

# **N4 Collooney to Castlebaldwin, Proposed Road Development**

## **APPENDIX NO. 12.3**

### **NON-VOLANT MAMMAL REPORT**

**PREPARED BY:**

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## Document Control

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# 1 INTRODUCTION

This report presents the non-volant mammal survey results recorded along the corridor of the proposed N4 Collooney to Castlebaldwin Realignment. It assesses all mammals excluding bats - a separate Bat Study Report has been prepared by Ecofact Environmental Consultants Ltd. concerning this group of mammals. This assessment was undertaken over a number of survey periods including January-April 2006, November 2009, September 2010, November 2012 and most recently during July 2013. Consultation during the assessment was undertaken with the National Parks and Wildlife Service (NPWS). This report has been prepared to inform the Flora and Fauna Impact Assessment (Chapter 12) of the N4 Collooney to Castlebaldwin Realignment EIS. The main objective of the field surveys was to record and document the potential value and significance of the Proposed Road Development area and its surroundings in relation to mammals, and in particular, protected species.

New road schemes have the potential to have a wide range of impacts on mammals. Construction results in habitat loss due to land take and, once built, roads can act as physical barriers to wildlife migrations, therefore reducing dispersal and colonisation movements (Lankester *et al.*, 1991). Road construction results in greater fragmentation of the landscape, and makes potentially suitable areas much less readily available for mammal populations to expand, and can result in isolation of existing populations (Clarke *et al.*, 1998, Lankester *et al.*, 1991). Noise disturbances and pollution of water, soils and air can also occur potentially resulting in indirect impacts on mammal populations. Road mortality of mammals as a result of vehicle collisions is also a serious potential impact.

Otters *Lutra lutra*, are listed under Annex II of the EU Habitats Directive, while badger *Meles meles*, Irish hare *Lepus timidus*, pygmy shrew *Sorex minutus*, hedgehog *Erinaceus europaeus* and pine martin *Martes martes*, are all listed under Appendix III of the Bern Convention. All these species, along with the Irish stoat *Mustela erminea*, are protected under the Wildlife Act (1976) and the Wildlife (Amendment) Act (2000). A list of protected mammals and their preferred habitat types recorded from and expected to occur within the study area of the proposed N4 Collooney to Castlebaldwin Realignment is presented in Table 1.

There is significant scope for avoiding and mitigating these potential impacts. The route of the proposed realignment has been carefully selected following both a constraints and route selection study. This has ensured that the road has avoided areas of particular importance to nature conservation (i.e. the Unshin River valley cSAC). Unlike the existing N4 road section, mammal exclusion fences and underpasses will be provided as required to ensure that road mortalities are minimised and allow mammals to cross under the road. The current survey has identified sensitive non-volant mammal features, including dwellings, along the route and a proportional mitigation response will be taken to ensure that impacts on non-volant mammals during both the construction and operation of the development will be avoided or remedied.

**Table 1** List of non-volant mammals recorded or expected to occur within the study area of the proposed N4 Collooney to Castlebaldwin Realignment; their preferred habitat types and protection status (Marnell, 2009) are also set out.

Common name	Scientific name	EU HD	RDB	WA	Bern	Preferred habitat type(s)	Geographic distribution
Otter	<i>Lutra lutra</i>	II, IV	NT	P	II	Watercourses, coast	Widespread
Badger	<i>Meles meles</i>	-	LC	P	III	Woodland, agricultural landscapes, diverse.	Widespread
Fox	<i>Vulpes vulpes</i>	-	LC	-	-	Diverse	Widespread
Irish Hare	<i>Lepus timidus hibernicus</i>	V	LC	P	III	Grassland, heathland, bog	Widespread
Rabbit	<i>Oryctolagus cuniculus</i>	-	-	-	-	Diverse	Widespread

Common name	Scientific name	EU HD	RDB	WA	Bern	Preferred habitat type(s)	Geographic distribution
Hedgehog	<i>Erinaceus europaeus</i>	-	LC	P	III	Woodland, scrub, hedgerow	Widespread
Pine Marten	<i>Martes martes</i>	V	LC	P	III	Woodland, scrub	Mainly west and midlands
Pygmy Shrew	<i>Sorex minutus</i>	-	LC	P	-	Diverse	Widespread
Red Squirrel	<i>Sciurus vulgaris</i>	-	NT	P	-	Woodland	Widespread
Irish Stoat	<i>Mustela erminea hibernica</i>	-	LC	P	-	Diverse	Widespread
Fallow Deer	<i>Dama dama</i>	-	LC	P	-	Woodland	Widespread
Wood mouse	<i>Apodemus sylvaticus</i>	-	LC	-	-	Diverse	Widespread
House mouse	<i>Mus (musculus) domesticus</i>	-	LC	-	-	Diverse	Widespread
Brown rat	<i>Rattus norvegicus</i>	-	-	-	-	Diverse	Widespread
American mink	<i>Mustela vison</i>	-	-	-	-	Diverse	Widespread

*EU HD* - EU Habitats Directive (Council Directive 92/43/EEC) II - Annex II animal and plant species, IV – Annex IV animal and plant species, V – Annex V animal and plant species.

*WA* - Wildlife Act (1976) & Wildlife (Amendment) Act (2000): P - Protected species

*RDB* - Red Data Book Category: NT – Near Threatened, LC – Least Concern.

*Bern* – Bern Convention (1979) 'Convention on the Conservation of European Wildlife and Natural Habitats'.

## 2 METHODOLOGY

### 2.1 Introduction

A walk-over survey of the entire route covering a corridor width of 350m on both sides of the route was undertaken for the preparation of this report. All field survey work was undertaken between the months of November and April, in the years 2006, 2009, 2010 and 2012 with a follow-up survey carried out during July 2013. The winter months comprise a period during which vegetation cover is at a minimum, thereby enhancing the probability of detection of field signs. The survey corridor was extended to 500m where necessary to locate particular features (i.e. main badger setts). The corridor was examined for signs of / or the presence of mammals. All paw prints, scrapings, burrows, holes, dung and droppings were sought and categorised. Tracks of mammals were followed to discover the route taken and whether any resting places or burrows were in evidence to either end of tracks. All data was recorded in the field on standard field sheets and marked onto 1:250,000 maps and aerial photographs. Locations of important mammal features were also recorded using a hand held GPS system and photographed for future reference.

### 2.2 Badger

The badger surveys were carried out according to recommended guidelines (Harris *et al*, 1989; NRA (2009) *Ecological Surveying Techniques for Protected Flora and Fauna during the Planning of National Road Schemes*). The whole corridor was carefully investigated on foot, with particular attention paid to hedgerows, wooded areas, banks and elevated ground. Searches were made primarily for badger setts, well-used badger paths (clearly marked pathways through fields and vegetation and paths pushed/dug through boundaries), badger hair caught on hedges and fences (often where a badger path passes through vegetation or a fence) and latrines (shallowly dug dung-pits, often concentrated on territorial boundaries). The timing of field surveys included the period when badger territorial marking is at a peak and also included broad habitat data to inform badger habitat suitability. Where setts were found, activity levels were scored using the following criteria:

- Number of well-used holes (with one or more of the following features: well worn entrance; freshly excavated soil; bedding material);
- Number of partially used holes (leaves or twigs in entrance and/or mosses and other plants growing in or around entrance);
- Number of disused holes (partially or completely blocked, with considerable amount of excavation required for reoccupation).
- Setts were also classified using the conventions shown in Table 2. Further details of badger setts and signs are given below.

**Table 2** Conventions used in classifying badger setts.

Sett type		Description
Primary	Main	Several holes with large spoil heaps and obvious paths emanating from and between sett entrances.
Secondary	Annex	Normally less than 150m from main sett, comprising several holes. May not be in use all the time, even if main sett is very active.
	Subsidiary	Usually at least 50m from main sett with no obvious paths connecting to other setts.  May only be used intermittently.
	Outlier	Little spoil outside holes. No obvious paths connecting to other setts and only used sporadically. May be used by foxes and rabbits.

## 2.2.1 Badger setts and excavated material

### 2.2.1.1 Entrances and tunnels

Entrances to badger setts are a low dome shape, broader than high forming the shape of the letter 'D' lying on its flat edge. Entrances are not less than 25 cm in diameter and are typically 30-35 cm. Newly excavated tunnels will have rough edges but the walls of well used entrances appear smooth, due to the constant rubbing of the badger bodies when passing in and out. After time the tunnels take on the near perfect symmetry of the badger's curved back. On closer inspection, with the assistance of a torch, the diameter of a badger tunnel will be the same as that of the entrance. In contrast a rabbit burrow dug in loose soil may seem large but within a short distance of the entrance the tunnel narrows. Badger tunnels usually dip down from the entrance and then curve up as they disappear from view. Steam rising from a sett entrance in the early morning indicates an animal is in occupancy. Foxes (*Vulpes vulpes*) and rabbits (*Oryctolagus cuniculus*) may use parts of badger setts but badgers leave numerous signs of their presence in the countryside.

### 2.2.1.2 Excavated material

Sett entrances are associated with extensive mounds of excavated spoil heaped at their mouth. Large Setts may have a dozen or more holes where the excavated material may form terraces of spoil. The particle size in the spoil heap from a badger tunnel will consist of larger pieces rather than the smaller particles excavated by rabbits. Large excavated stones may have scratch marks from the badgers' front claws. In soft rock these marks may show as parallel scoring.

## 2.2.2 Signs of badger activity

### 2.2.2.1 Spoil heaps

In the spoil heaps of active badger setts vegetable matter such as grass, bracken, moss or leaves may be found because badgers use vast quantities of bedding, which is periodically replaced and this will contain badger hairs (see below). This distinguishes an active badger sett from a fox's earth, because foxes do not use bedding. Bones may be found in the spoil heaps of both active badger setts and fox earths. In May if the spoil heap outside a well used entrance is flattened and hardened it is a sign that cubs are present and have been at play.

### 2.2.2.2 Hairs

When badger paths cross barbed wired fencing and a badger passes under, guard hairs may be found but if the animal passed over finer black hairs may be found which come from the underside of the badger. Badger guard hairs can be recognised due to their stiff and wiry texture. These are white at the base, dark in the middle and pale at the tapered tip. Badgers hairs also have an angular shaft and therefore when rotated go round in a jolting motion, rather than smoothly. In comparison rabbit hairs are soft and short and fox hairs (from the back) are usually softer and redder than that of the badger. The texture difference is the key when distinguishing between the hairs of a fox and an erythristic (sandy-coloured) badger.

### 2.2.2.3 Paths

In the vicinity of an occupied badger sett there is usually a well-marked system of paths which lead from the used entrances to places of importance within a territory such as alternate setts, main feeding grounds, dung pits and drinking places. Such paths are often very distinctive, being about 20 cm wide and may be quite denuded of vegetation, due to constant trampling by badger traffic.

### 2.2.2.4 Footprints

Badger footprints are broader than they are long, with a kidney shaped heel and five toes although often, only four make an impression. The best prints show their claws, especially the long ones of the front feet. Badgers leave a stride of about 0.5 m with a wide straddle between left and right feet in its gait, although at speed the stride may increase to 80 cm. One or both hind feet may register in the tracks of the fore print.



### 2.2.2.5 Dung pits & latrines

Appearance: Dung pits are funnel shaped depressions about 15 cm deep, with a diameter at the top of about the same measurement, into which badgers defecate. Often dung pits will be grouped together to form a latrine. When a pit becomes full it is left uncovered and another dug nearby.

Location: Approximately 70% of dung pits are found along territorial boundaries and used to mark special feeding areas or faeces may be deposited straight onto the ground. Dung pits are also found near inhabited setts where they may be located under low bushes or fallen trees. The use of latrines is most pronounced in March and April. Badger cubs use different pits from the adults, so their faeces and hence their presence can be easily recognised.

Contents: Badger dung is often an amorphous mass of finely chewed material with mud. After badgers have been consuming earthworms all that remains is mud from the worm's gut and some chaetae (the undigested remains of worms, which are ring-like in appearance). The badger is an omnivore and their diet will vary depending upon the time of year and may include carrion, fruit, seeds, grain, bulbs, rodents, birds and even hedgehogs. Badger dung sample surveys show that badgers tend to be more carnivorous in the spring and summer and more vegetarian in autumn and winter, due to the availability of food but these animals are opportunist feeders. Dung pits may contain a yellowish brown jelly-like substance which is probably a secretion from the animals' anal glands.

### 2.2.2.6 Scratching posts

It is not unusual to find a tree near a main sett which has been used by the inhabitants for scratching; this is often an elder or another rough barked species such as oak or elm. The bark becomes scored by the badgers' claws up to a height of about a meter and frequently stained with mud. On a well used tree the bark may have been progressively removed.

### 2.2.2.7 Smell of used entrances

Badgers have a pleasant musky aroma as do other Mustelidae in contrast to the rancidity of an entrance to a fox earth, which is due to food being taken underground.

### 2.2.2.8 Feeding signs

One of the most distinctive badger feeding signs are snuffle holes, small pits drilled typically in areas of short grass, in pursuit of retreating earthworms.

## 2.3 Otter

Surveys were undertaken to ascertain the level of otter activity along the banks of all watercourses affected by the *Proposed Road Development* and surrounding habitats. The survey was undertaken to 350m upstream and downstream of the proposed road crossings. Surveys were carried out in accordance with guidance provided by Macdonald *et al.*, (1998), Chanin (2003) and NRA (2009). Visual surveys of the rivers and their banks, as well as drainage ditches and any significant bodies of water were carried out on foot, allowing a thorough examination of the habitat. Banks were inspected from both sides, as well as from the centre of the river, where the water depth allowed. Close-focusing binoculars were used to examine sections of bank, where access was not possible. Searches for otter activity were made primarily for holts (otter nests or lairs), spraints (otter faeces, often found in elevated positions; on large stones, trees fallen across the river, tree roots, bridges, weirs or on grass piles on the bank), seals (paw-prints left in mud or silt), runways (pathways across fields, usually at bends in streams or rivers), slides and haul-out places. Holts are cavities in a river bank, often a hollow tree, between roots, rocky clefts, rabbit burrows or tunnels in peat. The entrance may be underwater with an air vent into the chamber, which is lined with dry vegetation. An otter may have many holts or resting sites within its home range.

## 2.4 Pine marten and other mammals

The proposed alignment corridor was examined for signs of all other mammal species. During the survey all paw prints, scrapings, burrows, holes, dung and droppings were sought and categorised. Tracks of mammals were followed to discover the route taken and whether any resting places or burrows were in evidence. The study area contains suitable habitat for pine marten, with records of this species identified; areas were

searched for distinctive pine marten droppings or direct sightings. In addition, prominent features where pine martens have a tendency to deposit scats (i.e. tree stumps, dead logs or stones) were also examined.

## 2.5 Consultation

Consultations with the local National Parks and Wildlife (NPWS) ranger and with the NPWS District Conservation Officer were undertaken during the preparation of this report. A field meeting to discuss the treatment of mammals during the proposed construction and operation of the *Proposed Road Development* took place in June 2006 during the initial field survey investigations. At this meeting, NPWS expressed their view that the constraints study and route selection study undertaken by Dr. Don Cotton contributed significantly to the minimisation of impact on ecology. NPWS ranger staff were satisfied with the detail field survey results especially with respect to mammals and had no further records of mammal dwellings in the study area and agreed that with mitigation measures included for the new road, there would be less mammal mortality as a result of traffic. NPWS were most concerned with the protection of the River Unshin and agreed with the mitigation measures proposed regarding watercourse crossings.

## 3 RESULTS OF THE NON-VOLANT MAMMAL SURVEY

### 3.1 Badger

Badger *Meles meles* is present throughout the survey area and a small number of badger setts are affected by the *Proposed Road Development*. Badger populations in Ireland have been reviewed in the report '*Conservation and management of the European badger*' edited by Griffiths & Thomas (1997) and the current survey is also informed by the '*Irish National Badger Sett Database*' created by the Department of Agriculture, Forestry and Food, based on 2009 data and uploaded to the National Biodiversity Data Centre website ([www.biodiversityireland.ie](http://www.biodiversityireland.ie)) in 2011. Badgers occur throughout the Republic of Ireland and are most common in areas such as Kilkenny and Louth, but much less so in areas such as Counties Longford, Galway and Sligo. In the mid-1990's it was estimated that around 200,500 adult badgers comprising of approximately 34,000 social groups were present in the country. This equated to an overall density of 0.46 badger setts/km<sup>2</sup>. Badger sett densities in County Sligo are generally in the range of 0.2-0.39 setts/km<sup>2</sup>; among the lowest in Ireland. The badger is protected in Ireland under the Wildlife Acts (1976) and Wildlife (Amendment) Act (2000). Despite protection, the illegal killing of badgers is widespread and common. Badger death due to vehicle road collisions are also thought to be significant. Badgers have been identified as a reservoir of bovine TB, and the law permits the culling of badgers by the Department of Agriculture each year in the Republic.

A breakdown of numbers of badger setts by category recorded, and directly affected, by the proposed N4 Collooney to Castlebaldwin Realignment is given in Table 3. A description and location details of badger setts recorded during the current survey along and near the corridor of the *Proposed Road Development* is given in Table 4.

**Table 3** Breakdown of badger setts by category recorded along the corridor of the N4 Collooney to Castlebaldwin Realignment. Satellite setts include both subsidiary and outlier setts.

Sett category	Number in surveyed area	Number in direct line of Proposed Road Development
Active main setts	3	1
Active annexe / satellite setts	6	2
Inactive setts	6	3
<b>Total</b>	<b>15</b>	<b>6</b>

#### 3.1.1 Individual badger groups affected by the proposed route

An overview of the study area is presented in the Figures 12.3.1 to 12.3.8 contained within volume 3 of this EIS, with records of badger activity and dwellings identified on OSI orthophotography. The lands to the north of the proposed alignment are quite disturbed and habitats are suboptimal for badgers. Badgers are however present in the Markree estate to the east of the existing N4 road and evidence of foraging activity was recorded along the boundary of the woodland. Habitats along the proposed realignment corridor included scrub, dry grassland including the roadside verges, hedgerows and stone walls. Adjacent habitats were dominated by improved and semi-improved pasture with some wet grassland.

Surveys in 2006 identified a main active sett and three subsidiary setts directly south of Toberscanavan Loughs and due west of the proposed road alignment. There was no evidence that this badger group crossed the existing N4 in this area. From the follow-up surveys in Autumn 2010, Autumn 2012 and July 2013 it was confirmed that this badger community no longer occupied this area, with the setts having been removed prior to the 2012 survey. No setts were recorded to the north of Toberscanavan, to the Collooney roundabout. Two new, inactive satellite setts (both single entrance) were recorded during 2012 on the north and south side of the access road to the Cloonamahon HSE Facility, these were confirmed as inactive during the 2013 survey.

No badger setts or definite signs of badger activity were recorded along an extensive section of the proposed alignment from Doorly to Drumfin. South of Doorly the land is hilly and intensively grazed by sheep. Many of hedgerows to the west of proposed route have been well managed. The route traverses low-lying wet grassland (GS4) in the area of Lackagh and also and dry pasture (GA1) due north of Lough Corran. Around

Lough Corran, the habitat is predominantly semi-improved species-poor agricultural grassland. Again, the generally flat wet countryside in this area is not favorable to badgers. The proposed alignment includes a small corner of the cutover bog at Drumfin, dominated by willow scrub, an active single entrance sett was recorded at this location. An additional, inactive single entrance dwelling was also recorded in a hedgerow to the east. Evidence of badger foraging was found in this locality during all surveys; however, no dwellings were identified within the study area.

In the Cloonlurg area, the proposed road alignment crosses a minor tertiary road and passes through a large area of coniferous plantation. A single entrance sett was recorded to the north of this minor road, close to the location of a previously recorded main sett which is no longer present. Two active setts, one a main sett and one an active annexe site, were recorded from the coniferous woodland directly south of the proposed road corridor (approximately 80m). Although this area is fairly wet, extensive badger foraging was recorded within the line of the proposed road route during the 2012 survey; this confirms previous records of badger activity from this area from the 2006 survey. No change was recorded during the 2013 survey.

To the south of the Drumfin River in the townland of Carrownagark an active main sett and a number of annexe and outlier setts were recorded in 2006 and 2010. This badger group also used lands to the north of Carrownagark cross roads and a badger mortality was recorded here during April 2006. A dead badger was found close to the southern annexe sett during 2006 and appeared to have been shot. These setts were found to be no longer present during the 2012 survey and may have been removed or degenerated over time. No change was recorded in 2013.

In the townland of Kingsbrook, to the north of Aghalenane Lough, extensive badger foraging and trails were recorded leading into the immature woodland which dominates the higher ground. No badger setts were recorded from this area during the 2006 and 2010 surveys; however the thick plantation and bramble scrub meant this area could not be thoroughly searched during 2012/2013 and it is possible that a badger community / sett may exist in this area or in lands to the west. No badger setts were recorded from the line of the road to the north of Aghalenane Lough, which crosses lower ground which is predominantly wet. A previously identified inactive sett directly west of this lake was no longer present in 2013.

To the west of the existing N4 road corridor at Ardloy, three annexe setts which were identified as being inactive in both 2006 and 2010 were found to have been removed prior to the 2012 survey. No badger activity was recorded from this area in the 2013 survey.

Two active setts were recorded from the west facing elevated ground to the north of Ardloy Bridge in the townland of Tawnagh. These sets were both identified in the 2006 survey, one of which was identified as being inactive during 2010. Both setts are located directly east and close to the existing minor road which is crossed by the proposed road alignment from Ardloy. The southernmost, single entrance dwelling lies within the line of the road. A single entrance annexe sett associated with this badger community was identified to the southeast and was active during 2006. This dwelling is in the line of the proposed road corridor and was found to be inactive in 2010 and was no longer present in 2013.

The townland of Drumderry was found to contain a badger community in 2006, which was confirmed as active in 2010 and again in 2012. An active, three entrance sett was recorded from scrub habitat in the corner of a field, with an inactive single entrance dwelling recorded to the southwest along the same hedgerow. This inactive sett is within the line of the proposed realignment, while the active main sett is located approximately 40m from the road corridor. An additional active sett was recorded from the southern side of an elevated ringfort to the east in 2010 and was confirmed to be active in 2012. This sett is part of the same community. An inactive outlier sett recorded in 2006 and 2010 to the south of this community was found to no longer exist in 2013.

**Table 4** Description and location of badger setts recorded historically during 2006-2012 and during the current 2013 survey; along and near the corridor of the proposed N4 Collooney to Castlebaldwin Realignment.

Badger Community	Location	Description
Cloonamahan	Located 50m west of existing N4 in agricultural grassland.	<u>No longer exists</u>
	Located to the west of the existing N4 corridor, due south of Cloonamahan	<u>No longer exists</u>

Badger Community	Location	Description
	Located west of the existing N4, to the north of the access road to the HSE centre	Active outlier sett.
	Located to the south of the access road to the HSE centre, on the west side of the existing N4	Active outlier sett. Signs of recent activity
Drumfin	Located in scrub at the corner of the peatland complex	Active outlier sett with single entrance.
	Located along hedgerow boundary, to the north of the local road (L-5502-0).	Inactive, single entrance outlier sett.
Cloonlurg	Located to the north of the Ballymote Road (L-1502-32). Within the footprint of the proposed road development.	Inactive badger sett with two entrances. Signs of recent activity.
	Located at the western side of the coniferous plantation at Cloonlurg	Active main sett with nine entrances in a raised area of peat within the coniferous plantation. Extensive activity within this area.
	Located at the western side of the coniferous plantation at Cloonlurg	Active annexe sett with three entrances to the south of the main sett.
Carrownagark	A number of setts north of Carrownagark and to the east of the Drumfin River.	Active and inactive setts recorded during 2006-2010 now found to no longer exist.
	Located in line of proposed N4 on southern side of Carrownagark hill.	Active outlier sett, two entrances. In the line of the proposed road corridor.
	Located to the south of Carrownagark, along the hedgerow. In the line of the proposed road corridor.	Inactive, single entrance outlier sett. Recently used.
Kingsbrook	Located in hedgerow to the west of Lough Aghalenane.	Inactive sett recorded during 2006-2010 now no longer exists. Extensive badger activity recorded due northwest from elevated ground within the immature plantation.
Ardloy	A number of setts due north of the existing N4 alignment at Ardloy. Located within the proposed alignment and the SR/BP Type 01-No.1 spoil repository site.	Active and inactive setts recorded during 2006-2010 now found to no longer exist.
Tawnagh	Hill to the north of Ardloy Bridge, immediately north of proposed alignment.	Active sett. Three entrances.
	Located to the south of the above sett in the line of the proposed road corridor.	Active annexe sett. One entrance.
	Annex sett recorded in 2010. Located on elevated ground, south of the farmhouse; due south of the main sett listed above.	Now no longer present.
Drumderry	Located in scrub at corner of field boundary	Active main sett. Three entrances.

Badger Community	Location	Description
	Located along same hedgerow, due southwest.	Inactive, single entrance sett.
	Annexe sett recorded at the southwestern corner of the ringfort, adjacent to a recently constructed house.	Active annexe sett. One entrance.
Castlebaldwin	Due east of Castlebaldwin, within the CPO line of the local road realignment (L-1403-0).	Inactive single entrance dwelling, not recently used.
	Elevated ground to the south east and southwest of Castlebaldwin village contained badger dwellings during the 2006-2010 surveys Hill to the west of Castlebaldwin village (hedgerow south of school).	Badger dwellings previously recorded due south of Castlebaldwin were found to no longer exist during the 2012 survey.

During the 2006 survey, badger activity was recorded in the vicinity of Castlebaldwin village with setts recorded to the south west and south east of the village. In 2010 the dwelling to the southwest of the village, due south of the primary school was found to no longer exist. Furthermore the annexe sett, adjacent to the ringfort to the southeast of the village and recorded as active in 2010, also was no longer present. An additional inactive sett to the south of Castlebaldwin along the corridor of the Drumderry Stream was also no longer present. An inactive, single entrance dwelling was recorded to the east of the village, in the line of the proposed tertiary road realignment.

From an assessment of the results of the 2006-2012 surveys and the 2013 update survey of badger activity in the study area the overall conclusion is that there has been a decline in both the activity of badger communities and also in the number of badger dwellings within the study area of the proposed N4 realignment. Factors influencing this include recorded removal of setts and persecution of badgers (instance of shooting), in addition to a general trend of wet summers and high annual rainfall from 2006 to present which has led to wet ground conditions within the study area. This has potentially resulted in badgers removing to higher ground. The habitats within the study area are evaluated as being of sub-optimal potential for badger; however, where communities occur, these dwellings are assessed as being of local importance (higher value).

## 3.2 Otter

Otter *Lutra lutra* is a widespread Irish species and occurs along the Drumfin River within the study area. Footprints and spraints were found along the Drumfin River and Lough Corran outflow during the survey period. Otter activity including trails and sprainting were also recorded along the southern margin of Aghalenane Lough. These findings suggest that otters use the loughs in the study area to some degree. The otter is listed in Annex II of the EU Habitats Directive and is protected under the Irish Wildlife Acts 1976 and 2000; this species is evaluated as being Near Threatened in the most recent Red Data list for mammals (Marnell *et al.*, 2009). Habitats for otter in the study area are rated of local importance (higher value).

## 3.3 Pine marten

Pine marten *Martes martes* have been previously recorded in the general study area, but no evidence of the species was observed during the field survey period. Habitat for this species is sub-optimal along most of the route. Unsubstantiated, anecdotal records of sightings of these species were recorded from local landowners. However, it is noted that this species can be confused with the American Mink *Mustela vison*, which is common in the study area. In general, the study area is deemed to be local importance (higher value) for pine marten.

### 3.4 Irish stoat

Irish stoat *Mustela erminea hibernica*, a protected species under the Wildlife Acts 1976 and 2000, is likely to be frequent because of the abundance of rabbits - its main prey. Much of the study area is too low lying for occupation by rabbits but drier areas suitable for burrowing are considered to be of local importance (higher value for stoat).

### 3.5 Red squirrel

The red squirrel (*Sciurus vulgaris*) is listed as Near Threatened on the updated Irish Red Data List (Marnell *et al.*, 2009). This species is protected under the Wildlife Acts (1976 and 2000). No red squirrel were recorded during the field survey element of the current study; however, this species is known to occur within the study area; likely associated with larger estates such as the Markree Demesne to the east. There is a general lack of suitable habitat for this species in the study area. The study area is thought to be of local importance (lower value) for this species. Outside Markree Demesne, the most likely location where squirrel would occur is in the coniferous woodlands at Tobercanavan Loughs and Cloonlurg. Only the latter would be affected; this coniferous plantation is evaluated to be of local importance (lower value) with regard to its habitat value.

### 3.6 Hares and rabbits

The Irish hare *Lepus timidus hibernicus* is present within the survey area and was recorded throughout the study area during the fieldwork period. The Irish hare is protected under the Wildlife Acts 1976 and 2000. The study area contains some optimal habitat for the Irish hare and this species is evaluated as being of local importance (higher value).

Rabbits *Oryctolagus cuniculus* are widespread and common in the area and were the most common mammal recorded (signs and sightings) during the current survey. Rabbits are not protected in Ireland and are widely hunted.

### 3.7 Deer

The Fallow deer *Dama dama* is present in the general area; particularly in the woodlands at the northern section i.e. Tobercanavan and Markree Demesne. No signs of this species were recorded along the corridor during the current survey. Fallow deer are protected under the Wildlife Acts, but are also a quarry species, hunted under licence. The availability and suitability of habitats within the study area are evaluated as being of local importance (lower value).

### 3.8 Others

Other species present along the corridor are thought to include pygmy shrew *Sorex minutus*, hedgehog *Erinaceus europaeus*, wood mouse *Apodemus sylvaticus*, house mouse *Mus (musculus) domesticus* and brown rat *Rattus norvegicus*. Hedgehogs and shrews are protected under the Wildlife Acts. Fox *Vulpes vulpes* is widespread and common. Fox dens were found at a number of locations throughout the proposed route corridor and foxes were seen occasionally during the survey period. Foxes are not protected and are hunted as a pest. The study area of the proposed road route is of local importance (lower value) for the above species.

## 4 POTENTIAL IMPACTS

### 4.1 Introduction

The impact assessment methodology provided in the 'Guidelines for Assessment of Ecological Impacts of National Road Schemes' (NRA, 2009) is used to evaluate the importance of mammal populations found and to assess the significance of potential impacts affecting these species; the criteria for evaluating ecological interests is presented in Table 5. Table 6 presents the criteria for assessing the type of impact i.e. positive, negative or neutral; while Table 7 provides the criteria for assessing impact magnitude affecting the ecological receptors. In the current assessment, populations of mammals listed on Annex II of the EU Habitats Directive are limited to otter; while populations of species protected under Irish legislation (i.e. Wildlife Acts) and / or listed on Annex III of the Berne Convention or on Annex V of the EU Habitats Directive include badger, stoat, red squirrel, hedgehog, Irish hare, pygmy shrew and pine marten.

Following the NRA (2009) 'Guidelines for Assessment of Ecological Impacts of National Road Schemes', the population of otter within the study area would be evaluated as being of County Importance, occurring outside of a designated conservation site. Likewise the populations of badger within the study area would be evaluated as being of county importance, due to the well established network of main setts and outliers, occurring in densities above what would be normally expected in County Sligo. The remaining mammal species are evaluated as being of local importance. The impacts are divided into construction phase impacts and operation phase impacts. In line with the NRA (2009) 'Guidelines for Assessment of Ecological Impacts of National Road Schemes', the following terms are defined when quantifying duration of impacts:

- Temporary: up to 1 year;
- Short-term: from 1-7 years;
- Medium-term: 7-15 years;
- Long-term: 15-60 years;
- Permanent: over 60 years.

**Table 5** Criteria used to determine the value of ecological resources (NRA, 2009).

Importance	Criteria
International Importance	<p>- 'European Site' including Special Area of Conservation (SAC), Site of Community Importance (SCI), Special Protection Area (SPA) or proposed SAC/SPA sites.</p> <p>- Site that fulfils the criteria for designation as a 'European Site' (see Annex III of the Habitats Directive, as amended).</p> <p>- Features essential to maintaining the coherence of the Natura 2000 Network</p> <p>- Site containing 'best examples' of the habitat types listed in Annex I of the Habitats Directive.</p> <p>- Resident or regularly occurring populations (assessed to be important at the national level) of the following:</p> <p>Species of bird, listed in Annex I and/or referred to in Article 4(2) of the Birds Directive; and/or</p> <p>Species of animal and plants listed in Annex II and/or IV of the Habitats Directive.</p> <p>- Ramsar Site (Convention on Wetlands of International Importance Especially Waterfowl Habitat 1971).</p> <p>- World Heritage Site (Convention for the Protection of World Cultural &amp; Natural Heritage, 1972).</p> <p>- Biosphere Reserve (UNESCO Man &amp; The Biosphere Programme)</p> <p>- Site hosting significant species populations under the Bonn Convention (Convention on the Conservation of Migratory Species of Wild Animals, 1979).</p> <p>- Site hosting significant populations under the Berne Convention (Convention on the -</p>



Importance	Criteria
	<p>Conservation of European Wildlife and Natural Habitats, 1979).</p> <ul style="list-style-type: none"> <li>-Biogenetic Reserve under the Council of Europe.</li> <li>-European Diploma Site under the Council of Europe.</li> <li>-Salmonid water designated pursuant to the European Communities (Quality of Salmonid Waters) Regulations, 1988, (S.I. No. 293 of 1988).</li> </ul>
National Importance	<ul style="list-style-type: none"> <li>-Site designated or proposed as a Natural Heritage Area (NHA).</li> <li>-Statutory Nature Reserve.</li> <li>-Refuge for Fauna and Flora protected under the Wildlife Acts.</li> <li>-National Park.</li> <li>-Undesignated site fulfilling the criteria for designation as a Natural Heritage Area (NHA); Statutory Nature Reserve; Refuge for Fauna and Flora protected under the Wildlife Act; and/or a National Park.</li> <li>-Resident or regularly occurring populations (assessed to be important at the national level) of the following: <ul style="list-style-type: none"> <li>Species protected under the Wildlife Acts; and/or</li> <li>Species listed on the relevant Red Data list.</li> <li>Site containing 'viable areas' of the habitat types listed in Annex I of the Habitats Directive.</li> </ul> </li> </ul>
County Importance	<ul style="list-style-type: none"> <li>-Area of Special Amenity.</li> <li>-Area subject to a Tree Preservation Order.</li> <li>-Area of High Amenity, or equivalent, designated under the County Development Plan.</li> <li>-Resident or regularly occurring populations (assessed to be important at the County level) of the following: <ul style="list-style-type: none"> <li>Species of bird, listed in Annex I and/or referred to in Article 4(2) of the Birds Directive;</li> <li>Species of animal and plants listed in Annex II and/or IV of the Habitats Directive;</li> <li>Species protected under the Wildlife Acts; and/or</li> <li>Species listed on the relevant Red Data list.</li> </ul> </li> <li>-Site containing area or areas of the habitat types listed in Annex I of the Habitats Directive that do not fulfil the criteria for valuation as of International or National importance.</li> <li>-County important populations of species; or viable areas of semi-natural habitats; or natural heritage features identified in the National or Local BAP; if prepared.</li> <li>-Sites containing semi-natural habitat types with high biodiversity in a county context and a high degree of naturalness, or populations of species that are uncommon within the county.</li> <li>-Sites containing habitats and species that are rare or are undergoing a decline in quality or extent at a national level.</li> </ul>
Local Importance (higher value)	<ul style="list-style-type: none"> <li>-Locally important populations of priority species or habitats or natural heritage features identified in the Local BAP, if this has been prepared;</li> <li>-Resident or regularly occurring populations (assessed to be important at the Local level) of the following: <ul style="list-style-type: none"> <li>Species of bird, listed in Annex I and/or referred to in Article 4(2) of the Birds Directive;</li> <li>Species of animal and plants listed in Annex II and/or IV of the Habitats Directive;</li> <li>Species protected under the Wildlife Acts; and/or</li> </ul> </li> </ul>

Importance	Criteria
	<p>Species listed on the relevant Red Data list.</p> <p>-Sites containing semi-natural habitat types with high biodiversity in a local context and a high degree of naturalness, or populations of species that are uncommon in the locality;</p> <p>-Sites or features containing common or lower value habitats, including naturalised species that are essential in maintaining links and ecological corridors between features of higher ecological value.</p>
Local Importance (lower value)	<p>-Sites containing small areas of semi-natural habitat that are of some local importance for wildlife;</p> <p>-Sites or features containing non-native species that are of some importance in maintaining habitat links.</p>

**Table 6** Criteria for assessing impact type.

Impact type	Criteria
Positive impact	A change which improves the quality of the environment (for example by increasing species diversity; or improving the reproductive capacity of an ecosystem; or removing nuisances; or improving amenities).
Neutral	A change which does not affect the quality of the environment.
Negative impact	A change which reduces the quality of the environment (for example, lessening species diversity or diminishing the reproductive capacity of an ecosystem, or damaging health or property or by causing nuisance).

**Table 7** Criteria for assessing impact magnitude.

Impact magnitude	Definition
No change	No discernible change in the ecology of the affected feature.
Imperceptible Impact	An impact capable of measurement but without noticeable consequences.
Slight Impact	An impact which causes noticeable changes in the character of the environment without affecting its sensitivities.
Moderate Impact	An impact that alters the character of the environment that is consistent with existing and emerging trends.
Significant Impact	An impact which, by its character, magnitude, duration or intensity alters a sensitive aspect of the environment.
Profound Impact	An impact which obliterates sensitive characteristics.

## 4.2 Construction phase impacts

### 4.2.1 Impact on badgers

According to the National Road Authority publication '*Guidelines for the treatment of badgers prior to the construction of National road schemes*' (NRA, 2006), road developments can potentially cause significant direct and indirect impacts on badgers. Construction may result in death or injury to badgers within setts; as well as the destruction of setts, loss of foraging habitat or dissection of their foraging areas. Construction works close to breeding setts can cause serious disturbance to badgers and mortality of cubs. Where loss of habitat is likely to adversely affect the conservation status of the badger community in the local context, the impact may be considered as significant. Badgers may be killed or injured by road traffic as they attempt to access their

feeding areas. This can significantly affect the viability of badger groups in an area. There is also a risk of road collisions, as badgers attempt to cross roads to and from foraging areas.

Many of the general potential impacts on badgers outlined above apply for the proposed N4 Collooney to Castlebaldwin Realignment. The construction phase has the potential for the destruction of active and inactive setts, division of social groups and division of territories. Although the overall density of badger setts along the proposed route is low, the territories six or seven social groups are affected to some degree. The road directly impacts on the habitats used by four badger communities.

One active main sett and two active annex setts are in the direct line of the proposed realignment, with three inactive dwellings also in the proposed road line. Other active sets are located in close proximity to the proposed corridor and could potentially be impacted on by disturbance.

The loss of active badger setts due to the construction of the proposed road has been evaluated, and the potential for a significant adverse effect is identified with regard to the badger social group in the immediate locality; in the absence of mitigation. The potential scale of effects is evaluated as not significant with regard to badgers in the scale of the overall road corridor study area. Badger territories would be disrupted during the construction phase and during the operational phase of the road badgers may find that the corridor of the proposed alignment, in addition to the existing N4 comprises a barrier to mobility. Provisions for badger passage will therefore be required as mitigation. A summary of the potential impacts on badgers of the proposed N4 Collooney to Castlebaldwin realignment is provided in Table 8.

**Table 8** Summary of impacts of the proposed N4 Collooney to Castlebaldwin Realignment on badgers. All impacts are evaluated in the local context for this species.

Badger Community	Construction Phase Impacts	Operational Phase Impacts
Cloonamahan	Disturbance due to construction of online section of road and will be at a distance from any dwelling.	New road will run online; design stage mitigation will avoid any change in the local context.
Drumfin	Loss of single entrance annex sett will occur.	Foraging habitat will be lost and access to foraging areas will be prevented.
Cloonlurg	Loss of annex sett to the north of the main sett.  Construction phase disturbance is unlikely to affect the main sett at a distance from the road corridor.	Foraging habitat will be lost and access to foraging areas will be prevented in the absence of mitigation.  Suitable foraging habitat will remain to the north, west and south.
Carrownagark	Disturbance to foraging areas and loss of single active sett. Mitigation measures proposed for the closure of this sett.	Minor loss of foraging habitat will occur.
Kingsbrook	CPO area will result in loss of territory and may cause disturbance impacts.	Foraging habitat will be lost and access to foraging areas will be prevented in the absence of mitigation. However, more suitable habitat to the west, north and south will not be affected.
Ardloy	Construction phase disturbance will be mitigation to avoid significant impacts.	Foraging habitat will be lost and access to foraging areas between the existing and proposed road corridors will be prevented in the absence of mitigation.
Tawnagh	A single entrance active sett will require removal. The proposed route crosses an active territory at this location. Mitigation measures proposed for the closure of this sett.	Foraging habitat will be lost and access to foraging areas between the existing and proposed road corridors will be prevented in the absence of mitigation.

Badger Community	Construction Phase Impacts	Operational Phase Impacts
Drumderry	A single entrance inactive sett will require removal. The proposed route crosses an active territory at this location.	Foraging habitat will be lost and access to foraging areas will be prevented in the absence of mitigation.
Castlebaldwin	A single entrance inactive sett will require removal. The proposed route crosses a historical territory at this location.	Foraging habitat will be lost and access to foraging areas will be prevented in the absence of mitigation.

#### 4.2.2 Impact on otters

No otter holts were recorded during the current survey. Otter footprints and spraints were recorded along the Lough Corran outflow river, the Drumfin River and along the southern margins of Lough Aghalenane. Construction work in the vicinity of watercourses and aquatic habitats can result in noise disturbances affecting otters. Otters and other mammals are known to utilize culverts to pass under roads (Clevenger *et al*, 2001); however it is recommended that culverts are oversized to improve use by otters (Philcox, 1999). Culverts and bridges over the rivers and streams along the subject road corridor could, if not adequately designed, prevent movements of otters or encourage them to leave the river channel and cross the road itself which can lead to mortalities. Mitigation measures will be implemented to effectively reduce the significance of impacts affecting otter.

#### 4.2.3 Impact on pine martens, stoats and red squirrels

Although these species were not recorded during the current survey, it is likely that stoats are common in the area due to the abundance of rabbits. Stoats are extremely adaptable animals that should cope well with the changes in the local landscape that would occur as a result of the construction and operation of the Proposed Road Development. Impacts affecting the stoat population within the study area are evaluated as not being significant.

Pine marten and red squirrel activity is closely correlated, as both species require extensively connected woodland habitat. Both species are extremely elusive mammals that avoid anthropogenic activity. The proposed road alignment crosses coniferous plantation and some limited scrub habitat giving rise to the potential for a long term impacts on pine martens at a local level in the affected areas; however, impacts would not be significant with regard to the conservation status of this species at a local level. Red squirrel requires smaller territories within woodland habitats and would not be significantly affected by the *Proposed Road Development*.

#### 4.2.4 Impact on hares

Hares were recorded in a number of areas along the proposed road corridor. The main impact of the *Proposed Road Development* on hares would be habitat loss, habitat fragmentation, disturbance and potential road mortality. Many of the impacts can be mitigated. Disturbance during the construction phase would be minimised and the provision of badger/mammal fencing would serve to keep hares off the road. Mitigation measures proposed for the protection of mammals will be implemented to reduce the significance of impacts affecting hares.

#### 4.2.5 Impact on deer

Evidence of deer along the road corridor was not found and none of the landowners spoken to were aware of deer on their lands. Fallow deer are present in the Markree Demesne and there may be a risk of deer entering onto the existing road in this area, to the north of the alignment. There are no impacts potentially affecting deer identified with regard to the proposed realignment from Collooney to Castlebaldwin.

#### 4.2.6 Impact on other mammals

Rabbits are not a protected species and are considered to be a pest by many landowners. Many of the hedgerows along the proposed road corridor are used by rabbits and these areas would be lost. This would result in loss of rabbit warrens and also perhaps the death of rabbits still underground at the time of the

works. Loss of rabbit foraging areas would also occur. It is proposed to remove hedgerows and ditches slowly to allow rabbits to escape. Rabbits are an adaptable and fast breeding species and the overall impact on rabbits is not significant. Foxes are not a protected species and are regularly controlled by shooting. Foxes are widespread along the road corridor but no fox dens will be directly affected. Foxes will benefit from the mitigation measures proposed for protected mammal species within the study area. The impact of the *Proposed Road Development* on this adaptable species will not be significant.

### 4.3 Operation phase impacts

The existing N4 Collooney to Castlebaldwin road was built during a time when little priority was given to nature conservation or protection of wildlife. Indeed, the road is identified as a significant health and safety risk for drivers and several serious accidents have occurred in recent years. In addition to significantly improving safety for people using the road, the new realignment will also ensure that animal deaths on the roads are much reduced by providing appropriate mammal fencing and targeted underpasses along the route. The existing N4 has no underpasses or mammal-friendly culverts and there is evidence that this has contributed to habitat fragmentation in some areas along the route. In addition to keeping badgers off the road, which are a potential driving hazard, other animals such as otters, rabbits, and foxes will also be excluded and directed to the underpasses, mammal-friendly culverts and under-bridges along the route.

The proposed N4 Collooney to Castlebaldwin Realignment will therefore have the potential for positive impacts on local mammal populations through the provision of exclusion fences and mammal passes. Although most of the existing N4 will be left in place following the construction of the new road, traffic along this route will be much reduced following the construction of the new road and the reduced traffic and disturbance is expected to significantly reduce the impact that this road currently has on local habitat connectivity. The main impact of the *Proposed Road Development* would be habitat loss and habitat fragmentation. There is scope for mitigating against habitat fragmentation by providing badger underpasses. These are most cost effective when associated with culverts (or required passes for local farm access).

### 4.4 'Do-nothing' scenario

In the event that the N4 Collooney to Castlebaldwin Realignment was not developed traffic levels would continue above and beyond the capacity of the road. Traffic build ups and increasing use of other local roads and alternative routes would also be expected. This would increase disturbance of adjacent habitats. Mammals would continue to cross the road to access foraging grounds and the increase in traffic volumes would mean an increase in the risk of animal collisions. Ongoing deterioration of the study area in terms of habitat suitability and usage by badger communities is also expected due to overstock and poaching of suitable hedgerow habitats, direct persecution and wet ground conditions. This is evaluated as being in line with ongoing trends and would not be significant with regard to the conservation status of these species.

### 4.5 'Worst-case scenario'

A small number of badger setts are located along the route within the CPO boundary. In the worst-case scenario, all badger setts would be destroyed during the construction phase, where artificial setts would not be successful and where local badger populations would evacuate the works area. This would be a significant negative impact to badgers in the direct local context of the road corridor but would not be significant impact on this species when assessed at the scale of the wider study area or indeed at a County level.

## 5 MITIGATION MEASURES

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### 5.1 Mitigation for badgers

#### 5.1.1 Introduction

The general mitigation measures for badgers will closely follow the National Road Authority's '*Guidelines for the treatment of badgers prior to the construction of National Road Schemes*' document (NRA, 2006). The mitigation measures aim to provide proportional type mitigation responses. Measures proposed for each community are summarised in Table 9 and are presented in Figures 12.3.1 to 12.3.8 in Volume 3 of the EIS.

#### 5.1.2 Pre-construction survey

Badgers can dig new setts and start using unused setts again over time. It is therefore recommended that further surveying of badgers should be undertaken, as necessary, immediately prior to the construction phase, as per the NRA (2006) '*Guidelines for the treatment of badgers prior to the construction of National Road Schemes*'. Any necessary modifications to the proposed mitigation measures should be made to accommodate any changes recorded in the badger community due to increased activity or the reuse of abandoned setts. These changes should be agreed in advance with the local NPWS ranger.

#### 5.1.3 Badger evacuation measures

Prior to any work commencing in the vicinity of a badger sett that will be directly affected by the Proposed Road Development (including inactive setts) it must be ensured that badgers are excluded and evacuated. Badger evacuation procedures are outlined in the NRA (2006) '*Guidelines for the treatment of badgers prior to the construction of National Road Schemes*'. It is an offence under the Wildlife Act (1976) and the Wildlife (Amendment) Act (2000) to injure or kill badgers and any works requiring the closure of a sett require a license from the NPWS. A derogation license to exclude the setts within the development area will be sought from the National Parks and Wildlife Service. Standard measures to exclude badgers and to excavate the sett will be employed under the guidance and supervision of a suitably qualified and experienced ecologist to ensure that badgers are unharmed. Exclusions must not be carried out in the period January to July to ensure that breeding badgers are not affected. Excluding a lactating mother from a sett would lead to the death of dependent cubs. Excavation of a sett within this period could only occur if the sett is proven over a period of examination to be empty of badgers. However, it is obviously safer to avoid undertaking exclusions during the breeding period.

#### 5.1.4 Protection of setts

In advance of any construction works taking place, temporary fencing should be installed to protect all known badger setts along the proposed realignment route corridor. This fencing should be highly visible and should have notification of its purpose in reducing impacts to protected fauna. All contractors working on the site should be made aware of the presence of badger setts and their protection status, via a 'tool-box talk' to be provided by the Environmental Manager, or appointed ecologist, under the prescribed Environmental Operating Plan (following the requirements of the NRA guidance, 2006) responsible for monitoring and auditing the ecological elements of the construction works. In advance of any construction works taking place, temporary fencing should be installed to protect all known badger setts. Exclusion zones for badgers should be marked clearly on ecology drawings made available to the contractor responsible for the land clearance works at an early stage of the development. During the construction phase, the use of heavy plant and machinery within 30m of a badger sett will be restricted and only light digging by hand is permitted within 10m of an active sett. All site offices and depots will be sited at least 50m away from badger setts. No work will be undertaken at night, to avoid contact with badgers and to reduce the need for artificial lighting.

#### 5.1.5 Wildlife Underpasses

Based on the location and activity levels within the study area it is recommended that two dedicated badger / mammal underpasses are installed along the road alignment; this is taking account of the requirement for the provision of mammal ledges within all culverts greater than 1m in diameter. Underpasses are recommended for the badger communities at Carrownagark and at Drumderry. Details of construction of such underpasses

and locations are given below. The proposed location of these underpasses will be reviewed and agreed with the project ecologist, site engineers and NPWS at the advance design stage prior to construction.

Badgers typically follow the same established pathways between setts, feedings areas and latrines. These were identified within the study area on the basis of the presence of tracks and feeding scrapes. In most cases, these pathways occurred along features such as watercourses, hedgerows, treelines, woodland and scrub margins. Where existing pathways cross the line of the proposed realignment and are associated with an active badger community with a main sett, these have been selected as suitable locations for underpasses to facilitate the continued movement of animals within their territories. Where engineering difficulties are encountered at the selected sites, it is recommended that underpasses be moved to the nearest most suitable location, but not more than c. 250m away. Expert advice should be sought on design of underpasses prior to construction. Generally, tunnels should be constructed of concrete pipe no less than 600mm in diameter, and designed to ensure that they do not fill with debris or flood. Provision for drainage will be required to ensure that pipes do not flood and that entrances to underpasses do not become waterlogged. Impediments for stock to pass through underpasses (in particular lambs) may need to be incorporated (e.g. a steel bar across the pipe entrance may be used). The following general guidelines should be adhered to:

- If laid on flat ground the pipe will form a U with gently ascending and descending sides. At the lowest point a gap will be left in the pipe with a gravel soak-away to prevent flooding. Gradients in the underpass will not exceed 1:10 at any point.
- The exit and entrance to tunnels will be flush with badger-proof fencing and the invert set at ground level. A concrete surround will provide a solid connection to the uprights of the fence and inhibit any efforts by badgers to dig under the pipe. Drainage will be adequate to prevent water-logging at the entrances during wet weather.
- Specific design of underpasses will be tailored to individual locations and will be carried out at the detailed design stage.

Please refer to the next section on mitigation for otters regarding the requirements for culvert design. For full details of culvert design refer to best practice design for mammal underpasses at culverts and bridges (NRA, 2006). Detailed design stage will consider appropriate design for each crossing and mammal underpass.

#### 5.1.6 **Badger resistant fencing**

The requirements for badger-resistant fencing are specified in Figure 2 of the NRA (2006) '*Guidelines for the treatment of badgers prior to the construction of National Road Schemes*'. Fencing is required to prevent badgers from crossing the road alignment and to encourage the use of underpasses provided, thus reducing mortalities. It is noted that fencing the entire alignment has certain advantages over targeted fencing in the current situation. It is considered that a further option would be to fence the majority of the route, leaving open ground with level, grassy verges free of fencing providing easy and obvious escape routes for mammals to exit the road corridor should they become trapped with the road. However, for the current development, taking account of the proposed central median barrier, it is proposed to combine the requirement for fencing the CPO line utilising mammal fencing in order to limit animals entering the alignment at the outset.

Badger fencing should be extended along targeted sections at all culverts/bridges greater than 1m diameter and at the required underpasses. It is of particular importance to avoid gaps or weak points in fencing at awkward features such as undulating ground or streams, as badgers may exploit such weaknesses, thus negating the effectiveness of fencing. Badger resistant fencing is partially buried and turned underground to prevent badgers digging under it. Badger-resistant fencing should be incorporated at early stages of road construction, during erection of the permanent take-line fencing. The standard specification for fencing is plastic-coated, heavy gauge chain-link on timber post and rail. The chain-link will be buried for a depth of 200 mm vertically and extend a further 300 mm horizontally to prevent badgers from digging under it. In order to ensure that the mitigation measures are operating effectively, badger-resistant fencing should be properly maintained and underpasses checked for viability.

#### 5.1.7 **Artificial setts**

To compensate for the loss of active badger setts, alternative or artificial setts may have to be constructed. The requirement, location and design of any artificial setts will be agreed at the pre-construction / advanced design stage with the site ecologist, site engineers, and NPWS. The provision of artificial setts may be reviewed based on activity surveys directly prior to construction.

### 5.1.8 Badger sett destruction

The destruction of a successfully evacuated badger sett may only be conducted under the supervision of qualified and experienced personnel, under license from the NPWS. Prior to demolition works badgers using a sett are usually excluded from the sett over a period of about two weeks using 'one way gates', which block badgers from re-entering the sett. The possibility of badgers remaining within a sett must always be considered; suitable equipment should be available on hand to deal with badgers within the sett or any badgers injured during sett destruction. Destruction is usually undertaken with a tracked 12-25 ton digger, commencing at c. 25m from the outer sett entrances and working towards the centre of the sett, cutting c. 0.5m slices in a trench to a depth of 2m. Exposed tunnels may be checked for recent badger activity, with full attention paid to safety requirements in so doing. The sett should be destroyed from several directions, in the above manner, until only the central core of the sett remains. Once it is ensured that no badgers remain, the core may then also be destroyed and the entire area back-filled and made safe. Sett excavation should, preferably, be concluded within one working day, as badgers may re-enter exposed tunnels and entrances. A report detailing evacuation procedures, sett excavation and destruction, and any other relevant issues should be submitted to the NPWS, in fulfilment of usual wildlife license conditions.

**Table 9** Mitigation measures proposed for each badger community within the study area.

Badger Community	Mitigation measures recommended
Cloonamahan	<ul style="list-style-type: none"> <li>• Minimise disturbance during construction</li> <li>• Badger fencing</li> <li>• Tree planting within CPO as specified in the Landscape and Visual Impact Assessment (Chapter 10).</li> </ul>
Drumfin	<ul style="list-style-type: none"> <li>• Resurvey area during preconstruction phase.</li> <li>• Exclude badgers from active sett at construction.</li> <li>• Provide badger fencing</li> </ul>
Cloonlurg	<ul style="list-style-type: none"> <li>• Minimise disturbance during construction.</li> <li>• Badger fencing</li> <li>• Connectivity via clear-span bridge on Drumfin River to south, and access via local access road underpass to the north.</li> <li>• Tree planting within CPO as specified in the Landscape and Visual Impact Assessment (Chapter 10).</li> </ul>
Carrownagark	<ul style="list-style-type: none"> <li>• Minimise disturbance during construction.</li> <li>• Tree planting within CPO as specified in the Landscape and Visual Impact Assessment (Chapter 10).</li> <li>• Install badger underpass at Chainage 8400.00</li> </ul>
Kingsbrook	<ul style="list-style-type: none"> <li>• Minimise disturbance during construction.</li> <li>• Badger fencing.</li> <li>• Tree planting within CPO as specified in the Landscape and Visual Impact Assessment (Chapter 10).</li> <li>• Connectivity via local access road underpass.</li> </ul>
Ardloy	<ul style="list-style-type: none"> <li>• Minimise disturbance during construction.</li> <li>• Badger fencing.</li> <li>• Tree planting within CPO as specified in the Landscape and Visual Impact Assessment (Chapter 10).</li> </ul>
Tawnagh	<ul style="list-style-type: none"> <li>• Minimise disturbance during construction.</li> <li>• Badger fencing.</li> <li>• Tree planting within CPO as specified in the Landscape and Visual Impact Assessment (Chapter 10).</li> <li>• Connectivity via Springfield Stream crossing, local access road and additional</li> </ul>



Badger Community	Mitigation measures recommended
	mammal ledge to be provided on culvert of land drain to the south east.
Drumderry	<ul style="list-style-type: none"> <li>• Minimise disturbance during construction.</li> <li>• Badger fencing</li> <li>• Tree planting within CPO as specified in the Landscape and Visual Impact Assessment (Chapter 10).</li> <li>• Install badger underpass at Chainage 12600.00</li> </ul>
Castlebaldwin	<ul style="list-style-type: none"> <li>• Minimise disturbance during construction.</li> <li>• Badger fencing</li> <li>• Tree planting within CPO as specified in the Landscape and Visual Impact Assessment (Chapter 10).</li> <li>• Connectivity via mammal ledges at culverts over Drumderry Stream and minor tributary of the Drumderry Stream at the extreme south of the alignment.</li> </ul>

## 5.2 Mitigation measures for otters

Temporary fencing (paling with 25 mm mesh) will be erected along the riparian margins of river corridors when construction work takes place to prevent otters accessing the site works. This fencing will be regularly monitored for damage. No work will be undertaken at night to avoid contact with otters and to reduce the need for light. The provision of badger / mammal fencing will serve to reduce the potential for otter entering the road corridor. All culverts/bridges greater than 1m in diameter will be designed to be passable by badgers/otters by providing a ledge on both banks, following NRA (2008b) '*Guidelines for the treatment of Otters prior to the construction of National Road Schemes*'. The ledge should be elevated above normal flood levels. An alternative approach to the provision of a ledge is a separate pipe culvert (600 mm) set above flood level adjacent to the stream culvert. Badger proof fencing will be installed at both sides of the road to ensure that otters do not enter onto the road alignment above watercourse crossings.

## 5.3 Mitigation measures for pine martens, stoats and squirrels

These species were not recorded during the current survey. It is proposed to remove hedgerows and ditches slowly to ensure that any stoats, pine marten or squirrels present can escape. This will be done regardless due to practical constraints. Ongoing monitoring for this and other species will be undertaken by the site ecologist. This species will benefit from the mitigation measures which will be provided for badgers. It is recommended that red squirrel nest boxes are incorporated into woodland compensation measures, the number of which is subject to consultation with the NPWS. Should a breeding den for pine marten be recorded from within the proposed road route or within the impact zone (ca. 50m), a license to close the den will be required from the NPWS. If a den is found, no works will be carried out during the breeding season (this can range from February to August).

## 5.4 Mitigation measures for other mammals

The provision of badger/mammal fencing would keep hares off the road. Hares would also use the underpasses to be provided at bridges/culverts and in specific areas, as part of the mitigation measures in place to reduce mammal mortalities on the road alignment. There are no recommendations for mitigation measures for deer species within the study area of the realignment.

It is proposed to remove hedgerows and ditches slowly to allow rabbits to escape. No specific mitigation measures are required for this species. Foxes occurring within the study area will benefit from the mitigation measures provided for badgers including the provision of underpasses and mammal fencing along the road corridor.

## 6 RESIDUAL IMPACTS

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### 6.1 Introduction

The residual impacts of the N4 Collooney to Castlebaldwin Realignment on non-volant mammals are those impacts that remain, after implementation of the mitigation measures described above. Though difficult to quantify, the magnitude of the residual impacts are considered not to be significant in the long term. This is predicted based on the low densities of protected mammal species occurring within the study area in addition to the widely available similar value habitat within the study area taking account of those habitats that are lost along the road corridor. Residual impacts relating to certain mammals are discussed below.

### 6.2 Residual impact on badgers

The residual impact of the proposed N4 Collooney to Castlebaldwin Realignment on badgers, following mitigation, is assessed as being not significant in the local context of each individual community, during both the short term construction and long term operational phase of the *Proposed Road Development*. The badger populations within the study area are evaluated as being of local importance (higher value). The road will result in the disruption of up to nine badger social groups along the route corridor and will result in the direct loss of at least one active main sett and two active annex / outlier setts. Other setts may also be lost due to disturbance impacts, as a result of their proximity to the Proposed Road Development. It is considered that the additional 3 inactive annexe / outlier setts within the realignment may become active prior to construction. In addition to impacts on setts the road will result in disturbance to foraging areas, habitat fragmentation and restriction of access to water in some cases. Mitigation measures have been provided to reduce the potential impacts and these will allow badgers to continue to use the local area following the completion of the project. Overall the study area presents sub-optimal habitat for badgers, with evidence of a depletion in badger territories and loss of previously recorded dwellings between the period 2006 to 2012. In the context of ongoing trends and taking account of the mobility of badger communities within the study area and the mitigation measures provided the predicted impacts are evaluated as not significant with regard to the conservation status of this species.

### 6.3 Residual impact on otters

With the provision of suitably designed culvert structures and badger/mammal proof fencing, the impacts on otters in the local area can be reduced to below significant levels in the local context, with no significant impacts expected at a County level outside of the current study area.

### 6.4 Residual impact on pine martens, stoats and squirrels

Although these species were not recorded during the current survey, it is likely that stoats are common in the area due to the presence of significant numbers of rabbits. Stoats are extremely adaptable animals that should cope well with the changes in the local landscape that would occur as a result of the construction and operation of the *Proposed Road Development*. They would also use the underpasses described above. Stoats will live in close proximity to human disturbance and the operation of the Proposed Road Development is not considered to pose a significant impact to this species. With the mitigation measures proposed, impacts on this species would be expected to be below significant levels in the local context. Red squirrel and Pine marten populations associated with affected woodland habitats will also be affected; however, residual impacts are evaluated as being below significant levels for both species.

### 6.5 Residual impact on hares

Hares were recorded in a number of areas along the proposed road corridor. The main impact of the *Proposed Road Development* on hares would be habitat loss, habitat fragmentation, disturbance and potential road mortality. Many of the impacts can be mitigated. Disturbance during the construction phase would be minimised and the provision of badger/mammal fencing would keep hares off the road. Hares would also use the underpasses to be provided at bridges/culverts and in specific areas as part of the badger mitigation measures. Overall, residual impacts on hares will be below significant levels.

## 7 MONITORING

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Badgers can dig new setts and start using unused setts again over time. It is therefore recommended that further surveying of badgers should be undertaken, as necessary, immediately prior to the construction phase, as per the NRA (2006) '*Guidelines for the treatment of badgers prior to the construction of a National Road Scheme*'. Any necessary modifications to the proposed mitigation measures should be made to accommodate any changes in the badger communities recorded along the road corridor; should new setts or reactivated setts be recorded. These changes should be agreed in advance with the local NPWS ranger.

Mammal activity should also be monitored during the construction phase and the efficacy of the mitigation measures proposed should be monitored following construction of the Proposed Road Development. Details of construction and operational phase monitoring will need to be agreed with NPWS at the pre-construction phase. The installation of artificial setts for badgers will require a detailed monitoring programme to establish the success of the setts. Construction and operational phase monitoring will be implemented by the Environmental Assurance Officer, or qualified ecologist appointed as necessary by the Environmental Assurance Officer, as per the guidance set out in the NRA Environmental Operating Plan.

Badger-resistant fencing needs to be properly maintained and underpasses checked periodically in the first two years to ensure that they remain clear of debris or have not become waterlogged. Upon completion of the road construction, quarterly monitoring should be carried out to determine the success of the measures employed. Monitoring should be continued for at least one year after construction work ceases. Any deficiencies in the measures should be reported to local NPWS ranger and corrected where possible. Where the site in question is outside the road land take, such monitoring can only be undertaken with the permission of the landowner.

## 8 REINSTATEMENT

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The requirement for providing alternative, artificial badger setts will be discussed with NPWS local staff during the pre-construction stage. There is a requirement for measures along the corridor of the road to reinstate foraging and commuting routes for mammals in the form of mammal underpasses to ensure continuity of territories. Additional measures would include the purposeful planting of linear scrub and treeline species to maintain wildlife corridors outside of the site, for example to the north of the new road in the vicinity of Lough Corran and Aghalenane / Ardloy Loughs. The landscaping plan for the road corridor has been designed in consultation with the project ecologists to ensure that the benefit of such measures to wildlife are maximized.

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## 10PLATES

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**Plate 1** Representative photo of an active badger sett with bedding at the entrance. Taken from the study area during the 2006 survey.



**Plate 2** Active sett north of Cloonlurg (2010).



**Plate 3** One entrance of the nine entrance main sett recorded in a peat bank in the conifer plantation at Cloonlurg (2012).



**Plate 4** Badger sett at Tawnagh recorded as active between 2006 and 2012.



**Plate 5** 'Snuffle holes' – a sign of recent badger feeding activity.



**Plate 6** A badger latrine.



**Plate 7** Badger road mortality along the existing N4 to the north of the Carrownagark cross-roads. This was the only badger road mortality recorded during the current survey.



**Plate 8** Dead badger (apparently shot) near the proposed N4 corridor at Carrownagark (2006).