BAT ECO SERVICES

Ulster Canal:

Monaghan Town

Bat Survey

Dr Tina Aughney

2013

Report prepared for:

Flynn & Furney Environmental Consultants

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SUMMARY

Site:	Ulster Canal
Development:	Proposed Cycle/Walking Route Enhancement Works
Grid reference:	Various – see main section of report for details
Proposed work:	Various works – see main section of report for details
Survey by:	Dr Tina Aughney
Bat species recorded:	Five species of bat: common pipistrelle, brown long-eared bat, soprano pipistrelle, Natterer's bat, Daubenton's bat and Leisler's bat.

1. Introduction

A 5km stretch of the Ulster Canal was surveyed by Dr Tina Aughney, Bat Eco Services, in relation to bat activity and potential bat roosts. Such surveying was completed due to the fact that bats are protected species under the Wildlife Act (1976) and Wildlife [Amendment] Act (2000). Across Europe, they are further protected under the Convention on the Conservation of European Wildlife and Natural Habitats (Bern Convention 1982), which, in relation to bats, exists to conserve all species and their habitats. The Convention on the Conservation of Migratory Species of Wild Animals (Bonn Convention 1979, enacted 1983) was instigated to protect migrant species across all European boundaries. The Irish government has ratified both these conventions. Also, the EC Directive on The Conservation of Natural habitats and of Wild Fauna and Flora (Habitats Directive 1992), seeks to protect rare species, including bats, and their habitats and requires that appropriate monitoring of populations be undertaken. All bat species are protected under Annex IV of the EU Habitats Directive, while the lesser horseshoe bat is listed under Annex II. Member states are required to designate Special Areas of Conservation for all species listed under Annex II in order to protect them. Therefore a bat survey was requested to determine the bat usage of the canal in view of the fact all bat species are protected under Irish and EU legislation.

1.1 Site description

A full site description of the 5km stretch of the Ulster Canal is described according to the following table which breaks down the survey area according to distances between particular bridges/areas. In addition, each bridge structure and other structure along the canal surveyed are described in relation to bat roosting potential.

Section	Starting point of section surveyed	Distance (km)
1	Townland of Killyconigan (R189) to Manor Wood (R162)	1.5 km
2	Manor Wood (R162) to Black Lane	1km
3	Black Lane to Townland of Tullyhirm	1.5km
4	Townland of Tullyhirm to N12	1km

2. Survey Methodology

This report presents the results of a site visit by Dr Tina Aughney carried out in September 2013 during which a series of bat surveys were completed. A daytime survey was undertaken to identify any Potential Bat Roosts (PBRs) in the structures. Using a 4-point classification system for bridges, the structures were inspected using this system. The survey methodology follows that of Billington and Norman (1997) and each bridge is categorised as follows:

0 = no potential (no suitable crevices)
1 = crevices present may be of use to bats
2 = crevices ideal for bats but no evidence of usage
3 = evidence of bats (e.g. bat present, droppings etc.)

Evidence of bats is in the form of actual bats (visible or audible), bat droppings, urine staining, grease marks (oily secretions from glands present on stonework) and claw marks. In addition, the presence of bat fly pupae (bat parasite) also indicates that bat usage of a crevice has occurred in the past. To complete this grading inspection, each structure was inspected using a high-powered narrow beamed torch to inspect crevices, holes, cracks and joints within the structures. Where necessary, this inspection is assisted by using a fiberscope to check deep crevices not visible using a torch.

A Passive Monitoring System of bat detection was employed for these surveys where the bat detector is effectively used as a bat activity data logger. One unit was employed for each survey. The unit would have been located under the arch of the bridge, if possible, to detect and record any emerging bat species. The use of these recording devices results in a far greater sampling effort over a shorter period of time. Bat detectors are employed as the ultrasonic calls produced by bats cannot be heard by human hearing.

Bat surveying was completed using units of the Frequency Division AnaBat Detector System (AnaBat SD1 Flash Card Bat Detector). Frequency Division is a technique used to convert the inaudible bat echolocation calls to audible sounds. The AnaBat unit also uses Zero-Crossing Analysis (ZCA) to make the real-time recorded calls visible for display purposes. It is these sonograms (2-d sound pictures) that are digitally stored on the CF card and downloaded for analysis. Each time a bat is detected, an individual time-stamped (date and time to the second) file is recorded.

Bats are identified by their ultrasonic calls. This detector system records bat ultrasonic calls on a continuous basis and stores the information onto an internal CF card. Data was then downloaded and analysed using Analook (sound software for the AnaBat system). Each time-stamped AnaBat file was analysed and the species of bat recorded was noted as a bat pass. Some files may have recorded more than one species. In this instance, a bat pass is noted for each species (e.g. two species identified in a time-stamped file which corresponded to one soprano pipistrelle bat pass and one common pipistrelle bat pass). However, in the light of two individuals of the same species being recorded in the same time-stamped file, only one bat pass was noted for this time-stamped file.

To support the Passive Monitoring Programme, dusk and dawn surveying was also completed on each of the survey dates for details using a bat detector (Pettersson 240x Time Expansion and Heterodyne Bat Detector). Dusk surveys were completed during the hours of 8:30 p.m. to 12:00 a.m. and involved a general walkabout of the canal.

2.1 Survey Constraints

This survey was undertaken inside the preferred summer months as specified in tender document. There were no survey constraints with regards to the current structure inspections and bat surveys.

Section	Starting point of section surveyed	Distance (km)	Survey Date
1	Townland of Killyconigan (R189) to Manor Wood (R162)	1.5 km	13/9 & 14/9
2	Manor Wood (R162) to Black Lane	1km	14/9
3	Black Lane to Townland of Tullyhirm	1.5km	14/9 & 16/9
4	Townland of Tullyhirm to N12	1km	16/9

Table 1: Dates on which the night-time survey of routes was completed.

Plate 1: SongMeter SM2 in tree.

KEY TO SPECIES CODES

CP = common pipistrelle *Pipistrellus pipistrellus*

SP = soprano pipistrelle *Pipistrellus pygmaeus*

Leis = Leisler's bat *Nyctalus leisleri*

Daub = Daubenton's bat *Myotis daubentonii*

Natt = Natterer's bat *Myotis nattereri*

Myotis = *Myotis* species (family group consisting of Natterer's bat, Daubenton's bat and whiskered bat species)

3. Results

3.1 Bat Survey Results – Inspection of structures

Structure Name	Bridge, Tom Young's Wood	**Grid Reference**	H662334
 			
Survey Date	13/09/2013	**Weather**	Dry, calm, full cloud cover, 12^0C
Surveys completed	Daytime Inspection	Dusk Survey	AnaBat Detector
4-point Grade	**Roosts Recorded**	**Bat Species**	**Bat Species**
4 – roost	Brown long-eared bat roost	Sp, CP and ble foraging in area	Sp, CP, Leis, Natts
Bat Assessment	Crevices suitable for individual bats, single brown long-eared bat recorded in a crevice.		
Mitigation Measures	1. Retain crevices for bat usage. 2. If any crevices are to be filled, they should be hand filled and checked prior to filling to ensure that there is no residing wildlife. 3. Ensure that impact on adjacent habitats is kept to a minimum.		
Bat Survey Work	Re-survey bridges if works are required on the bridge as there ae multiple suitable crevices and as many as possible should be retained for local bat populations.		

Structure Name	Bridge (Section 3)	**Grid Reference**	H679346
			
Survey Date	16/09/2013	**Weather**	Dry, calm, full cloud cover, 13^0C
Surveys completed	Daytime Inspection	Dusk Survey	None deployed
4-point Grade	**Roosts Recorded**	**Bat Species**	**Bat Species**
4 – suitable	Daub roost	SP, Daubs foraging	Not applicable
Bat Assessment	Crevices suitable for individual bats, small roost of Daubenton's bats present, approx.. 5 individuals.		
Mitigation Measures	1. Retain crevices for bat usage. 2. If any crevices are to be filled, they should be hand filled and checked prior to filling to ensure that there is no residing wildlife. 3. Ensure that impact on adjacent habitats is kept to a minimum.		
Bat Survey Work	Re-survey bridges if works are required on the bridge as there are multiple suitable crevices and as many as possible should be retained for local bat populations. Bat roosts present also.		

Structure Name	Bridge at end of Black Lane over canal	Grid Reference	H6705833261

Survey Date	16/09/2013	Weather	Dry, calm, clear sky, 15^{0}C
Surveys completed	Daytime Inspection	Dusk Survey	None deployed
4-point Grade	**Roosts Recorded**	**Bat Species**	**Bat Species**
2 – suitable	None	None	Not applicable
Bat Assessment	Crevices suitable for individual bats, none present during current survey.		
Mitigation Measures	1. Retain crevices for bat usage. 2. Suitable building for bat mitigation. The internal space of this structure could be used to erect bat tubes, thereby providing some roosting sites for bats, in particular, *Myotis* species.		
Bat Survey Work	Re-survey bridges if works are required on the bridge as there are multiple suitable crevices and as many as possible should be retained for local bat populations. However, due to over grown conditions, this is a difficult bridge to survey.		

3.2 Walkabout Bat Detector Survey

The 5km length of the canal from the Townland of Killyconigan (Tom Young's Wood) to the section of the canal along the N12 was surveyed using Pettersson D240x Time Expansion and Heterodyne bat detector. Any encounters with bats were noted and presented on the tables below. For each section as presented in Table 1, the grid reference point where bats were detected along each section of the canal is detailed.

Survey Date: 13/9/2013 20:00hrs to 00.00 hrs. Weather was dry, full cloud cover and calm with occasional light rain showers. Air temperature ranging from 12-11^{0}C.

Section 1 Townland of Killyconigan to Manor Wood (1.5 km)

This section of the canal was accessible within Tom Young's Wood but with more difficult access around Manor Wood.

Easting	Northing	Species	Details
265803	333100	Soprano pipistrelle	Individual foraging over treeline/ towpath.
265900	333192	Soprano pipistrelle	Individual foraging over treeline/ towpath.
266042	333280	Common pipistrelle	Individual foraging along treeline/ towpath.
265932	333045	Soprano pipistrelle	Within Tom Young's Wood
266047	333160	Common pipistrelle	Individual foraging along treeline/ towpath.
266097	333220	Brown long-eared bat	Along treeline adjacent to private land
266254	333238	Brown long-eared bat	Individual foraging along treeline/ towpath.
266074	333220	Leisler's bat	Commuting over head
266240	333238	Common pipistrelle	Individual foraging along treeline/ towpath.


Plate 2 & 3: Tom Young's Wood (Section 1)


Plate 4 & 5: Treelines and woodland adjacent to Tom Young's Wood (Section 1) where brown long-eared bats were recorded foraging.

Survey Date: 14/9/2013 20:00hrs to 00.00 hrs. Weather was dry, full cloud cover and calm with occasional light rain showers. Air temperature ranging from 13-10^{0}C.

Section 2 Manor Wood to Black Lane (1 km)

This section of the canal was surveyed from 20:00 hrs to 21:30 hrs. Reduced bat activity compared to Sections 1 due to the fact that the habitat is less favourable in this area.

Easting	Northing	Species	Details
266984	333174	Common pipistrelle	Individual foraging
266984	333174	Soprano pipistrelle	Individual foraging

Section 3 Black Lane to the Townland of Tullyhirm (1.5km)

This section of the canal was surveyed from 22:00 hrs to 00:00 hrs. Surveying was concentrated along the lane from the hotel down to the canal/wooded area. Bat activity was concentrated along the lane way.

Easting	Northing	Species	Details
267095	333252	Leisler's bat	Individual foraging over treeline along laneway.
267095	333252	Common pipistrelle	Individual foraging along treeline along laneway.
267095	333252	Soprano pipistrelle	Individual foraging along treeline along laneway.
267095	333289	Soprano pipistrelle	Individual foraging over canal.
267026	333284	Soprano pipistrelle	Individual foraging along treeline/ towpath.

Plate 6 & 7: Treelines and canal tow path along Black Lane.

Plate 8 & 9: Treelines and canal tow path in the Townland of Tullyhirm.

Survey Date: 16/9/2013 20:00hrs to 00.00 hrs. Weather was dry and full cloud cover. Air temperature ranging from 13-11^{0}C.

Section 4 Townland of Tullyhirm to N12 (1.5 km)

This section of the canal was surveyed from 20:00 hrs to 00:00 hrs. Medium level of bat activity compared to Section 1. A Grey Squirrel was also recorded in the trees adjacent to the canal at the end of Black Lane.

Easting	Northing	Species	Details
268087	334196	Soprano pipistrelle	Along canal tow path
268079	334288	Soprano pipistrelle	Along canal tow path
268129	334978	Soprano pipistrelle	Adjacent to roundabout of N12 - south
268125	335038	Soprano pipistrelle	Adjacent to roundabout of N12 - north
268171	335167	Soprano pipistrelle	Individual foraging along field adjacent to storage yard at N12

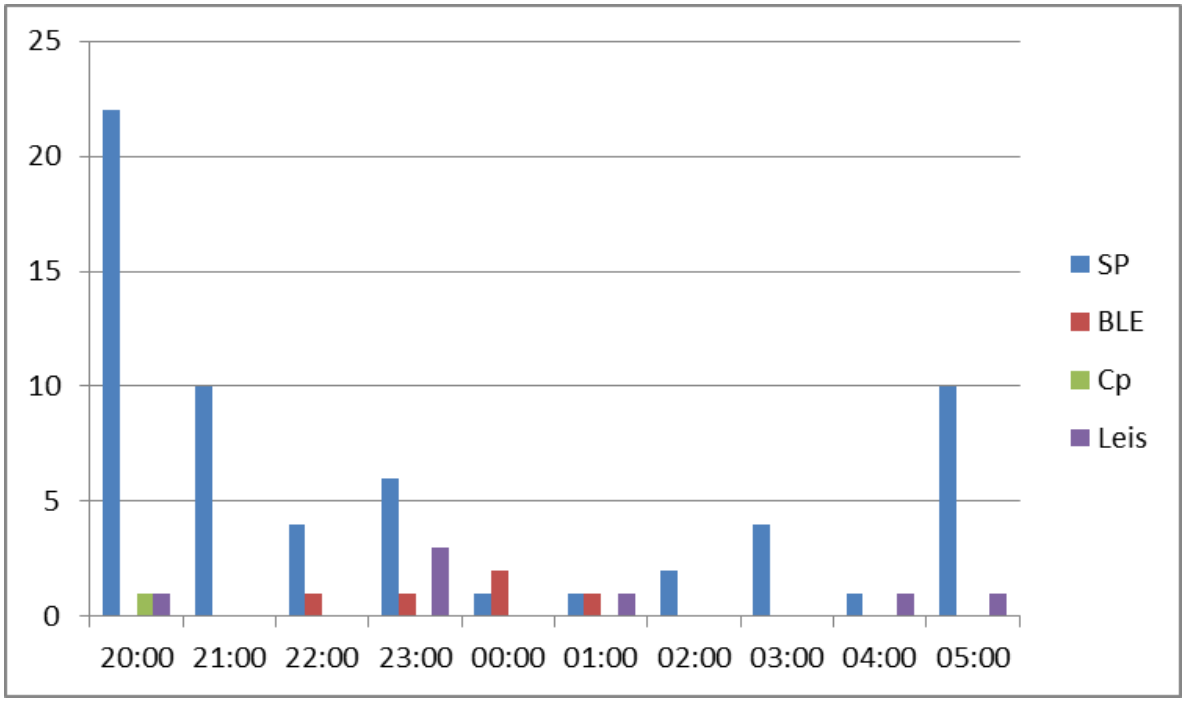
268171	335167	Soprano pipistrelle	Individual foraging along field adjacent to storage yard
268010	334463	Common pipistrelle	Individual foraging along treeline.
267982	334509	Daubenton's bat	Individual foraging over canal surface.
268304	335432	Common pipistrelle	Individual foraging in woodland.
268304	335432	Soprano pipistrelle	Individual foraging in woodland.

Plate 10 & 11: Open grassland field off the N12 long the canal and the wooded area further east along this section of the canal.

3.3 Passive Monitoring Survey

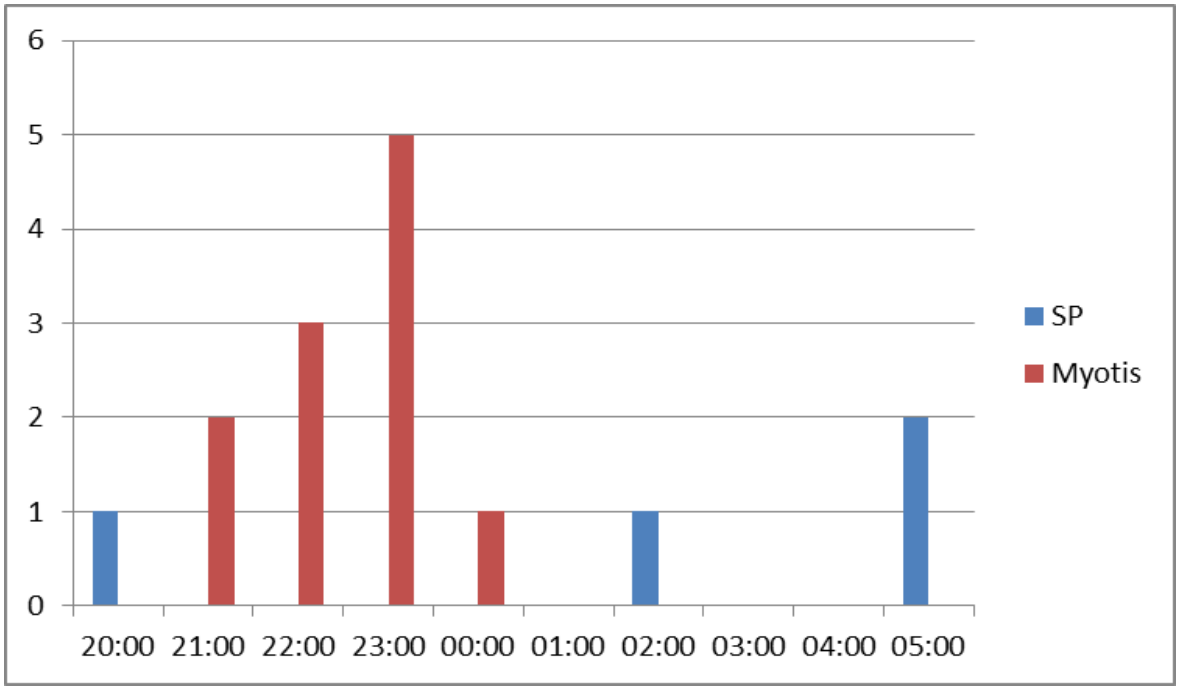
An AnaBat SD1 Frequency Division Unit was erected on a mature tree in an open section of the canal from 20:00 to 06:00 hrs on 13/9/2013. This section of the canal is adjacent to treelines and wooded area on private land.

The unit was located approximately 40m west from the bridge where a brown long-eared bat was recorded roosting in a crevice. The brown long-eared bat activity recorded by the unit indicates that there is likely to be a much larger roost located in buildings nearby. In addition, common pipistrelle and Leisler's bat passes were also recorded in low numbers (Graph 1). A high level of soprano pipistrelle activity was recorded, especially at the beginning of the night indicating that the roost is adjacent to the canal.



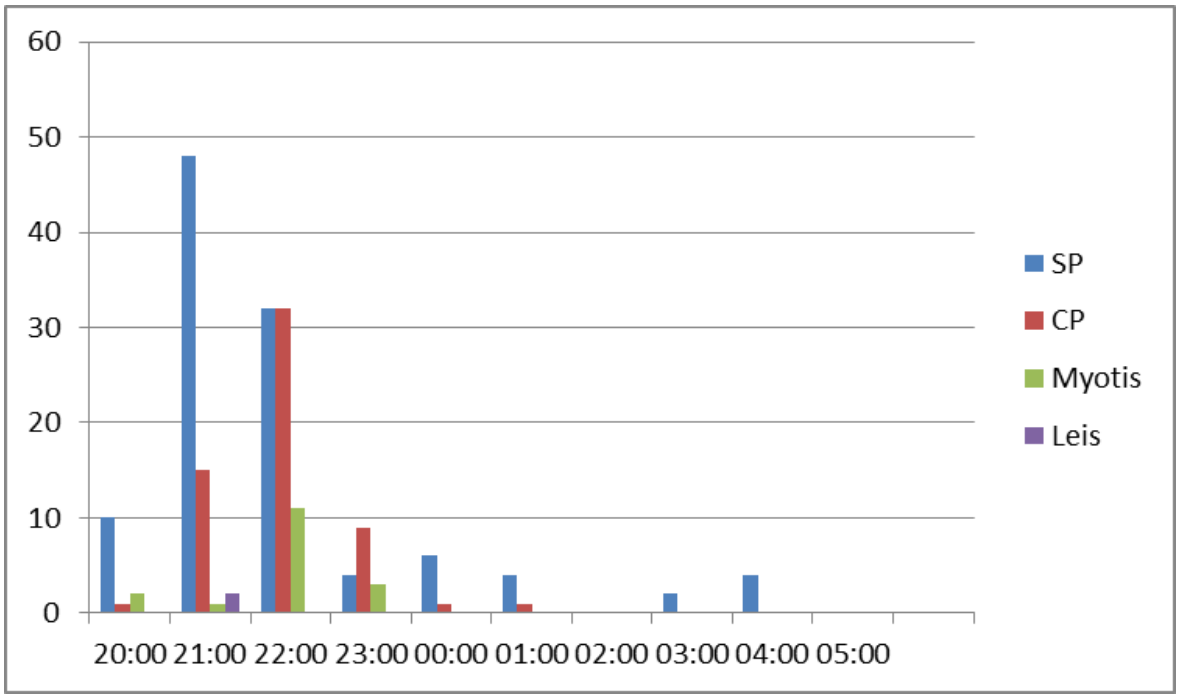
Graph 1: No. of bat passes recorded along the Canal within Section 1 (Tom Young's Wood) on the 13/9/2013.

A second AnaBat SD1 Frequency Division Unit was erected on a mature tree east of the canal from 20:00 to 06:00 hrs on 13/9/2013 adjacent to Manor Wood. This section of the canal is adjacent scrub and hedgerows. Soprano pipistrelle and *Myotis* bat passes were recorded in low numbers (Graph 2).



Graph 2: No. of bat passes recorded along the Canal within Section 1 (Manor Wood, further east towards Monaghan Town) on the 13/9/2013.

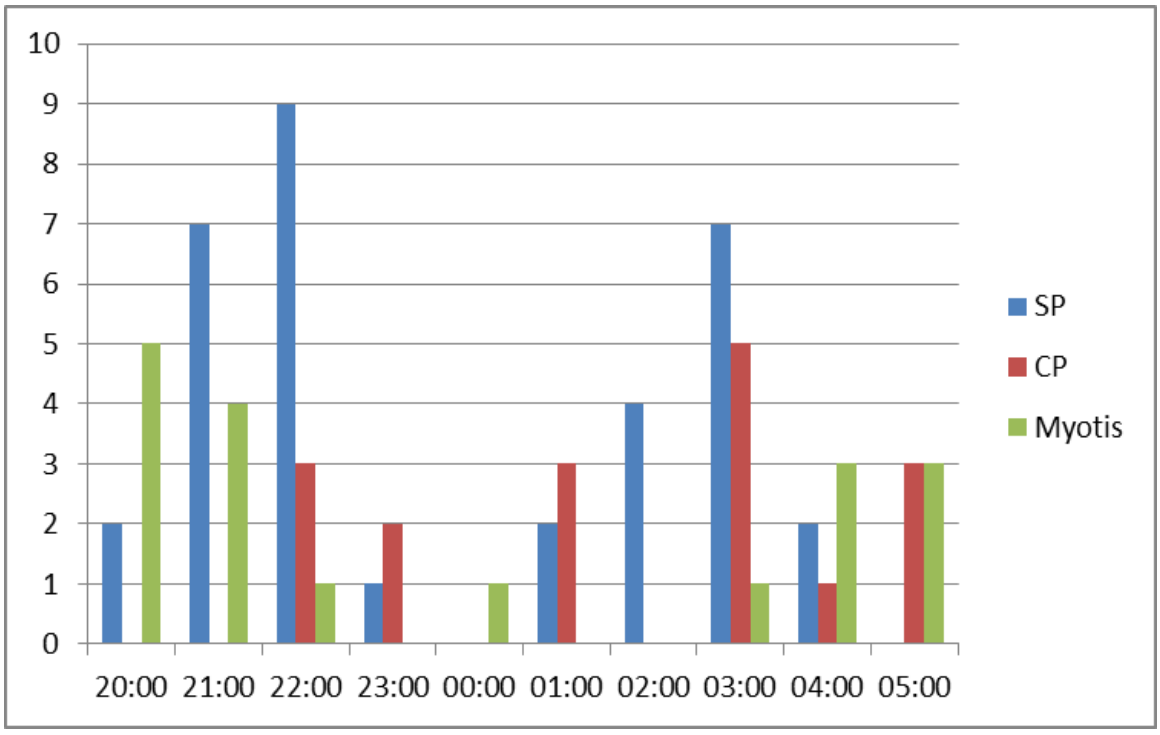
A SongMeter SM2+ Platform Unit was erected on a tree adjacent to the canal to recorded bat activity from 20:00hrs to 06:00 hrs on the 14/9/2013. A high level of bat activity was recorded at this point, particularly for soprano and common pipistrelles. A low level of *Myotis* bat species and Leisler's bat activity was recorded (Graph 3).



Graph 3: No. of bat passes recorded along the Canal within Section 1 (Tom Young's Wood) 14/9/2013.

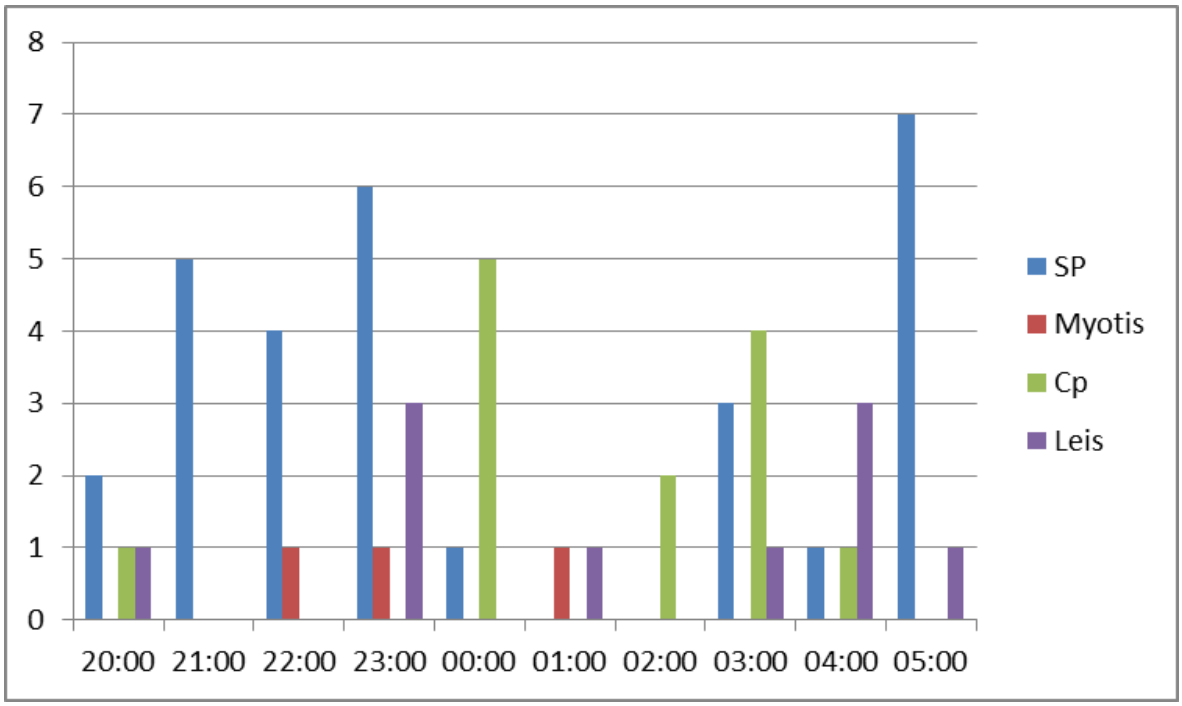
A SongMeter SM2+ Platform Unit was erected on a tree adjacent to the canal and the bridge along the western end of Section 3 to recorded bat activity from 20:00hrs to 06:00 hrs on the 14/9/2013. A high level of bat activity was recorded at this point, particularly for soprano and common pipistrelles. A low level of *Myotis* bat species and Leisler's bat activity was recorded (Graph 4).

This unit was located adjacent to the bridge where a small Daubenton's bat roost was recorded. This is reflected in the number of *Myotis* species bat passes that was recorded at the beginning and at the end of the night as shown on Graph 4.



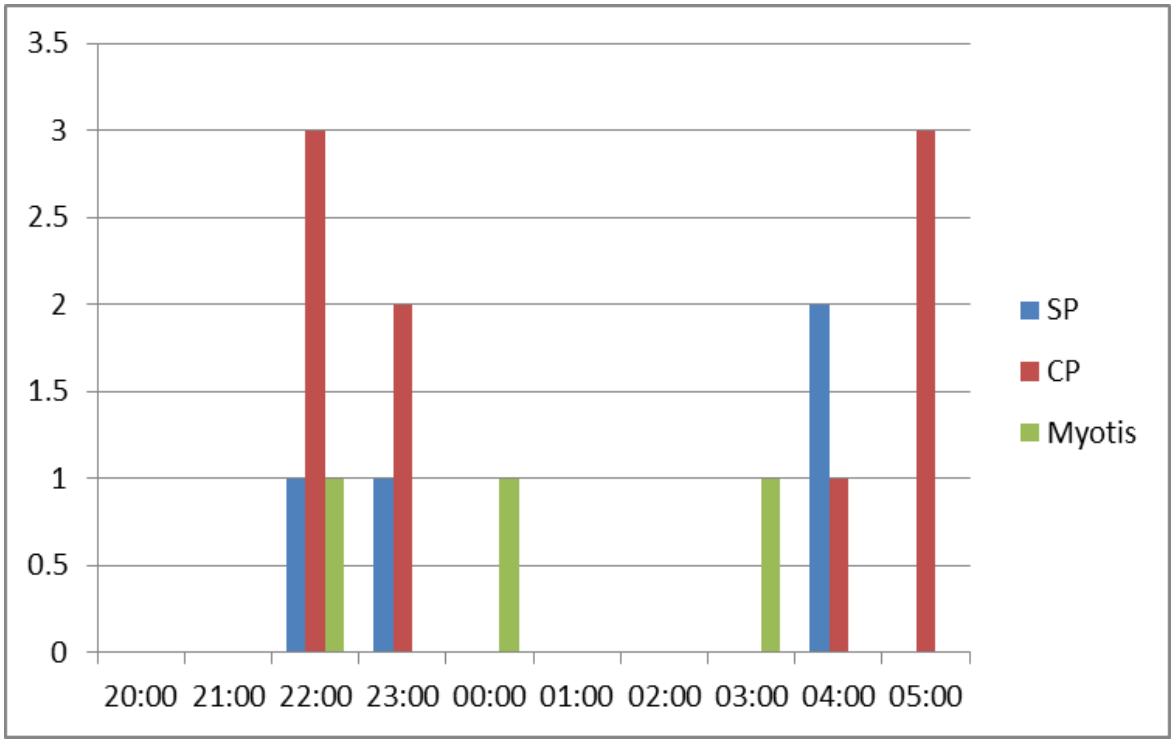
Graph 4: No. of bat passes recorded along the Canal adjacent to bridge within Section 3 on 14/9/2013.

A SongMeter SM2+ Platform Unit was erected on a tree adjacent to the canal and a wooded area at the start of Section 3 to recorded bat activity from 20:00hrs to 06:00 hrs on the 16/9/2013. A medium level of bat activity was recorded at this point, particularly for soprano and *Myotis* species. A low level of soprano pipistrelle species and Leisler's bat activity was recorded (Graph 5).



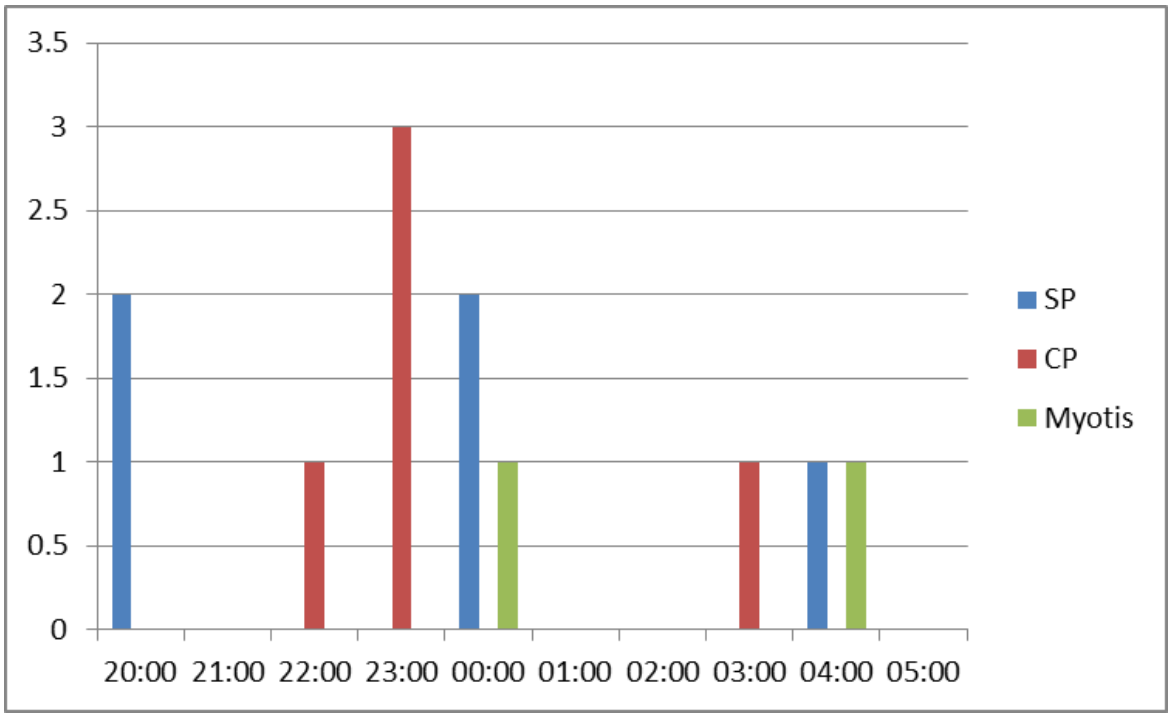
Graph 5: No. of bat passes recorded along the Canal within Section 2 on 16/9/2013.

A SongMeter SM2+ Platform Unit was erected on a tree adjacent to the canal and the eastern end of Section 3 to recorded bat activity from 20:00hrs to 06:00 hrs on the 16/9/2013. A low level of bat activity was recorded at this point (Graph 6).



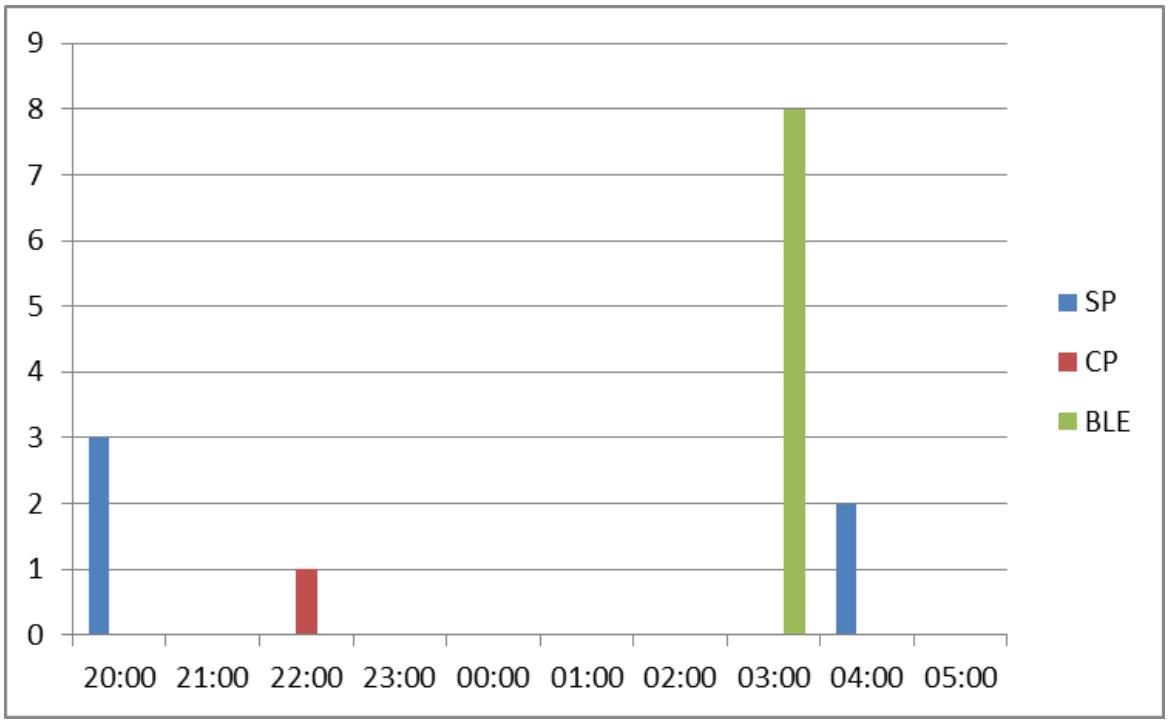
Graph 6: No. of bat passes recorded along the Canal within Section 3 (eastern end) on 16/9/2013.

A SongMeter SM2+ Platform Unit was erected on a tree adjacent to the canal and the western end of Section 4 to recorded bat activity from 20:00hrs to 06:00 hrs on the 16/9/2013. A low level of bat activity was recorded at this point (Graph 7).



Graph 7: No. of bat passes recorded along the Canal within Section 4 just off N12 on 16/9/2013.

A SongMeter SM2+ Platform Unit was erected on a tree adjacent to the canal and the eastern end of Section 4 in a wooded area to recorded bat activity from 20:00hrs to 06:00 hrs on the 16/9/2013. A low level of bat activity was recorded at this point (Graph 8).



Graph 8: No. of bat passes recordedin a wooded area along the Canal within Section 4 on 16/9/2013.

In Summary:

As expected, soprano pipistrelle is the most frequently encountered species. It is likely that there are a number of roosts in the town, including a number of derelict buildings located along the canal route (e.g. at the end of Black Lane, derelict building).

Myotis species bat activity was only recorded on sections of the canal where there was open water present. A Daubenton's bat roost was recorded in one of the bridges.

Leisler's bat activity was recorded only commuting over the canal indicating that individuals of this species are travelling to foraging areas elsewhere. A maternity roost of national importance was recorded by the author in 2012 in a school building in Monaghan Town. It is likely that the Leisler's bat activity recorded in this survey is of individuals from the above roost.

Brown long-eared bat activity was recorded only in areas where there was woodland present adjacent to the canal.

The section of the canal with the greatest number of species and bat activity is adjacent to Tom Young's Wood. This is also located adjacent to Rossmore Park, which is an ideal bat foraging, commuting and roosting area.

3.4 Potential Bat Roosts in Trees

There is a large array of trees located along the 5km route. There are pockets of mature trees/woodland at sections of the canal particularly in Tom Young's Wood and adjacent habitat. As a consequence there are trees with heavy ivy growth and trees with dead limbs and/or tree holes that would provide roosting sites for bats. It is therefore important that any removal of vegetation to facilitate widening the current towpath should consider that type of trees that may require removal or trimming.

Plate 12: Examples of trees located along the canal route deemed suitable as potential bat roosts (PBRs)

The importance of trees to bats varies with species, season and foraging behaviour. For Leisler's bats, trees are essential for both summer and winter roosts while Daubenton's and Natterer's bats utilise trees more often during the summer months. Other species such as brown long-eared bats and pipistrelle bats avail of trees in the winter months. In general, individual males throughout the season use tree roosts, more often, while females will use trees for temporary night roosts or night perches for consuming prey. Hollow trees are widely used by bats for both summer and winter roosts (weather dependent) and bats will roost in 'sound' trees in crevices, holes and under split bark. Bats rest, give birth, raise young and hibernate in tree holes, crevices and beneath loose bark. Species of trees utilised by bats include oak, ash, beech and Scots pine. Trees, especially native ones also play host to numerous insect species which are prey items for bat species. Trees also provide shelter for swarming insects which bats will avail of. In addition, trees are important commuting routes for bats. A gap in a hedge/treeline of greater than 10m may force some species of bats to seek an alternative commuting route.

It is recommended that any trees proposed to be felled or subject to tree surgery works should be subjected to a bat survey to ensure that trees are felled with harming potentially roosting bats.

4. Management in view of Bat Fauna recorded

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

- *A conservation plan for Irish vesper bats, Irish Wildlife Manual No. 20 National Parks and Wildlife Service, Department of Environment, Heritage and Local Government, Dublin, Ireland.*
- *Bat Mitigation Guidelines for Ireland. Irish Wildlife Manuals, No. 25. National Parks and Wildlife Service, Department of Environment, Heritage and Local Government, Dublin, Ireland.*
- *National Biodiversity Plan. Department of Arts, Heritage, Gealtacht and the Islands.*
- *The status of EU protected habitats and species in Ireland: Conservation status in Ireland of habitats and species listed in the European Council Directive on the Conservation of Habitats, Flora and Fauna 92/43/EEC. National Parks and Wildlife Service, Department of Environment, Heritage and Local Government.*

4.1 Ecological Assessment

The following bat species have been recorded during this bat survey: common pipistrelle, soprano pipistrelle, brown long-eared bat, Natterer's bat, Daubenton's bat and Leisler's bats.

In summary, the proposed development will need to consider the following:

a. Bats and their bat roosts are protected by Irish legislation (Wildlife Act 1976 and 2000 Amendment) which make it an offence to wilfully interfere with or destroy the breeding or resting place of these species. All species of bats are listed in Schedule 5 of the 1976 Act and therefore are subject to the provisions of Section 23.

b. The EU Habitats Regulations Directive 1992 seeks to protect rare and vulnerable species, including all species of bats. All ten species of bat are protected with the lesser horseshoe bat listed as an Annex II species while all other bats (commonly known as vesper bats) are listed as Annex IV species.

c. Local Planning Authorities are required to give consideration to nature conservation interests under the guidance of the SEA Directive 2001/42/EC. This directive states that the protected status afforded to bats means that planning authorities must consider their presence in order to reduce the impact of developments through mitigation measures.

d. The National Biodiversity Plan confers general responsibilities on all participants in the development process to take into account of protected species. "*The overall objective is to secure the conservation, and where possible the enhancement, and sustainable use of biological diversity in Ireland and contribute to conservation and sustainable use of biodiversity globally".*

NPWS Conservation Status Assessment report for each of the species recorded is presented in a summary below the species list:

Leisler's bat *Nyctalus leisleri* (Species Code 1331)

Common pipistrelle *Pipistrellus pipistrellus* (Species Code 1309)

Soprano pipistrelle *Pipistrellus pygmaeus* (Species Code 5009)

Daubenton's bats *Myotis daubentonii (*Species Code 1314*)*

Brown long-eared bats *Plecotus auritus* (Species Code 1326)

Natterer's bat *Myotis nattereri* (Species Code 1322)

All Irish bat species are given a Favourable Status in Republic of Ireland. The Irish Leisler's bat population is of International Importance. The principal pressures on Irish bat species are as follows:

- urbanized 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
- speleology and vandalism
- communication routes: roads
- forestry management

4.2 Predicted Impacts

All bat species recorded during this bat survey are Annex IV species under the EU Habitats Directive and all have a Favourable Status in Ireland. The likely impact of widening the canal towpaths to facilitate walking and cycling routes will reduce the degree of vegetation along the boundary of the canal route. This will lead to a more open habitat and a reduction in vegetation and potentially less insect association. However, the primary concern would be more in relation to potential light spillage in urban areas along the route. In addition, there is a tendency to light up new pathways and this would have a much greater impact on foraging species such as Daubenton's bats and brown long-eared bats.

4.3 Mitigation Measures

Mitigation is best achieved through avoidance. It is proposed that the following measures be put in place to avoid or lessen the degree of impacts.

Mitigation by avoidance

1. Limit the amount of lighting to be in place along the canal route, along treelines/hedgerows and adjacent to potential roosts in structures and mature trees.
2. Treelines/hedgerows should remain in-situ and remain protected from proposed development and any infrastructure to support the development. Mature trees with dead wood and crevices should be retained.

The measures described below are also additional general recommendations to inform the managers of other elements that are likely impact on bat populations.

1 Removal of linear habitats

a) Removal of treeline/hedgerow/woodland should be to a minimum amount. Any landscaping works proposed for the development site should be native shrubs and tree species only and reflect the species present in the adjacent landscape.

2 Mature trees

a) Trees, which are to be removed, will be felled during the autumn months of September, October or November (felling during the spring or autumn months avoids the periods when the bats are most active).

b) Any trees showing crevices, hollows etc., should not be removed at all.

c) Any ivy covered trees which require felling will be left to lie for 24 hours after cutting to allow any bats beneath the cover to escape. This measure applies to the majority of trees identified on-site.

d) A full tree survey is recommended for any trees proposed to be felled.

3 Future planting

Native tree and shrub species are recommended to be planted along the perimeter of the canal, if the need arises – tree species found in the local area e.g. hawthorn, ash, oak and blackthorn.

4 Lighting

Lighting should not be installed as part of the proposed works as it deters some bat species from foraging. Studies have shown that illumination levels as low as 0.06 lux can have an effect on the behaviour of bats. Even a full moon night (0.02 lux) can reduce bat activity to more sheltered, darker wildlife corridors and foraging areas (e.g. woodlands). The slower flying broad-winged species (Natterer's bats, Daubenton's bats, whiskered bats, Brandt's bats, lesser horseshoe bats and brown long-eared bats) have been shown to avoid street lights. In a study of a roost in Suffolk, UK, the numbers of Natterer's bats, whiskered bats, Daubenton's bats and brown long-eared bats fell after the installation of street lights adjacent to the roost being monitored.

A study on the above controls was undertaken by Emery (2008) and concluded that shielding and masking of street lights can reduce light spillage by as much as 40%. While internal and external louvers are more effective, the external louvers can reduce light spillage by as much as 97%.

- It is important to maintain Dark Zones for foraging bats in areas where lighting is not necessary. However, where lighting is required, this lighting should be placed at a minimum height using the lowest lux value permitted for health and safety.

- The lighting should be directional on to the buildings only with no spillage of light to adjoining habitats. To reduce light spillage from luminaries, lights that are designed not to emit light at angles greater than 70^{o} from the vertical plane should be used. Consequently a flat glass protector is often used to reduce light spillage. Other methods to control light spillage:

a. Shields: these can be mounted on lamps to control direction of the light

b. Masking: part of the luminaries is painted to block light to control the direction of the light

c. Louvers': either as internal or external slates organized in rows or at angles depending on the direction of light control.

- No white light should be permitted as this has the greatest impact on bats. Low pressure sodium lights have a minimum impact on bats. Lighting that has little or no UV content have the least impact on bats.

5 Stone crevices

Crevices in stonework are often used as temporary roosts. Two roosts were recorded in two bridges and a third bridge contains suitable crevices. Crevices recorded as bat roosts should be retained as bat roosts. Other crevices that may require filling in order to ensure the integrity of the bridge should only be hand-filled. Where possible, retain some crevices to allow usage for individual bats. Where re-pointing of stonework is required, care should be taken not to entomb bats within the crevices. It is important to listen for bats and observe for any signs of dropping or urine stains to ensure that no bats are present. Suitable crevices are 10cm wide, 2cm tall and 10cm deep. Please consult a bat specialist for any clarification of this measure.

If a bat is encountered during the process please remove gently with a pair of gloves and return to a safe crevice in another wall or remove to a bat box. A woodcrete bat box should be erected on a mature tree adjacent to the structure on a mature tree, if possible. Or consult the bat specialist or local NPWS Conservation Ranger.

6 Bat Box Scheme

Bats are very transient mammals and move around buildings and structures changing roosting sites regularly, especially male bats and especially during the spring and autumn months. Therefore constant vigilance is required when under taking proposed works. In the

event of a bat being located during works (outside the maternity season), a bat box should be erected on a mature tree. This bat box should be used to re-locate bats if found during works. In such events, please contact bat specialist or NPWS Conservation Ranger for advise on the such situations.

Details of sourcing these boxes and erection can be supplied. 'Schwegler' woodcrete bat boxes are recommended but other designs are available – timber, concrete and concrete/sawdust).

A bat box scheme could also be considered as a management tool, especially to encourage bats roosting along the canal length. Bat boxes can be hung on poles or erected on mature trees. Bat tubes are also suitable to erect on vertical walls of structures located along the canal.

In the event of mature trees being removed, a bat box scheme should be erected along the canal to compensate for potential loss of bat roosts. For every three trees removed, a bat box should be erected.

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Appendices

Bat ecology – general

The bat is the only mammal that is capable of true flight. There are over 1,100 species worldwide, representing almost a quarter of all mammal species. There are 47 species in Europe - in Ireland, ten species of bat are currently known to exist, which are classified into two families, the Rhinolophidae (Horseshoe bats) and the Vespertilionidae (Common bats).

Prey

All the European bat species feed exclusively on insects. A Pipistrelle, weighing only 4 to 8 grammes, will eat up to 3000 insects every night, ensuring a build up of fat in the bat's body to allow it to survive the winter deep in hibernation.

Breeding and longevity

Irish bats can produce one young per year but, more usually, only one young is born every two years (Boyd & Stebbings, 1989). This slow rate of reproduction inhibits repopulation in areas of rapid decline. Although bats have been known to live for twenty or more years, this is rare as most die in their first and the average lifespan, in the wild, is four years.

Threats

All bat species are in decline as they face many threats to their highly developed and specialised lifestyles. Many bats succumb to poisons used as woodworm treatments within their roosting sites (Racey & Swift, 1986). Agricultural intensification, with the loss of hedgerows, treelines, woodlands and species-rich grasslands have impacted bat species also. Habitual roosting or hibernation sites in caves, mines, trees and disused buildings are also often lost to development. Summer roosts are prone to disturbance from vandals. Agricultural pesticides accumulate in their prey, reaching lethal doses (Jefferies, 1972). Chemical treatments in cattle production sterilise dung thus ensuring that no insects can breed within it to be fed upon by bats. Likewise, river pollution, from agricultural runoff, reduces the abundance of aquatic insects. Road building, with the resultant loss of foraging and roosting sites is a significant cause in the reduction of bat populations across Europe.

Extinction

As recently as 1992, the greater mouse-eared bat *Myotis myotis* became the first mammal to become extinct in Britain since the wolf in the 18th century.

Ireland Red List No. 3: Terrestrial Mammals

Bats

Species: Common Name	Irish Status	European Status	Global Status
Brandt's bat	Data deficient	Least Concern	Least Concern
Daubenton's bat	Least Concern	Least Concern	Least Concern
Whiskered bat	Least Concern	Least Concern	Least Concern
Natterer's bat	Least Concern	Least Concern	Least Concern
Leisler's bat	Near threatened	Least Concern	Least Concern
Nathusius' pipistrelle	Least Concern	Least Concern	Least Concern
Common pipistrelle	Least Concern	Least Concern	Least Concern
Soprano pipistrelle	Least Concern	Least Concern	Least Concern
Brown long-eared bat	Least Concern	Least Concern	Least Concern
Lesser horseshoe bat	Least Concern	Least Concern	Least Concern

Marnell, F., Kingston, N. & Looney, D. (2009) *Ireland Red List No. 3: Terrestrial Mammals*, National Parks and Wildlife Service, Department of the Environment, Heritage and Local Government, Dublin, Ireland.