/09/2016	20:05:46	Myotis sp.
18/09/2016	21:47:26	Brown Long-eared Bat
18/09/2016	22:06:35	Brown Long-eared Bat
18/09/2016	22:26:19	Brown Long-eared Bat
18/09/2016	22:26:47	Brown Long-eared Bat
18/09/2016	23:27:55	Brown Long-eared Bat
19/09/2016	01:12:31	Brown Long-eared Bat
19/09/2016	01:58:44	Brown Long-eared Bat
19/09/2016	02:33:27	Myotis sp.
19/09/2016	02:42:54	Myotis sp.
19/09/2016	03:10:39	Brown Long-eared Bat
19/09/2016	06:03:36	Brown Long-eared Bat
19/09/2016	21:13:08	Brown Long-eared Bat
19/09/2016	21:15:31	Brown Long-eared Bat
19/09/2016	21:27:39	Brown Long-eared Bat
19/09/2016	22:02:35	Brown Long-eared Bat
19/09/2016	22:36:12	Brown Long-eared Bat
19/09/2016	22:44:54	Brown Long-eared Bat
19/09/2016	22:55:30	Brown Long-eared Bat
19/09/2016	23:08:29	Brown Long-eared Bat
19/09/2016	23:17:34	Brown Long-eared Bat
19/09/2016	23:45:50	Brown Long-eared Bat
20/09/2016	01:13:24	Brown Long-eared Bat
20/09/2016	01:34:35	Leisler's Bat

Letter Lodge Outhouse – Static Detector Results 2016

DATE	TIME	SPECIES
20/09/2016	06:22:24	Soprano Pipistrelle
20/09/2016	06:57:41	Leisler's Bat
20/09/2016	06:57:55	Leisler's Bat
20/09/2016	07:01:51	Leisler's Bat
20/09/2016	07:02:05	Leisler's Bat
20/09/2016	07:02:17	Leisler's Bat
20/09/2016	07:02:23	Leisler's Bat
20/09/2016	07:02:31	Leisler's Bat
20/09/2016	07:02:39	Leisler's Bat
20/09/2016	07:02:54	Leisler's Bat
20/09/2016	07:03:08	Leisler's Bat
20/09/2016	07:03:24	Leisler's Bat
20/09/2016	07:03:40	Leisler's Bat
20/09/2016	07:18:25	Leisler's Bat
11/10/2016	18:56:34	Soprano Pipistrelle
11/10/2016	19:00:52	Soprano Pipistrelle
11/10/2016	19:04:31	Soprano Pipistrelle
11/10/2016	19:09:28	Leisler's Bat
11/10/2016	19:09:36	Leisler's Bat
11/10/2016	19:09:45	Leisler's Bat
11/10/2016	19:09:53	Leisler's Bat
11/10/2016	21:00:28	Myotis sp.
11/10/2016	22:53:05	Myotis sp.
11/10/2016	22:53:15	Myotis sp.
11/10/2016	23:02:11	Myotis sp.
12/10/2016	00:01:00	Myotis sp.
12/10/2016	00:13:47	Myotis sp.
12/10/2016	01:43:54	Lesser Horseshoe Bat
12/10/2016	02:13:43	Myotis sp.
12/10/2016	03:29:31	Myotis sp.
12/10/2016	03:31:36	Myotis sp.
12/10/2016	03:34:52	Myotis sp.
12/10/2016	07:01:13	Soprano Pipistrelle
12/10/2016	07:22:51	Soprano Pipistrelle
12/10/2016	07:24:52	Soprano Pipistrelle
12/10/2016	07:26:29	Soprano Pipistrelle
12/10/2016	07:27:25	Soprano Pipistrelle
12/10/2016	19:03:03	Soprano Pipistrelle
12/10/2016	19:04:32	Soprano Pipistrelle
12/10/2016	19:05:57	Leisler's Bat
12/10/2016	23:46:57	Myotis sp.
12/10/2016	23:47:05	Myotis sp.

DATE	TIME	SPECIES
12/10/2016	23:55:30	Myotis sp.

Appendix 9

Met Mast Monitoring Results 2017

Met Mast Monitoring Results 2017

Date	Mic	Time	Species
28/03/2017	Ground	21:26:43	Pipistrelle sp.
28/03/2017	Ground	22:38:59	Soprano Pipistrelle
28/03/2017	Ground	23:50:51	Soprano Pipistrelle
29/03/2017	Ground	06:02:59	Brown Long-eared Bat
29/03/2017	Ground	22:06:30	Brown Long-eared Bat
30/03/2017	Ground	01:19:03	Lesser Horseshoe Bat
31/03/2017	Ground	20:59:19	Soprano Pipistrelle
31/03/2017	Ground	21:49:35	Soprano Pipistrelle
31/03/2017	Ground	21:49:38	Soprano Pipistrelle
02/04/2017	Ground	20:46:52	Soprano Pipistrelle
27/04/2017	At Height	23:54:30	Leisler's Bat
30/04/2017	Ground	22:03:44	Soprano Pipistrelle
30/04/2017	Ground	22:04:00	Common Pipistrelle
01/05/2017	Ground	05:14:41	Soprano Pipistrelle
01/05/2017	Ground	22:20:30	Leisler's Bat
01/05/2017	Ground	22:20:37	Leisler's Bat
01/05/2017	Ground	23:36:37	Soprano Pipistrelle
01/05/2017	Ground	23:37:08	Soprano Pipistrelle
02/05/2017	Ground	01:06:23	Leisler's Bat
02/05/2017	Ground	01:21:47	Soprano Pipistrelle
02/05/2017	Ground	01:21:57	Soprano Pipistrelle
02/05/2017	Ground	01:26:02	Common Pipistrelle
02/05/2017	Ground	21:53:41	Common Pipistrelle
02/05/2017	Ground	22:02:41	Soprano Pipistrelle
02/05/2017	Ground	22:58:05	Leisler's Bat
02/05/2017	Ground	23:50:53	Soprano Pipistrelle
03/05/2017	Ground	01:19:45	Soprano Pipistrelle
03/05/2017	Ground	23:03:26	Leisler's Bat
04/05/2017	Ground	00:31:05	Common Pipistrelle
04/05/2017	Ground	22:06:53	Common Pipistrelle
04/05/2017	Ground	22:07:01	Common Pipistrelle
05/05/2017	Ground	23:30:16	Myotis sp.
06/05/2017	Ground	23:04:19	Common Pipistrelle
06/05/2017	Ground	23:13:28	Leisler's Bat
06/05/2017	Ground	23:13:33	Leisler's Bat
07/05/2017	Ground	21:55:30	Soprano Pipistrelle
07/05/2017	Ground	22:09:00	Common Pipistrelle
07/05/2017	Ground	22:14:31	Common Pipistrelle
07/05/2017	Ground	22:18:31	Common Pipistrelle
07/05/2017	Ground	22:18:40	Common Pipistrelle
07/05/2017	Ground	22:47:18	Soprano Pipistrelle
07/05/2017	Ground	23:00:40	Soprano Pipistrelle
07/05/2017	Ground	23:32:52	Soprano Pipistrelle
07/05/2017	Ground	23:33:04	Soprano Pipistrelle
07/05/2017	Ground	23:59:56	Brown Long-eared Bat
08/05/2017	Ground	00:02:48	Common Pipistrelle
08/05/2017	Ground	00:14:47	Common Pipistrelle
08/05/2017	Ground	00:28:30	Brown Long-eared Bat
08/05/2017	Ground	01:33:40	Common Pipistrelle
08/05/2017	Ground	01:51:01	Leisler's Bat
08/05/2017	Ground	01:51:12	Leisler's Bat
08/05/2017	Ground	01:51:27	Leisler's Bat
08/05/2017	Ground	01:52:29	Common Pipistrelle
08/05/2017	Ground	01:53:08	Leisler's Bat
08/05/2017	Ground	01:53:15	Leisler's Bat
08/05/2017	Ground	01:54:13	Leisler's Bat
08/05/2017	Ground	01:54:21	Leisler's Bat
08/05/2017	Ground	01:55:59	Leisler's Bat
08/05/2017	Ground	01:56:32	Leisler's Bat
08/05/2017	Ground	02:00:11	Common Pipistrelle
08/05/2017	Ground	02:00:21	Common Pipistrelle
08/05/2017	Ground	02:00:28	Common Pipistrelle
08/05/2017	Ground	02:02:35	Lesser Horseshoe Bat
08/05/2017	Ground	02:32:05	Common Pipistrelle
08/05/2017	Ground	02:32:12	Common Pipistrelle
24/05/2017	Ground	22:52:18	Myotis sp.
24/05/2017	Ground	23:36:53	Soprano Pipistrelle
24/05/2017	Ground	23:53:20	Soprano Pipistrelle
25/05/2017	Ground	00:48:54	Common Pipistrelle
25/05/2017	Ground	01:19:22	Soprano Pipistrelle
25/05/2017	Ground	01:54:11	Nathusius' Pipistrelle
25/05/2017	Ground	02:04:33	Soprano Pipistrelle
25/05/2017	Ground	02:04:38	Soprano Pipistrelle
25/05/2017	Ground	02:04:47	Myotis sp.
25/05/2017	Ground	02:04:47	Soprano Pipistrelle
25/05/2017	Ground	02:05:07	Soprano Pipistrelle
25/05/2017	Ground	02:05:30	Soprano Pipistrelle
25/05/2017	Ground	02:05:45	Soprano Pipistrelle
25/05/2017	Ground	02:06:00	Soprano Pipistrelle
25/05/2017	Ground	02:06:15	Soprano Pipistrelle
25/05/2017	Ground	02:06:26	Soprano Pipistrelle
25/05/2017	Ground	02:26:53	Soprano Pipistrelle
25/05/2017	Ground	02:26:58	Soprano Pipistrelle
25/05/2017	Ground	02:27:14	Soprano Pipistrelle
25/05/2017	Ground	02:27:30	Soprano Pipistrelle
25/05/2017	Ground	02:27:34	Soprano Pipistrelle

Met Mast Monitoring Results 2017

Date	Mic	Time	Species
25/05/2017	Ground	02:32:04	Common Pipistrelle
25/05/2017	Ground	03:12:43	Soprano Pipistrelle
25/05/2017	Ground	03:12:50	Soprano Pipistrelle
25/05/2017	Ground	22:39:58	Pipistrelle sp.
25/05/2017	Ground	22:40:01	Common Pipistrelle
25/05/2017	Ground	22:41:07	Soprano Pipistrelle
25/05/2017	Ground	22:41:11	Soprano Pipistrelle
25/05/2017	Ground	22:49:08	Common Pipistrelle
25/05/2017	Ground	22:54:04	Soprano Pipistrelle
25/05/2017	Ground	23:55:36	Brown Long-eared Bat
26/05/2017	Ground	00:08:16	Pipistrelle sp.
26/05/2017	Ground	00:24:33	Leisler's Bat
26/05/2017	Ground	00:31:29	Common Pipistrelle
26/05/2017	Ground	00:40:56	Nathusius' Pipistrelle
26/05/2017	Ground	01:12:38	Soprano Pipistrelle
26/05/2017	Ground	01:12:50	Soprano Pipistrelle
26/05/2017	Ground	01:14:00	Soprano Pipistrelle
26/05/2017	Ground	01:14:14	Soprano Pipistrelle
26/05/2017	Ground	01:14:20	Soprano Pipistrelle
26/05/2017	Ground	01:14:27	Soprano Pipistrelle
26/05/2017	Ground	01:14:33	Soprano Pipistrelle
26/05/2017	Ground	01:21:39	Soprano Pipistrelle
26/05/2017	Ground	01:21:53	Soprano Pipistrelle
26/05/2017	Ground	01:22:09	Soprano Pipistrelle
26/05/2017	Ground	01:22:19	Soprano Pipistrelle
26/05/2017	Ground	02:01:14	Soprano Pipistrelle
26/05/2017	Ground	02:01:25	Soprano Pipistrelle
26/05/2017	Ground	02:01:40	Soprano Pipistrelle
26/05/2017	Ground	02:01:45	Soprano Pipistrelle
26/05/2017	Ground	02:01:54	Soprano Pipistrelle
26/05/2017	Ground	02:02:07	Soprano Pipistrelle
26/05/2017	Ground	02:02:14	Soprano Pipistrelle
26/05/2017	Ground	02:02:24	Soprano Pipistrelle
26/05/2017	Ground	03:48:26	Common Pipistrelle
26/05/2017	Ground	03:55:55	Pipistrelle sp.
26/05/2017	Ground	23:52:11	Soprano Pipistrelle
27/05/2017	Ground	02:29:44	Pipistrelle sp.
27/05/2017	Ground	22:32:10	Common Pipistrelle
28/05/2017	Ground	00:00:05	Common Pipistrelle
28/05/2017	Ground	01:25:28	Myotis sp.
28/05/2017	Ground	02:06:26	Soprano Pipistrelle
28/05/2017	Ground	02:41:10	Brown Long-eared Bat
28/05/2017	Ground	22:25:57	Soprano Pipistrelle
28/05/2017	Ground	22:31:01	Soprano Pipistrelle
28/05/2017	At Height	22:32:48	Soprano Pipistrelle
28/05/2017	Ground	22:35:55	Pipistrelle sp.
28/05/2017	Ground	22:44:02	Common Pipistrelle
29/05/2017	Ground	01:39:08	Pipistrelle sp.
29/05/2017	Ground	01:48:51	Common Pipistrelle
29/05/2017	Ground	02:51:37	Pipistrelle sp.
29/05/2017	Ground	03:21:24	Soprano Pipistrelle
29/05/2017	Ground	03:39:33	Pipistrelle sp.
29/05/2017	Ground	04:30:44	Soprano Pipistrelle
29/05/2017	Ground	22:46:02	Pipistrelle sp.
29/05/2017	Ground	22:46:05	Pipistrelle sp.
29/05/2017	Ground	22:59:24	Soprano Pipistrelle
30/05/2017	Ground	00:54:28	Common Pipistrelle
30/05/2017	At Height	01:08:27	Pipistrelle sp.
30/05/2017	Ground	01:10:42	Soprano Pipistrelle
30/05/2017	Ground	02:32:04	Brown Long-eared Bat
30/05/2017	Ground	22:45:05	Common Pipistrelle
30/05/2017	Ground	23:04:58	Common Pipistrelle
30/05/2017	Ground	23:23:02	Myotis sp.
31/05/2017	Ground	00:09:17	Brown Long-eared Bat
31/05/2017	Ground	00:55:57	Pipistrelle sp.
31/05/2017	Ground	00:56:01	Soprano Pipistrelle
31/05/2017	Ground	01:47:01	Common Pipistrelle
31/05/2017	Ground	01:47:05	Common Pipistrelle
31/05/2017	Ground	02:04:01	Soprano Pipistrelle
31/05/2017	Ground	03:09:49	Brown Long-eared Bat
31/05/2017	Ground	03:09:57	Soprano Pipistrelle
31/05/2017	Ground	23:12:07	Common Pipistrelle
01/06/2017	At Height	01:45:16	Pipistrelle sp.
01/06/2017	Ground	02:04:01	Leisler's Bat
01/06/2017	At Height	02:04:01	Leisler's Bat
01/06/2017	Ground	03:10:51	Soprano Pipistrelle
02/06/2017	Ground	00:37:44	Myotis sp.
02/06/2017	Ground	02:25:34	Myotis sp.
02/06/2017	Ground	02:45:57	Common Pipistrelle
02/06/2017	Ground	23:44:57	Brown Long-eared Bat
03/06/2017	Ground	00:18:45	Soprano Pipistrelle
03/06/2017	Ground	01:12:10	Brown Long-eared Bat
04/06/2017	Ground	03:16:57	Lesser Horseshoe Bat
09/08/2017	Ground	22:09:36	Common Pipistrelle
09/08/2017	Ground	22:09:42	Common Pipistrelle
09/08/2017	Ground	23:14:09	Common Pipistrelle
09/08/2017	Ground	23:14:13	Common Pipistrelle
09/08/2017	Ground	23:28:25	Soprano Pipistrelle
09/08/2017	Ground	23:44:19	Soprano Pipistrelle
10/08/2017	Ground	00:08:19	Common Pipistrelle
10/08/2017	Ground	00:08:21	Common Pipistrelle
10/08/2017	Ground	00:11:37	Soprano Pipistrelle

Met Mast Monitoring Results 2017

Date	Mic	Time	Species
10/08/2017	Ground	00:11:42	Pipistrelle sp.
10/08/2017	Ground	00:13:01	Soprano Pipistrelle
10/08/2017	Ground	00:33:08	Common Pipistrelle
10/08/2017	At Height	01:06:15	Soprano Pipistrelle
10/08/2017	Ground	01:09:39	Brown Long-eared Bat
10/08/2017	Ground	01:25:26	Soprano Pipistrelle
10/08/2017	Ground	01:28:52	Soprano Pipistrelle
10/08/2017	Ground	01:37:40	Brown Long-eared Bat
10/08/2017	Ground	03:04:17	Myotis sp.
10/08/2017	Ground	03:04:57	Myotis sp.
12/08/2017	Ground	01:31:20	Soprano Pipistrelle
12/08/2017	Ground	02:12:39	Brown Long-eared Bat
12/08/2017	Ground	05:03:18	Soprano Pipistrelle
12/08/2017	Ground	22:02:43	Common Pipistrelle
12/08/2017	Ground	22:25:00	Common Pipistrelle
12/08/2017	Ground	23:26:55	Leisler's Bat
12/08/2017	Ground	23:27:36	Leisler's Bat
12/08/2017	Ground	23:27:44	Leisler's Bat
12/08/2017	Ground	23:28:00	Leisler's Bat
12/08/2017	Ground	23:28:09	Leisler's Bat
12/08/2017	Ground	23:28:15	Leisler's Bat
12/08/2017	Ground	23:28:25	Leisler's Bat
12/08/2017	Ground	23:28:39	Leisler's Bat
12/08/2017	Ground	23:28:43	Leisler's Bat
12/08/2017	Ground	23:28:54	Leisler's Bat
12/08/2017	Ground	23:29:10	Leisler's Bat
12/08/2017	Ground	23:29:23	Leisler's Bat
12/08/2017	Ground	23:29:28	Leisler's Bat
12/08/2017	Ground	23:29:37	Leisler's Bat
12/08/2017	Ground	23:29:44	Leisler's Bat
12/08/2017	Ground	23:30:07	Leisler's Bat
12/08/2017	Ground	23:30:15	Leisler's Bat
12/08/2017	Ground	23:30:27	Leisler's Bat
12/08/2017	Ground	23:30:39	Leisler's Bat
12/08/2017	Ground	23:30:46	Leisler's Bat
12/08/2017	Ground	23:30:52	Leisler's Bat
12/08/2017	Ground	23:31:06	Leisler's Bat
12/08/2017	Ground	23:31:50	Leisler's Bat
12/08/2017	Ground	23:47:01	Soprano Pipistrelle
12/08/2017	Ground	23:52:26	Soprano Pipistrelle
13/08/2017	At Height	00:55:02	Leisler's Bat
13/08/2017	Ground	01:20:50	Common Pipistrelle
13/08/2017	Ground	04:16:55	Myotis sp.