

Appendix A

A.4.2 Ecological Constraints Report

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**N6 GALWAY CITY TRANSPORT PROJECT
ECOLOGICAL CONSTRAINTS REPORT**

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1 Introduction

This report details the methodologies and results of the ecological surveys carried out to inform the route selection process for the N6 Galway City Transport Project (N6 GCTP).

This report is intended to provide supplementary information to the contents of **Chapter 4** of the N6 GCTP Route Selection Report (**Section 4.3 Ecology**), and should be read in conjunction with that text and the accompanying mapping figures (**Figures 4.3.1 to 4.3.23**).

The focus of this report is on the survey methodologies and findings of the desk review and field surveys in collating and recording the ecological baseline with respect to habitats and rare/protected species within the N6 GCTP Study Area (scheme study area). The ecological constraints, as they relate to designated sites for nature conservation, are described in full in **Chapter 4** of the N6 GCTP Route Selection Report (**Section 4.3 Ecology**).

Section 2 of this report outlines the relevant legislation, policy and guidance documents which informed the process of collating ecological baseline data for the scheme study area and preparing the ecological section of the Constraints chapter. The collation of desktop data is described in **Section 3**. **Section 4** details the methodologies and results relating to the habitat and species surveys. References are presented in **Section 5**.

2 Relevant Legislation, Policy Documents and Plans, and Guidance Documents

The collation of ecological baseline data and the preparation of the ecological constraints chapter has had regard to the following legislation, policy and guidance documents.

2.1 Relevant Legislation and Policy

Legislation:

- *Council Directive 92/43/EEC of 21 May 1992 on the conservation of natural habitats and of wild fauna and flora*, hereafter referred to as the Habitats Directive;
- *Directive 2009/147/EC of the European Parliament and of the Council of 30 November 2009 on the conservation of wild birds*, hereafter referred to as the Birds Directive;
- *European Communities (Birds and Natural Habitats) Regulations, 2011 (S.I. No. 477 of 2011)*, hereafter referred to as the Birds and Habitats Regulations;
- *Directive 2014/52/EU of the European Parliament and of the Council of 16 April 2014 amending Directive 2011/92/EU on the assessment of the effects of certain public and private projects on the environment*, hereafter referred to as the EIA Directive;

- *Planning & Development Act 2000 & the Planning and Development (Amendment) Act, 2010 (as amended)*, hereafter referred to as the Planning Acts;
- *Wildlife Acts 1976 to 2012*, hereafter referred to as the Wildlife Acts;
- *Flora (Protection) Order, 1999 (S.I. No. 94 of 1999)*; and
- *Fisheries (Consolidation) Act, 1959 (as amended)*, hereafter referred to as the Fisheries Act.

Policies and Plans:

- *Actions for Biodiversity 2011-2016. Ireland's National Biodiversity Plan* (Department of Arts, Heritage and the Gaeltacht, 2011);
- *Galway County Development Plan 2015-2021* (Galway County Council, 2015);
- *Biodiversity Action Plan for County Galway 2008-2013* (Galway County Council, 2008);
- *Galway City Draft Biodiversity Action Plan 2014-2024* (Galway City Council, 2013);
- *Galway City Development Plan 2011-2017* (Galway City Council, 2011); and
- *Bearna Local Area Plan 2007 – 2017* (Galway County Council, 2007a).

2.2 Guidance Documents

Guidance Documents:

- *Guidelines on the information to be contained in Environmental Impact Statements* (Environmental Protection Agency, 2002);
- *Advice Notes on Current Practice (in the preparation of Environmental Impact Statements)* (Environmental Protection Agency, 2003);
- *Guidelines for Ecological Impact Assessment in the United Kingdom* (Institute of Ecology and Environmental Management, 2006);
- *Environmental Impact Assessment of National Road Schemes – A Practical Guide* (National Roads Authority, 2008);
- *Guidelines for Assessment of Ecological Impacts of National Road Schemes* (National Roads Authority, 2009);
- *Ecological Surveying Techniques for Protected Flora and Fauna during the Planning of National Road Schemes* (National Roads Authority, 2008);
- *Bat Surveys: Good Practice Guidelines, Second Edition* (Hundt, 2012);
- *The Bat Workers' Manual, 2nd Edition* (Mitchell-Jones & McLeish, 1999);
- *Bat Mitigation Guidelines for Ireland. Irish Wildlife Manuals, No. 25.* (Kelleher & Marnell, 2006);

- *Best Practice Guidelines for the Conservation of Bats in the Planning of National Road Schemes* (National Roads Authority, 2006);
- *Design Manual for Roads and Bridges: Volume 10: Environmental Design and Management. Section 4: Nature Conservation: Part 3, HA 80/99; Nature Conservation Advice in Relation to Bats* (The Highways Agency, 2001);
- *Circular NPW 1/10 & PSSP 2/10 Appropriate Assessment under Article 6 of the Habitats Directive: Guidance for Planning Authorities* (National Parks & Wildlife Service, 2010);
- *Circular Letter PD 2/07 and NPWS 1/07 Compliance Conditions in respect of Developments requiring (1) Environmental Impact Assessment (EIA); or (2) having potential impacts on Natura 2000 sites* (National Parks & Wildlife Service, 2007); and
- *Circular Letter NPWS 2/07 Guidance on compliance with Regulation 23 of the Habitats Regulations 1997 – strict protection of certain species/applications for derogation licences* (National Parks & Wildlife Service, 2007).

3 Desktop Study

3.1 Methodology

The desktop study involved collection and review of relevant published and unpublished sources of data, collation of existing information on the ecological environment and consultation with relevant statutory bodies.

3.1.1 Desktop Data Sources

The following sources were consulted during the desktop study and informed the constraints study:

- Online data available on Natura 2000 sites (hereafter referred to as European sites)¹ and designated sites protected at the national level (i.e. Natural Heritage Areas, or NHAs, and proposed Natural Heritage Areas, or pNHAs) as held by the National Parks and Wildlife Service (NPWS). Available online at <www.npws.ie/protectedsites/> and <<http://webgis.npws.ie/npwsviewer/>>. Accessed 23/05/2014;
- National Biodiversity Data Centre (NBDC) Online Database. Available online at <<http://maps.biodiversityireland.ie/#/Map>>. Accessed 23/05/2014;

¹ European sites, are defined under the Habitats Directive (Article 3) as a European ecological network of Special Areas of Conservation and Special Protection Areas, composed of sites which host the natural habitat types listed in Annex I and habitats of the protected species listed in Annex II. The aim of the network is to aid the long-term survival of Europe's most vulnerable and threatened species and habitats. In Ireland these sites are designated as European sites – defined under the Planning Acts and/or Birds and Habitats Regulations as (a) a candidate site of Community importance, (b) a site of Community importance, (c) a candidate special area of conservation, (d) a special area of conservation, (e) a candidate special protection area, or (f) a special protection area. They are commonly referred to in Ireland as Special Areas of Conservation (SACs) and Special Protection Areas (SPAs).

- Ordnance Survey Ireland (OSI) orthophotography (from 2012) for the scheme study area;
- Records of rare and protected species for the 10km grid squares M22 and M32, provided by the NPWS;
- Habitat and species GIS datasets provided by the NPWS;
- Bat records from Bat Conservation Ireland's (BCI) database;
- *N6 Galway City Outer Bypass. Environmental Impact Statement* (RPS, 2006);
- *N59 Maigh Cuilinn (Moycullen) Bypass Road Project Environmental Impact Statement* (Galway County Council/Roscommon National Roads Design Office, 2011);
- Series of ecological reports carried out by RPS relating to the proposed R336 to N59 Road Scheme, Co. Galway (RPS, 2012a; RPS, 2012b; RPS, 2013a; RPS, 2013b; and, RPS, 2013c);
- *Galway City Habitat Inventory. Galway City Council* (Natura Environmental Consultants, 2005) – including digital mapping dataset;
- *The Wildflowers of Merlin Woods and The Butterflies of Merlin Woods* (Stanley 2013a and 2013b);
- *Galway City Council Ardaun Local Area Plan Habitat Assessment* (Natura Environmental Consultants, 2012);
- *Coastal Habitat Study for Bearna* (Galway County Council, 2007b);
- *Merlin Park Woodland Habitat Survey and Management Plan* (Browne, & Fuller, 2009);
- *Pseudorchis albida at Doughiska, Galway City – Report of a search in May-June 2005* (Roden, 2005);
- *Galway Harbour Extension Environmental Impact Statement* (Galway Harbour Company, 2014);
- *The Barna Woods Project, Biodiversity Report* (Browne et al., 2009);
- Results of the NBDC's 'Bioblitz' event at the NUI Galway campus;
- *The phytosociology and ecology of the aquatic and the wetland plant communities of the Lower Corrib Basin, Co. Galway*. Proceedings of the Royal Irish Academy 90B (5) (Mooney & O'Connell, 1990); and
- Various environmental planning reports relating to developments associated with NUI Galway (McCarthy, Keville & O'Sullivan, 2014a; McCarthy, Keville & O'Sullivan, 2014b; McCarthy, Keville & O'Sullivan, 2009a; McCarthy, Keville & O'Sullivan, 2009b; McCarthy, Keville & O'Sullivan, 2011; A.P. McCarthy Planning Consultants, 2007a and 2007b; and, Moore Group, 2011);
- Other environmental planning reports from within the N6 scheme study area (Tobin Consulting Engineers, 2004; EIS Limited, 2005; Crushell, 2009).

3.1.2 Consultation

The following organisations/individuals with relevance to collating information on ecological constraints were consulted as part of the constraints study.

- National Parks & Wildlife Service (NPWS);
- Inland Fisheries Ireland (IFI);
- BirdWatch Ireland (BWI);
- Bat Conservation Ireland (BCI);
- Kate McAney-Vincent Wildlife Trust; and
- Other members of the public with local knowledge/records (e.g. relating to bat roosts).

3.2 Results

3.2.1 Flora

Desktop records of protected, rare, or other notable plant species are listed below in **Table 3.1**. Where a grid reference is available for the record, the location is mapped on **Figure 4.3.4**.

Table 3.1 Records of Protected, Red-listed or Notable Flora Recorded from the Desk Study within the scheme study area

Common Name/ Scientific name	Legal Status ²	Red List Status ³	Source
Slender cottongrass <i>Eriophorum gracile</i>	FPO	Rare	NPWS online database ⁴ Galway City Council (2013) Galway Harbour Company (2014)
Small-white orchid <i>Pseudorchis albida</i>	FPO	Vulnerable	Galway City Council (2013) Galway Harbour Company (2014) Natura Environmental Consultants (2012) Roden (2005)
Chives <i>Allium schoenoprasum</i>	FPO	Rare	NPWS online database record NBDC online database record ⁵
Henbane <i>Hyoscyamus niger</i>	none	Rare	NBDC online database record
Northern yellow-cress <i>Rorippa islandica</i>	none	Rare	NBDC online database record
Blue fleabane <i>Erigeron acer</i>	none	Endangered	NBDC online database record

² HDII/IV/V = Habitats Directive Annexes II/IV/V; FPO = Flora (Protection) Order, 1999; WA = Wildlife Acts

³ Vascular Flora from the Irish Red Data Book 1 Vascular Plants (Curtis & McGough, 2005)

⁴ National Parks and Wildlife Service (NPWS) online database (<http://webgis.npws.ie/npwsviewer/>) accessed in May 2014.

⁵ National Biodiversity Data Centre (NBDC) records (<http://maps.biodiversityireland.ie/#/Map>) accessed in May 2014.

Common Name/ Scientific name	Legal Status ²	Red List Status ³	Source
Cornflower <i>Centaurea cyanus</i>	none	Endangered	NBDC online database record
Funck's rustwort <i>Marsupella funckii</i>	none	Near threatened	NPWS online database record
Fine-leaved marsh feather-moss <i>Campyliadelphus elodes</i>	none	Near threatened	NPWS online database record NBDC online database record
Lesser striated feather- moss <i>Eurhynchium striatulum</i>	none	Near threatened	NPWS online database record NBDC online database record
Red-neck forklet-moss <i>Dicranella cerviculata</i>	none	Near threatened	NPWS online database record
Saltmarsh thread-moss <i>Bryum salinum</i>	none	Near threatened	NPWS online database record NBDC online database record
Woodsy thyme-moss <i>Plagiomnium cuspidatum</i>	none	Near threatened	NPWS online database record NBDC online database record

The majority of the bryophyte species proposed for inclusion in the proposed revised Flora Protection Order legislation were considered highly unlikely to occur within the scheme study area, based on a review of the habitat preferences for each species and on the habitats present within the scheme study area. Two species were considered to have potential to occur: Varnished hook-moss *Hamatocaulis vernicosus*, which was subject to a dedicated survey; and, Veilwort *Pallavicinia lyellii*, which is known to occur on wet, peaty ground in bogs and mires, such as that found in the peaty areas in the western part of the scheme study area.

3.2.2 Fauna

There are a number of European and Nationally protected mammal, bird, fish and amphibian species which have been recorded within the scheme study area. These are summarised in **Table 3.2** below. In the case of bird species, only those species listed in Annex I of the Birds Directive or on the Birds of Conservation Concern in Ireland (BoCCI) Red List are included in the table below.

Table 3.2 Records of Protected, Red-listed or Notable Fauna from the Desktop Study within the scheme study area

Common Name/ Scientific name	Legal Status ⁶	Red List Status ⁷	Source
Amphibians			
Common frog <i>Rana temporaria</i>	HD_V, WA	Least concern	NBDC online database record McCarthy, Keville & O'Sullivan (2009b) A.P. McCarthy Planning Consultants (2007)
Smooth newt <i>Triturus vulgaris</i>	WA	Least concern	NBDC online database record ⁸
Reptiles			
Common lizard <i>Lacerta vivipara</i>	WA	Least concern	NBDC online database record
Mammals (Terrestrial)			
Badger	WA	Least concern	Browne & Fuller (2009) Galway City Council (2013) McCarthy, Keville & O'Sullivan (2014a) NBDC online database record Galway County Council/Roscommon National Roads Design Office (2011) RPS (2006) RPS (2013b)
Otter <i>Lutra lutra</i>	HD_II & IV, WA	Near threatened	Browne <i>et al.</i> (2009) Galway City Council (2013) Galway Harbour Company (2014) NBDC online database record Galway County Council/Roscommon National Roads Design Office (2011) RPS (2006) RPS (2013b)
Lesser horseshoe bat <i>Rhinolophus hipposideros</i>	HD_II & IV, WA	Least concern	BCI database record ⁹ Galway City Council (2013) McCarthy, Keville & O'Sullivan (2014a) McCarthy, Keville & O'Sullivan (2014b) NBDC online database record

⁶ HD_II/IV/V = Habitats Directive Annexes II/IV/V; WA = Wildlife Acts; BD_I/II/III = Birds Directive Annex I/II/III; OSPAR = Convention for the protection of the marine environment of the North-east Atlantic 1992

⁷ Mammal Red-list from Marnell *et al.*, 2009; Birds from Birds of Conservation Concern in Ireland (Colhoun & Cummins, 2013); Fish and Amphibians from King *et al.*, 2011; Non-Marine Molluscs from Byrne *et al.*, 2009

⁸ National Biodiversity Data Centre (NBDC) records (<http://maps.biodiversityireland.ie/#/Map>) accessed in May 2014.

⁹ Bat Conservation Ireland (BCI) database record accessed in October 2014

Common Name/ Scientific name	Legal Status ⁶	Red List Status ⁷	Source
			Galway County Council/Roscommon National Roads Design Office (2011) RPS (2006)
Natterer's bat <i>Myotis nattereri</i>	HD_IV, WA	Least concern	BCI database record NBDC online database record RPS (2006) RPS (2013a)
Brandt's bat/Whiskered bat <i>Myotis brandtii</i> / <i>Myotis mystacinus</i>	HD_IV, WA	Data deficient/ least concern	BCI database record
Unidentified <i>Myotis</i> spp. bat	HD_IV, WA	Least concern	BCI database record McCarthy, Keville & O'Sullivan (2014a) McCarthy, Keville & O'Sullivan (2014b) NBDC online database record
Brown long-eared bat <i>Plecotus auritus</i>	HD_IV, WA	Least concern	BCI database record Browne, A. & Fuller, J. (2009) Galway City Council (2013) McCarthy, Keville & O'Sullivan (2014a) NBDC online database record Galway County Council/Roscommon National Roads Design Office (2011) RPS (2006) RPS (2013a)
Daubenton's bat <i>Myotis daubentonii</i>	HD_IV, WA	Least concern	BCI database record Galway City Council (2013) McCarthy, Keville & O'Sullivan (2014a) McCarthy, Keville & O'Sullivan (2014b) NBDC online database record RPS (2006)
Leisler's bat <i>Nyctalus leisleri</i>	HD_IV, WA	Least concern	A.P. McCarthy Planning Consultants (2007a) BCI database record Galway City Council (2013) McCarthy, Keville & O'Sullivan (2014a) McCarthy, Keville & O'Sullivan (2014b) McCarthy, Keville & O'Sullivan (2009b) NBDC online database record Galway County Council/Roscommon National Roads Design Office (2011)

Common Name/ Scientific name	Legal Status ⁶	Red List Status ⁷	Source
			RPS (2013a)
Soprano pipistrelle <i>Pipistrellus pygmaeus</i>	HD_IV, WA	Least concern	A.P. McCarthy Planning Consultants (2007a) BCI database record Browne <i>et al.</i> (2009) Browne & Fuller (2009) Galway City Council (2013) Galway County Council/Roscommon National Roads Design Office (2011) McCarthy, Keville & O'Sullivan (2014a) McCarthy, Keville & O'Sullivan (2014b) McCarthy, Keville & O'Sullivan (2009b) NBDC online database record RPS (2006) RPS (2013a)
Common pipistrelle <i>Pipistrellus pipistrellus</i>	HD_IV, WA	Least concern	A.P. McCarthy Planning Consultants (2007a) BCI database record Galway City Council (2013) McCarthy, Keville & O'Sullivan (2014a) McCarthy, Keville & O'Sullivan (2014b) McCarthy, Keville & O'Sullivan (2009b) NBDC online database record RPS (2006) RPS (2013a)
Hedgehog <i>Erinaceus europaeus</i>	WA	Least concern	Galway City Council (2013) NBDC online database record
Irish hare <i>Lepus timidus subsp. hibernicus</i>	HD_V, WA	Least concern	Galway City Council (2013) NBDC online database record RPS (2013b)
Pine marten <i>Martes martes</i>	HD_V, WA	Least concern	Galway City Council (2013) Galway County Council/Roscommon National Roads Design Office (2011) NBDC online database record
Red squirrel <i>Sciurus vulgaris</i>	WA	Near threatened	Browne & Fuller (2009) NBDC online database record
Pygmy shrew <i>Sorex minutus</i>	WA	Least concern	Galway City Council (2013) NBDC online database record
Stoat <i>Mustela erminea</i>	WA	Least concern	Galway City Council (2013) NBDC online database record

Common Name/ Scientific name	Legal Status ⁶	Red List Status ⁷	Source
Fish ¹⁰			
Atlantic salmon <i>Salmo salar</i>	HD_II & V (in freshwater), OSPAR	Vulnerable	Galway Harbour Company (2014) O'Connor (2007)
Sea lamprey <i>Petromyzon marinus</i>	HD_II, OSPAR	Near threatened	NBDC online database record O'Connor (2007)
Brook lamprey <i>Lampetra planeri</i>	HD_II	Least concern	Galway City Council (2013) O'Connor (2007)
Eel <i>Anguilla anguilla</i>	OSPAR	Critically endangered	Galway Harbour Company (2014) NBDC online database record
Crustaceans			
White-clawed crayfish <i>Austropotamobius pallipes</i>	HD_II & V, WA	Endangered	NBDC online database record RPS (2006) ¹¹ O'Connor (2007)
Invertebrates			
Marsh fritillary butterfly <i>Euphydryas aurinia</i>	HD_II	Vulnerable	Barron <i>et al.</i> (2013)
Wall butterfly <i>Lasiommata megera</i>	none	Endangered	NBDC online database record Galway County Council/Roscommon National Roads Design Office (2011)
Dark green fritillary butterfly <i>Argynnis aglaja</i>	none	Vulnerable	NBDC online database record
Wood white butterfly <i>Leptidea sinapis</i>	none	Near threatened	NBDC online database record Galway County Council/Roscommon National Roads Design Office (2011) Stanley (2013a)
Gatekeeper butterfly <i>Pyronia tithonus</i>	none	Near threatened	NBDC online database record
Dingy skipper butterfly <i>Erynnis tages</i>	none	Near threatened	NBDC online database record Galway County Council/Roscommon National Roads Design Office (2011)
Large heath butterfly <i>Coenonympha tullia</i>	none	Vulnerable	Galway County Council/Roscommon National Roads Design Office (2011)
Small heath butterfly <i>Coenonympha pamphilus</i>	none	Near threatened	Galway County Council/Roscommon National Roads Design Office (2011)

¹⁰ Inland Fisheries Ireland (IFI) noted in their consultation response that the Bearna Stream supports Brown trout and Eel, with trout spawning habitat present. Brown trout are also found in the Tonabrocky and Cappagh Streams and likely to be present in the Trusky and Sruthán na Líbeirtí Streams.

¹¹ Existing records for this species relate to the shores of Lough Corrib with the species never having been recorded from the River Corrib within the scheme study area

Common Name/ Scientific name	Legal Status ⁶	Red List Status ⁷	Source
Zircon reed beetle <i>Donacia aquatica</i>	none	Vulnerable	NBDC online database record
Large red tailed bumble bee <i>Bombus</i> (<i>Melanobombus</i>) <i>lapidarius</i>	none	Near threatened	NBDC online database record
Moss carder-bee <i>Bombus</i> (<i>Thoracombus</i>) <i>muscorum</i>	none	Near threatened	NBDC online database record
Red-tailed carder bee <i>Bombus</i> (<i>Thoracombus</i>) <i>ruderarius</i>	none	Vulnerable	NBDC online database record
Birds			
Barn owl <i>Tyto alba</i>	WA	Red	Bird Atlas Database Record ¹² Galway City Council (2013)
Black-headed gull <i>Larus ridibundus</i>	WA	Red	Bird Atlas Database Record Galway Harbour Company (2014) I_WeBS database record ¹³ McCarthy, Keville & O'Sullivan (2009a) McCarthy, Keville & O'Sullivan (2009b) Whilde (1983)
Black-necked grebe <i>Podiceps nigricollis</i>	WA	Red	Bird Atlas Database Record Galway City Council (2013)
Common scoter <i>Melanitta nigra</i>	WA	Red	Bird Atlas Database Record I_WeBS database record
Curlew <i>Numenius arquata</i>	BD_II (II), WA	Red	Bird Atlas Database Record EIS Limited (2005) Galway Harbour Company (2014) I_WeBS database record RPS (2006)
Dunlin <i>Calidris alpina</i>	BD_I	Red	Bird Atlas Database Record I_WeBS database record Whilde (1983)
Golden plover <i>Pluvialis apricaria</i>	BD_I, II (II), III (III), WA	Red	Bird Atlas Database Record I_WeBS database record
Goldeneye <i>Bucephala clangula</i>	BD_II (II), WA	Red	Bird Atlas Database Record I_WeBS database record

¹² Bird Atlas database held by BirdWatch Ireland for 10km grid squares IM22 and IM32

¹³ Irish Wetland Bird Survey (I_WeBS database record) database held by BirdWatch Ireland

Common Name/ Scientific name	Legal Status ⁶	Red List Status ⁷	Source
Grey wagtail <i>Motacilla cinerea</i>	WA	Red	Bird Atlas Database Record
Herring gull <i>Larus argentatus</i>	WA	Red	Bird Atlas Database Record Galway Harbour Company (2014) I_WeBS database record Whilde (1983)
Lapwing <i>Vanellus vanellus</i>	BD_II (II), WA	Red	Bird Atlas Database Record I_WeBS database record
Long-tailed duck <i>Clangula hyemalis</i>	BD_II (II), WA	Red	Bird Atlas Database Record I_WeBS database record
Meadow pipit <i>Anthus pratensis</i>	WA	Red	Bird Atlas Database Record Browne <i>et al.</i> (2009) Crushell (2009) Galway Harbour Company (2014) RPS (2006) Tobin Consulting (2004)
Pintail <i>Anas acuta</i>	BD_II (I), III (II), WA	Red	Bird Atlas Database Record I_WeBS database record
Pochard <i>Aythya ferina</i>	BD_II (I), III (II), WA	Red	Bird Atlas Database Record I_WeBS database record
Red grouse <i>Lagopus lagopus</i>	BD_II (I), III (I), WA	Red	Bird Atlas Database Record Crushell (2009)
Redshank <i>Tringa totanus</i>	WA	Red	Bird Atlas Database Record Galway Harbour Company (2014) I_WeBS database record Whilde (1983)
Shoveler <i>Anas clypeata</i>	BD_II (I), III (III), WA	Red	Bird Atlas Database Record I_WeBS database record
Tufted duck <i>Aythya fuligula</i>	BD_II (I), III (II), WA	Red	Bird Atlas Database Record I_WeBS database record
Twite <i>Carduelis flavirostris</i>	WA	Red	Bird Atlas Database Record Galway Harbour Company (2014)
Wigeon <i>Anas penelope</i>	BD_II (I), III (II), WA	Red	Bird Atlas Database Record I_WeBS database record
Woodcock <i>Scolopax rusticola</i>	BD_II (I), III (III), WA	Red	Bird Atlas Database Record
Yellowhammer <i>Emberiza citrinella</i>	WA	Red	Bird Atlas Database Record
Arctic tern <i>Sterna paradisaea</i>	BD_I, WA	Amber	Bird Atlas Database Record
Bar-tailed godwit	BD_I, WA	Amber	Bird Atlas Database Record

Common Name/ Scientific name	Legal Status ⁶	Red List Status ⁷	Source
<i>Limosa lapponica</i>			I_WeBS database record Whilde (1983)
Black-throated diver <i>Gavia arctica</i>	BD_I, WA	Amber	Bird Atlas Database Record
Common tern <i>Sterna hirundo</i>	BD_I, WA	Amber	Bird Atlas Database Record Galway Harbour Company (2014) RPS (2006)
Great northern diver <i>Gavia immer</i>	BD_I, WA	Amber	Bird Atlas Database Record Galway Harbour Company (2014) I_WeBS database record
Greenland white-fronted goose <i>Anser albifrons flavirostris</i>	BD_I, II (II), III (III), WA	Amber	Bird Atlas Database Record I_WeBS database record
Hen harrier <i>Circus cyaneus</i>	BD_I, WA	Amber	Bird Atlas Database Record RPS (2006)
Jack snipe <i>Lymnocyptes minimus</i>	WA	Amber	Bird Atlas Database Record I_WeBS database record
Kestrel <i>Falco tinnunculus</i>	BD_I, WA	Amber	Bird Atlas Database Record Galway Harbour Company (2014)
Kingfisher <i>Alcedo atthis</i>	BD_I, WA	Amber	Bird Atlas Database Record Galway County Council/Roscommon National Roads Design Office (2011)
Little egret <i>Egretta garzetta</i>	BD_I, WA	Green	Bird Atlas Database Record Galway Harbour Company (2014) I_WeBS database record
Little gull <i>Larus minutus</i>	BD_I, WA	Amber	Bird Atlas Database Record I_WeBS database record RPS (2006) Whilde (1983)
Little tern <i>Sterna albifrons</i>	BD_I, WA	Amber	Bird Atlas Database Record
Mediterranean gull <i>Larus melanocephalus</i>	BD_I, WA	Amber	Bird Atlas Database Record I_WeBS database record
Merlin <i>Falco columbarius</i>	BD_I, WA	Amber	Bird Atlas Database Record Galway Harbour Company (2014) RPS (2006)
Peregrine <i>Falco peregrinus</i>	BD_I, WA	Green	Bird Atlas Database Record
Red-throated diver <i>Gavia stellata</i>	BD_I, WA	Amber	Bird Atlas Database Record Galway Harbour Company (2014) I_WeBS database record Whilde (1983)

Common Name/ Scientific name	Legal Status ⁶	Red List Status ⁷	Source
Ruff <i>Philomachus pugnax</i>	BD_I, WA	Amber	Bird Atlas Database Record I_WeBS database record
Sandwich tern <i>Sterna sandvicensis</i>	BD_I, WA	Amber	Bird Atlas Database Record Galway Harbour Company (2014) I_WeBS database record
Snowy owl <i>Nyctea scandiaca</i>	BD_I, WA	Green	Bird Atlas Database Record
Storm petrel <i>Hydrobates pelagicus</i>	BD_I, WA	Amber	Bird Atlas Database Record
Whooper swan <i>Cygnus cygnus</i>	BD_I, WA	Amber	Bird Atlas Database Record Galway Harbour Company (2014) I_WeBS database record

4 Field Surveys

4.1 Overview

The ecological baseline surveys comprised the following survey elements:

- Habitats;
- Rare and protected plant species;
- Bats;
- Otter;
- White-clawed crayfish;
- Freshwater pearl mussel;
- Other Annex II molluscan species;
- Marsh fritillary;
- Red grouse;
- Barn owl; and
- Wintering birds.

An overview of the surveys undertaken is outlined below with the details of these surveys included in **Sections 4.2 to 4.10** below and the accompanying appendices.

Habitat Surveys

The habitat surveys comprised a number of different survey elements:

- A survey for the presence of the priority Annex I habitat type *7220 Petrifying springs with tufa formation (hereafter referred to as petrifying springs), undertaken in 2014;
- A survey of habitats within the Lough Corrib cSAC Survey Area;
- A habitat survey of the identified Ecological Sites; and

- Aquatic habitat surveys.

The details of the ecological site surveys and the aquatic habitat surveys are described in full in this report. The results of the petrifying spring survey and the habitat surveys within the Lough Corrib cSAC Survey Area are provided as Appendices to this ecological constraints report in the following reports:

- **Appendix A**, *N6 Galway City Transport Project: Report on the presence of Annex I habitat *7220 Petrifying springs with tufa formation* (O'Neill & Barron, 2014);
- **Appendix B**, *N6 Galway City Transport Project – Assessment of Annex I habitats in the Ballygarraun survey area* (Perrin, 2014); and
- **Appendix C**, *N6 Galway City Transport Project – Habitat mapping and assessment of a section of Lough Corrib cSAC and surrounding areas* (Barron et al., 2014).

The aquatic plant species recorded as part of that survey are provided in **Appendix D**.

Rare and protected plant species

A dedicated survey for the Annex II plant species Varnished hook-moss *Hamatocaulis vernicosus*, was undertaken and is described in full in this report. This species is a qualifying interest species for the Lough Corrib cSAC.

A survey for the presence of the Annex II plant species Slender naiad *Najas flexilis* was also carried out as part of the aquatic habitat surveys, and is described in full in this report. This species is also a qualifying interest species for the Lough Corrib cSAC.

Bats

A combination of radio-tracking surveys, detector surveys (walked and driven transects, and static detector monitoring), and building surveys to establish baseline information on bat populations within the scheme study area were undertaken with a particular focus on the Lesser horseshoe bat, a qualifying interest species of the Lough Corrib cSAC.

Elements of these surveys are described in full in this report with the full radio-tracking survey reports, and the report describing the results of the static detector monitoring, provided as Appendices to this ecological constraints report, in the following reports:

- **Appendix E**, *Galway Bat Radio-tracking Project - Bat Radio-tracking surveys. Radio-tracking studies of Lesser horseshoe and vesper bat species, August and September 2014* (Rush & Billington, 2014);
- **Appendix F**, *Galway City Transport Project - Bat Acoustic Surveys: Summer-Autumn 2014* (Geckoella Ltd., 2015a);
- **Appendix G**, *N6 Galway City Transport Project - Bat Radio-tracking and Roost Surveys 19th to 29th August 2014* (Geckoella Ltd., 2015b).

Otter

An Otter survey of suitable habitat within the Lough Corrib cSAC study area was undertaken and is described in full in this report.

White-clawed crayfish

White-clawed crayfish surveys of potentially suitable habitat within the scheme study area were undertaken and, are described in full in this report.

Freshwater pearl mussel

Surveys for the presence of the Freshwater pearl mussel in selected watercourses, with the potential to support the species, within the scheme study area were undertaken.

The full survey report is provided as an Appendix to this ecological constraints report – see **Appendix H**, *A Survey of Selected Rivers for the Galway City Transport Project with Potential for Margaritifera* (Moorkens, 2014a).

Other Annex II molluscan species

Molluscan survey of habitat with the potential to support Annex II species, in particular species of the *Vertigo* genus was undertaken.

The full survey report is provided as an Appendix to this ecological constraints report – see **Appendix I**, *A Molluscan Survey of Selected Wetland Sites for the Galway City Transport Project* (Moorkens, 2014b).

Marsh fritillary

Survey of potentially suitable habitat for the presence of the Annex II Marsh fritillary butterfly *Euphydras aurinia* was undertaken over two survey seasons.

The full survey reports are provided as Appendices to this ecological constraints report – see **Appendix J**, *Galway City Outer Bypass Marsh Fritillary Survey Report* (Barron et al., 2013), and **Appendix K**, *N6 Galway City Transport Project Marsh Fritillary Survey Summary Report – 2014* (Woodrow Sustainable Solutions Ltd., 2015).

Red grouse

A survey of areas of potentially suitable habitat within the scheme study area for the presence of Red grouse *Lagopus lagopus scoticus* was undertaken and is described in full in this report.

Barn owl

A survey to determine the current status of Barn owl *Tyto alba* within the scheme study area was undertaken.

The full survey report is provided as an Appendix to this ecological constraints report – see **Appendix L**, *The status of Barn Owls within the study area for the N6 Galway City Transport Project* (O'Clery & Lusby, 2014).

Wintering birds

A survey to identify sites of importance to wintering bird species within the scheme study area was undertaken and is described in full in this report – see **Appendix M** for species results.

4.2 Terrestrial Habitats

4.2.1 Lough Corrib cSAC Survey Area

4.2.1.1 Methodology

Previous Surveys

Annex I Habitat Survey – General

An initial habitat mapping survey was carried out by Botanical, Environmental & Conservation (BEC) Consultants Ltd. in 2013 to classify the habitats present in selected locations within the study area for the proposed scheme (see **Appendix B** and **Appendix C** for details): within the Lough Corrib cSAC at Menlough (northeast of Coolagh Road), at areas adjacent to the River Corrib at Dangan Lower and Menlough, and at areas of limestone pavement at Ballygarraun (to the east of the currently defined Lough Corrib cSAC study area – see **Figure 4.3.3**). The habitat map and data from this survey was incorporated into the results from the 2014 surveys.

Petrifying Springs Survey

A dedicated survey for this priority Annex I habitat type – Petrifying springs with tufa formation (Cratoneurion) – was carried out by BEC in 2013 (see **Appendix A**). A combination of desktop review and Geographic Information System (GIS) analysis was used to define the survey sites, which were then visited to establish the presence/absence of a petrifying spring feature. This was supplemented by the additional habitat survey work carried out in 2014 within the scheme study area, as described below.

Current Survey

Habitat surveys were carried out by BEC and Wetland Surveys Ireland Ltd. from May to September 2014 within the Lough Corrib cSAC habitat survey area. The extent of the Lough Corrib cSAC habitat survey area is shown on **Figure 4.3.3**. The survey methodology comprised two stages: Stage 1 comprised mapping to level 3 of the Heritage Council habitat codes (Fossitt, 2000 – a summary of the classification is provided in **Appendix N**) with areas of Annex I habitat also being identified; for Stage 2, all polygons were revisited and indicator species recorded, a rapid quality assessment score was attributed to each polygon which contained an Annex I habitat type, and relevé data was collected across the survey area to support the habitat classification given during the mapping exercise and to provide additional data on the conservation value of habitats. All habitat polygons were also attributed with an ecological valuation as per the criteria set out in Guidelines for Assessment of Ecological Impacts of National Roads Schemes: Revision 2 (NRA, 2009).

The conservation status of each Annex I habitat within this study area was assessed. The assessment was based on the guidelines available from the National Parks and Wildlife Service (NPWS) and on the approach used for the national conservation assessment of Annex I habitats, which is carried out according to guidelines published by the EU (Evans & Arvela, 2011).

Assessment criteria were available from NPWS for the majority of the Annex I habitats recorded but where not available, the criteria relating to similar habitats were used. Annex I habitats were defined with reference to recent national studies co-ordinated by NPWS and the Interpretation manual of European Union Habitats EUR28 (CEC, 2013). Vegetation communities were assigned to Annex I habitat areas based on the relevé data gathered and on published definitions. In cases where published vegetation community definitions were not available, novel classifications were assigned.

The full details of the survey and assessment methodologies used - including the assessment criteria, Annex I habitat definitions, and novel vegetation community classifications – are described in the relevant survey reports in **Appendix A**, **Appendix B** and **Appendix C**.

4.2.1.2 Results

The full results of the habitat surveys undertaken within the Lough Corrib cSAC habitat survey study area are detailed in the following reports provided in **Appendices A, B** and **C**, and are shown on **Figures 4.3.3** and **4.3.5 – 4.3.10**:

- Galway City Transport Project. *Report on the presence of Annex I habitat *7220 Petrifying springs with tufa formation* (O’Neill and Barron, 2014);
- Galway City Transport Project. *Assessment of Annex I habitats in the Ballygarraun survey area* (Perrin, 2014); and
- Galway City Transport Project. *Habitat mapping and assessment of a section of Lough Corrib cSAC and surrounding areas* (Barron et al., 2014).

4.2.2 Ecological Sites

4.2.2.1 Methodology

The aim of the ecological sites habitat survey was to describe, classify and map the habitats of the Ecological Sites based on The Heritage Council classification (Fossitt 2000), with particular emphasis on habitats conforming to Annex I habitats (as listed in the EU Habitats Directive), and to assess their ecological importance. Any plant species of restricted distribution and ecological importance were noted.

Ecological Sites, in this case, are sites of potential ecological value for the habitats present; the boundaries of which were initially defined based on interpretation of orthophotography and collation of available existing habitat information, in conjunction with a ground truthing exercise to verify the orthophotography interpretation. These boundaries were then refined, where appropriate, based on the findings of the various habitat surveys undertaken.

The surveys were carried out by Dr Joanne Denyer, Dr John Conaghan, Dr Janice Fuller, Katharine Duff and Eamon O’Sullivan from the 15 June to the 15 October 2014. The locations of the Ecological Sites are shown on **Figure 4.3.3**.

Annex I Habitat Classification

Reference was made to the National and Regional habitat survey reports (as listed below and in the reference list at the end of this report), in terms of the criteria for classifying the different Annex I habitats and assessing their condition.

Assessment criteria for *Calcareous fens with *Cladium mariscus* and species of the *Caricion davalliana* [7210] which were developed during the Constraints Study for the N6 Galway City Transport Project (by Crushell and Foss 2014a and 2014b) were used. The Annex I habitats surveyed are listed in **Table 4.1**.

Table 4.1 Annex I habitats recorded, the reference for assessment criteria used, and size of the assessment relevé

Annex I habitat code	Habitat name ¹	Reference	Relevé size (metres)
1220	Perennial vegetation of stony banks	n/a	n/a
1330	Atlantic salt meadows	McCorry & Ryle (2009)	2x2
4010	Atlantic wet heaths	Perrin et al. (2014, 2010)	2x2
4030	European dry heaths	Perrin et al. (2014, 2010)	2x2
6210	Semi-natural dry calcareous grassland	O'Neill et al. (2013)	2x2
*6210	(* important orchid sites)	O'Neill et al. (2013)	2x2
*6230	Species-rich <i>Nardus</i> upland grassland	O'Neill et al. (2013)	2x2
6410	Molinia meadows	O'Neill et al. (2013)	2x2
6430	Hydrophilous tall-herb communities	O'Neill et al. (2013)	2x2
6510	Lowland Hay Meadows	O'Neill et al. (2013)	2x2
*7130	Active Blanket Bog	Perrin et al. (2014, 2010)	2x2
7140	Transition mires	Perrin et al. (2014, 2010)	2x2
7150	Depressions of peat substrates of the Rhynchosporion	Perrin et al. (2014, 2010)	2x2
*7210	Calcareous fens with <i>Cladium mariscus</i>	Crushell & Foss (2014a); criteria developed for GCTP project	2x2
7230	Alkaline fens	Perrin et al. (2014, 2010)	2x2
*8240	Limestone pavement (exposed and wooded)	Wilson & Fernández (2013)	5x5
*91EO	Alluvial forests	O'Neill & Barron (2013)	
*3180	Turloughs	Goodwillie (1992)	2x2

¹Abbreviated Annex I habitat names, full Annex I habitat titles are available in *Interpretation manual of European Union Habitats EUR28* (CEC, 2013)

Field sheets were prepared in advance for recording site notes and habitat descriptions, which included condition assessment criteria. Vascular plant nomenclature follows that of the *New Flora of the British Isles* 3rd Edition (Stace, 2010); bryophyte nomenclature follows the *Checklist of British and Irish bryophytes* (BBS, 2009).

Ecological Evaluation

The ecological importance of habitats was assessed using the criteria listed in the Guidelines for Assessment of Ecological Impacts of National Roads Schemes (NRA, 2009). For Annex I habitats recorded, a further rapid quality assessment of the Annex I habitat (scale 1, 2, or 3) was made, based on the following criteria, whereby:

- 1 = the habitat was a poor example of the Annex I habitat;
- 2 = the habitat was a good example of the Annex I habitat; and
- 3 = the habitat was an excellent example of the Annex I habitat.

Field Survey

Field survey maps were prepared from aerial photographs of the Ecological Sites (1:5,000 scale minimum). The Ecological Sites were subject to a walkover survey by experienced botanists. Each habitat present was described and classified (Fossitt for non-Annex habitats or Annex I habitats per NPWS guidance from the relevant national Annex I habitat surveys) and the main plant species were listed on the habitat recording form. The habitat extent was mapped onto the aerial photograph, with GPS points taken where a habitat extent could not clearly be identified from the aerial photograph. For each Annex I habitat type encountered, a relevé(s) was (were) taken using a prepared form. The relevé size was 2m² for all Annex I habitats except for woodland, which was 5m². The relevé form included a habitat condition assessment based on criteria which were drawn from the relevant national habitat surveys for the National Parks and Wildlife Service (NPWS). Where applicable, the Annex I habitat was assigned to a vegetation community.

A photographic record of the habitats and relevé(s) for each ecological site was taken; two photos per relevé – one for the relevé and one for a view from the relevé. Notes on management, threats and habitat condition were also taken.

For each ecological site the following were completed:

- a) Site form: summary description of the EC site, list of habitats and notable features;
- b) Habitat map: hand drawn polygons (attributed with the corresponding habitat codes) on aerial photograph;
- c) Field survey notes: hand written on habitat recording forms;
- d) Relevé forms: hand written and completed for Annex I habitats;
- e) Photographs: photographic record (digital) of habitats and relevé(s); and
- f) Habitat table: tabulated summary of all habitats, including habitat description, classification (Fossitt and Annex I), plant species list, habitat condition and ecological evaluation/importance.

Other Areas

Within the scheme study area, those areas not covered by the surveys described above were subject to a walkover survey; the purpose of which was to rule out the presence of Annex I habitat types in these areas. The survey was confined to terrestrial habitats in greenfield areas and excluded residential properties and associated gardens, and commercial and industrial complexes.

Notes were taken on the habitat types present (according to the habitat categories described in Fossitt, 2000) and where habitat plots were assessed to be of a high ecological value, with the potential to correspond to an Annex I habitat type, these were subject to more detailed survey as described above under Ecological Sites. If appropriate, these were then incorporated into Ecological Sites for consideration as part of the route selection process.

4.2.2.2 Results

The full results of the habitat surveys undertaken within the Ecological Sites are presented on **Figures 4.3.5 – 4.3.10**. A summary of each Ecological Site is provided in **Section 4.3.3.3** of the Route Selection Report (see **Table 4.3.6**).

4.3 Aquatic Habitats

4.3.1 Methodology

Aquatic habitats were surveyed for the presence of Annex I habitat types by Cilian Roden, from the 16 June 2014 to the 8 September 2014.

The survey sites included the River Corrib corridor, Lough Inch, Ballindooley Lough, and the Terryland Stream. The locations of the survey sites are shown on **Figure 4.3.3**.

Sites were accessed either from the shore or by boat and two personnel were always present during snorkelling surveys. Sub-littoral vegetation was examined by snorkelling. Smaller sites (such as the Terryland Stream) were examined by wading or by shore sampling. A list of species present, the depth of the sub-littoral vegetation and the exact position of each site was determined. Depths were measured using a SCUBAPRO depth gauge accurate to 0.1m and position determined using a hand held GPS recorder. GPS position shows approximate area surveyed by snorkel. Species present were recorded on an underwater writing slate. Samples for later examination were stored in plastic bags and identified within one day of collection. Underwater photographs were taken with a Panasonic Lumix DMC-FT3 underwater camera.

4.3.2 Results

The results of the aquatic habitat surveys are described below with reference to the following locations: Lough Inch, Ballindooley Lough, Coolagh Lakes, River Corrib from Tonacurragh to Menlo Castle, River Corrib main channel, from Menlo Castle to the Salmon Weir, Backwater on the east side of Jordan's Island, River Corrib and Canals south of the Salmon Weir, and Terryland Stream.

The habitat classifications attributed to waterbodies described below have been incorporated into the habitat survey results figures (**Figures 4.3.5 to 4.3.10**). Aquatic plane species recorded as part of this survey is provided in **Appendix D**.

4.3.2.1 Lough Inch

This lake, of about 25ha, lies to the west of Galway City on granite bedrock and is included within Ecological Site EC15. The maximum depth recorded was less than 4m. Water transparency was good with plant growth occurring throughout the lake bottom. Shallow water contained a community of *Isoetes lacustris*, *Lobelia dortmanna* and *Littorella uniflora* as well as *Eriocaulon aquaticum*. At greater depth (2m) *Isoetes lacustris* and *Chara virgata* occurred. Below 3m, large areas of the charophyte *Nitella translucens* were found along with occasional patches of *Nitella confervacea* and *Elatine hexandra*. The presence of these species indicated that the lake corresponded with the Annex I habitats [3110] *Oligotrophic waters containing very few minerals of sandy plains* and [3130] *Oligotrophic to mesotrophic standing waters with vegetation of the Littorelleta uniflorae and/or the Isoeto-Nanojuncetea*. This corresponded with the Fossitt classification of FL2 Oligotrophic lakes.

An unusual community of *Chara virgata*, *Potamogeton crispus*, *Potamogeton pectinatus*, and occasional *Nitella flexilis*, covered large areas in the centre of the lake. *Potamogeton crispus* and *P. pectinatus* are usually indicative of more eutrophic conditions. In addition, much fouling by algae including *Cladophora* and diatoms was noted. Other species noted were *Potamogeton berchtoldii*, *Juncus bulbosus*, and *Myriophyllum alterniflorum*.

The lake corresponded with two Annex I habitats [3110 and 3130] but these may have been negatively influenced by nutrient input. In addition a number of Connemara aquatic plants such as *Eriocaulon aquaticum* and *Elatine hexandra* reach their eastern limit in this lake. The charophyte *Nitella confervacea* is rarely recorded in Irish lakes but may be under recorded due to its small size.

The aquatic plant species list from this site is included in **Appendix D**, Site 1.

4.3.2.2 Ballindooley Lough

This small lake lies on limestone to the north-east of Galway City and is included within Ecological Site EC39. It was surrounded by fen and reed bed vegetation with stands of *Cladium mariscus*, *Phragmites australis*, and *Schoenoplectus lacustris*. Several large drains or ditches cut into fen peat drained into the lough. A large area of marl occurred at the north-eastern end while deeper water was present at the southern end. The shore line shelved very rapidly in the southern part of the lake. The sub-littoral vegetation was dominated by charophyte algae. *Chara rudis* was exceptionally abundant from 0-3m with some other species occurring in very shallow water including *Chara aspera*, *Chara aculeolata* and *Chara curta*. Flowering plants were rare, as is often the case in marl lakes, with only *Elodea Canadensis* and *Urticularia cf. vulgaris* observed.

Most of the lake was deeper than the euphotic depth of about 4m and no plants were found. The marl area in the north east may contain additional species but could not be examined in detail as it was too exposed for snorkelling (due to low water) and was too liquid to allow wading.

The lake was classified as the Annex I habitat 3140 *hard oligo- mesotrophic waters with benthic vegetation of charophytes* (FL4 under the Fossitt classification). The complete dominance of *Chara rudis* however, probably indicates some degree of eutrophication. The rather turbid lake water would support this conclusion.

Some of the drainage ditches (FW4) were also examined. The ditches appeared to be regularly dredged and contained a limited flora of *Chara virgata*, *Chara aspera*, *Chara aculeolata*, *Chara rudis*, *Potamogeton coloratus* and *Lemna trisulca*. They did not correspond to any Annex I habitat type.

In addition to the main lake, two further small water bodies were present at this site. The southernmost pool (531244 728619 ITM) was shallow with a sublittoral flora of *Elodea canadensis*, *Lemna trisulca* and *Fontinalis antipyretica*. Floating species included *Nymphaea alba*. The abundance of *Lemna* and *Elodea* indicated a eutrophic pond (Fossitt classification FL5). The smaller circular pond (531194 728778 ITM) had floating species present including *Potamogeton natans*, *Nymphaea alba* and *Sparganium natans*. Sublittoral species included abundant *Chara virgata* and *Urticularia cf. vulgaris*. This pond was classified as a mesotrophic water body (FL4).

Ballindooley is the site of an old record for the rare charophyte *Nitella tenuissima*. At present the species is known from the Burren, in Co. Clare and some sections of the Grand Canal (near Edenderry, Co. Offaly). Its most likely habitat would be the drainage ditches leading into the lough but it was not found there during these surveys.

The aquatic plant species list from this site is included in **Appendix D**, Sites 12 to 14.

4.3.2.3 Coolagh Lakes

The open areas of deep water in the Coolagh Lakes appeared to be the remnants of a large open water area shown in 19th century maps. All lakes were surrounded by dense beds of *Cladium mariscus* and *Phragmites australis*, whose spread appeared limited only by the depth of the remaining open water (>5m). As the lake bed sloped rapidly there was comparatively little ground for aquatic macrophytes. Like Ballindooley Lough, Coolagh Lakes was a calcareous site with large areas of fen peat and no outcropping rock. In both lakes *Chara hispida* and *Chara rudis* were very abundant from the surface to 4m depth.

The upper lake contained some flowering plants including *Hippuris vulgaris*, *Myriophyllum spicatum* *Nuphar lutea* and *Elodea Canadensis* (which grew at the base of the euphotic zone at about 4m, as did some *Lemna trisulca*). However, *Chara rudis* or *Chara hispida* dominated most of the euphotic zone.

The lower lake also contained large stands of *Chara hispida* and *Carex rudis* but flowering plants were more abundant with *Lemna trisulca* forming a zone at the base of the euphotic zone (4m) and *Elodea Canadensis* intermixed with the *Chara* species. Other species included *Potamogeton lucens*, *Sparganium sp.*, *Myriophyllum spicatum* and *Urticularia cf. vulgaris*. Two other species of charophyte, *Chara contraria* and *Chara vulgaris* occurred in small quantities.

The lakes correspond to the Annex I habitat [3140] *Hard oligo- mesotrophic waters with benthic vegetation of charophytes* and type FL3 in Fossitt. The lower lake however, was considered the borderline eutrophic type FL5, due to the increased presence of *Elodea canadensis* and *Lemna trisulca*. A strong case could be made that the area has changed greatly due to eutrophication and was not an exceptional example of the habitat. The presence of Zebra mussels *Dreissena polymorpha* also degrades the value of habitat.

The channel linking the Coolagh Lakes to the main channel of the River Corrib was probably maintained by cutting. It was fringed by very dense stands of *Phragmites australis* and *Cladium mariscus*. It was up to 1m deep with *Nuphar lutea*, *Menyanthes trifoliata*, *Elodea canadensis*, *Chara rudis*, and *Lemna trisulca* growing in the channel. *Ranunculus lingua* is conspicuous in the reed swamp on the channel edge. This habitat was classified as a drainage ditch (FW4).

The aquatic plant species list from this site is included in **Appendix D**, Sites 6 and 7.

4.3.2.4 River Corrib from Tonacurragh to Menlo Castle

This section of the river had a low flow rate (in summer) and had characteristics resembling a hard water lake. Vegetation was determined by sampling transects along the river. The vegetation was dominated by charophyte algae in many places, especially *Chara rudis*.

In the upper river near the junction of the Friar's Cut, the shore included backwaters dominated by reed swamp and open water with *Chara curta*, *Chara virgate annulata* and cyanobacterial crust on stones, as on the shore of Lough Corrib and other calcareous lakes. In deeper water (1m) *Chara rudis* was dominant with emergent vegetation including *Schoenoplectus lacustris* and *Phragmites australis*. *Chara rudis* extended to 2m depth along with *Zannichella palustris*, *Potamogeton lucens*, a little *Potamogeton crispus* and *Myriophyllum spicatum*, while *Chara globularis* extended to 3m along with some *Nuphar lutea* and abundant Zebra mussels. At this depth a white, shelly marl replaces the dark peat and mud of shallower water. In the main channel the river shelves very steeply and *Potamogeton perfoliatus* occurred.

Midway between the Friars cut and Menlough Pier the river was divided by a long narrow bank vegetated with swamp (527715 728520 ITM) with species present including *Eleocharis palustris*, *Hippuris vulgaris*, *Lythrum salicaria*, *Ranunculus flammula*, *Valeriana officinalis*, *Iris pseudacorus*, *Schoenoplectus lacustris*, *Sparganium* sp., *Menyanthes trifoliata*, *Calystegia sepium* and *Myosotis laxa*.¹⁴

The shallower western channel to a depth of 2m contained reed swamp followed by *Chara virgate annulata*, *Lemna trisulca*, *Elodea canadensis* and *Nuphar lutea* in 1m depth, and *Potamogeton perfoliatus* beds at 2m. In places bare areas of mud were colonized by *Nitella opaca*. The main channel shelved very steeply with *Potamogeton perfoliatus*, *Lemna trisulca*, and *Elodea canadensis*, followed by bare ground with Zebra mussels.

On the east bank *Chara rudis* was dominant with some *Potamogeton berchtoldii*, *Lemna trisulca* and *Elodea canadensis*.

Below Menlo Pier the river narrowed and deepened with little vegetation other than *Potamogeton perfoliatus* and *Potamogeton natans* along with some *Chara rudis* in shallow water close to the bank.

The depth of the river varies greatly with many shallow inshore areas but the main channel was cut into white marl which exceeded 8m depth in places.

¹⁴ Note that these species are provided here for information and do not appear in Appendix D as they were associated with the island habitat

Vegetation was largely confined to water less than 4m but Zebra mussels occurred deeper than this. A variety of flowering plants occurred, especially pond weeds (*Potamogeton* sp.). Nearly all shallow areas of any extent were occupied by *Schoenoplectus* and *Phragmites* reed swamp.

As the area is technically a river, it was classified as a depositing lowland river (FW2) and does not correspond with any Annex I habitat type. Parts at least might equally be viewed as a southern extension of Lough Corrib, in which case it would be classified as the Annex I habitat [3140] *Hard oligo- mesotrophic waters with benthic vegetation of charophytes* and lake type FL4 in Fossitt.

The aquatic plant species list from this site is included in **Appendix D**, Sites 2, 3 and 4.

4.3.2.5 River Corrib main channel, from Menlo Castle to the Salmon Weir

In this section the river flow was stronger and river vegetation largely confined to shallows along the banks. Vegetation was only found in depths of <2 m and as largely either reed swamp of *Phragmites australis* and *Equisetum fluviatile*, with some stands of *Potamogeton natans* and *Carex rostrata*. *Chara rudis* and some *Chara virgata* were common in the shallow sublittoral. Species composition was similar but less diverse than the upstream section and the main channel was classified as a depositing lowland river (FW2), and did not correspond with any Annex I habitat type.

The aquatic plant species list from this site is included in **Appendix D**, Sites 5 and 9.

4.3.2.6 Backwater on the east side of Jordan's Island

This section consisted of small pools and channels cut through extensive *Phragmites australis*, *Schoenoplectus lacustris* and *Cladium mariscus* reed swamp. The area contained a diverse flora, especially of charophytes, but like all habitats in the survey showed signs of eutrophication. Species present include *Chara aspera*, *Chara contraria*, *Chara curta*, *Chara globularis*, *Chara rudis*, *Chara vulgaris* and *Chara virgata*. Other aquatic species included *Potamogeton pectinatus*, *Potamogeton perfoliatus*, *Potamogeton lucens*, *Potamogeton natans*, *Myriophyllum spicatum*, *Elodea canadensis*, *Berula erecta*, *Lemna trisulca*, *Nuphar lutea*, *Oenanthe aquatica*. Blanket weed or *Cladophora* sp. was common, suggesting eutrophication. As the original channel is now almost completely filled with reed swamp the remaining open water might be best classified as a series of meso or eutrophic pools (FL4/5) linked by channels or drainage ditches (FW4).

The aquatic plant species list from this site is included in **Appendix D**, Site 8.

4.3.2.7 River Corrib and Canals south of the Salmon Weir

There was aquatic vegetation similar to the river section above the weir but poorer and vegetated areas were classified as canal (FW3) as it is largely confined to the Eglinton Canal and old mill races.

Species included *Potamogeton perfoliatus*, *Potamogeton natans*, *Potamogeton pusilus* (species Id not confirmed under microscope), *Elodea Canadensis*, *Myriophyllum spicatum*, *Chara rudis* and *Ranunculus* sp.

The main river channel was tidal below the weirs and classified as estuary (MW4), though the exact boundary between river and estuary was not defined in this study.

The aquatic plant species list from this site is included in **Appendix D**, Site 10.

4.3.2.8 Terryland Stream

The river appeared very eutrophic and had a limited flora present including *Potamogeton natans*, *Callitriche* sp., *Alisma plantago aquatica*, *Chara hispida/rudis*, *Myriophyllum spicatum*, *Sparganium* sp. and *Elodea canadensis*. Large areas of bare mud and extensive development of blanket weed, *Cladophora* sp. indicate significant eutrophication. The Terryland Stream was classified as a depositing lowland river (FW2).

The aquatic plant species list from this site is included in **Appendix D**, Site 11.

4.3.3 Conclusion

From the survey results, the vegetation of Lough Inch was very different from all other survey sites and was classified as containing the Annex I habitat types [3110] and [3130]; it also contains communities A22, A23, and A24¹⁵ of Rodwell (1995). The other survey sites showed similarities in their relative vegetation communities probably because of a similar calcareous aquatic habitat. However, the commonest, and in places most abundant, species included the introduced plant species *Elodea canadensis*, *Lemna trisulca*, and *Chara rudis*. Rodwell's type A15 *Elodea Canadensis* community shows certain affinities with the vegetation found in these waterbodies. A case might be made that the upper part of the River Corrib main channel, near the junction of Friar's Cut, could correspond with the Annex I habitat type [3260] *Water courses of plain to montane levels with the Ranunculion fluitantis and Callitriche-Batrachion* vegetation but given the absence of *Ranunculus* species and scarcity of *Callitriche* sp., it does not match a strict interpretation of [3260] as per the *Interpretation manual of European Union Habitats EUR28*.

It was considered by the surveyors that most of the habitats showed signs of eutrophication, including:

- Abundant *Cladophora* growth;
- A shallow euphotic or vegetation depth in Ballindooley, Coolagh and River Corrib (4m in these lakes vs 8-10m in unpolluted hard water lakes);
- The dominance of *Chara rudis* at all hard water sites. In unpolluted lakes a more diverse Charophyte flora would be expected. Abundant *Lemna trisulca* is also indicative of eutrophication;

¹⁵ These codes represent the following vegetation communities from Rodwell (1995): A22 *Littorella uniflora* – *Lobelia dortmanna* community, A23 *Isoetes lacustris/setacea* community, and A24 *Juncus bulbosus* community.

- The presence of *Potamogeton crispus* and *Potamogeton pectinatus* in Lough Inch;
- The absence of the enrichment sensitive *Nitella tenuissima* from Ballindooly Lough; and
- The presence of very dense and extensive reed swamp, not usually encountered in unpolluted limestone water bodies in western Ireland.

This widespread nutrient enrichment reduces the quality of the aquatic Annex I habitats but they may recover in the event of nutrient reduction.

Stewart (2004) suggested that the presence of five or more charophyte species indicated a site of conservation value in the UK. An equivalent Irish classification has not been proposed but given that at least seven charophyte species have been recorded in sites such as Jordan's Island and Ballindooley, they could be considered to have noteworthy charophyte floras.

4.4 Species

4.4.1 Rare and/or Protected Species

4.4.1.1 Methodology

Dedicated surveys for the following plant species were carried out: Varnished hook-moss *Hamatocaulis vernicosus* and the Slender naiad *Najas flexilis*. Both of these plant species are listed on Annex II of the Habitats Directive and listed as qualifying interest species of Lough Corrib cSAC (with the Slender naiad also listed on Annex IV of the Habitats Directive), and are protected under the Flora Protection Order, 1999.

Varnished hook-moss

The Varnished hook-moss survey was carried out by Rory Hodd from the 2 to the 7 September 2014.

Potential sites for survey were selected in consultation with ecologists carrying out habitat mapping within the scheme study area. Potential sites were identified as those where fen occurred, and where brown moss species (i.e. a suite of moss species indicative of, and generally restricted to, fen habitats) had been noted. Sites where fen transitions into bog, or where transition mire or intermediate fen had been noted, were prioritised as they had the most potentially suitable habitat for the species.

Nine potential sites were surveyed for the presence of Varnished hook-moss (**Figure 4.3.4**). The nearest known site for Varnished hook-moss, at Gortachalla Lough, north of Moycullen, was also visited in order to establish the species' habitat preferences in the area. Each site was extensively searched for areas where conditions were suitable for the growth of this species, and areas where plant species with similar requirements were found. Any areas which were deemed potentially suitable were thoroughly searched and the moss flora of these areas was examined in detail.

Slender naiad

This species was surveyed for in lakes within the scheme study area as part of the aquatic Annex I habitat survey (see **Figure 4.3.3**), as described above under the relevant section.

Other Species

Records were kept of the locations of any other rare or protected plant encountered during the course of the habitat surveys, with a particular focus on Flora Protection Order plant species where there were known or historic records.

4.4.1.2 Results

Slender cottongrass *Eriophorum gracile* was the only protected plant species recorded during the course of the habitat surveys. It was recorded at two locations: Tonabrocky Bog and in Coolanillaun. Its presence at Tonabrocky Bog is consistent with the findings of the desktop review; the location at Coolanillaun is a new record.

The presence of the FPO listed bryophyte species Varnished hook-moss was confirmed at Gortachalla, 9.4km to the north of the scheme study area.

Records of all rare or protected plant species known from the scheme study area, or recorded during the field surveys, are shown on **Figure 4.3.4**.

4.4.2 Bats

4.4.2.1 Methodology

All bat species found in Ireland are listed on Annex IV of the Habitats Directive. The Lesser horseshoe bat *Rhinolophus hipposideros* is also listed on Annex II of the Habitats Directive and is a qualifying interest species of Lough Corrib cSAC. Therefore considerable survey effort and specialist surveys were required to collect information on this particular species. Other bat species were also fully addressed by field surveys and other means of data collection, as set out below.

The following surveys for bats were carried out in the preparation of this report (refer also to **Appendices E, F and G**):

Population assessment

An analysis of the NPWS Lesser horseshoe bat roost database was conducted to estimate the importance of the maternity colony at Menlo Castle for the Lesser horseshoe bat population of Lough Corrib cSAC and County Galway. The most recent counts of all summer roosts within 6km of Lough Corrib cSAC – often shown in other tracking studies as being the maximum distance Lesser horseshoe bats generally travel to foraging areas during the maternity period – and across Co. Galway were used to estimate what proportion the Menlo Castle roost contributed to the Lough Corrib cSAC and County populations. This is a precautionary approach with regard to the Lough Corrib cSAC population; while many roosts within this 6km buffer may not depend upon habitat within Lough Corrib cSAC, this may be offset by the fact that there may be other Lesser horseshoe roosts in or around the cSAC boundary that have not been recorded.

Winter hibernation surveys

Previous records for Lesser horseshoe bats within the scheme study area were sourced from the Bat Conservation Ireland database and the NPWS Lesser horseshoe bat database. Mr Conor Kelleher, Mr Brian Keely, Dr Kate Mc Aney, Dr Catriona Carlin (Galway Bat Group) and local NPWS conservation ranger Rebecca Teesdale were also consulted to collate any additional roost records that were not in the above databases.

A cave database compiled by David Drew, formerly of Trinity College (<http://www.ubss.org.uk/irishcaves/irishcaves.php>), and the Geological Survey of Ireland (GSI) karst features GIS layer were consulted to determine the presence of caves within the scheme study area. The National Monuments Service database (<http://www.archaeology.ie>) was consulted to determine if man-made underground sites (souterrains, mines, ice houses) and unoccupied structures, such as caves and manor houses that may have underground structures or large chimneys, were present within the scheme study area.

Potential hibernation sites identified from the desktop study were surveyed on the 11-14 March 2014 and on the 21 March 2014. Sites were visited during the day and inspected for the presence of hibernating Lesser horseshoe bats (and other bat species) and secondary evidence of bat presence (e.g. droppings, staining). Checks of specific hibernation sites were undertaken in January and February 2015 to check if any Lesser horseshoe bats were present. In addition, bat detectors were deployed at four winter hibernation sites to record bats as they arose from hibernation on occasions throughout the winter. Detectors were in place from 5 February to the 26 March 2015.

Internal building surveys

A list of potential bat roost buildings was compiled by conducting a drive-by survey in areas within, and adjacent to, the scheme study area. The physical characteristics (construction material, roofing material, estimated age etc.) and GPS location were recorded and a photograph of the building was taken. Buildings were ranked (low, medium, high) for their general potential as a bat roost and specifically for their potential as a Lesser horseshoe bat roost.

Internal surveys of buildings were conducted between July and October 2014. The locations of all buildings surveyed are shown on **Figure 4.3.11**. The daytime survey involved a full examination of the internal and external areas of the structure in order to search for the presence of bats and identify potential roost sites. Bat activity is usually detected by the following signs:

- bat droppings (these will accumulate under an established roost or under access points);
- insect remains (under feeding perches);
- oil (from fur) and urine stains;
- scratch marks; and
- bat corpses.

Surveyors filled out a roost survey form and these were compiled into a Potential Bat Roost (PBR) building database.

In some situations, where a building had a high potential as a Lesser horseshoe bat roost but no physical evidence was found, an Anabat SD1 detector (Titley Scientific) was left in situ for up to two nights.

Any droppings that were found were placed in 1.5 ml eppendorf tubes with silica and sent to Waterford Institute of Technology for genetic analysis to determine the bat species involved.

The roost surveys were carried out under licence from the NPWS (DER BAT 2014-39).

Driven transect surveys

Driven transect surveys took place in June and July 2014. Three transect routes were designed within the scheme study area; an eastern transect (east of the River Corrib), a western transect (west of the River Corrib) and an urban transect (roads within Galway City). The location of the driven transect route is shown on **Figure 4.3.11**. The survey methodology was designed with reference to that used by the all-Ireland car-based bat monitoring scheme (Roche *et al.*, 2009). The only deviation from that survey methodology related to the use of a GPS unit to georeference the call records, removing the requirement to survey a section and stop to record location references on a map.

Prior to the first survey, surveyors mapped out their driving route during the day, identifying potential hazards. Roads that were unsafe (carrying large volumes of traffic) were excluded from the survey. Surveys were conducted (if possible) on nights with potential for high levels of bat flight activity (i.e. warm, dry, calm conditions).

Surveying commenced 45 minutes after sunset with roads being driven at approximately 25km/h. Bat activity was recorded using EM3 bat detectors (Wildlife Acoustics) with a GPS unit (Garmin) attached to record the location of bat calls and to plot the transect route. Detectors were mounted on the passenger window of the survey vehicle. Detectors were set to record continuously, saving call files in the compressed WAC format. Each transect was surveyed twice (eastern and western transects on the 17 and 18 June 2014; urban transect on the 26 June and 1 July 2014). For the second night of surveying, the transect start and end points were reversed.

Bat calls were analysed using the Kaleidoscope auto-identification software (Wildlife Acoustics) and were all manually verified to ensure the software identified calls correctly.

Walked transect surveys

Walked transect surveys took place in June and July 2014. Twenty-one survey sites were selected and a transect route was designed within this to encompass a representative sample of the habitats within the area. These areas are shown on **Figure 4.3.11**.

Prior to the detector survey commencing, the survey sites were walked during the day to plot a route and identify any health and safety issues. Surveys were conducted (if possible) on nights with potential for high levels of bat flight activity (i.e. warm, dry, calm conditions).

Surveying commenced 45 minutes after sunset. Bat activity was recorded using EM3 bat detectors (Wildlife Acoustics) with a GPS unit (Garmin) attached to record the location of bat calls and to plot the transect route. Detectors were set to record continuously, saving call files in the compressed WAC format. Each transect was walked once. In addition, an Anabat SD1 detector was placed overnight in suitable bat habitat along the transect route.

Bat calls recorded using EM3 detectors were analysed using the Kaleidoscope auto-identification software (Wildlife Acoustics) and were all manually verified to ensure the software identified calls correctly. Bat calls recorded on the Anabat detectors were analysed using the software Analook (Titley Scientific).

Static activity surveys

Static detector surveys of habitats within the scheme study area were conducted from the 12 August to the 2 November 2014. Twenty-four sites for static detector deployment were selected across the scheme study area to survey the bat species present at different locations, as well as to collect comparative data on species richness and general levels of bat activity. The locations of the static detectors are shown on **Figure 4.3.11**. The static detectors used were SM2 or SM2+ bat detectors (Wildlife Acoustics). Detectors were set to record in WAC format from half-an-hour before dusk to half-an-hour after dawn, using recommended manufacturer's settings to determine when the unit would be triggered to record a potential bat call.

Static monitoring using SM3BAT bat detectors (Wildlife Acoustics) was also conducted at three underground sites in the scheme study area: (Cooper's Cave, Newry's Cave and Prospect Hill Railway tunnel) in the autumn period from the 29 September to the 31 October 2014 and in winter from 4 February to 26 March 2015, in order to determine their use during the autumn mating and winter hibernation periods. An additional bat detector (SMZC-type) was placed in the chimney flue in Menlo Castle under the known maternity roost in winter to determine if bats were present there during this time. Whilst Lesser horseshoe bats are generally inactive in winter, they do wake up to move around the roost space and to feed and drink water and can be detected doing so by the installed equipment. Licences specifically permitting these winter surveys were acquired from the National Parks and Wildlife Service (DER BAT 2015-02).

Bat calls were analysed using the Kaleidoscope Auto-id software (Wildlife Acoustics) and were all manually verified to ensure the software identified calls correctly.

Radio-tracking studies

Radio-tracking work in the scheme study area was divided into three sessions:

- Session 1 took place from the 30 July to the 7 August 2014 and was led by Greena Ecological Consultancy with the aim of radio-tracking Lesser horseshoe bats and (to a lesser extent) Vespertilionid bats in order to identify the location and extent of foraging areas and the location of day/night/transitional roosts in the scheme study area;
- Session 2 took place from the 19 to the 20 August 2014 and was led by Geckoella Environmental Consultants with the aim of locating Vespertilionid bat roosts within the scheme study area; and

- Session 3 took place from the 2 to the 9 September 2014 with the aim of identifying and mapping bat movements to mating sites or winter roosts.

Lesser horseshoe bats were captured at two sites in the scheme study area, Menlo Castle and Cooper's Cave, during sessions 1 and 3, using mist nets and harp traps as they emerged or arrived at roosts after sunset. Vespertilionid bats were captured at six sites (Bearn Woods, Cooper's Cave, Menlo Woods, Merlin Woods, NUI Galway, and the NUI Galway Recreational Facilities) using mist nets, harp traps and an acoustic lure (Sussex Autobat) that attracts bats by emitting artificial foraging and social calls (Hill and Greenaway, 2005).

Several licences were issued by the National Parks and Wildlife Service to permit capture of bats using the traps and use of the acoustic lure and the fitting of the radio transmitters - Refs: C098/2014, C009/2014, 027/2014.

Captured bats were identified to species level and weighed to determine if they were suitable for tagging with radio transmitters. Priority was given to female Lesser horseshoe bats, *Myotis* bats and Common pipistrelles. Soprano pipistrelles were not tagged. Radio transmitters (Biotrack and Holohil) were glued between the fur-clipped shoulder blades of the bats using latex adhesive and usually detached from the tagged bat within two weeks of being attached.

Bats were tracked using *Australis 26K* and *Sika UHF* radio receivers with *Yaggi* rigid aerials to track bats. Omni directional antennas were used to search for bats by vehicle. Both receivers were able to automatically scan through different frequencies, which made it possible to search for a number of tagged bats at any one time. For sessions 1 and 3, bats were tracked at night while they were foraging to determine home ranges, core foraging areas and identify night roosts; bats were also tracked during the day to locate roosts. For session 2, bats were only tracked during the day to locate roosts. For sessions 1 and 3, foraging and commuting bats were observed from fixed (often elevated) points chosen where good radio reception was available, such as at elevated or other suitable vantage points. Where possible surveyors made close approaches to bats, to ascertain the exact foraging area and behaviour or to attempt pursuit if the bat was moving away. Accurate bearings of bat locations were taken from hand held sighting Silva Expedition 54 compasses simultaneously by two or more surveyors. Bearings of 1⁰ accuracy were obtained. The positions of bats was estimated using joint bearings (positive contact) recorded by two or more surveyors at the same time using the software Locate. GPS units (Garmin) were used to increase the speed and accuracy of the surveyors to continuously supply their location. Over survey nights, surveyors built up a picture of bat commuting routes and of bat foraging areas. Foraging areas were estimated using minimum convex polygons (MCP) and multi-lateral polygons (MLP). A MCP is defined as an animal's home range size, with the shape, and position represented by joining the outermost fixes (Mohr, 1947). A MLP is defined as the minimal area between all confirmed points of an animal's occurrence during a radio-tracking session.

Marking studies

In order to provide long-term data on bat movements that may be recaptured or rediscovered in other roosts (such as hibernation roosts), several bats that were caught as part of the radio-tracking surveys were fitted with special anodised aluminium rings, each with a unique serial number. The rings were fitted over the forearm of the bat by experienced bat workers under licence from the National

Parks and Wildlife Service (Licence No. C009/2014). All Lesser horseshoe bats that were fitted with radio transmitters were also marked with rings so that if captured again in a later survey session, they would not be re-fitted with transmitters. Bats other than Lesser horseshoe bats were also ringed, as these bats had the potential to be re-caught at potential mating sites in the September capture sessions, as identifying where they were caught earlier was regarded to be important.

In total, 42 bats caught in the three capture sessions in August and September 2014 were marked with rings. These included 27 Lesser horseshoe bats, eight Daubenton's bats, two Leisler's bats, two Common pipistrelle bats, single male Natterer's bat, single Brown Long-eared bat and single male Whiskered bat.

Surveys of roosts in winter 2014 and 2015 included looking for Lesser horseshoe bats that were fitted with rings. This would provide valuable data as to the relationship between winter roost sites and the location where the bat was originally caught.

These marking studies are also essential ways of monitoring the population over longer periods of time.

4.4.2.2 Results

The following text is a summary of the results of the various bat surveys undertaken in 2014 and 15. The full results of the bat surveys are shown on **Figures 4.3.12 to 4.3.16**. The full results of the radio tracking studies are provided in **Appendix E** and **Appendix G**; the full results of the static detector monitoring are detailed in **Appendix F**.

Lesser horseshoe bat

Population assessment

Based on the most recent counts of roosts available, the maternity roost at Menlo Castle makes up approximately 8% of the summer population of Lesser horseshoe bats that use Lough Corrib cSAC. This figure was calculated from collecting data on populations of bats counted at roosts within 6km of the cSAC boundary. It was assumed, based on scientific research of the foraging behaviour of this species in Ireland and elsewhere, that Lesser horseshoe bats roosting within 6km of the cSAC may use the designated area as part of their feeding resource.

Based on the numbers present, the Menlo Castle Lesser horseshoe bat population would be regarded as being a significant percentage of what could be regarded as the Lough Corrib cSAC population, and also the known County population. It cannot be determined, without long-term population studies as to how "critical" the Menlo Castle population is in the context of the wider population. It could be that it has the highest reproductive rate and is regularly supplemented by individuals from other roosts nearby— thereby being able to tolerate increased mortality to a relatively high degree. Or alternatively it could be an isolated population, a remnant of the larger bat population that used surrounding lands prior to changes in land use and/or loss of suitable roost sites.

Winter survey results

Seven structures were surveyed in winter 2014; Menlo Castle, Merlin Castle, Ballybrit Castle, Roscam Round Tower, Cooper's Cave, Dangan Ice House and a souterrain in the townland of Lydican. Both Ballybrit Castle and Merlin Castle were inaccessible for these winter surveys. Evidence of Lesser horseshoe bats was only found in Cooper's Cave, where a small number of fresh droppings were recorded.

In 2014-15, monitoring was carried out at the Lesser horseshoe bat hibernation roosts at Menlo Castle, Cooper's Cave and also potential sites at Newry's cave in Merlin Woods and an abandoned railway tunnel in the city centre. Bat detectors were deployed at all four locations to record bats as they arose from hibernation on occasions throughout the winter. These detectors recorded Lesser horseshoe bat activity at Cooper's Cave and Menlo Castle; and only recorded occasional Pipistrelle bat calls at the railway tunnel, on a single mild evening in February.

Daytime visual inspections of these four sites were undertaken in February and March 2015. Six Lesser horseshoe bats were recorded within Cooper's Cave on the February visit. It was noted that two of the bats were ringed. The ring numbers corresponded to the following bats ringed as part of the bat surveys in summer 2014: one was a male bat ringed and radio-tracked at Menlo Castle on the 30 August 2014; the other, a male bat ringed and radio-tracked at Cooper's Cave on the 1 September 2014. This confirmed that some of the individuals using the Menlo Castle summer roost also use the cave as a hibernation site, and that bats using Cooper's cave in summer months also use the cave as a hibernation site.

No bats were seen or otherwise recorded at Newry's Cave.

Checks for ringed bats using other known underground sites on the western side of the scheme study area, and outside of this in the direction of Moycullen, was completed on 6 February 2015. Five Lesser horseshoe bats (not ringed) were found hibernating in Cloonnabinnia Cave, outside Moycullen. A large pile of Lesser horseshoe bat droppings were also found in Moycullen Cave suggesting that it is used as a roosting site. Attempts were made to gain access to land where the cave named "Rhinolophus Retreat" is located; however, entry to lands was not granted. A souterrain near Athenry was also visited but was inaccessible and probably unsuitable for use by Lesser horseshoe bats as the entrance was blocked.

Summer roost surveys

Of the 106 buildings identified as potential bat roosts, evidence of Lesser horseshoe bats was recorded at nine during the summer roost surveys. Most roosts were located in the vicinity of Menlough and Castlegar but two others were found on the western edge of the city in the vicinity of Bearna Woods, one other was in the townland of Aubwee just off the N59 to the north west of the city, and one was located adjacent to the Corinthian's Rugby Club off the N17 to the north east of the city. All roosts, except one, were confirmed by droppings. One roost near Bearna was identified based on Lesser horseshoe sonograms recorded on an Anabat detector. Eight of the roosts were in unoccupied houses and outbuildings and one was located in an alcove of a bridge. All the roosts, except one, were classified as potential night roosts. No new maternity roosts were found.

Bat detector records

Lesser horseshoe bats were not recorded during the road transect surveys. However, the walked transect surveys recorded this species at Menlo Castle and Cooper's Cave, whilst Anabat detectors left out during the walked transects recorded them by a culvert on the N6 (where the Terryland Stream flows under the road), by the Coolagh Lakes and by Ballindooley Lough.

The static detectors (**Figures 4.3.11**), recorded Lesser horseshoe bats at 14 locations. Sites S5, S6 and S21 recorded the highest amount of activity for this species, which is unsurprising as these locations are all in close proximity to Menlo Castle (see summary of radio-tracking studies below). Beyond the "core" Menlough area, Lesser horseshoes were also recorded at a woodland edge in the Ballindooley area (S2), close to a known roost identified during the building surveys, in the hazel scrub-limestone pavement complex east of Menlough (S4 and S22), within the grounds of Glenlo Abbey Hotel (S8), in Castlegar Valley (S10), on three sites on the north western edge of Galway City (S11, S13 and S15), the outskirts of Bearna village (S19), and two sites on the north eastern edge of Galway City just to the north of Galway Technology Park (S1, S24).

The static detector left at Newry's Cave in Merlin Woods recorded a small number of Lesser horseshoe bat calls on the 26 and 28 September, 2014. A large number of Lesser horseshoe calls were recorded throughout September and October in Cooper's Cave, which would suggest that this cave is a mating site.

Radio-tracking results

13 Lesser horseshoe bats were captured and fitted with radio-transmitters in the first August radio tracking session; 10 of which were caught at the Menlo Castle maternity roost (seven females and three males) and three were caught at Cooper's Cave (all males). Five bats were captured and fitted with radio-transmitters in the September session; one was caught in Menlough Woods (female) and four were captured at Cooper's Cave (three males and one female).

Six daytime roosts and 11 night roosts for this species were identified during the August study. Three of the six daytime roosts and seven of the night roosts had already been identified as lesser horseshoe roosts from the summer roost surveys. Nine daytime roosts and eight night roosts were identified in the September session of radio-tracking. Only three roosts (Menlo Castle, Angliham Quarry shed and Cooper's cave) were used by bats during both tracking sessions. All roosts used by radio tracked bats were located in the vicinity of Menlough Village, Coolagh, Castlegar and Angliham Quarry.

In August, the maximum foraging distance from the roost of the Lesser horseshoe bat ranged from 0.59km up to 5.15km, with the average maximum distance of foraging area from the roost being 2.93km. On average, males foraged slightly further afield, with the average maximum distance from the roost 3.68km, while females averaged a maximum distance of 2.29km. In September, the maximum foraging distance from the roost ranged from 1.11km up to 4.40km with the average maximum distance of foraging from the roost being 3.39 km. On average, males foraged a maximum distance from the roost of 2.88km, while females averaged a maximum distance of 4.16km.

The overall foraging area in August comprised 21.75km² (MCP) or 13.70km² (MLP), whilst it was 56.10km² (MCP) or 26.46km² (MLP) in September. The majority of foraging areas recorded in both August and September, overlapped in woodland and field boundaries in the Menlo Castle and Menlough Village areas; suggesting that this was a key foraging area. Field systems and quarries north-east and east of Menlo Castle and field systems north of Cooper's Cave also served as foraging areas. The majority of Lesser horseshoe bat foraging areas in August and September overlapped in the area of River Corrib, field boundaries and woodland around Menlo Castle and Village, limestone pavement, woodland, scrub and lake around Coolagh and Menlough Village, field boundaries and scrub around Castlegar and Ballindooley Lough, and an abandoned quarry in Angliham. No foraging areas extended south of the existing N6, towards Galway City. The area of overlapping home-ranges from August and September was 11.96km² (MCP) or 8.1km² (MLP).

Based on the results of the radio-tracking studies carried out in 2014, it was concluded that Lesser horseshoe bats utilised existing woodlands, field boundaries and watercourses for foraging and navigating during this period. Areas of scrub over limestone pavement were often used as foraging areas for prolonged periods of time. Quarries in the Galway area appeared to be of particular importance to Lesser horseshoe bats. Areas used both during late maternity period in summer as well as for foraging in preparation for hibernation in late summer are regarded to be crucial in supporting the local Lesser horseshoe bats population.

The radio-tracking studies confirmed a strong link between the maternity roost present at Menlo Castle and Cooper's Cave. Although there was a direct connection between both sites via the River Corrib and Terryland Stream, the radio-tracked bats tended not to utilise this potential commuting route and instead travelled overland via Lackagh quarry to the Terryland Stream valley, via a small area of green space around Castlegar Village. Bats were regularly recorded commuting between the roosts and have been confirmed to be a part of the same Lesser horseshoe bat population.

All evidence suggests that Cooper's Cave is an important roosting site for male Lesser horseshoes in summer and an important autumn mating site in the area as well as a hibernation site for this species.

Leisler's bat

Bat detector records

Leisler's bats were recorded widely across the scheme study area during the walked and driven transect surveys. However, very few calls were recorded within the city limits. The species was recorded at every static detector location.

Radio-tracking results

During the August session of radio-tracking, a single male Leisler's bat was captured and tagged in Menlough Woods, using the acoustic lure. The maximum distance that this individual was recorded travelling was 4.85km over a foraging area of 8.96 km² that encompassed the southern area of Lough Corrib, the River Corrib and the Menlough area. Two roosts were located; a large modern house along the N84 near Ballinfoyle and an Ash tree at the edge of Menlough Woods.

During the second August session of radio tracking, another two male Leisler's bats were captured via luring in Bearna Woods; however, data was only collected for one of these bats. The remaining individual was found to roost during the day at two modern dwelling houses on the Cappagh Road. Foraging and roosting data was also collected for this individual during the September tracking session and he was found to roost in one of the buildings on the Cappagh Road that had been used in the previous tracking session. This bat had a recorded foraging area of 13.62km² (MCP) that encompassed the southern area of Lough Corrib, along the River Corrib corridor and Menlough area.

Common pipistrelle

Summer roost surveys

Only a single roost was located in an outbuilding in the Ballindooley area and was confirmed by DNA testing of collected droppings. The building was classified as a night roost.

Bat detector records

Common pipistrelle were recorded widely across the scheme study area during the walked and driven transect surveys. However, very few calls were recorded within the city limits, apart from areas adjacent to the River Corrib. The species was recorded at every static detector location.

Radio-tracking results

Six common pipistrelle were captured during the second August radio-tracking session; two at NUI Galway, two at the NUI Galway Recreational Facilities, and two at Menlough Woods. A male and female captured in NUI Galway were tagged and tracked to their day roosts. The female was found to roost in two modern buildings in a housing estate at Ballymoneen on the north western edge of the city, while the male was found to roost in two modern agricultural barns in Cloonacauneen, to the north of the Roadstone Quarry.

Soprano pipistrelle

Summer roost surveys

Four roosts of this species were located in Aubwee, Letteragh, Gortacleva, and Roscam during the summer building surveys. The roost sites were in unoccupied farm buildings and the species identification was confirmed by the DNA testing of droppings.

A historical record was also provided by the NPWS of a roost from Menlough Village in 2014.

Bat detector records

Soprano pipistrelle were recorded widely across the scheme study area during the walked and driven transect surveys. However, very few calls were recorded within the city limits apart from areas adjacent to the River Corrib. This species was recorded at every static detector location.

Nathusius' pipistrelle

Bat detector records

Nathusius' pipistrelle was recorded in localised areas during the walked and driven transect survey. They were recorded in the following locations; an area of farmland east of Galway Technology Park, Bearna Woods, Coolagh Lakes and Letteragh. However, the species was recorded at 21 static detector locations, although they were much less frequent than the other pipistrelle species, revealing that the species was more widespread than was shown by the walked and driven transects. Sites with higher numbers of calls included S20, S16, S21 and S06, which were located around the River Corrib.

Brown long-eared bat

Summer roost surveys

Twelve roosts of this species were recorded during the summer building survey. Eight of these were confirmed by DNA testing of droppings collected at these locations. Three of the roosts were classified as daytime roosts; Merlin Castle, an abandoned bungalow on the R338 to Oranmore, and a barn on the R399 east of Ballybrit. Six of the buildings were classified as night roosts, while the remaining three were not classified (two of these were probably night roosts also). The night roosts were found in the following locations; an abandoned house adjacent to the Corinthians RFC, an abandoned house in Rockmount, an abandoned cottage in Ballintemple, three outbuildings near Ballindooley Lough, an outbuilding and archway in Menlo, and an unfinished modern house in Gortacleva, A period house and outbuildings on the Letteragh Road and outbuildings on the coast road to Oranmore. A possible maternity roost for this species was also located during the second August radio-tracking session in a bungalow in Castlegar (see radio-tracking section below).

Bat detector records

Brown long-eared bats were only recorded at two locations during the walked and driven transects but these results are typical for this bat species which echo locates very quietly and intermittently and is therefore difficult to pick up on a bat detector. However, they were recorded at 18 static detector locations, indicating that the species is quite widespread in the scheme study area, consistent with the findings of the summer roost surveys.

Radio-tracking results

During the second August radio-tracking session, four Brown long-eared bats were captured with the aid of an acoustic lure (two bats at Bearna Woods, one bat at Menlough Woods, and one bat at Cooper's Cave). A female brown long-eared captured at Cooper's Cave was fitted with a radio transmitter and tracked to its sole daytime roost; a bungalow in Castlegar. An emergence count carried out on this building observed six bats leaving the roost. As this bat was an adult female it is likely that this building was being used as a maternity roost. This bat was also tracked during the September radio-tracking session and was found to again solely roost in the same bungalow. On one night the bat was recorded night roosting in the stone arch between Menlough Village and Menlo Castle during heavy rain. The maximum commuting distance recorded for this individual in a single night was approximately 4.07km. The foraging area of 2.18km² (MCP) mainly encompassed the valley where Cooper's Cave was located but also around Ballindooley Lough.

Myotis bat species

Summer roost surveys

Five Natterer's bat roosts were recorded during the summer roost survey. Four of these were confirmed based on the presence of droppings, which were DNA-tested to identify the species concerned. There was also an historical record of a roost of Natterer's bats at St James's Church, Bushypark and Menlo Castle was historically known as a Daubenton's and Natterer's roost. An emergence survey of Menlo Castle carried out on the 8 July 2014 found Daubenton's bats to be still roosting in the castle.

Bat detector records

For the walked and driven transects, and the static detectors, the majority of *Myotis* calls were not identified by species due to the heavy overlap in call characteristics between species when analysed. However, on a number of occasions *Myotis* species were confirmed by visual observations. Natterer's bats were recorded at Bearna Woods and Daubenton's bats were recorded foraging on the River Corrib and the Terryland Stream. The majority of *Myotis* calls were recorded along the River Corrib and Terryland Stream for the walked and driven transects and were very infrequently recorded in the rest of the scheme study area. In contrast *Myotis* calls were recorded across all static detector locations, although at a lower frequency than pipistrelle species. Location S07 recorded the highest amount of *Myotis* activity. This site was close to the River Corrib and a known Daubenton's maternity roost (see radio-tracking results below).

Radio-tracking results

During the first August radio-tracking session, nine Daubenton's bats (one female and eight males) were captured with an acoustic lure in Menlough Woods and a single male Daubenton's bat was captured at Cooper's Cave – a single male Daubenton's bat captured in Menlough Woods was tagged. During the second August tracking session, ten Daubenton's bats were captured (one from Merlin Wood, three from NUI Galway, and six from Menlough Woods) and four were tagged (one female from Merlin Wood, two females and one male from NUI Galway). The male bat from the first August session was found to roost in a walled enclosure on the banks of the River Corrib. An emergence count found 25 Daubenton's bats to be roosting in the wall, suggesting that this may be a maternity roost. Roosting information was recorded for three Daubenton's bats tracked during the second August session. They were found to roost in three buildings and two bridges in Galway City Centre. Foraging data was recorded in the September session for two Daubenton's bats that were captured during the second August session. One bat travelled a maximum distance of 1.06 km and had a foraging area of 0.26km² (MCP) encompassing Merlin Woods and the Coolagh Lakes. The other had a maximum distance of 2.48km and had a foraging area of 0.55km² (MCP) encompassing the River Corrib from Menlo Castle into Galway City Centre.

Two male Whiskered bats were captured during the second August session (one from NUI Galway and one from Merlin Woods). However, one of these bats (the one captured in Merlin Wood) disappeared and no data was gathered for it. The other bat was found to roost in two modern dwelling houses in a residential estate by the Sports Centre, near Bearna Woods. Foraging data for this individual was gathered during the September tracking session.

The maximum distance this bat travelled was 3.71km and had a foraging area of 2.02km², encompassing areas of scrub and rough grassland in the Bearna area.

A Natterer's bat was captured in Menlough Woods during the second August tracking session but was not tagged. Another male Natterer's bat was captured and tagged in Menlough Woods during the September tracking session; however no data was recorded from this bat (possibly due to the bat leaving the area, or transmitter failure).

4.4.3 Otters

4.4.3.1 Methodology

The Otter survey was carried out by Scott Cawley Ltd. from the 15 April to the 7 May 2014.

The survey covered Otter habitat (as defined in the Threat Response Plan: Otter (2009-2011) document: NPWS, 2009) within the boundary of the Lough Corrib cSAC. The Otter survey study area is shown on **Figure 4.3.17**. The status and activity of any Otter holts was recorded along with any evidence of activity, including paths, tracks, feeding signs, sprainting sites or couches (Otter resting places).

4.4.3.2 Results

Otter activity was present throughout the surveyed area, extending from the shores of Lough Corrib at Coolanillaun to the Salmon Weir in Galway City. The highest concentration of Otter activity was recorded at Coolanillaun, which included numerous couch sites. The results of the Otter survey are summarised in **Table 4.2** below and shown on **Figure 4.3.17**.

Table 4.2 Lough Corrib cSAC Otter survey results

Feature	Reference No.	Note
Couch site	C1	Couch site on the shore of Jordan's Island; high level of Otter activity in the vicinity
Couch site	C2	Couch site at edge of reeds on the shore of Coolagh Lakes
Couch site	C3	Couch site in marsh near the river bank
Couch site	C4	Couch site along the river bank
Couch site	C5	Couch site along the river bank
Holt/couch site	C6	Dense scrub patch on lakeshore with Otter trails leading into vegetation; high level of Otter activity locally; evidence of juvenile Otter presence
Couch site	C7	Couch site along lake shore; high level of Otter activity in the vicinity
Couch site	C8	Couch site along lake shore; high level of Otter activity in the vicinity
Couch site	C9	Couch site along lake shore; high level of Otter activity in the vicinity

4.4.4 White Clawed Crayfish

4.4.4.1 Methodology

The White-clawed crayfish survey was carried out by Scott Cawley Ltd. and Julian Reynolds, under licence from the Department of Arts, Heritage and the Gaeltacht, from the 23 August 2014 to the 6 September 2014.

The watercourses surveyed are shown on **Figure 4.3.18**. Watercourses were located and, depending on the size of the waterbody, either sweep-netted with hand nets (following Reynolds *et al.* 2010) or trapped using crayfish traps of appropriate mesh size. Where trapping was undertaken, traps were checked for crayfish and baited each morning and were left out over two or three nights.

4.4.4.2 Results

There were no White-clawed crayfish recorded at any of the survey sites within the scheme study area. No other evidence of the presence of the species within the scheme study area was observed (i.e. Otter spraints will commonly contain crayfish remains if they form part of their diet).

The survey was carried out in September 2014 during a period of low water levels, considered to aid in indicating those streams suitable of supporting White-clawed crayfish, and relatively high water temperatures, which would be expected to encourage crayfish activity.

All watercourses in the western part of the scheme study area were considered unsuitable to support the species, the water chemistry being too acidic and the lack of suitable habitat and/or quality; many of these streams were small or intermittent.

The Terryland Stream and the River Corrib appeared to be suitable for White-clawed crayfish but none were recorded. The Merlin Park Stream was considered unsuitable.

4.4.5 Freshwater Pearl Mussel

4.4.5.1 Methodology

The Freshwater pearl mussel *Margaritifera margaritifera* survey work was carried out by Evelyn Moorkens and Ian Killeen, under licenses from the Department of Arts, Heritage and the Gaeltacht, from the 11 to the 24 August 2014.

The level of survey undertaken was determined in consideration of the potential for the presence of the Freshwater pearl mussel from a review of the following maps: OSI Discovery Series mapping, and the Geological Survey of Ireland's (GSI) Bedrock Geological Map of Ireland. Suitable habitat potential was considered to include areas of acid rock with sufficient gradient to have the potential for good flow in the river channel, including riffle habitat.

The main channel of the River Corrib and the area east of the River Corrib were discounted through not having the appropriate underlying geology to support the Freshwater pearl mussel. The watercourses west of the River Corrib which were surveyed as part of the N6 GCTP Constraints Study are shown on **Figure 4.3.19**.

In each stream a rapid assessment was undertaken of river stretches identified from the desktop assessment, following the current standard methods for Freshwater pearl mussel survey (Anon., 2004). As the streams were small, survey was carried out by wading in an upstream direction using a bathyscope according to published Stage 1 survey techniques (Anon., 2004).

4.4.5.2 Results

There were no populations, or individual records, of the Freshwater pearl mussel recorded within the scheme study area. The full results of the Freshwater pearl mussel surveys are provided in **Appendix H**.

The watercourses present were found to be poor habitat for the species, and although the Bearna Stream had good potential, no mussels were found. While the Lough Inch River itself had poor habitat and was impacted by various pressures, this watercourse was upstream of, and in direct connectivity with, the Knock River - the confluence of the Lough Inch River and the Knock River is upstream of a known Freshwater pearl mussel population. The Knock/Lough Inch catchment is shown on **Figure 4.3.19**.

4.4.6 Other Annex II molluscan species

4.4.6.1 Methodology

The molluscan survey work was carried out by Evelyn Moorkens and Ian Killeen, under licenses from the Department of Arts, Heritage and the Gaeltacht, from the 11 to the 24 August 2014.

This element of the survey work included the following four Annex II molluscan species (surveys for the Freshwater pearl mussel were carried out separately, as described above under **Section 4.4.5**):

- *Vertigo geyeri* (Geyer's whorl snail);
- *Vertigo angustior* (Narrow-mouthed whorl snail);
- *Vertigo moulinsiana* (Desmoulin's whorl snail); and
- *Geomalacus maculosus* (the Kerry slug).

The molluscan survey sites were chosen based on a review of habitats within the scheme study area from recent aerial photography in combination with the results of habitat mapping surveys carried out within Lough Corrib cSAC, the Ecological Sites, and the wider scheme study area (as described above under *Habitats*), to locate habitat types with potential to support Annex II molluscan species. The survey sites are shown on **Figure 4.3.19**.

The habitat requirements for each of the four species concerned are described in detail in *Monitoring and Condition Assessment of Populations of Vertigo geyeri, Vertigo angustior and Vertigo moulinsiana in Ireland* (Moorkens & Killeen, 2011) and in *Database of association with habitat and environmental variables for non-shelled slugs and bivalves of Britain and Ireland* (Moorkens & Killeen, 2009).

Overall, initial surveys and the aerial photography review indicated that there were four main areas of potential habitat for *Vertigo* snail species:

Areas of reed swamp, wet grassland and fen along the River Corrib corridor;

- Coolagh Lakes area;
- Ballindooley Lough area; and
- Turlough features east of the River Corrib.

No potential suitable habitat was recorded for the Kerry slug within the scheme study area.

At each survey site a wide area was investigated and the main habitats with the potential to support *Vertigo* species were sampled. Habitats were sampled by hand, (i.e. examination of litter, stems and the underside of timber). Suitable habitat vegetation was sampled by banging leaves onto a white tray, and by the removal of amalgamated litter samples from areas of best potential for *Vertigo* species.

Approximately 2 to 3 litres of litter was taken from each sampling site, air dried in the laboratory, and then sieved through two mesh sizes (3mm and 0.5mm). The contents of each sieve was examined for snails. An Olympus 40X binocular microscope was used to examine the smaller species.

4.4.6.2 Results

There were no nationally or internationally rare or protected molluscan species found during the survey. A total of 39 molluscan species were found in the survey, with a range of between one and twelve species per surveyed site. The species assemblage recorded in some areas (e.g. Wetland habitats associated with the Coolagh Lakes and some Calcareous grassland habitat nearby) was considered to be of local interest. The full results of molluscan species found are presented in **Appendix I**. Species are listed according to the nomenclature of Anderson (2005).

There were no protected *Vertigo* species recorded during the survey. Three other *Vertigo* species (*Vertigo pygmaea*, *Vertigo antivertigo* and *Vertigo substriata*) were recorded, suggesting that the habitat conditions were not quite even in wetness and/or calcareous enough for the three Annex II *Vertigo* species. The remainder of the species recorded were typical of wet grassland, reed bed, riparian fringe, and fen habitats. Together the sites displayed a good range of species assemblage with good variety across the sites, reflecting the level of variation in wetness and vegetative succession of different areas. It should be noted that *Vertigo antivertigo* is listed as vulnerable in the Irish Red Data List of molluscs (Byrne *et al.*, 2009).

The best molluscan habitat was found towards the southern end of the Coolagh Lakes, concentrated in the high quality fen and transitional habitat areas (see **Figure 4.3.19** and the full survey report in **Appendix I**). Here the most concentrated searches for *Vertigo geyeri* were undertaken but no individuals of this species were found in the field or in samples removed for laboratory analysis.

4.4.7 Marsh Fritillary

4.4.7.1 Methodology

Large scale larval web and habitat suitability surveys for Marsh fritillary were carried out by Woodrow Environmental Consultants Ltd. between the 15 September

and 10 October 2014 (see **Appendix K** for full report), with the vast majority of the work completed by 26 September 2014.

The selection of areas for survey within the scheme study area was informed by:

- Desktop records for the species;
- Results from Marsh fritillary surveys of the area undertaken in 2013 (Barron et al., 2013) – see **Appendix J**; and
- Results of the large scale habitat surveys across the scheme study area which yielded useful information on potential suitability of habitat based on the presence of the species' food plant Devil's-bit scabious *Succisa pratensis*;
- A review of orthophotography within those habitat polygons known to support Devil's-bit scabious - for example, where areas were clearly improved they were discounted as being unsuitable; areas for priority survey included those close to the existing known population, or areas holding habitat similar in character to known suitable habitat polygons.

Based on this information, large areas within the scheme study area which were either known or considered likely to support Marsh fritillary, were selected for survey as indicated on **Figure 4.3.20**.

Habitat condition and larval web surveys followed approaches adopted by NPWS in 2010 with amendments agreed following the 2011 National Marsh Fritillary report (Woodrow *et al.*, 2012)

Larval Web Survey

Larval web surveys were undertaken during targeted walks of each site relying on the experience of the surveyors to identify potential areas of search while in the field. Experience has shown that, given highly experienced surveyors, this can be a very effective and reliable survey method where the intention is to identify the presence of colonies rather than undertaking a full population survey.

The method for larval web surveys relied on the high level of experience of the survey team and was undertaken as follows:

- Site surveys were undertaken with two or more surveyors. Each surveyor was responsible for undertaking habitat condition surveys and larval web surveys;
- Larval web surveyors walked a zig-zag route through the most appropriate habitat, concentrating on the most likely features and aspects for larval webs;
- Where a larval web was found, surveyors undertook a short more intensive zig-zag search of the neighbouring area to ascertain whether it was a significant colony;
- After three or four larval webs were recorded, or if no more were located immediately, the surveyors continued to cover the remainder of the site in a zig-zag pattern, until all the habitat survey was completed and then moved on to the next site;
- Handheld GPS units were used to record 10 Figure grids of each larval web;
- Habitat condition was recorded at all web locations.

Habitat Condition Survey

The number of sites, and the size of many, meant that full habitat condition assessment of all sites would be unfeasible within the timescales. For this reason, habitat condition parameters were recorded only at sites where larval webs were recorded. While habitat condition assessments are particularly useful in Marsh fritillary monitoring programmes and habitat management assessments, since they allow for analysis of the selection of different sites (or sub-sites) by Marsh fritillaries based on different criteria, such assessments were not central to this project which aimed to identify any *potentially suitable* habitat. The extensive experience of the survey team allowed this to be done for all sites, based on identification of areas of dense and/or extensive Devil's-bit scabious within a reasonably open sward.

Habitat condition assessments involved the collection of data on the following criteria:

- Vegetation height recorded by the average band in which the sample fell into (A = <12cm, B = 12-25cm, C = 25--50cm, and D = >50cm);
- Devil's bit Scabious abundance (A = 1-2 plants /m², B = 3-9 plants /m², C=10+ plants /m², and D = no plants);
- Presence of tussocks/dominant tussock-forming species present;
- Presence of low invading scrub (<25cm tall and >10% cover); and
- Evidence of stock grazing (poaching, dung etc.).

Survey Limitations

Safe access to the whole of one area was not obtained due to blocking watercourses (the area highlighted as limited coverage (access) – surveyed remotely for scabious) in **Figure 4.3.20**. In this instance, where access was not feasible, the surrounding area was surveyed for potentially suitable habitat from vantage points using binoculars. Much of the area comprised fairly improved pasture, scrub, woodland and wetland and so would have held very little potential for the species. No flowering devil's-bit scabious was observed.

4.4.7.2 Results

Suitable Habitat

A total of 196 polygons were surveyed, comprising a total area of 936ha. A total of 105 areas of suitable marsh fritillary habitat were mapped, comprising a total area of 80.6ha. The quality of habitat ranged from marginal sparse through to good condition. Many areas were fairly rank and were likely to be limited in their longevity, with management often apparently abandoned or affected by access due to development in the vicinity.

Webs and Colonies Located

A total of 111 webs were located within around 40 areas of suitable habitat that were separated to some degree from other areas of suitable habitat. In many cases the separation was simply related to sporadic occurrence of areas of dense Devil's-bit scabious across a varied habitat landscape.

In other cases, the areas of suitable habitat holding colonies were separated as a result of land use change, management or infrastructure. Eleven of the webs were located in four different areas identified as suitable habitat in the 2013 surveys but with no webs recorded in that year. The rest of the webs were recorded in areas that had not previously been surveyed.

Some sites held significant numbers of webs, or a significant numbers of webs were shared between a collection of proximal suitable sites. In other cases small numbers of webs or individual webs were found at sites a significant distance from other sites holding webs. In this latter case, this may suggest colonisation or re-colonisation of suitable habitat in 2014.

Webs located included both active webs and hibernation webs.

Discussion

The surveys undertaken in 2014 reveal a population of Marsh fritillaries in the vicinity of Galway City. As detailed previously, a full population survey was not undertaken. However, considering the number of polygons and total area recorded as holding suitable habitat for the species (105 polygons, comprising 80.6ha), the number of polygons within those shown to hold marsh fritillary larval webs (40 polygons), and the number of larval webs recorded (111), it is reasonable to conclude that the wider area holds a population of conservation significance. In many cases the population occurs as small and somewhat disjointed colonies across a fairly fragmented landscape. The area clearly holds some core colonies in extensive and coherent habitat networks (with the area around Boleybeg East particularly notable considering the amount of unbroken or closely connected suitable habitat and polygons recorded as holding larval webs) and also holds Marsh fritillaries in areas where suitable habitat is limited and colonies may be considered either transient, precarious or both (for example the Galway Racecourse and in the vicinity of Roscam and Cartron).

Some records of larval webs are consistent with the species colonising or re-colonising areas during what was a fairly settled year weather-wise (for example in the vicinity of Roscam and Cartron). However, the majority of records were in areas holding fairly significant numbers of webs and therefore, probably well-established colonies.

The area to be covered meant that surveys had to be undertaken rapidly in order to ensure full coverage. This meant that full population surveys were not undertaken at sites beyond a general understanding of whether a colony was generally of a significant size or not. This means that the number of webs located is likely to be a significant underestimation in terms of population size. However, the experience of the survey team in finding webs within suitable habitat means that, from a presence / absence perspective, the results can be considered reliable. The general approach to surveys, in identifying potentially suitable habitat for the species, as well as confirmed colonies, allows for precautionary avoidance of potential future colonies.

A total of 105 polygons of suitable habitat were located ranging from very small areas to areas covering a number of hectares. Larval webs were located within 40 of these. The proximity of many of these areas of suitable habitat means that, even though webs were not located in 2014, they may be used by the species in other years and may, in some cases, be important to the future survival of metapopulations.

The nature of the species means that, in good years for the species when individuals are colonising the wider area, the smallest patches of Devil's-bit scabious may attract travelling females and may consequently hold larval webs. These patches may not have been identified during the survey. However, such areas are not considered likely to be central to the survival of the species in the area.

4.4.8 Red Grouse

4.4.8.1 Methodology

The Red grouse survey was carried out by Dr Chris Peppiatt from 18 June 2014 to the 9 August 2014.

The Red grouse survey sites were chosen based on a review of recent aerial photography of the scheme study area to identify areas of potentially suitable habitat (i.e. areas of blanket bog and heath). Within each of the survey sites, transects spaced 100m apart were walked such that the surveyor came within 50m of all parts of the survey site. The location of any flushed birds, or evidence of Red grouse such as droppings, was recorded and mapped. The survey sites are shown on **Figure 4.3.21**.

4.4.8.2 Results

No sightings, or evidence, of Red grouse was recorded during the survey. During the course of other survey work in September (and over the course of the winter bird survey work from October 2014 to March 2015), evidence of Red grouse (droppings) was recorded adjacent to the scheme study area at Na Forá Maola/Lough Inch (see **Figure 4.3.21**).

4.4.9 Barn Owl

4.4.9.1 Methodology

The Barn owl survey was carried out by BirdWatch Ireland from 27 June 2014 to 18 July 2014.

A desktop study in combination with field assessment was conducted on the 26 June 2014 to determine the extent of the scheme study area potentially suitable for Barn owls. This initial assessment identified an area of $c.30\text{km}^2$ within Galway City and surrounds as largely unsuitable for nesting Barn owls, which was based on knowledge of nest site selection and requirements in Ireland. Although Barn owls may use urban areas for foraging, nesting within built up areas is unusual (Copland and Lusby, 2012). In addition, survey work is less effective due to access to buildings and for these reasons this area was excluded from further survey work. Therefore the overall scheme study area considered as potentially suitable and which was the focus for further survey work, comprised an area of $c.195\text{km}^2$. A map of the Barn owl study area is shown in the Barn owl survey report in **Appendix L (Figure 1.1)**.

Prior to beginning the fieldwork, all relevant information on existing and previously active Barn owl sites and sightings from within the Barn owl survey area were extracted from relevant BirdWatch Ireland databases; including the Barn owl registered site and sightings database and the recent Breeding Birds Atlas (2007 – 2011) database (refer to Balmer *et al.*, 2013). All data was collated and the details included on suitable large-scale Ordnance Survey maps.

A detailed survey sheet for use in the field was drafted to take account of the following aspects for each site surveyed; date, county, grid reference, site type, site name, suitability rating (0 – 3), status, nesting opportunities, signs, and whether a roost watch was required and/or carried out. Additional information was recorded relating to the suitability and presence of other raptors, corvids, or other species of note.

All roads within the survey boundaries were systematically travelled and the suitability of all buildings and quarries within the Barn owl study area was assessed. Sites that were considered to be potentially suitable were comprehensively searched for signs of the presence of Barn owls. All sites were categorised on a scale of 0 – 3 based on potential nesting and roosting opportunities for Barn owls: 0, for unsuitable; 1, representing potentially suitable sites for roosting but unlikely for nesting; 2, being suitable roosting or nesting sites; and 3, representing sites considered to be very suitable.

At each site, a thorough search was conducted inside and outside of the building, or within the quarry, in order to locate signs indicating the presence of Barn owls (particularly pellets, evidence of whitewash splashings and moulted feathers). Depending on the site characteristics, adjacent buildings and potential perches in the immediate vicinity of the site were also assessed. At certain active Barn owl sites, due to the concealed nature of nest and roost sites (e.g. blocked chimneys, deep cavities etc.), signs are not always obvious or accessible. Therefore at the particular sites where this was judged to be an issue, it was necessary to conduct a vantage point watch lasting a minimum of one hour and commencing at dusk (i.e. a ‘roost watch’) in order to confirm activity. These sites were then recorded as active if calls from an adult or owlets were heard, or if a Barn owl was observed either within the site, or entering/exiting the site. These methods were designed to locate all Barn owl sites in buildings and quarries within the Barn owl study area. All signs and sightings of other raptors encountered during fieldwork were also recorded.

Tree sites were not assessed as part of this study. However information on Barn owl activity was sought whenever landowners were encountered over the course of survey work and on an opportunistic basis during fieldwork. Interviews with landowners have been successfully used to assess Barn owl occupation in previous Barn owl surveys (Toms *et al.*, 2001). Landowners were asked a series of standardized questions, shown images of Barn owls, and played vocalizations of the species for identification purposes. An assessment was made as to the reliability of each individual report, based on the account, the observer’s description and their relevant level of knowledge. Reports that were considered to be potentially unreliable were discarded. Reliable reports were divided into two categories, “breeding season” which consists of the period March to July and “non-breeding season” which comprises the remainder of the year. Greater importance was afforded to those sightings which originated from within the defined breeding season period as these are likely to represent birds holding territory, as opposed to non-breeding season sightings which could represent dispersing juveniles.

At all active or potentially active sites, or those where it was deemed necessary to conduct a roost watch to accurately determine status, additional nocturnal visits were carried out to confirm activity and breeding status.

4.4.9.2 Results

A total of 76 sites were comprehensively surveyed for the presence of Barn owls in the scheme study area. Of these the commonest site type was derelict cottages (27 sites), followed by stone barns (13 sites), castles (11 sites), derelict two-story farmhouses (7 sites), disused metal-roofed barns (5 sites), quarries (3 sites), derelict mansions (3 sites) and derelict or disused churches (2 sites). Other sites included a derelict mill, a priory, a round tower, a derelict school and a derelict warehouse. The locations of the surveyed sites are shown in the Barn owl survey report in **Appendix L**.

The presence of Barn owls was confirmed at five of these sites within the scheme study area, which included all three sites which were previously known to BirdWatch Ireland and an additional two previously undocumented sites. These included two castles (nest sites at Menlo Castle and Ardfry House), a ruined mansion (roost site at Rinvile House), a derelict two-story farmhouse and a quarry (both roost sites). The distribution of all sites is shown on **Figure 4.3.22**.

A total of 21 nocturnal visits were carried out across all 14 sites classed as category 3 both to determine occupation, and for those sites where signs were encountered, to determine activity and breeding status. Two sites in castles were confirmed as nest sites, a ruined mansion was classed as regular roosts which are likely to be associated with both nesting pairs, and an independent occasional roosting site in a derelict farm house was also recorded. Monitoring revealed that both nesting sites failed to breed in 2014.

All records of other raptor species encountered during survey work or known to be active within the scheme study area in 2014 are shown on **Figure 4.3.22**. A total of 17 other raptor sites were confirmed, which included eight Kestrel sites (three nests and five roosts), six Peregrine sites (three nests and three roosts), two Sparrowhawk sites (one nest and one displaying pair) and a single Long-eared owl nest. Specific surveys were not undertaken for these species and therefore these sites should not be assumed to be a complete representation of raptor activity within the study area, but merely those encountered as part of the Barn owl survey.

4.4.10 Winter Birds

4.4.10.1 Methodology

Winter bird field surveys were conducted by Chris Peppiatt, Gerry Murphy and Scott Cawley staff, once a month during daylight hours from September 2014 to March 2015. Due to the diverse nature of the sites surveyed, surveys were conducted using a combination of methodologies. In general, the approach was a 'look-see' methodology (based on Gilbert *et al.* 2011). The survey sites are shown on **Figure 4.3.23**.

Wetland and Peatland Sites

Where possible, sites were surveyed from vantage points (e.g. Ballindooley Lough and Coolagh Lakes) and any species utilising the area and the activity were recorded. Larger sites were surveyed using a hybrid methodology of thorough walks through the site with point counts and/or vantage points undertaken along the route, where possible. The sites covered included:

- River Corrib;
- Terryland Stream;
- Ballindooley Lough;
- Coolagh Lakes;
- Moycullen Bogs NHA at Ballagh and Tonabrocky;
- Moycullen Bog pNHA at Tonabrocky;
- Cappagh Road Peatland;
- Lough Inch north-eastern peatland;
- Lough Inch southern peatland; and
- Lough Inch south western peatland.

Hen harrier Roost Surveys

Hen harrier Roost Surveys were undertaken at Ballindooley Lough and the Coolagh Lakes on the same days as the other winter bird surveys. This involved vantage point surveys of the area from 1.5 hours before sunset to 0.5 hours after sunset to record any Hen harriers in the area.

Quarries, Agricultural Areas, and Amenity Areas

Three quarries were surveyed using a hybrid methodology of walks and/or drive through the site with point counts and/or vantage points undertaken along the survey route.

Agricultural and amenity areas were surveyed using a combination of windscreen surveys and roadside views where possible, with some areas requiring a walk through to determine usage by wintering birds.

4.4.10.2 Results

The winter bird surveys recorded a wider range of bird species at sites across the scheme study area.

Eight bird species which are listed as SCIs for Lough Corrib SPA were recorded during the survey: Black-headed gull, Common gull, Shoveler, Hen harrier, Coot, Golden plover, and Tufted duck.

Fourteen bird species which are listed as SCIs for Inner Galway Bay SPA were recorded during the survey: Bar-tailed godwit, Light-bellied Brent goose, Black-headed gull, Cormorant, Common gull, Curlew, Grey heron, Lapwing, Great northern diver, Shoveler, Redshank, Teal, Turnstone, and Wigeon.

Eight species listed on Annex I of the Birds Directive (2008/144/EC) were also recorded during these surveys (some of which are also SCIs of the SPAs discussed above):, Bar-tailed godwit, Bittern, Golden plover, Great northern diver, Hen harrier, Little egret, Merlin, and Peregrine falcon.

Of the bird species recorded during the winter bird surveys, five are on the BoCCI Red List for their wintering populations: Curlew, Lapwing, Redshank, Shoveler, and Wigeon.

Brief species accounts from the winter bird surveys are provided for these species below.

Black-headed gull

Black-headed gull were the most frequently recorded species and were distributed widely across the scheme study area (recorded from 39 out of the 72 winter bird sites surveyed in 2014/2015) and in numbers ranging from single individuals to a flock of 130 birds; the average count per surveyed site per month was 20. Those sites which recorded the larger flocks of over 40 individuals were the River Corrib corridor (WB12), several urban parks within Galway City (WB28, WB31, WB38, and WB44), fields along the northern shore of Oranmore Bay (WB71, where 130 were recorded in October 2014; the highest single record during the surveys), and the recreational facilities at NUI Galway (WB45).

Common gull

Common gull were recorded widely across the scheme study area (recorded from 27 out of the 72 winter bird sites surveyed in 2014/2015) and in numbers ranging in size from single individuals to a flock of 120 birds. However, the species was generally recorded infrequently at individual sites and in relatively low numbers; at 23 of the 27 surveyed sites this species was only recorded on one or two of the seven survey visits, and at 21 surveyed sites fewer than ten birds were recorded during any survey visit. The largest flocks were recorded along the north shore of Oranmore Bay (WB71), where 120 were recorded in October 2014, and along the River Corrib corridor (WB12) where flocks of 48 and 78 were recorded in the area immediately upstream of the Salmon Weir in September and November 2014, respectively.

Shoveler

Shoveler were recorded on, or flying into, only one of the winter bird survey sites in 2014/15: Ballindooly Lough (WB02). They were recorded in five of the seven survey visits in numbers ranging from 10 to 144 birds.

Tufted duck

Tufted duck were recorded at one of the winter bird sites surveyed in 2014/2015: Ballindooly Lough (WB02), where the species was recorded on four occasions over the winter (November, January, February and March). The maximum number recorded was a count of 26 in January 2015.

Coot

Coot were recorded at three of the winter bird sites surveyed in 2014/15: Ballindooly Lough (WB02), the Coolagh Lakes (WB04), and along the River Corrib corridor (WB12).

Although Coot were regularly recorded at all of these sites, the numbers were low with a maximum of 11 recorded at Ballinoooley Lough in February/March 2015.

Golden plover

Golden plover¹⁶ were recorded at two of the winter bird sites surveyed in 2014/15: to the east and west of Lough Inch (WB06 and WB08 respectively). Golden plover were only recorded once at WB06 – a flock of 9 in October 2014). Golden plover were recorded frequently at WB08 (on four out of seven survey visits) but, on all but one occasion when a flock of 73 were recorded (November 2014), in relatively low numbers (maximum of 9 birds).

Hen harrier

A Hen harrier¹⁷ (a single individual) was recorded in the vicinity of Lough Inch in January 2015.

Bar-tailed godwit

Nine Bar-tailed godwit were recorded at one winter bird survey site, Ballinoooley Lough (WB02), on a single occasion in February 2015.

Light-bellied Brent goose

Light-bellied Brent goose were recorded at three winter bird sites surveyed in 2014/15: Galway Golf Course (WB19), Claddagh/Nimo's Pier (WB38) and along the north shore of Oranmore Bay (WB71). At WB19 the species was recorded twice (27 in January 2015 and 32 in February 2015); at WB38 on two occasions (127 in January 2015 and 83 in March 2015); and at WB71 three times (5 in December 2014, 52 in January 2015 and 4 in February 2015).

Cormorant

Cormorant were recorded at six winter bird survey sites across the scheme study area (WB02, WB04, WB07, WB08, WB12, and WB31) but in all instances the numbers recorded were low; generally one or two individuals with the exception of a record for four in February along the River Corrib (WB12).

Curlew

Curlew were distributed widely across the scheme study area, recorded at 24 of the 72 winter bird sites surveyed in 2014/15. Over the majority of survey sites and dates on which they were recorded (81%), fewer than 10 birds were present. At ten sites (WB23, WB70, WB28, WB19, WB20, WB71, WB12, WB51, WB27 and WB40) larger numbers were recorded – between 12 and 37 – but only on a single occasion at each site. The species was only regularly recorded at two winter bird survey sites: Ballinoooley Lough (WB02) and along the north shore of Oranmore Bay (WB71) where it was present on 5 of the 7 survey visits – on all but one occasion with eight or fewer birds present (that was a record of 17 from February 2015 at WB71).

¹⁶ Also listed on Annex I of the Birds Directive 2009/147/EC

¹⁷ Also listed on Annex I of the Birds Directive 2009/147/EC

Grey heron

Grey heron were recorded from 15 out of the 72 winter bird sites surveyed in 2014/2015, with generally only single individual birds recorded. Notable exceptions were records of 18 and eight Grey heron from two of the coastal sites along the north shore of Oranmore Bay (WB70 and WB71 respectively).

Lapwing

Lapwing were recorded at four winter bird survey sites: Ballindooly Lough (WB02) where a flock of 16 and a single individual were recorded on January and March 2015 respectively; Na Foráí Maola/West of Lough Inch (WB08), where 17 were recorded in October 2014; Lough Atalia (WB22), where 26 were recorded in November 2014; and, along the north shore of Oranmore Bay (WB71), where flocks of 13 and 70 were recorded in September and December 2014 respectively.

Great northern diver

Great northern diver were only recorded at one of the winter bird sites surveyed in 2014/15; an area of coastal grasslands at Ballyloughaun (WB30) where a single bird was recorded in January 2015.

Redshank

Redshank were recorded at six winter bird sites surveyed in 2014/15: WB08, WB12, WB30, WB52, WB70 and WB71. The numbers present were generally low (<9) with the exception of a flock of 47 Redshank recorded in WB71 in January 2015. WB71 was the only site at which the species was regularly recorded (i.e. on four survey visits).

Teal

Teal were recorded at six winter bird sites surveyed in 2014/15: WB02, WB04, WB08, WB10, WB14 and WB71.

The numbers recorded at WB04, WB08, WB10, and WB71 were generally low (<6 birds) and Teal were not present regularly throughout the winter period (recorded on 2, 4, 1 and 1 occasions respectively). In WB14, Teal were recorded during all survey visits in numbers ranging from 9 to 29. Teal were recorded on, or flying into, Ballindooly Lough (WB02) during all survey visits in numbers ranging from 3 on October 2014, to 146 in January 2015.

Turnstone

Turnstone were recorded at one winter bird survey site; an area of coastal grasslands at Ballyloughaun (WB30) where five birds were recorded in October 2014.

Wigeon

Wigeon were recorded at five winter bird sites surveyed in 2014/15: WB02, WB22, WB31, WB70 and WB71.

WB71, along the north shore of Oranmore Bay, was the only site at which the species was regularly recorded (i.e. on five survey visits) in numbers ranging from 5 to 83 birds. Wigeon were recorded twice at site WB70 (max count of four and 15 birds) and three times at WB22 (between five and 15 birds).

Wigeon were recorded on one occasion at Ballindooly Lough (WB02), where 28 birds were recorded in February 2015, and once at (WB31) where 4 were recorded the same month.

Peregrine falcon

Peregrine falcon were recorded at two winter bird survey sites: Angliham Quarry (WB15) and the Roadstone Quarry (WN17). At the Roadstone Quarry a single bird was recorded on three occasions; at Angliham Quarry two birds were recorded in September 2014 and a single individual in October 2014.

Bittern

A single Bittern was recorded at the Coolagh Lakes (WB04) in February 2015.

Little egret

Little egret were recorded from four winter bird survey sites: along the north shore of Oranmore Bay (WB70 in December 2014 and WB71 in September and December 2014), coastal grasslands at Rusheen Bay in September 2014 and March 2015 (WB52), and along the coastline at Renmore in December 2014 (WB31). The maximum number recorded was a count of 4 from WB70.

Merlin

A single Merlin was recorded in the area west of Lough Inch (WB08) in December 2014.

The full results of the winter bird surveys are provided in **Appendix M**.

5 References

- Anon. (2004) *Margaritifera margaritifera*. Stage 1 and Stage 2 survey guidelines. *Irish Wildlife Manuals, No. 12*. National Parks and Wildlife Service, Department of Environment, Heritage and Local Government, Dublin, Ireland.
- Anderson, R. (2005) An annotated list of the non-marine mollusca of Britain and Ireland. *Journal of Conchology* 38, 607-638.
- A.P. McCarthy Planning Consultants. (2007a) *Environmental Impact Statement – Park & Ride Facility NUI Galway*.
- A.P. McCarthy Planning Consultants. (2007b) *Environmental Impact Statement – Proposed New Engineering Building at The National University of Ireland, Galway*.
- Balmer, D.E., Gillings, S., Caffrey, B.J., Swann, R.L., Downie, I.S. & Fuller, R.J. (2013) *Bird Atlas Database Record 2007-11: the breeding and wintering birds of Britain and Ireland*. BTO Books, Thetford.
- Barron, S.B., O'Neill, F.H. & Martin, J.R. (2014) Galway City Transport Project – Habitat mapping and assessment of a section of Lough Corrib cSAC and surrounding areas. Unpublished Report by BEC Consultants Ltd.
- Barron, S.J., Daly, O.H., Seale, E.G. & Brophy, J.T. (2013) *Galway City Outer Bypass Marsh Fritillary Survey Report*. Unpublished Report by BEC Consultants Ltd.
- BBS (British Bryological Society). (2009). *Checklist of British and Irish bryophytes*. The British Bryological Society, Stafford, U.K.
- Browne, A., Connolly, K., McDonnell, R., Peppiatt, C., Springer, S, Williams, C. & Fuller, J. (2009) *The Barna Woods Project, Biodiversity Report*. Galway City Council.
- Browne, A. & Fuller, J. (2009) *Merlin Park Woodland Habitat Survey and Management Plan*. Galway City Council.
- Byrne, A., Moorkens, E.A., Anderson, R., Killeen, I.J. & Regan, E.C. (2009) *Ireland Red List No. 2 – Non-Marine Molluscs*. National Parks and Wildlife Service, Department of Environment, Heritage and Local Government, Dublin, Ireland.
- CEC (Commission of the European Communities). (2013) *Interpretation manual of European Union Habitats EUR28*. European Commission, DG Environment.
- Colhoun, K. & Cummins, S. (2013) Birds of Conservation Concern in Ireland 2014-2019. *Irish Birds* 9:523-544.
- Copland, A. & Lusby, J. (2012) Lowland Farmland. In Nairn, R & O'Halloran, J. *Bird Habitats in Ireland*. The Collins Press; Chapter 10, pgs. 124 – 137.
- Crushell, P. (2009) *Ecological Impact Assessment of a Proposed Windfarm Development At Leitir Gungaid and Doire Chrith, Co. Galway*.

Crushell, P. & Foss, P. (2014a) *Coolagh Lakes, Lough Corrib SAC, Co. Galway: Wetland Survey and Conservation Assessment*. Report prepared on behalf of Wetland Surveys Ireland Ltd for BEC Consultants.

Crushell, P. & Foss, P. (2014b) *Coolanillaun Bog, Lough Corrib SAC, Co. Galway: Wetland Survey and Conservation Assessment*. Report prepared on behalf of Wetland Surveys Ireland Ltd for BEC Consultants.

Curtis, T.G.F., & McGough, H.N. (2005) *The Irish Red Data Book, 1 Vascular Plants*. Updated Version.

Department of Arts, Heritage and the Gaeltacht. (2011) *Actions for Biodiversity 2011-2016. Ireland's National Biodiversity Plan*.

EIS Limited. (2005) *Environmental Impact Statement – IDA Galway Western Region Science and Technology Park*. Galway County Council.

Evans, D. & Arvela, M. (2011) *Assessment and reporting under Article 17 of the Habitats Directive. Explanatory notes & guidelines for the period 2007-2012*. European Topic Centre on Biological Diversity. Paris, France.

Fossitt, J.A. (2000) *A guide to habitats in Ireland*. Heritage Council, Kilkenny, Ireland.

Galway County Council. (2007a) *Bearna Local Area Plan 2007 – 2017*.

Galway County Council. (2007b) *Coastal Habitat Study for Bearna*.

Galway County Council. (2008) *Biodiversity Action Plan for County Galway 2008-2013*.

Galway County Council. (2009) *Galway County Development Plan 2009-2015*.

Galway City Council. (2011) *Galway City Development Plan 2011-2017*.

Galway City Council. (2014) *Galway City Draft Biodiversity Action Plan 2014-2024*.

Galway County Council/Roscommon National Roads Design Office. (2011) *N59 Maigh Cuilinn (Moycullen) Bypass Road Project Environmental Impact Statement*.

Galway Harbour Company. (2014) *Galway Harbour Extension Environmental Impact Statement*.

Geckoella Ltd. (2014a) *Galway City Transport Project Bat Acoustic Surveys: Summer-Autumn 2014*.

Geckoella Ltd. (2014b) *Galway City Transport Project Bat Radio-tracking and Roost Surveys 19th to 29th August 2014*.

Gilbert, G., Gibbons, D.W., and Evans, J. (2011) *Bird Monitoring Methods—a manual of techniques for key UK species*. RSPB, Sandy. (2011 reprint of 1998 publication).

Highways Agency. (2001) *Design Manual for Roads and Bridges: Volume 10: Environmental Design and Management. Section 4: Nature Conservation: Part 3, HA 80/99; Nature Conservation Advice in Relation to Bats*. The Highways Agency.

- Hundt, L. (2012) *Bat Surveys: Good Practice Guidelines, Second Edition*. Bat Conservation Trust.
- Kelleher, C. & Marnell, F. (2006) Bat Mitigation Guidelines for Ireland. *Irish Wildlife Manuals, No. 25*. National Parks and Wildlife Service, Department of Environment, Heritage and Local Government, Dublin, Ireland.
- King, J.L., Marnell, F., Kingston, N., Rosell, R., Boylan, P., Caffrey, J.M., Fitzpatrick, Ú., Gargan, P.G., Kelly, F.L., O'Grady, M.F., Poole, R., Roche, W.K. & Cassidy, D. (2011) Ireland Red List No. 5: Amphibians, Reptiles & Freshwater Fish. National Parks and Wildlife Service, Department of Arts, Heritage and the Gaeltacht, Dublin, Ireland.
- McCarthy, Keville and O'Sullivan. (2009a) *Environmental Impact Statement - Translational Research Facility/Clinical Research Facility, University Hospital Galway Campus, Lower Newcastle Road, Galway*.
- McCarthy, Keville and O'Sullivan. (2009b) *Environmental Impact Statement - Science Research Building*.
- McCarthy, Keville and O'Sullivan. (2011) *Natura Impact Statement - Proposed Development at Liam Mellows GAA, Ballyloughmane, Renmore, Co. Galway*.
- McCarthy, Keville and O'Sullivan. (2014a) *Ecological Impact Assessment & Natura Impact Statement, Proposed 3G All Weather Pitches NUI Galway, Dangan, Galway*.
- McCarthy, Keville and O'Sullivan. (2014b) *Bat Survey of the NUI Galway Sports Facilities at Dangan, Co. Galway*.
- Mitchell-Jones A. J. & McLeish A. P. (1999). *The Bat Workers' Manual, 2nd Edition*. Joint Nature Conservation Committee.
- Mohr, C.O. (1947). Table of equivalent populations of North American small mammals. *Am Midl Nat* 37: pp.223–249.
- Moorkens, E. (2014a) *A Survey of Selected Rivers for the Galway City Transport Project with Potential for Margaritifera*.
- Moorkens, E. (2014b) *A Molluscan Survey of Selected Wetland Sites for the Galway City Transport Project*.
- Moorkens, E.A. & Killeen, I.J. (2009) Database of association with habitat and environmental variables for non-shelled slugs and bivalves of Britain and Ireland. *Irish Wildlife Manuals No. 41*. National Parks and Wildlife Service, Department of the Environment, Heritage and Local Government, Dublin, Ireland.
- Moorkens, E.A. & Killeen, I.J. (2011) Monitoring and Condition Assessment of Populations of *Vertigo geyeri*, *Vertigo angustior* and *Vertigo moulinsiana* in Ireland. *Irish Wildlife Manuals, No. 55*. National Parks and Wildlife Service, Department of Arts, Heritage and Gaeltacht, Dublin, Ireland.
- NPWS (2009) *Threat Response Plan: Otter (2009-2011)* National Parks & Wildlife Service, Department of the Environment, Heritage & Local Government, Dublin.

- National Roads Authority. (2008) *Ecological Surveying Techniques for Protected Flora and Fauna during the Planning of National Road Schemes*. National Roads Authority.
- National Roads Authority. (2009) *Guidelines for Assessment of Ecological Impacts of National Roads Schemes: Revision 2*. National Roads Authority
- National Roads Authority. (2006) *Best Practice Guidelines for the Conservation of Bats in the Planning of National Road Schemes*. National Roads Authority.
- Natura Environmental Consultants. (2012) *Galway City Council, Ardaun Local Area Plan Habitat Assessment*. Report prepared for Galway City Council.
- Natura Environmental Consultants. (2005) *Galway City Habitat Inventory*. Galway City Council.
- O'Clery, M & Lusby, J. (2014). *The status of Barn Owls within the study area for the N6 Galway City Transport Project*.
- O'Connor, W. (2007) A Survey of Juvenile Lamprey Populations in the Corrib and Suir Catchments. *Irish Wildlife Manuals No. 26*. National Parks and Wildlife Service, Department of Environment, Heritage and Local Government, Dublin, Ireland.
- O'Neill, F.H. & Barron, S.J. (2013) Results of a monitoring survey of old sessile oak woods and alluvial forests. *Irish Wildlife Manuals*, No. 71. National Parks and Wildlife Service, Dublin.
- O'Neill, F.H. & Barron, S.J. (2014) Galway City Transport Project: Report on the presence of Annex I habitat *7220 Petrifying springs with tufa formation. Unpublished report by BEC Consultants Ltd.
- O'Neill, F.H., Martin, J.R., Devaney, F.M. & Perrin, P.M. (2013) The Irish semi-natural grasslands survey 2007-2012. *Irish Wildlife Manuals*, No. 78. National Parks and Wildlife Service, Dublin.
- Perrin, P.M., Barron, S.J., Roche, J.R. & O'Hanrahan, B. (2010) Guidelines for a national survey and conservation assessment of upland vegetation and habitats in Ireland. Version 1.0. *Irish Wildlife Manuals*, No. 48. National Parks and Wildlife Service, Department of Environment, Heritage and Local Government, Dublin, Ireland.
- Perrin, P.M. (2014) Galway City Transport Plan – Assessment of Annex I habitats in the Ballygarraun survey area. Unpublished Report by BEC Consultants Ltd.
- Reynolds, J.D., O'Connor, W., O'Keefe, C. & Lynn, D. (2010) A technical manual for monitoring white-clawed crayfish *Austropotamobius pallipes* in Irish lakes. *Irish Wildlife Manuals*, No 45. National Parks and Wildlife Service, Department of the Environment, Heritage and Local Government, Dublin.
- Roche N., Langton S. and Aughney T. (2009) The Car-Based Bat Monitoring Scheme for Ireland: Synthesis Report 2003-2008. *Irish Wildlife Manuals*, No. 39. National Parks and Wildlife Service, Department of the Environment, Heritage and Local Government, Dublin, Ireland.
- Roden, C. (2005) *Pseudorchis albida at Doughiska, Galway City – Report of a search in May-June 2005*.

- Rodwell, J.S. (ed) (1995) *British plant communities Volume 4: Aquatic communities, swamps and tall-herb fens*. Cambridge University Press, Cambridge.
- RPS. (2006) *N6 Galway City Outer Bypass. Environmental Impact Statement*. Galway County Council and Galway City Council.
- RPS. (2012a) *Flora and Habitat Survey Proposed R336 to N59 Road Scheme, Co. Galway*. Unpublished Report by RPS Planning & Environment Ltd.
- RPS. (2012b) *R336 to N59 Road Scheme, Co. Galway Marsh Fritillary Survey Report*. Unpublished Report by RPS Planning & Environment Ltd.
- RPS. (2013a) *R336 to N59 Road Scheme, Co. Galway Bat Survey Report*. Unpublished Report by RPS Planning & Environment Ltd.
- RPS. (2013b) *R336 to N59 Road Scheme, Co. Galway Mammal Survey Report*. Unpublished Report by RPS Planning & Environment Ltd.
- RPS. (2013c) *R336 to N59 Road Scheme, Co. Galway Wintering Bird Survey Report*. Unpublished Report by RPS Planning & Environment Ltd.
- Rush, T., Billington, G. (2014). Galway bat radio-tracking project. Radio-tracking studies of Lesser horseshoe and vesper bat species, August and September 2014. Greena Ecological Consultancy. Witham Friary, 2014.
- Stace, C.A. (2010) *New flora of the British Isles, 3rd ed*. Cambridge: Cambridge University Press.
- Stanley, C. (2013a) *The Butterflies of Merlin Woods*. Friends of Merlin Woods.
- Stanley, C. (2013b) *The Wildflowers of Merlin Woods*. Friends of Merlin Woods.
- Tobin Consulting Engineers. (2004) *Environmental Impact Statement – Proposed Residential and Commercial Development at Carrowmoneash, Oranmore, Co. Galway. Lackagh Group Properties*.
- Toms, M.P., Crick, H.Q.P. & Shawyer, C.R. (2001) The status of breeding Barn Owls *Tyto alba* in the United Kingdom 1995-97. *Bird Study* 48, 23-37.
- Whilde, A. (1983) *The Winter Bird Community of Inner Galway Bay*. *Irish Birds* 2:278-293.
- Wilson, S. and Fernández, F. (2013) National survey of limestone pavement and associated habitats in Ireland. *Irish Wildlife Manuals*, No. 73. National Parks & Wildlife Service, Department of Arts, Heritage and the Gaeltacht, Dublin, Ireland.
- Woodrow Sustainable Solutions Ltd. (2015) *N6 Galway City Transport Project Marsh Fritillary Survey Summary Report – 2014*.