8. Biodiversity

8.0 Executive Summary

This an update to Chapter 8 of the 2018 EIAR and it presents an assessment of the likely significant effects of the Project on the receiving biodiversity environment. As per the 2018 EIAR and given the considerable level of detail contained in this chapter, a summary is first presented to give an overview and assist in an understanding of this chapter. Alongside the term "biodiversity", the terms "ecology" and "ecological" are also used throughout this chapter as a broader term to refer to the relationships of biodiversity receptors to one another and to their environment.

The key changes to the biodiversity chapter since the 2018 EIAR involve updating:

- the description of the receiving environment to take account of the results of the surveys undertaken between 2022 and 2024
- the figures and appendices to reflect the updated data and assessment
- the chapter to take account of points raised in the RFI Response dated 30 August 2019, the Brief of Evidence presented to An Bord Pleanála (ABP) at the oral hearing in 2020 and from the ABP Inspector's Report dated 22 June 2021

The collation of the biodiversity baseline data and the preparation of this updated chapter has had regard to current legislation relating to biodiversity protection and current best practice guidance documents on valuing biodiversity receptors and impact assessment - both for the purposes of EIA and AA.

A desktop study was carried out to inform the initial scope of the ecological surveys required for the environmental impact assessment. The desktop study involved the collection and review of relevant published and unpublished sources of data, collation of existing information on the ecological environment and consultation with relevant statutory bodies (e.g. National Parks & Wildlife Service (NPWS) and Inland Fisheries Ireland (IFI)).

A comprehensive range of field surveys were carried out between 2013 and 2018 which informed the 2018 EIAR, in 2019 in response to the RFI received by Galway County Council from ABP, and then again between 2022 and 2024, to inform this updated EIAR. These included habitat surveys, surveys for protected plant species, mammal surveys (including dedicated surveys for Otter, Badger and bats), White-clawed crayfish surveys, molluscan surveys (including Freshwater pearl mussel and *Vertigo* snail species surveys), Marsh fritillary butterfly surveys, breeding and wintering bird surveys (including dedicated Barn owl, Peregrine falcon, Red grouse and Woodcock surveys), amphibian surveys, Common lizard surveys and fish surveys (including assessment of biological water quality status).

Each of the sections below provides a summary for each of the key ecological receptors (KERs[1]) in the receiving environment. These summaries include an overview of the baseline, the likely impacts of the Project and the mitigation measures proposed to avoid or minimise the predicted impacts, including a monitoring[2] programme where relevant, the residual impacts remaining, and (where relevant) any compensation measures proposed to further address those residual impacts. Where used below, the term Zone of Influence (ZoI) refers to the area within which the Project could affect the receiving biodiversity environment as a consequence of a particular potential impact.

The KER summaries are divided into the following headings for ease of reading:

- Designated areas for nature conservation:

[1]KERs are those biodiversity receptors within the ZoI of the proposed Project which are "both of sufficient value to be material in decision making and likely to be affected significantly" i.e. with an ecological value of local importance (higher value) or greater.

[2] In accordance with the requirement for monitoring set out in the EIA Directive 2014/52/EU to monitor significant effects on the environment

  - European sites (SAC & SPA)
  - Natural Heritage Areas (NHA)
  - Proposed Natural Heritage Areas (pNHA)
- Habitats
- Rare and protected species
- Otter
- Bats
- Badger
- Other Mammal Species
- Mollusc species
- Marsh fritillary butterfly
- Breeding birds
- Wintering birds
- Amphibians
- Reptiles
- Fish

Local biodiversity areas, as defined in the *Galway City Development Plan 2017–2023*, the Galway City Development Plan 2023-2029 and the most recent draft of the *Galway City Biodiversity Action Plan 2014–2024*, are also considered. Local biodiversity areas provide habitat for a range of species, with the River Corrib corridor providing an important link between Galway Bay and the mosaic of habitats surrounding the city, which includes the wetland complex associated with Lough Corrib. The local biodiversity areas that lie within the zone of influence of the Project are:

- Rusheen Bay – Barna Woods – Illaunafamona
- Cappagh – Ballymoneen
- Ballagh – Barnacranny Hill
- River Corrib and adjoining wetlands
- Menlough to Coolough Hill
- Ballindooley – Castlegar (which is linked to the River Corrib by the Terryland River)
- Galway Racecourse, Ballybrit
- Doughiska
- Mutton Island and nearby shoreline
- City Canal System
- Waterbody
- Terryland Glenanail
- Cooper's Cave Terryland

The impact assessment has been updated to incorporate all relevant clarifications, amendments and updates made since the 2018 EIAR, including the 2019 RFI Response, the Oral Hearing in 2020 in response to queries raised by An Bord Pleanála (ABP), statutory consultees, and other participating third parties, and the assessment undertaken by the Inspector appointed by An Bord Pleanála presented in the Inspector's Report dated 22 June 2021[3].

Although the baseline changes have required some level of minor updates to the impact assessment to capture the biodiversity baseline variances recorded between 2018 and 2024, the updates are not material and do not affect the conclusions of the impact assessment.

Additional pNHA sites have been included as KERs and these sites have been incorporated into the impact assessment and are at risk of likely significant effects.

The mitigation strategy has also been updated to incorporate all relevant clarifications, amendments and updates made since the 2018 EIAR, including the 2019 RFI Response, the Oral Hearing in 2020 and presented in the Inspector's Report dated 22 June 2021.

The minor updates made to the impact assessment resulting from the updated baseline results, and the conclusions of the updated impact assessment, have not resulted in any material changes to the mitigation strategy. The changes to the mitigation strategy do not alter the conclusions of the residual impact assessment.

The cumulative impact assessment has been updated (see Section 8.8 below, and Section 19.5 of Chapter 21 of this updated EIAR) to capture new planned and committed schemes since the conclusion of the Oral Hearing in 2020. With the implementation of the specified mitigation measures, the additional new planned and committed schemes do not change the assessment of residual likely significant effects of the Project on biodiversity as set out in Section 8.7 below.

8.0.1 Designed Areas for Nature Conservation

8.0.1.1 European sites –Special Areas of Conservation (SACs) and Special Protection Areas (SPAs)

There are 23 European sites within or in the vicinity of the ZoI of the Project, of which 22 fall within its ZoI. Lough Corrib SAC is traversed by the proposed N6 GCRR, Lough Corrib SPA is located upstream, and Galway Bay Complex SAC and Inner Galway Bay SPA are located downstream of the Project. Other European sites that are within the ZoI of the Project due to additional impact pathways considered in the Natura Impact Statement (NIS), include: Ardrahan Grassland SAC, Castletaylor Complex SAC, Kiltiernan Turlough SAC, Lough Fingall Complex SAC, Rahasane Turlough SPA, Rahasane Turlough SAC, Cregganna Marsh SPA, Maumturk Mountains SAC, The Twelve Bens/Garraun Complex SAC, Connemara Bog Complex SAC, Connemara Bog Complex SPA, Ross Lake and Woods SAC, East Burren Complex SAC, Moneen Mountain SAC, Black Head-Poulsallagh Complex SAC, Gortnandarragh Limestone Pavement SAC, Inishmore Island SAC and Kilkieran Bay and Island SAC. There are no other European sites at risk of impacts from the Project.

The potential impacts associated with the Project, how these might affect the European sites' conservation objectives, and the mitigation measures that will be implemented to ensure that adverse effects on site integrity do not arise, are considered and assessed in full detail in the updated NIS. The conclusion of the updated NIS remains that the Project will not adversely affect the integrity of any European site, either alone or in combination with other plans or projects.

The Project will, however, have a residual biodiversity effect on Lough Corrib SAC locally, as there will be permanent habitat losses, habitat degradation (due to tunnelling/excavation, hydrogeological, hydrological,

[3] Inspector's Report (2021) ABP-302885-18 & ABP302848-18 and Appendix 4: Ecological Impact Assessment Report, N6 Galway City Ring Road For An Bord Pleanála, ABP Ref. ABP-302848-18, ABP302885-18, Project No.: IABP106/002 (2020), prepared by Dr Arnold of Thomson Environmental Consultants

air quality, and non-native invasive plant species impacts), and long-term effects on local bat populations[4] that use habitats within the European site. None of these impacts will affect the site's conservation objectives or adversely affect the integrity of Lough Corrib SAC and therefore, the Project will not result in a likely significant residual effect on any European sites.

The European sites are discussed in detail below with the receiving environment in Section 8.3.4.1; evaluation of impacts in Section 8.5.4.1; proposed mitigation measures in Section 8.6.2.1 and residual impacts in Section 8.7.2.1.

Furthermore, the Project does not traverse any SPA, and therefore none of the special conservation interest (SCI) species, or their supporting habitats within nearby SPAs, will be directly impacted by the Project if mitigation is applied.

8.0.1.2 Natural Heritage Areas (NHAs) and proposed Natural Heritage Areas (pNHAs)

Moycullen Bogs NHA lies immediately adjacent to the Project at Tonabrocky and is the only NHA site within the ZoI of the Project.

The potential impacts associated with the Project on Moycullen Bogs NHA, in the absence of mitigation measures, include the deposition of dust during construction, the introduction of non-native invasive plant species and surface water impacts during construction. Moycullen Bogs NHA is beyond the ZoI of any hydrogeological effects from the Project. Mitigation measures will be implemented to ensure that the Project does not affect habitats and species in Moycullen Bogs NHA via these impacts. Therefore, the Project will not result in likely significant residual effects on the NHA.

There are a number of pNHA sites within the ZoI of the Project: Lough Corrib pNHA, Galway bay Complex pNHA, Furbogh Wood pNHA, Kiltullagh Turlough pNHA, Drimcong Wood pNHA, Turloughcor pNHA, Ballycuirke Lough pNHA, Connemara Bog Complex pNHA, Ross Lake and Woods pNHA, Black Head-Poulsallagh Complex pNHA, Lough Fingall Complex pNHA, Rahasane Turlough pNHA, Gortnandarragh Limestone Pavement pNHA, Moneen Mountain pNHA, East Burren Complex pNHA, Kiltiernan Turlough pNHA, Castletaylor Complex pNHA, Inishmore Island pNHA, Maumturk Mountains pNHA and The Twelve Bens/Garraun Complex pNHA.

Lough Corrib pNHA is traversed by the proposed N6 GCRR at the River Corrib Bridge crossing. The potential impacts associated with the Project on this pNHA site are generally as per those discussed in the updated NIS in relation to Lough Corrib SAC and Lough Corrib SPA – habitat loss, surface water impacts during construction, deposition of dust during construction, the introduction of non-native invasive plant species, hydrogeological impacts and mortality risk to aquatic species. However, the zone within which the Project directly interacts with Lough Corrib pNHA is much smaller than that directly affected within Lough Corrib SAC, and is limited to the River Corrib channel and banks at the proposed River Corrib Bridge. Mitigation measures will be implemented to avoid and minimise effects on biodiversity receptors in the receiving environment. As with Lough Corrib SAC, although there will be some level of residual impact in the vicinity of the River Corrib this is not likely to affect the integrity of Lough Corrib pNHA.

Galway Bay Complex pNHA lies downstream of the Project where it crosses the Bearna Stream catchment, the Knocknacarra Stream catchment and the River Corrib. The potential impacts associated with the Project on this pNHA site are generally as per those discussed in the updated NIS in relation to Galway Bay Complex SAC and Inner Galway Bay SPA - surface water impacts during construction, the introduction of non-native invasive plant species, barrier effect and mortality risk to aquatic species, affecting groundwater and disturbing wintering birds at important wetland sites (e.g. Ballindooley Lough). Mitigation measures will be implemented to ensure that the Project will not result in likely significant residual effects on the pNHA via these impacts.

Therefore, the Project will not result in likely significant residual effects on pNHAs.

[4] The Menlo Castle Lesser horseshoe bat population is not connected to the Eborhall Lesser horseshoe bat population, which is the qualifying interest (QI) population for Lough Corrib SAC. Any predicted impacts on Lesser horseshoe bats associated with the Project will not affect the conservation objectives of the Lough Corrib SAC's QI Lesser horseshoe bat population.

The NHA and pNHA sites are discussed in detail below with the receiving environment in Section 8.3.4.2; evaluation of impacts in Section 8.5.4.2; proposed mitigation measures in Section 8.6.2.2 and residual impacts in Section 8.7.2.2.

8.0.2 Habitats

West of the River Corrib, outside of the built environment, habitats recorded during the surveys generally consisted of a mosaic of agricultural fields, peatland/heath habitats, and scrub; separated into distinct habitat blocks of varying sizes by the local road network and the associated linear residential development. The peatland habitat blocks consisted of predominantly wet heath, dry heath and bog habitat mosaics, with those habitat patches closest to the Assessment Boundary being either the edges of larger peatland habitat blocks or smaller, more isolated, remnant patches. Small areas of fen and transition mire are also present.

The area from the River Corrib to the N84 Headford Road comprised of a patchwork of semi-natural woodland, Limestone pavement, scrub and calcareous grassland fields. East of the N84 Headford Road, habitats predominantly comprised of improved agricultural grasslands surrounded by residential and industrial development in Parkmore, Ballybrit, Briarhill and Doughiska, although there were some isolated patches of semi-natural habitats – calcareous grassland and limestone pavement – in the Coolagh/Doughiska area. There were also two wetland complexes of note: at the Coolagh Lakes and at Ballindooley Lough.

As discussed in Appendix 4 of ABP's Inspectors Report, clusters of important habitats occur within the Assessment Boundary, forming a mosaic of higher and lower value habitat clusters. Clusters 1-6 lie in the western section of the Assessment Boundary and are underlain by granite bedrock and are this characterised by acid habitats including peatland habitat mosaics. By contrast, clusters 7-12 lie to the east of the River Corrib and are underlain by limestone and thus are characterised by calcareous habitat mosaics.

Non-native invasive plant species (Japanese knotweed, Himalayan knotweed, Three-cornered garlic, Rhododendron, Giant rhubarb, Old man's beard, and Canadian pondweed) were recorded in dispersed locations across the habitat survey area. The invasive mollusc Zebra mussel and invasive fish Roach were also recorded.

The following Annex I habitats were recorded within, or adjacent to, the Assessment Boundary: Hard water lakes [3140], Turloughs [*3180], Petrifying springs [*7220], Residual alluvial forests [*91E0], Limestone pavement [*8240], Wet heath [4010], Dry heath [4030], Calcareous grassland [*6210/6210], *Molinia* meadow [6410], Blanket bog (active) [*7130], *Cladium* fen [*7210], Alkaline fen [7230], Vegetation of flowing waters [3260], and Hydrophilous tall herb [6430].

The potential impacts of the Project are loss of habitat, habitat fragmentation, and habitat degradation through effects on surface water quality, groundwater, deposition of dust during construction, deterioration of air quality from traffic emissions and depositions during operations, the introduction of non-native invasive plant species and the structural stability of rock around tunnels and deep excavations/cuttings.

Mitigation measures will be implemented to protect surface water quality and groundwater in the receiving environment, control dust emissions from the construction site, control and prevent the spread of non-native invasive plant species, ensure that tunnelling and deep excavations do not affect the structural integrity of the surrounding rock mass, and to minimise habitat losses within the Assessment Boundary.

However, the permanent losses of the following habitats will result in a likely significant negative residual effect at geographic scales ranging from local to international: four Petrifying spring features at Lackagh Quarry, c.0.01ha of Blanket bog (active) [*7130], c.0.01ha of Wet heath/Dry heath/Blanket bog (active) [4010/4030/*7130] mosaic, c.0.14ha of Residual alluvial forest habitat, c.1.54ha of Limestone pavement habitat, c.0.03 ha of Limestone pavement/Calcareous grassland mosaic [*8240/6210], c.2.54ha of Wet heath habitat, c.1.76ha of Dry heath habitat, c.0.96ha of Wet heath/Dry heath habitat mosaic, c.0.45ha of Wet heath/Dry heath/*Molinia* habitat mosaic, c.0.25ha of Calcareous grassland habitat (non-priority), c.0.29ha of *Molinia* meadow habitat, 18 Calcareous spring features (FP1), c.14.86ha of Dry calcareous and grassy verges (GS2), c.5.24ha of Dry-humid acid grassland habitat (GS3), 9.43ha of Wet grassland (GS4), 0.42ha of Marsh (GM1), 4.87ha of Dry calcareous and neutral grassland/Scrub mosaic (GS1/WS1), 0.2ha of Rich fen and flush (PF1), c.1.30ha of Poor fen and flush (PF2) habitat, c.0.04ha of Mixed broadleaved/conifer woodland (WD2), c.2.09ha of (Mixed) broadleaved woodland (WD1), c.0.01ha of (Mixed) conifer woodland, c.2.93ha of Oak-ash-hazel woodland (WN2), c.26.53ha of Scrub (WS1), c.2.89ha of Scrub/Dry meadows and grassy

verges (WS1/GS2), c.0.49ha of Scrub/Oak-ash-hazel woodland/ Exposed calcareous rock (WS1/WN2/ER2), c.0.03ha of Reed and large sedge swamps (FS1), c. 0.08ha of Drainage ditches (FW4), c.7.88km of Hedgerows (WL1), c.4.05km of Treelines (WL2), and c.120m of Sruthán na Líbeirtí, c.220m of the Trusky Stream, c.140m of the Bearna Stream (and tributary), c.475m of the Tonabrocky Stream, all of which are Sections of stream/River channel (FW1). The residual impacts associated with the clusters of important habitats as described in Appendix 4 of ABP's Inspectors Report are related to and dependent upon the potential impacts of the Project on each of the individual ecological receptors that make up the biodiversity resource within a given habitat cluster.

Compensatory habitat will be provided to replace the areas of Residual alluvial forest (c.0.17ha), Dry heath (c.4.10ha), Calcareous grassland (c.87.98ha), *Molinia* meadow (0.49ha), (Mixed) broadleaved woodland (> 2.09ha), Hedgerows (> 7.88km) and Treelines (> 4.05km) by providing a greater area to that being permanently lost to the Project.

However, some of the Annex I habitat types that are being lost, outside of any European sites, cannot be directly compensated. Therefore, there will be a likely significant residual negative effect at the international geographic scale for the permanent loss of c.1.54ha of Limestone pavement, and c.0.01 ha of Blanket bog (active) [*7130] and blanket bog mosaic habitat, at the national geographic scale for the permanent loss of c.3.95ha of Wet heath and wet heath mosaic habitat, at the county geographic scale for the loss of a Petrifying spring feature at Lackagh Quarry, and at the local geographic scale for the permanent loss of six Calcareous springs at Lackagh Quarry, c.5.24ha of Dry-humid acid grassland and c.1.30ha of Poor fen and flush habitat. The Annex I habitat impacts are summarised in Table 8.0 below.

Table 8.0: Summary of Annex I Habitat Impacts

Annex I habitat type	Total Area within the Assessment Boundary Potentially Impacted	Area to be Retained	Actual Permanent area of habitat loss	Residual Impact Significance
Turlough [*3180]		All (c.0.04ha)	None	No likely significant residual effect
Petrifying springs [*7220]	Six Petrifying spring at Lackagh Quarry	Two features to be retained	Four Petrifying spring features	Likely significant residual effect at the county geographic scale
Blanket bog (active) [*7130]	c. 0.01ha	None	c. 0.01ha	Likely significant residual effect at the international geographic scale
Wet heath/Dry heath/Active Blanket Bog [4010/4030/*7130]	c. 0.01ha	None	c.0.01ha	Likely significant residual effect at the national geographic scale
Residual alluvial forest [*91E0]	c.0.14ha	None	c.0.14ha	Likely significant residual effect at the international geographic scale
Limestone pavement [*8240]	c.2.73ha	c.1.19ha	c.1.54ha	Likely significant residual effect at the international geographic scale
Limestone pavement/Calcareous grassland [*8240/6210]	c.0.03ha		0.03ha	Likely significant residual effect at the international geographic scale

Annex I habitat type	Total Area within the Assessment Boundary Potentially Impacted	Area to be Retained	Actual Permanent area of habitat loss	Residual Impact Significance
Wet heath [4010]	c.2.72ha	c. 0.17ha[5]	c.2.54ha	Likely significant residual effect at the national geographic scale
Dry heath [4030]	c.1.76ha	None	c.1.76ha	Likely significant residual effect at the national geographic scale
Dry heath/Wet heath mosaic [4030/4010]	c.0.96	None	c.0.96	Likely significant residual effect at the national geographic scale
Wet heath/Dry heath/Molinia mosaic [4010/4030/6410]	c.0.45	None	c.0.45	Likely significant residual effect at the national geographic scale
Calcareous grassland [6210]	c.0.25ha	None	c.0.25ha	Likely significant residual effect at the national geographic scale
Molinia meadow [6410]	c.1.03ha	c.0.74ha	c.0.29ha	Likely significant residual effect at the national geographic scale
Total area	c.10.66ha of Annex I habitats and 6 Petrifying spring features	c.2.26ha of Annex I habitats and 2 Petrifying spring features	8.4ha of Annex I habitats and 4 Petrifying spring features	

Habitats are discussed in detail below with the receiving environment in Section 8.3.4 and 8.3.6 (for non-native invasive plants); evaluation of impacts in Section 8.5.4; proposed mitigation measures in Section 8.6.2 to 8.6.6; residual impacts in Section 8.7.2 and proposed compensatory measures in Section 8.9.1.

8.0.3 Rare and protected plant species

As discussed in Appendix 4 of ABP's Inspector's Report (2021), six red list plant species are within the Assessment Boundary and therefore at risk of being directly impacted by the Project, including; four bryophyte species listed on *Ireland Red List No. 8: Bryophytes* (Lockhart *et al.*, 2012), i.e., Woodsy thyme moss, Lesser striated feathermoss, Imbricate bog-moss, and Red bog-moss, and one vascular plant species listed on *Ireland Red List No. 10: Vascular Plants* (Jackson *et al.*, 2016) i.e., Spring gentian.

Three other plant species of Least Concern (Jackson *et al.*, 2016), i.e. Fern grass, Eyebright, and Downy oat-grass, identified within the Assessment Boundary were valued as being of Local Importance (Higher Value) within Appendix 4 of the Inspector's Report. Therefore, the Project may result in the loss of these species directly by removal, and/or indirectly through impacts on the receiving hydrogeological or hydrological

[5] This area accounts for operational air quality effects. The affected area of wet heath habitat to be retained that may be affected by air quality effects has been excluded from this calculation.

environments, dust deposition, shading effects or through introducing/spreading non-native invasive plant species.

Rare and protected plant species are discussed in detail below with the receiving environment in Section 8.3.6; evaluation of impacts in Section 8.5.6 and residual impacts in Section 8.7.4.

8.0.4 Otter

Otter, and their breeding and resting places, are protected under the Wildlife Acts. Otter are also listed on Annex II and Annex IV of the EU Habitats Directive. Evidence of Otter activity was abundant and widespread along the River Corrib corridor and the south-eastern shore of Lough Corrib. Otter were also recorded in the catchment of the Bearna Stream and the Tonabrocky Stream. There were no Otter holt or couch sites within the ZoI of the Project.

The Project will result in the loss of a small area of Otter habitat, it may pose a temporary habitat severance/barrier effect, and will result in some level of disturbance to Otter during construction and operation. However, this will not result in any long-term effects on the local Otter population. During operation, the combination of the network of wildlife passage facilities, culverts, bridges and viaduct structures (e.g. the proposed River Corrib Bridge and the Menlough Viaduct), and the mammal fencing, will reduce any long-term severance or barrier effects and the mortality risk associated with the Project, such that the local Otter population will not be negatively affected. The effectiveness of the mitigation measures will be monitored post-construction.

Therefore, the Project will not result in likely significant residual effects on the local Otter population.

Otter are discussed in detail below with the receiving environment in Section 8.3.8.1; evaluation of impacts in Section 8.5.7.1; proposed mitigation measures in Section 8.6.5.1 and residual impacts in Section 8.7.5.1.

8.0.5 Bats

Bats, and their breeding and resting places, are protected under the Wildlife Acts. All bat species are also listed on Annex IV of the Habitats Directive; with the Lesser horseshoe bat also listed on Annex II. The following bat species were recorded locally during the field surveys: the Lesser horseshoe bat, Leisler's bat, the Common pipistrelle bat, the Soprano pipistrelle bat, Nathusius' pipistrelle bat, the Brown long-eared bat, Daubenton's bat, Natterer's bat and the Whiskered bat. A total of 58 roost sites were recorded within the local area during the field surveys.

The local Lesser horseshoe bat population is of particular importance given its Annex II status and the importance of the local area as a stepping-stone for the species between Lesser horseshoe bat populations in north Galway/south Mayo and south Galway/Clare[6]. The maternity/hibernation roost at Menlo Castle and the mating/hibernation roost at Cooper's Cave in Castlegar are key roost sites for the Menlo Castle Lesser horseshoe bat population, which are also supported by a network of smaller day/night roost sites across the local area. The foraging habitat surrounding the maternity roost is vital in supporting the local Lesser horseshoe bat population, as is the extent of foraging habitat and the commuting routes that connect the landscape between those key roost sites at Menlo Castle and Cooper's Cave. Although the Project does not directly affect either the Menlo Castle or Cooper's Cave roosts, it will affect three Lesser horseshoe bat roost sites used by the Menlo Castle population, will result in habitat loss within their foraging area (including in the vicinity of the maternity roost), and will present a barrier to movement between the maternity, mating and hibernation roost sites.

Nineteen buildings which support 23 bat roosts are located within the Assessment Boundary:

- Eight Soprano pipistrelle roosts
- One Common pipistrelle roost

[6] The Menlough Lesser horseshoe bat population is not connected to the Eborhall Lesser horseshoe bat population, which is the qualifying interest (QI) population for Lough Corrib cSAC. Any predicted impacts on Lesser horseshoe bats associated with the proposed N6 GCRR will not affect the conservation objectives of the Lough Corrib cSACs QI Lesser horseshoe bat population.

- Three unidentified Pipistrelle species bat roost
- Three Brown long-eared bats roost
- Three Lesser horseshoe bat roosts
- Two Leisler's bat roosts
- Three unidentified *Myotis* species bat roosts

Eighteen of these buildings will be demolished with one (Soprano pipistrelle roost) being retained.

Three trees along the Project that have been confirmed as supporting bats (one for Leisler's bat and two for Pipistrelle bats) will be felled, and an additional 13 trees that have high (or category 1 as per 2014 – 2018 classification) potential to support bats will also be felled.

During construction, the Project will also result in the loss of foraging habitat, habitat severance will affect bat commuting routes, habitat loss will present a barrier to bat flight paths, construction works will cause disturbance to roost sites, and lighting will disturb foraging and commuting bats.

During operation, the Project will present a permanent mortality risk to the local bat populations, will permanently sever bat habitat and commuting routes and present a barrier to bat movements at a landscape scale. Operational lighting will also disturb and displace bats.

Mitigation measures will be implemented during construction to protect bats during building demolitions and tree removal and to preserve flight paths across the construction site. During operation, a series of underpasses and the Castlegar Wildlife Overpass will be installed to allow bats to cross the proposed N6 GCRR away from traffic, reducing the mortality risk and any permanent barrier effects. The lighting design has minimised the disturbance and displacement effects on bats during operation. The mitigation strategy includes pre-construction monitoring and monitoring of the effectiveness of the mitigation measures during and post-construction.

Despite the implementation of these mitigation measures there will be a significant residual effect on the local Lesser horseshoe bat population at the national geographic scale (given the importance of the local population), and on all other bat species at the local geographic scale.

To further reduce the effects of the residual impacts on the local bat populations, compensation measures are also proposed. These measures are:

- The provision of new roosting sites (new buildings, buildings retrofitted to create roost sites and bat boxes)
- Measures to protect these roosts during construction
- Habitat enhancement measures (e.g. planting)

The effectiveness of the mitigation measures will be monitored as part of the monitoring programme.

With the compensation measures implemented, the residual impacts of the Project on bats will be reduced from a likely significant residual negative effect on the local bat populations at the national geographic scale to a local geographic scale.

Bats are discussed in detail below with the receiving environment in Section 8.3.8.2; evaluation of impacts in Section 8.5.7.2; proposed mitigation measures in Section 8.6.5.2; residual impacts in Section 8.7.5.2 and proposed compensatory measures in Section 8.9.2.

8.0.6 Badger

Badger are protected under the Wildlife Acts and were recorded across the mammal survey area from Na Foraí Maola to the N83 Tuam Road. The highest concentrations of Badger activity were recorded in the Menlough area and the area between Lackagh Quarry and the N84 Headford Road. A total of 17 Badger setts were identified both within and in the vicinity of the mammal survey area between 2014 and 2015, and, while a further seven Badger setts were recorded in 2023, bringing the total number of setts across the survey

areas for Badgers to 24 (although the classification of one is based on anecdotal evidence of Badger using a rock mound as a sett was also recorded in the Coolagh Area).

Although the Project will result in the loss of foraging habitat, the permanent loss of four Badger setts, disturbance due to light spill during operation, and habitat severance/barrier effects, these impacts will not result in any long-term effects on the local population. The Project will result in the loss of three Badger setts, which includes the main and a subsidiary sett of one Badger group at Lackagh. An artificial Badger sett will be provided to reduce the effects of sett loss on this Badger group.

Mitigation measures will also be implemented during construction to minimise the effects of disturbance on the local Badger population and to avoid Badgers being killed during sett removal. During operation, the combination of the network of wildlife passage facilities, culverts, bridges and viaduct structures (e.g. the proposed River Corrib Bridge and the Menlough Viaduct), and mammal fencing will reduce any long-term severance or barrier effects and the mortality risk associated with the Project, such that the local Badger population will not be negatively affected. The effectiveness of the mitigation measures will be monitored post-construction.

Therefore, the Project will not result in likely significant residual effects on the local Badger population.

Badgers are discussed in detail below with the receiving environment in Section 8.3.8.3; evaluation of impacts in Section 8.5.7.3; proposed mitigation measures in Section 8.6.5.3 and residual impacts in Section 8.7.5.3.

8.0.7 Other Mammal Species

The following terrestrial mammal species protected under the Wildlife Acts were recorded, or are known, from the area surrounding the Project:

- Pine marten
- Wood mouse
- Red squirrel
- Irish stoat
- Irish hare
- Hedgehog
- Pygmy shrew

Fox, Rabbit, Mink and Bank vole were also recorded during the field surveys.

Although the Project will result in the loss of foraging habitat for these mammals, will present a low level of mortality risk and will result in disturbance/displacement effects, these impacts will not result in any long-term effects on local populations.

During operation, the combination of the network of wildlife passage facilities, culverts, bridges and viaduct structures (e.g. the proposed River Corrib Bridge and the Menlough Viaduct) will reduce any long-term severance or barrier effects associated with the Project such that the local populations of these mammal species will not be negatively affected.

Harbour seal, Grey seal, Common dolphin and Harbour porpoise are known from Galway Bay and these species are all protected under the Wildlife Acts. Both seal species are also listed on Annex II of the habitats directive and all cetacean species are listed on Annex IV of the Habitats Directive.

Mitigation measures will be implemented to ensure that the Project will not affect water quality in the receiving aquatic or marine environments and therefore, will not affect the marine mammal populations in Galway Bay.

Therefore, the Project will not result in likely significant residual effects on these terrestrial or marine mammal species.

These species are discussed in detail below with the receiving environment in Section 8.3.8.4; evaluation of impacts in Section 8.5.7.4; proposed mitigation measures in Section 8.6.5.4 and residual impacts in Section 8.7.5.4.

8.0.8 Mollusc species

Neither the White-clawed crayfish, the Freshwater pearl mussel, nor any other legally protected mollusc species, were recorded within the ZoI of the Project.

There is a Freshwater pearl mussel population in the Owenriff River (c.23km to the north, at Oughterard, Co. Galway) which the Project could affect indirectly through impacts on salmonid fish populations in the River Corrib. This was considered and assessed in the updated NIS, as the Owenriff population are the qualifying interest population for Lough Corrib SAC. The conclusion of this assessment was that, considering the mitigation measures to protect the aquatic environment, the Project would not affect salmonid fish species in the receiving environment and therefore not affect that Freshwater pearl mussel population.

The Marsh whorl snail is listed as vulnerable in the Irish Red Data List of molluscs (Byrne *et al*., 2009) and was recorded in wetland habitat along the River Corrib, in fringing wetland habitat at the Coolagh Lakes, at Ballindooley Lough and at the marsh in Castlegar during the 2014 – 2017 survey period. However, no Annex II mollusc species were recorded during the 2023 surveys.

The Swan mussel, which is classified as Vulnerable in *Irelands Red List No. 2: Non-Marine Molluscs* (Byrne *et al.*, 2009), was not identified during surveys. However, this species was raised in a submission during the Oral Hearing in 2020 that suggested mussels are present in the River Corrib. Scott Cawley Ltd. clarified on behalf of Galway County Council, during the oral hearing that this was likely Swan mussel, and the ecologist appointed by ABP agreed with this conclusion, as discussed in Appendix 4 of ABP's Inspector's Report dated 22 June 2021. This species is therefore within the ZoI of the Project.

Although the Project will result in some level of habitat loss locally, and may also result in a level of mortality at affected sites during construction, this will not result in any long-term effects on the local population. Mitigation measures will be implemented to ensure that the Project will not affect water quality in the receiving environment during construction or affect the local groundwater regime.

Therefore, the Project will not result in likely significant residual effects on mollusc species.

White-clawed crayfish and Freshwater pearl mussel are discussed in detail below with the receiving environment in Section 8.3.9.1 and 8.3.9.2; evaluation of impacts in Section 8.5.8.1 and 8.5.8.2 and residual impacts in Section 8.7.6.1 and 8.7.6.2.

8.0.9 Marsh fritillary butterfly

The Marsh fritillary butterfly is listed on Annex II of the Habitats Directive. A local breeding population is present and is supported by suitable habitat patches across the western part of the Scheme Study Area, some of which are directly affected by the Project.

Although the Project will result in the loss of Marsh fritillary habitat, and will sever some habitat areas within their local range, and will likely cause a low level of mortality during operation, this will not result in any long-term effects on the local population. However, the mortality risk during site clearance has the potential to have a significant effect on the local Marsh fritillary butterfly population. A mitigation strategy will be implemented to minimise this risk and avoid any population level effects.

Therefore, the Project will not result in likely significant residual effects on the Marsh fritillary butterfly.

Marsh fritillary butterfly is discussed in detail below with the receiving environment in Section 8.3.9.5; evaluation of impacts in Section 8.5.8.5; proposed mitigation measures in Section 8.6.6.3 and residual impacts in Section 8.7.6.4.

8.0.10 Breeding birds

A wide range of breeding bird species (62 in total during the 2014 – 2018 survey period and 64 during the 2022 – 2024 survey period) were recorded across the breeding birds survey area. These included species of conservation concern listed on the Amber and Red Birds of Conservation Concern in Ireland (BoCCI) lists,

Annex I bird species, and species listed as SCIs for nearby SPA sites. All wild bird species are protected under the Wildlife Acts.

The Project will result in the loss of breeding bird nesting and foraging habitat, it will pose a mortality risk to birds and it will disturb and potentially displace birds from breeding and foraging habitat. However, it will not result in any long-term effects on the majority of local breeding bird populations. Moreover, the assessment detailed in the updated NIS concluded that the Project would not affect breeding colonies or have any long-term effects on the local breeding populations of SCI bird species recorded within the breeding birds survey area or that were linked to SPA populations (Black-headed gull, Common gull, Cormorant and Common tern for Lough Corrib SPA and Inner Galway Bay SPA). For these species, the Project will not affect the conservation status of the breeding populations and will not result in a likely significant negative effect at any geographic scale.

Barn owl are a breeding bird species of high conservation concern in Ireland and are particularly at risk of mortality from collisions with traffic. Only a single confirmed Barn owl breeding site occurs in close proximity (within 5km) to the Project, namely at Menlo Castle, and therefore occurs in close proximity to the main construction works. Mitigation measures will be implemented to minimise the risk of impacts on Barn owl and to avoid any significant long-term residual impact on the local Barn owl population. These measures include the provision of additional nesting opportunities (either nest boxes erected on suitable trees or pole-mounted nest boxes) and planting in high-risk areas to discourage Barn owl from foraging along the road edge and to encourage Barn owl to fly over the road carriageway above traffic height. Also, to minimise the potential for construction works to affect the nest site at Menlo Castle, all works which have the potential to cause disturbance will be undertaken outside of the Barn owl breeding season. The effectiveness of the mitigation measures will be monitored post-construction as part of the monitoring programme.

Although both of the former Peregrine falcon nest sites, and the most recently occupied nest site, (identified in 2018) at Lackagh Quarry will be retained, it will be subject to high levels of disturbance during construction and operation. Mitigation measures will be implemented to minimise any disturbance effects (seasonal constraint during construction). However, there remains a risk that the Peregrine falcon will abandon Lackagh Quarry as a nesting site as a result of the proximity of the road carriageway to the existing nest site and due to the lack of suitable alternative ledges in the quarry post-construction. This is likely to have long-term effects on the Peregrine falcon population at a local and county geographic scale. As a further mitigation measure, an alternative nest site for Peregrine falcon will be provided on Galway City Council owned lands to the southeast of Lackagh Quarry. Artificial Peregrine falcon nest boxes will also be installed at each of the two former nest sites in Lackagh Quarry.

Although the Project is not likely to result in any significant residual effects on the majority of breeding bird species, there is likely to be a significant negative residual effect on Peregrine falcon at the county geographic scale, and a significant residual effect on Barn owl at the local geographic scale.

Breeding birds are discussed in detail below with the receiving environment in Section 8.3.10.1; evaluation of impacts in Section 8.5.9.1; proposed mitigation measures in Section 8.6.7.1; residual impacts in Section 8.7.7.1 and proposed compensation measures in Section 8.9.3.

8.0.11 Wintering birds

A wide range of wintering bird species were recorded across the wintering birds survey area. These included species of conservation concern listed on the Amber and Red BoCCI lists, Annex I bird species, and species listed as SCIs for nearby SPA sites. All wild bird species are protected under the Wildlife Acts.

The Project will result in habitat loss across sites where wintering birds were recorded. It will result in some level of disturbance during operation and the proposed River Corrib Bridge poses a low level of collision risk to birds. However, it is not likely to result in any long-term effects on most local wintering bird populations. Ballindooley Lough, however, is an important local site for wintering birds – 14 wintering bird species were recorded during the field surveys, including species listed as SCIs for Lough Corrib SPA and Inner Galway Bay SPA. Blasting in the vicinity of Ballindooley Lough during construction has the potential to displace wintering birds from this wetland habitat complex over multiple seasons. A seasonal restriction on blasting in this area will minimise the impact and avoid any long-term effects on wintering birds at Ballindooley Lough. Mitigation measures will also be implemented to ensure that the Project will not affect water quality

in the receiving environment during construction or affect the local groundwater regime that supports wetland used by wintering birds.

Therefore, the Project will not result in likely significant residual effects on wintering birds.

Wintering birds are discussed in detail below with the receiving environment in Section 8.3.10.2; evaluation of impacts in Section 8.5.9.2; proposed mitigation measures in Section 8.6.7.2 and residual impacts in Section 8.7.7.2.

8.0.12 Amphibians

The Common frog and the Smooth newt are protected under the Wildlife Acts and were recorded in wetland habitats across the mammal survey area, including habitat impacted by the Project.

Although the Project will result in a temporary severance/barrier effect during construction, and present a mortality risk during operation, these impacts will not result in any long-term effects on the local population.

Mitigation measures will be implemented during construction to minimise the effects of habitat loss and disturbance to amphibians, to ensure that Common frog and Smooth newt are not killed during site clearance works, and to protect water quality in wetland habitat used by these species. During operation, the combination of the network of wildlife passage facilities, culverts, bridges and viaduct structures (e.g. the proposed River Corrib Bridge and the Menlough Viaduct) will reduce any long-term severance or barrier effects associated with the Project such that the local amphibian populations will not be negatively affected.

Therefore, the Project will not result in likely significant residual effects on amphibian species.

Amphibians are discussed in detail below with the receiving environment in Section 8.3.11; evaluation of impacts in Section 8.5.10; proposed mitigation measures in Section 8.6.8 and residual impacts in Section 8.7.8.

8.0.13 Reptiles

Common lizard are protected under the Wildlife Acts and were recorded at Troscaigh Thiar, north of Bearna Woods and Knocknafroska/Knocknabrona during the field surveys.

Although the Project will result in a temporary severance/barrier effect during construction, and present a mortality risk during operation, these impacts will not result in any long-term effects on the local population.

Mitigation measures will be implemented during construction to minimise the effects of habitat loss and disturbance on the local Common lizard population and to ensure that lizards are not killed during site clearance works. During operation, the combination of the network of wildlife passage facilities, culverts, bridges and viaduct structures (e.g. the proposed River Corrib Bridge and the Menlough Viaduct) will reduce any long-term severance or barrier effects associated with the Project such that the local lizard populations will not be negatively affected.

Therefore, the Project will not result in likely significant residual effects on the Common lizard.

Reptiles are discussed in detail below with the receiving environment in Section 8.3.12; evaluation of impacts in Section 8.4.11; proposed mitigation measures in Section 8.6.9 and residual impacts in Section 8.7.9.

8.0.14 Fish

Fish species are protected under the Fisheries Acts, with Atlantic salmon, Brook lamprey and Sea lamprey also listed on Annex II of the Habitats Directive. European eel is also listed as Critically Endangered under the International Union for Conservation of Nature (IUCN) Red List of threatened species.

The Project will result the loss of aquatic habitat, construction works may disturb fish species, and construction works may pose a temporary barrier to fish movement on minor watercourses. However, it will not result in any long-term effects on local fish populations. The drainage design will protect water quality in the receiving aquatic environment during operation. Mitigation measures will be implemented to ensure that the Project will not affect water quality in the receiving environment during construction, affect the local groundwater regime, and minimise the risk of fish mortality during construction.

Therefore, the Project will not result in likely significant residual effects on fish species.

Fish are discussed in detail below with the receiving environment in Section 8.3.13; evaluation of impacts in Section 8.5.12; proposed mitigation measures in Section 8.6.10 and residual impacts in Section 8.7.10.

8.0.15 Significant Residual Impacts

The significant residual impacts remaining after mitigation are those associated with habitat loss (see Section 8.1.2), impacts on bats (see Section 8.1.5) and impacts on Peregrine falcon and Barn owl (see Section 8.1.10). In relation to habitat loss, this includes four priority Annex I habitats (Petrifying springs, Residual alluvial forests, Blanket bog (active) and Limestone pavement), four Annex I habitat types (Wet heath, Dry heath, *Molinia* meadow and Calcareous grassland), in addition to six other non-Annex habitat types of a local biodiversity value.

Where possible, compensatory measures will be implemented to reduce or avoid these significant residual impacts. The loss of areas of the Annex I habitats Residual alluvial forests, Dry heath, *Molinia* meadows and Calcareous grassland will be compensated for, as will the loss of broadleaved woodland, hedgerows and treelines, and there will not be any significant residual impacts. The compensatory measures will reduce the residual impact significance on all bat species to a local level.

Despite the implementation of the mitigation and compensation measures proposed, the Project will have the following likely significant residual effects on biodiversity:

- A likely significant residual effect, at the international geographic scale, for the permanent loss of c.1.54ha of the priority Annex I habitat Limestone pavement [*8240]
- A likely significant residual effect, at the national geographic scale, for the permanent loss of c.3.95ha of a mosaic containing Wet heath [4010], Dry heath [4030] and *Molinia* [6410][7]
- A likely significant residual effect, at the international geographic scale, for the permanent loss of c.0.01ha of the priority Annex I habitat Blanket bog (active) [*7130]
- A likely significant residual effect, at the international geographic scale, for the permanent loss of c.0.01ha of the mosaic containing the priority Annex I habitat Blanket bog (active) [*7130], Wet heath [4010] and Dry heath [4030]
- A likely significant residual effect, at the county geographic scale, for the permanent loss of four Petrifying spring [*7220] features at Lackagh Quarry
- A likely significant residual effect, at the international geographic scale, for the permanent loss of c.0.03ha of the mosaic containing the priority Annex I habitat Limestone pavement [*8240], and Calcareous grassland [6210]
- Likely significant residual effects on Habitat Clusters 1-12 ranging from the local to international scale, dependent upon the potential impacts of the Project on each of the individual ecological receptors that make up the biodiversity resource within a given habitat cluster (additional since 2018 EIAR)
- A likely significant residual effect for the loss of local populations of the red-listed bryophyte species Imbricate bog moss *Sphagnum affine* at the national geographic scale (additional since the 2018 EIAR)
- A likely significant residual effect for the loss of local populations of the red-listed bryophyte species Woodsy thyme *moss Plagiomnium cuspidatum*, Lesser striated feathermoss *Plasteurhynchium striatulum* and Red bog-moss *Sphagnum capillifolium* at the county geographic scale (additional since the 2018 EIAR)
- A likely significant residual effect for the loss of local populations Eyebright *Euphrasia arctica* at a local geographic scale (additional since the 2018 EIAR)

[7] This comprises c.2.54ha of Wet heath dominated habitat and an additional c.1.41 ha of habitat mosaic which contains Wet heath.

- A likely significant residual effect, at the county geographic scale, for the potential permanent loss of a Peregrine falcon nest site at Lackagh Quarry
- A likely significant residual effect, at the local geographic scale, for the potential permanent loss of a Barn Owl nest site at Menlough
- A likely significant residual effect, at the local geographic scale, on all bat species (including lesser horseshoe bat) due to the presence of the proposed N6 GCRR within their foraging areas
- A likely significant residual effect, at the local geographic scale, for the permanent loss of 18 Calcareous springs (FP1) at Lackagh Quarry, c.5.24ha of Dry-humid acid grassland (GS3) and c.1.30ha of Poor fen and flush habitat (PF2).

These significant residual effects will also affect the following local biodiversity areas[2]: Coast Road (R336) to the N59 Moycullen Road, the River Corrib and the Coolagh Lakes, Menlough to Coolagh Hill, Ballindooley – Castlegar, Doughiska local biodiversity area, Cooper's Cave Terryland local biodiversity area, Terryland Glenanail local biodiversity area, City Canal System local biodiversity area, and Waterbody local biodiversity area

Although the significant residual effects associated with the losses of Limestone pavement and Wet heath habitat cannot be directly compensated for, areas of related habitats will be created to provide a biodiversity gain for both peatland habitats containing dry heath and limestone associated habitats locally. The area of Dry heath habitat being provided is c.4.10ha which is greater than the combined losses of peatland habitats containing dry heath (i.e. [4030], and the mosaics [4030/4010], [4030/4010/*7130] and [4030/4010/6410]) combined (c.3.18ha). The area of Calcareous grassland habitat being provided is c.7.98ha which is greater than the combined losses of Limestone pavement and Calcareous grassland habitat (c.1.82ha).

[2] These local biodiversity areas are defined in the *Galway City Development Plan 2017–2023* and the most recent draft of the *Galway City Biodiversity Action Plan 2014–2024*

8.1 Introduction

As set out in Chapter 1 of this updated EIAR, this is an update to Chapter 8 of the EIAR submitted to An Bord Pleanála in October 2018 as part of the application for approval of the proposed N6 GCRR pursuant to Section 51 of the Roads Act 1993 (as amended). It forms part of the response to the request by ABP for further information in December 2023 where they (in addition to a number of other requests) requested GCC to "*Update the Environmental Impact Assessment Report*". It provides an appraisal of the Project under the heading of biodiversity. Cognisance has also been taken of the ecological assessment undertaken by the Inspector appointed by An Bord Pleanála (ABP) and presented in their report dated 22 June 2021[8], and reflected in this updated EIAR in terms of receptor valuations, potential impacts, mitigation measures, and residual impacts under the respective headings. Where there have been any changes to the assessment and or any updates since the 2018 EIAR these have been set out in this updated chapter.

A number of questions arose at the Oral Hearing in 2020 specifically in relation to Barn owl mitigation and foraging habitat impacts, Marsh fritillary butterfly mitigation, compensatory habitat provision, habitat classifications (including Annex I limestone pavement habitat), mammal underpass design, Common lizard impacts and mitigation, shading impact of the Menlough Viaduct on limestone pavement habitat, reuse of limestone pavement habitat for wildlife habitat creation and planning policy in relation to biodiversity, and these are specifically referred to and dealt with in the appropriate sections throughout this updated chapter. Further, the documentation submitted by GCC during the Oral Hearing in 2020 have also been reflected in this updated chapter and, where appropriate, the appendices to this updated chapter.

In accordance with the requirements of 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 (i.e. the EIA Directive), this chapter of the updated EIAR identifies, describes and assesses the likely direct and indirect significant effects of the Project on biodiversity, with particular attention to species and habitats protected under Directive 92/43/EEC and Directive 2009/147/EC (i.e. the Habitats and Birds Directives). In addition, this chapter of the updated EIAR also identifies, describes and assesses the likely direct and indirect significant effects of the Project on species protected pursuant to the Wildlife Acts 1976 to 2024.

The EIA Directive does not provide a definition of biodiversity. The Convention on Biological Diversity, however, gives a formal definition of biodiversity in its Article 2: "biological diversity means the variability among living organisms from all sources including, inter alia, terrestrial, marine and other aquatic ecosystems and the ecological complexes of which they are part; this includes diversity within species, between species and of ecosystems". Alongside the term "biodiversity" the terms "ecology" and "ecological" are also used throughout this chapter as a broader term to consider the relationships of biodiversity receptors to one another and to their environment.

The chapter is set out as follows:

- Section 8.2 presents the methodology, updated as necessary for 2024
- Section 8.3 describes the existing environment, updated with the results of biodiversity surveys undertaken between 2022 and 20244
- Section 8.4 summarises the main characteristics of the Project which are of relevance for biodiversity
- Section 8.5 evaluates the impacts of the Project on biodiversity
- Section 8.6 describes the measures proposed to mitigate these impacts
- Section 8.7 describes the residual impacts
- Section 8.8 describes the cumulative impacts

[8] Inspector's Report (2021) ABP-302885-18 & ABP302848-18 and Appendix 4: Ecological Impact Assessment Report, N6 Galway City Ring Road For An Bord Pleanála, ABP Ref. ABP-302848-18, ABP302885-18, Project No.: IABP106/002 (2021), prepared by Dr Arnold of Thomson Environmental Consultants

- Section 8.9 describes the compensatory measures proposed to address the residual impacts
- Section 8.10 presents a summary of the biodiversity chapter
- Section 8.11 are the references quoted throughout the chapter

Table 8.1 below presents an outline of where the various groupings of ecological receptors are discussed in this chapter, for ease of reference.

Table 8.1 Ecological Receptors Presented within this Chapter of the updated EIAR

Ecological Receptor	Information Presented	Section Reference
Designated Areas for Nature Conservation	Receiving Environment	8.3.4
	Evaluation of Impacts	8.5.4
	Mitigation Measures	8.6.2
	Residual Impacts	8.7.2
	Compensation	N/A
Habitats	Receiving Environment	8.3.5
	Evaluation of Impacts	8.5.5
	Mitigation Measures	8.6.3
	Residual Impacts	8.7.3
	Compensation	8.9.1
Rare and protected plant species	Receiving Environment	8.3.6
	Evaluation of Impacts	8.5.6
	Mitigation Measures	8.6.4
	Residual Impacts	8.7.4
	Compensation	N/A
Non-native invasive plant species	Receiving Environment	8.3.7
	Evaluation of Impacts	8.5.6
	Mitigation Measures	8.6.4
	Residual Impacts	8.7.4
	Compensation	N/A
Otter	Receiving Environment	8.3.8.1
	Evaluation of Impacts	8.5.7.1
	Mitigation Measures	8.6.5.1
	Residual Impacts	8.7.5.1
	Compensation	N/A
Bats	Receiving Environment	8.3.8.2

Ecological Receptor	Information Presented	Section Reference
	Evaluation of Impacts	8.5.7.2
	Mitigation Measures	8.6.5.2
	Residual Impacts	8.7.5.2
	Compensation	8.9.2
Badger	Receiving Environment	8.3.8.3
	Evaluation of Impacts	8.5.7.3
	Mitigation Measures	8.6.5.3
	Residual Impacts	8.7.5.3
	Compensation	N/A
Other Mammal Species	Receiving Environment	8.3.8.4
	Evaluation of Impacts	8.5.7.4
	Mitigation Measures	8.6.5.4
	Residual Impacts	8.7.5.4
	Compensation	N/A
White-clawed crayfish	Receiving Environment	8.3.9.1
	Evaluation of Impacts	8.5.8.1
	Mitigation Measures	N/A
	Residual Impacts	8.7.6.1
	Compensation	N/A
Freshwater pearl mussel	Receiving Environment	8.3.9.2
	Evaluation of Impacts	8.5.8.2
	Mitigation Measures	N/A
	Residual Impacts	8.7.6.2
	Compensation	N/A
Swan Mussel	Receiving Environment	8.3.9.3
	Evaluation of Impacts	8.5.8.3
	Mitigation Measures	8.6.6.1
	Residual Impacts	8.7.6.3
	Compensation	N/A
Marsh whorl snail	Receiving Environment	8.3.9.4
	Evaluation of Impacts	8.5.8.4

Ecological Receptor	Information Presented	Section Reference
	Mitigation Measures	8.6.6.2
	Residual Impacts	8.7.6.4
	Compensation	N/A
Marsh fritillary butterfly	Receiving Environment	8.3.9.5
	Evaluation of Impacts	8.5.8.5
	Mitigation Measures	8.6.6.3
	Residual Impacts	8.7.6.5
	Compensation	N/A
Breeding Birds	Receiving Environment	8.3.10.1
	Evaluation of Impacts	8.5.9.1
	Mitigation Measures	8.6.7.1
	Residual Impacts	8.7.7.1
	Compensation	8.9.3
Wintering Birds	Receiving Environment	8.3.10.2
	Evaluation of Impacts	8.5.9.2
	Mitigation Measures	8.6.7.2
	Residual Impacts	8.7.7.2
	Compensation	N/A
Amphibians	Receiving Environment	8.3.11
	Evaluation of Impacts	8.5.10
	Mitigation Measures	8.6.8
	Residual Impacts	8.7.8
	Compensation	N/A
Reptiles	Receiving Environment	8.3.12
	Evaluation of Impacts	8.5.11
	Mitigation Measures	8.6.9
	Residual Impacts	8.7.9
	Compensation	N/A
Fish	Receiving Environment	8.3.13
	Evaluation of Impacts	8.5.12
	Mitigation Measures	8.6.10

Ecological Receptor	Information Presented	Section Reference
	Residual Impacts	8.7.10
	Compensation	N/A

This chapter has utilised the information gathered during the constraints and route selection studies for the proposed N6 GCRR along with the surveys and studies carried out to inform the 2018 EIAR, the 2019 RFI Response and for the oral hearing in 2020 and more recent surveys in 2022, 2023 and 2024 to inform the biodiversity impact assessment of this updated EIAR. Chapter 5, Project Description, provides a detailed description of the Project and Chapter 7, Construction Activities, outlines how it is proposed to construct the Project.

The key changes to the biodiversity chapter since the 2018 EIAR involve updating:

- the description of the receiving environment to take account of the results of the surveys undertaken between 2022 and 2024
- the figures and appendices to reflect the updated data and assessment
- the chapter to take account of points raised in the RFI Response dated 30 August 2019, the Brief of Evidence presented to An Bord Pleanála (ABP) at the oral hearing in 2020 and from the ABP Inspector's Report dated 22 June 2021

8.2 Methodology

8.2.1 Introduction

The methodologies used to collate information on the baseline biodiversity environment and assess the potential impacts of the Project are summarised in the following sections. For a comprehensive account of all methodologies followed see Appendix A.8.1 of this updated EIAR.

8.2.2 Changes in Guidance and Standards in Methodology since 2018 EIAR

Since the 2018 EIAR, several key biodiversity guidelines have been published, affecting survey methodologies, impact assessments, and mitigation designs. Notable publications include:

- Bat Surveys for Professional Ecologists: Good Practice Guidelines (4th ed.) (Collins, 2023)
- Bat Mitigation Guidelines for Ireland V2 (NPWS, 2022)
- UK Bat Mitigation Guidelines (Reason and Wray, 2023)
- Survey and Mitigation Standards for Barn owls to inform the Planning, Construction and Operation of National Road Projects (Transport Infrastructure Ireland, 2021)
- EPA Guidelines on Environmental Impact Assessment Reports (2022)
- CIEEM Guidelines for Ecological Impact Assessment version 1.3 (CIEEM 2018 – updated 2024)

The bat surveys for the Project, conducted between 2018 and 2023, followed comparable methodologies to those adopted for the 2014-2018 surveys as per NRA (2005-2009) and Collins (2016) and sufficiently informed the impact assessment and mitigation strategy. Updated Bat Survey Guidelines (Collins, 2023) were published in late 2023, after the 2023 bat surveys were completed. These updated guidelines were reviewed to ensure the surveys already completed were consistent with the new guidelines. Given the extensive bat surveys undertaken over the previous 10 years and the extent of data available to inform the impact assessment on bats, also noted by the NWPS in consultations (refer to Section 8.2.4), it was determined that further surveys were not required. In addition, the NPWS were consulted throughout the Bat Derogation Licence process, particularly in relation to the survey scope. No issues were raised by them during the consultation process regarding the survey methods or mitigation strategies proposed or within

their granting of the Bat Derogation Licence for the proposed N6 GCRR in April 2024 (see Appendix A.8.25 Part 1 of this updated EIAR for the 2024 bat derogation licence).

As the 2024 Bat Derogation Licence expired on 31 December 2024, a new derogation licence application was submitted to the NPWS on 1 April 2025 (included in Appendix A.8.25 Part 2 of this updated EIAR).

Further to the collection of the bat survey data in 2023, a review was undertaken in March 2025 to evaluate whether there have been any landscape scale habitat changes since then that might influence the movement or foraging behaviour of bats along, and in the immediate vicinity of, the Project. The review comprised an examination of recent orthophotography, along with a drive through and vantage point validation from the nearest publicly accessible location (generally a roadside), to record any large-scale land-use changes that might materially affect bat movement. The conclusion of the review was that there were no material landscape scale habitat changes since 2023 that would affect bat the movement or foraging behaviour of bats along, and in the immediate vicinity of, the Project. Therefore, it is the professional opinion of the author of this chapter that the scientific data presented within this chapter and the Bat Derogation Licence application remains valid to robustly inform and support the bat impact assessment and conclusions set out in the bat derogation licence application.

Derogation licences granted by the NPWS are published, along with the application and any supporting documentation, on their website at https://www.npws.ie/licensesandconsents/disturbance/application-for-derogation/bat-derogations-issued. **Please note, ABP will be able to see when the Bat Derogation Licence is granted, and obtain a copy of the final granted licence, by clicking on this link**.

The Barn owl surveys undertaken in 2023 follow the methodology set out in the 2021 guidelines which are comparable to and consistent with the methodologies used for the 2014-2018 surveys. The Barn owl mitigation strategy has also been reviewed and updated for consistency with the current guidelines.

Additionally, several updated biodiversity policies have been published since September 2022, including:

- Ireland's 4th National Biodiversity Action Plan 2023-2030
- Galway City Development Plan 2023-2029
- Galway County Development Plan 2022-2028
- Various local biodiversity action plans (as listed below)

The Project aligns with all relevant biodiversity protective policies and compliments the TII Biodiversity and Landscape Plans (2023).

All of the references within this chapter have been updated to reflect the latest available in 2024.

8.2.3 Legislation and Guidelines

The collation of ecological baseline data and the preparation of this chapter of this updated EIAR has had regard to the following legislation and guidance documents (all of which remain relevant today to this updated assessment). This is not an exhaustive list of all legislation and guidelines but the most relevant legislative and guidelines basis for the purposes of preparing this updated EIAR.

Legislation:

- Council Directive 92/43/EEC of 21 May 1992 on the conservation of natural habitats and of wild fauna and flora (as amended), 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 (as amended), hereafter referred to as the Birds Directive
- European Communities (Birds and Natural Habitats) Regulations, 2011 (S.I. No. 477 of 2011), as amended, hereafter referred to as the Birds and Habitats Regulations
- Directive 2011/92/EU of the European Parliament and of the Council of 13 December 2011 on the assessment of the effects of certain public and private projects on the environment, as amended, hereafter referred to as the EIA Directive

- Planning and Development Acts 2000 to 2023, hereafter referred to as the Planning Acts
- Wildlife Acts 1976 to 2023, hereafter referred to as the Wildlife Acts
- Flora (Protection) Order, 2022 (S.I. No. 235 of 2022)
- Inland Fisheries Acts 1959 to 2017, hereafter referred to as the Fisheries Acts

Guidance Documents:

- Environmental Impact Assessment of Projects, Guidance on the preparation of the Environmental Impact Assessment Report (European Commission *et al*., 2017)
- Guidelines on the Information to be Contained in Environmental Impact Assessment Reports (European Commission *et al*., 2017)
- Guidelines on the Information to be Contained in Environmental Impact Assessment Reports (Environmental Protection Agency EPA 2022)
- Guidance on Integrating Climate Change and Biodiversity into Environmental Impact Assessment (European Commission, Directorate-General for Environment, 2013)
- Guidelines for Ecological Impact Assessment in the UK and Ireland version 1.3 (CIEEM 2018 – updated 2024)
- Environmental Guidelines Series for Planning and Construction of National Roads (Transport Infrastructure Ireland, 2005-2009)
- 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, 2008a)
- Environmental Impact Assessment of National Road Schemes – A Practical Guide (National Roads Authority, 2008b)
- Bat Surveys for Professional Ecologists: Good Practice Guidelines (3rd edition) (Collins, 2016)
- The Bat Workers' Manual, 3rd Edition (Mitchell-Jones & McLeish, 2004)
- Bat mitigation guidelines for Ireland v2 (Marnell, *et al.*, 2022) UK Bat Mitigation Guidelines: A Guide to Impact Assessment, Mitigation and Compensation for Developments Affecting Bats (CIEEM, 2023)
- Conservation objectives supporting document – Lesser horseshoe bat (*Rhinolophus hipposideros*) Version 1 (NPWS, 2022a)
- Circular NPW 1/10 & PSSP 2/10 Appropriate Assessment under Article 6 of the Habitats Directive: Guidance for Planning Authorities (Wright, 2010)
- 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 (NPWS, 2007a)
- 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 (NPWS, 2007b)
- Turloughs over 10 ha: vegetation survey and evaluation (Goodwillie, 1992)
- Turlough Hydrology, Ecology and Conservation (Waldren, S. 2015, Ed.)
- Summary of findings from the Survey of Potential Turloughs 2015 (O'Neill & Martin, 2015)
- The Irish semi-natural grasslands survey 2007-2012. Irish Wildlife Manuals, No. 78 (O'Neill *et al.*, 2013)

- Results of monitoring survey of old sessile oak woods and alluvial forests. Irish Wildlife Manuals, No. 71 (O'Neill & Barron, 2013)
- National survey of limestone pavement and associated habitats in Ireland. Irish Wildlife Manuals, No. 73 (Wilson & Fernández, 2013)
- Coolagh Lakes, Lough Corrib SAC, Co. Galway: Wetland Survey and Conservation Assessment (Crushell & Foss, 2014a: unpublished report)
- Coolanillaun Bog, Lough Corrib SAC, Co. Galway: Wetland Survey and Conservation Assessment (Crushell & Foss, 2014b: unpublished report)
- Guidelines for a national survey and conservation assessment of upland vegetation and habitats in Ireland. Version 2.0. Irish Wildlife Manuals, No. 79 (Perrin *et al.*, 2014)
- Guidelines for the Assessment of Annex I Priority Petrifying Springs in Ireland. Irish Wildlife Manuals, No. 142. National Parks and Wildlife Service, Department of Housing, Local Government and Heritage, Ireland (Denyer, Eakin, & Gill 2023)
- Guidance on the Strict Protection of Certain Animal and Plant Species under the Habitats Directive in Ireland (NPWS, 2021a)
- The Strict Protection of Animal Species of Community Interest under the Habitats Directive (European Commission, Directorate-General for Environment, 2021)
- The monitoring and assessment of four EU Habitats Directive Annex I woodland habitats. Irish Wildlife Manuals, No. 146 (NPWS, 2023)

Planning Policies:

- National Planning Framework – Ireland 2040
- National Development Plan 2018 – 2027
- Climate Action Plan 2024
- 4th National Biodiversity Action Plan – Actions for Biodiversity 2023 – 2027
- Regional Spatial and Economic Strategy for the Northern and Western Region 2020 – 2032
- Galway County Heritage and Biodiversity Plan 2017 – 2022
- The All Ireland Pollinator Plan 2021 – 2025
- Galway County Local Economic and Community Plan 2016 – 2022 (still in effect)
- Galway City Local Economic and Community Plan 2024 – 2029
- Galway County Development Plan 2022 – 2028[9]
- Galway City Development Plan 2023 – 2029[10]
- Galway City – Biodiversity Action Plan 2014 – 2024[11]
- Clare County Development Plan 2023 – 2029[12]

[9] https://consult.galway.ie/en/consultation/adopted-galway-county-development-plan-2022-2028

[10] https://www.galwaycity.ie/development-plan-2023-2029

[11] https://galwaybiodiversity.com/galway-city-biodiversity-action-plan/

[12] https://www.clarecoco.ie/services/planning/clarecountydevelopmentplan23-2029/

- Mayo County Development Plan 2022 – 2028[13]
- Gaeltacht Local Area Plan 2017 – 2023[14]
- Athenry Local Area Plan 2023 – 2029[15]
- Bearna Local Area Plan as incorporated into the Galway County Development Plan 2022 – 2028[16]
- Gort Local Area Plan 2013 – 2023[17]
- Headford Local Area Plan 2018 – 2024[18]
- Loughrea Local Area Plan 2024 – 2030[19]
- Maigh Cuilinn Local Area Plan 2013 – 2023[20]
- Oranmore Local Area Plan 2012 – 2022[21]
- Tuam Local Area Plan 2023 – 2029[22]

8.2.4 Data Sources and Consultations

The desktop studies undertaken previously were reviewed to determine scope of the ecological surveys required to inform this updated EIAR. The desktop study involved collection and review of relevant published and unpublished sources of data, collation of existing information on the ecological environment, including a review of the results of the previous surveys completed to inform the 2018 EIAR, and consultation with relevant statutory bodies.

8.2.4.1 Desk Study

The following sources were consulted during the desktop study to inform the scope of the ecological surveys for both the 2018 EIAR and this updated EIAR:

- Bat records from Bat Conservation Ireland's (BCI) database
- Coastal Habitat Study for Bearna (Galway County Council, 2007)
- Corrib Estuary: Sampling Fish for the Water Framework Directive – Transitional Waters 2008 (The Central and Regional Fisheries Board, 2009)
- Data on European sites, Natural Heritage Areas (NHAs) and proposed Natural Heritage Areas (pNHAs) as held by the National Parks and Wildlife Service (NPWS) from https://www.npws.ie/protected-sites and https://www.npws.ie/maps-and-data - Accessed in February 2025
- Data on waterbodies, available for download from the Environmental Protection Agency (EPA) web map service. Available from https://gis.epa.ie/EPAMaps/ - Accessed in February 2025

[13] https://www.mayo.ie/planning/county-development-plans/2022-2028

[14] https://www.galway.ie/en/media/Gaeltacht%20Issues%20Paper.pdf

[15] https://consult.galway.ie/en/consultation/draft-athenry-local-area-plan-2023-2029

[16] https://www.galway.ie/en/media/1.%20Variation%20No.2(a)%20to%20GCDP%202015-21-Bearna%20title.pdf

[17] https://www.galway.ie/en/media/Gort%20Local%20Area%20Plan%202013-2023-Deferral%20of%20Notice.pdf

[18] https://data.gov.ie/dataset/headford-lap-2015-20217

[19] https://consult.galway.ie/en/consultation/draft-loughrea-local-area-plan-2024-2030

[20] https://www.galway.ie/en/media/Maigh%20Cuilinn%20Local%20Area%20Plan%202013-2023.pdf

[21] https://www.galway.ie/en/media/Oranmore%20LAP%202012-22.pdf

[22] https://www.galway.ie/en/services/planning/planspolicy/lap/tuamlap2023-2029/

- Environmental information/data for the area available from www.epa.ie (Envision Online Environmental Map Viewer - http://gis.epa.ie)
- Fish Stock Survey of Lough Corrib, June/July 2018. National Research Survey Programme, Inland Fisheries Ireland (Connor *et al.*, 2018)
- Fish Stock Survey of Lough Corrib, June/July 2021. National Research Survey Programme, Inland Fisheries Ireland (McLoone *et al.*, 2022)
- Galway City Council Draft Ardaun Local Area Plan Habitat Assessment (2018 - 2024)
- Galway City Council Ardaun Local Area Plan Habitat Assessment (Natura Environmental Consultants, 2012)
- Galway City Habitat Inventory. Galway City Council (Natura Environmental Consultants, 2005) – including digital mapping dataset
- Galway Harbour Extension Environmental Impact Statement (Galway Harbour Company, 2014)
- Habitat and species GIS datasets provided by the NPWS
- Information in relation to the biodiversity of the study area as gathered and presented within the Chapter 8 Biodiversity of an EIAR for the N6 Galway City Ring Road Project prepared by Scott Cawley Ltd. and submitted to An Bord Pleanála in 2018
- Information on soils, geology and hydrogeology in the area available from the Geological Survey Ireland (GSI) online Spatial Resources service. Available from https://www.gsi.ie/en-ie/data-and-maps/Pages/Groundwater.aspx - Accessed in February 2025
- Information on the conservation status of birds in Ireland from Birds of Conservation Concern in Ireland 4 2020 – 2026 (Gilbert *et al.*, 2021)
- Information on the status of EU protected habitats and species in Ireland (NPWS, 2019a, 2019b and 2019c)
- N59 Maigh Cuilinn (Moycullen) Bypass Road Project Environmental Impact Statement (Galway County Council/Roscommon National Roads Design Office, 2011)
- N6 Galway City Outer Bypass. Environmental Impact Statement (RPS, 2006)
- National Biodiversity Data Centre (NBDC) Online Database. Available online at <http://maps.biodiversityireland.ie/#/Map>. Accessed in February 2025
- Online data available on Natura 2000 network of sites (hereafter referred to as European sites[23]) and on Natural Heritage Areas (NHAs) or proposed Natural Heritage Areas (pNHAs) as held by the National Parks and Wildlife Service (NPWS) from https://www.npws.ie/protected-sites and https://www.npws.ie/maps-and-data - Accessed in February 2025
- Ordnance Survey Ireland (OSI) orthophotography (from 1995 to 2012) for the Scheme Study Area
- Ordnance Survey Ireland mapping and aerial photography from http://map.geohive.ie/ - Accessed in February 2025

[23] Article 3 of the Habitats Directive provides for the establishment of a coherent European ecological network of special areas of conservation, under the title Natura 2000. All Special Protection Areas for birds, as designated by legislation implementing the Birds Directive, are part of this Natura 2000 network. 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 mapping and aerial photography from http://map.geohive.ie/ - Accessed in February 2025
- *Pseudorchis albida* at Doughiska, Galway City – Report of a search in May-June 2005 (Roden, 2005)
- Records of rare and protected species for the 10km grid square(s) M22 and M32, as held by the National Biodiversity Data Centre www.biodiversityireland.ie - Accessed in February 2025
- Records of rare and protected species for the 10km grid square(s) M32, as held by the National Biodiversity Data Centre www.biodiversityireland.ie - Accessed in February 2025
- Records of rare and protected species for the 10km grid squares M22 and M32, held by the NPWS
- Results of the NBDC's 'Bioblitz' event (2014 & 2015) at the NUI Galway Campus
- 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)
- The Barna Woods Project, Biodiversity Report (Browne *et al*., 2009)
- 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)
- The results of a summer bat survey of Menlo Castle completed by McCarthy Keville, & O'Sullivan in 2022 (McCarthy, Keville, & O'Sullivan, 2022)
- The results of bird surveys carried out for the 2006 N6 Galway City Outer Bypass EIS (RPS, 2006a)
- The results of ecological surveys undertaken as part of the constraints and route selection studies (N6 Galway City Transport Project: Route Selection Report (Arup, 2016a)
- Various environmental planning reports relating to developments associated with NUI Galway (MKO, 2020a, MKO, 2020b, MKO, 2020c, 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 Environmental Services, 2011)
- Water Framework Directive Fish Stock Survey of Lough Corrib, June 2014 (Kelly *et al.* 2015)

8.2.4.2 Consultations

The following organisations with relevance to ecology were consulted:

- The National Parks & Wildlife Service (NPWS) section of the Department of Housing, Local Government and Heritage (formerly Department of Culture, Heritage and the Gaeltacht; and previous to that Department of Arts, Heritage, Regional, Rural and Gaeltacht Affairs)
- Inland Fisheries Ireland (IFI)
- Bat Conservation Ireland (BCI)
- BirdWatch Ireland (BWI)
- Botanical Society of Britain & Ireland (BSBI)
- Kate McAney of the Vincent Wildlife Trust
- Other members of the public with local knowledge/records (e.g. relating to bat roosts)

A summary of consultations with the NPWS Section of the Department of Culture, Heritage and the Gaeltacht (formerly Department of Arts, Heritage, Regional, Rural and Gaeltacht Affairs and previous to that Department of Arts, Heritage and the Gaeltacht)/NPWS and IFI is provided below. Species or plant records are included under the relevant headings in Section 8.3 Receiving Environment.

The National Parks & Wildlife Service (NPWS) section of the Department of Housing, Local Government and Heritage

A summary of the formal observations, written consultations and meetings with the National Parks & Wildlife Service (NPWS), the points discussed, and decisions agreed is provided below.

A meeting was held with the NPWS on 3 March 2023 in relation to the 2018 bat survey baseline and proposed scope of surveys for the 2023 survey season and any requirements for the Bat Derogation Licence Application.

The NPWS noted the substantial bat surveys undertaken previously by the project team which provided excellent baseline data for the Project, and the purpose of the meeting was to determine how to bring this data up to date, including the scope of potential additional bat surveys.

As a licence is required from the NPWS to undertake the radiotracking surveys and given the extensive bat surveys previously undertaken and the risk of mortality to the Lesser horseshoe bat when captured and tagged for radiotracking purposes it was agreed not to repeat these surveys at this time. Instead, Lesser horseshoe bats were to be ringed and the known bat roots visited to determine if the same pattern of bat movements exist as previously surveyed, i.e. the Menlo Castle bats roost and forage primarily in the surrounding area and that there is no linkage to Ebor Hall bat roost. These surveys were also complimented with walked transects and extensive static detector surveys. It was agreed that a review of the landscape would also be undertaken to determine if there have been any changes since the previous surveys which could alter the movement, foraging behaviour or roosting patterns of bats within the study area. A review of the results of the surveys confirmed the pattern of bat movements were unchanged and there was no need for radiotracking to be undertaken.

A further meeting was held with the NPWS on 5 March 2024 to discuss the findings of the bat surveys and discuss the draft of the Bat Derogation Licence Application. The NPWS had no further comment on the bat surveys and confirmed the timeline for the application process for the Bat Derogation Licence. The licence was approved by the NPWS on 10 April 2024. As noted above in Section 8.2.2, the 2024 Bat Derogation Licence expired on 31 December 2024 and a new derogation licence application was submitted to the NPWS on 1 April 2025 (included in Appendix A.8.25 Part 2 of this updated EIAR). Derogation licences granted by the NPWS are published, along with the application and any supporting documentation, on their website at https://www.npws.ie/licensesandconsents/disturbance/application-for-derogation/bat-derogations-issued.

The NPWS made two written submissions at the Oral Hearing in 2020: one on the 21 February 2020 and a second on the 11 March 2020.

In the first, the NPWS requested clarifications in relation to:

- The groundwater regime operating in the vicinity of Lackagh Quarry and its relationship to groundwater dependant qualifying interest habitats associated with the Coolagh Lakes in Lough Corrib SAC
- Dewatering in the vicinity of Moycullen Bogs NHA and associated risks to the ecology of the bog
- The Marsh fritillary butterfly mitigation measures
- The provision of compensatory Annex I habitats

In the second, the NPWS responded to questions raised by Dr Arnold, on behalf of An Bord Pleanála, in relation to losses of limestone pavement habitat outside of Lough Corrib SAC, the Lough Corrib SAC boundary in the vicinity of Menlo Castle, the definition of limestone pavement habitat, and specific relevé results/photographs.

The second NPWS submission also included the minutes of two meetings held with the NPWS during the Oral Hearing (on the 21 February 2020 and on the 9 March 2020) where the following matters were discussed:

- Hydrogeological matters in relation to Lough Corrib SAC
- Hydrogeological matters in relation to Moycullen Bogs NHA
- Compensatory habitat provision regarding Calcareous grassland and Dry heath

- Barn owl and Peregrine falcon mitigation measures
- Marsh fritillary mitigation measures

Copies of the submissions made by the NPWS during the Oral Hearing in 2020 are included in Appendix A.8.2.

On 24 January 2020, the NPWS submitted an observation with respect to the proposed N6 GCRR, the subject of Section 51 Application. In their observation, reference was made to the 2018 EIAR, 2018 NIS and the 2019 Request for Further Information Response. A meeting was held with NPWS on the 27 February 2020 regarding the 2020 submission, birds, eco-hydrogeology and EIAR items. For the full details, see Appendix 8.2. A summary is provided below.

The following observations were made by the NPWS in relation to the 2018 EIAR:

Item 1 - Likely effects on European sites:

- Annex I habitats - Qualifying Interests (QIs) including the Limestone pavement [8240] habitat near Menlo
- Updates to the boundary of Lough Corrib SAC
- Lough Corrib SAC Hydrology - clarity required in relation to changes in the hydrological regime and its impact on the groundwater catchment area as a result of the Lackagh Tunnel - as addressed in Section 4.12.1 of the 2019 Request for Further Information Response Report (Volume 1)
- Birds - The NPWS raised issues in relation to habitat loss and fragmentation and the potential for this to impact SCI bird species for SPAs in the vicinity of the proposed N6 GCRR

Item 2 - Likely effects on the Environment:

- Moycullen Bog NHA - The potential for impacts needs to be assessed and mitigation measures proposed to address the dewatering of the 'Galway Granite batholith' within cutting areas during construction and operation of the proposed N6 GCRR as appropriate
- Habitats - The NPWS noted that there will be a number of habitat types of local biodiversity importance which will be permanently lost and where significant residual impacts are likely, including calcareous springs, dry-humid acid grasslands, poor fen and flush, mixed broadleaved woodland, hedgerows and treelines. Also, species such as Marsh fritillary could be affected by such changes arising in connection with the Project and could lead to loss of habitat in 'favourable management'. The NPWS requested that further clarification should be provided by the applicant
- Compensatory Habitat - The NPWS re-iterated its view that it would assist interpretation if a table with the details of donor and receptor sites, including areas and habitat types present in each, was provided to clarify, among other things, what habitats will be lost in the receptor sites as a result of the compensation measures and what habitat gains are predicted to accrue. Clarification was requested on amendments proposed in the 2019 Request for Further Information Response Report to the Material Deposition Areas in Lackagh Quarry (areas DA23, DA24, DA25, DA28)
- Birds – The NPWS re-iterated the matters raised in its previous observations in relation to the need for compensatory long-term habitat management for Barn owl. The NPWS also raised issues in relation to the potential for impacts to Peregrine falcon and to wintering birds at Ballindooley Lough arising from blasting activity at Lackagh Quarry (and Castlegar), and the mitigation measures proposed to address such impacts
- Marsh fritillary - The NPWS reiterated its concerns in relation to the mitigation measures proposed for this Annex II species which, as set out in their previous observations, lacked sufficient detail. The NPWS observed that this matter needs to be addressed to ensure that the mitigation measures proposed are realisable
- Bats - The NPWS requested clarification in relation to Lesser horseshoe bat populations information provided in relation to core sustenance zones (CSZ) for bats, noting that the conclusions in the 2018

EIAR in relation to bats are contingent on i) the effective and timely implementation of these mitigation and compensation measures at or prior to construction stage, ii) their continued effective functioning for the lifetime of the proposed N6 GCRR, and iii) their safeguarding in any future projects and development planning

- Habitat Connectivity - The NPWS noted the clarification in relation to habitat connectivity for Pine marten, Squirrel and Common lizard set out in the 2019 Request for Further Information Response Report

Other items:

- The NPWS queried the extent and nature of habitat impacts and/or changes in the Lough Corrib SAC and noted that an access route had been altered to avoid a section of Annex I limestone pavement [*8240], thus avoiding impacts to Lough Corrib SAC. The NPWS queried the alteration to the boundary of Lough Corrib SAC and minor NPWS mapping errors related to the proposed N6 GCRR; since 2018, the Lough Corrib SAC boundary has been revised and published by the NPWS and the revised boundary has been incorporated into this updated EIAR

- Comments were raised on the hydrogeological regime related to the Lackagh Tunnel on the groundwater catchment area. They noted it is unclear what the hydrological connectivity between the groundwater dependent terrestrial ecosystems (GWDTEs) are, particularly the fen habitats within the Lough Corrib SAC. They also questioned whether the groundwater drainage associated with tunnelling construction work, during and post development, and the inclusion of 'water-tight' barriers and the conclusion that it will not have an effect in Lough Corrib Fen 1, needs further interrogation. This had been interrogated and results captured in the 2018 EIAR and this updated EIAR

- Acknowledgement of the clarification of the query raised by the NPWS regarding the assessment of the specific Designated Sites' conservation objectives within the 2018 EIAR. This clarification is also included in this updated EIAR

- Acknowledgement of the additional information provided regarding the risk of bird collision with the bridge, including the fact that no nocturnal surveys were completed, and that they consider that impact assessment to potential SCIs from neighbouring SPAs is sufficient given that the bridge will not be lit, data from surveys conducted to date and available literature

- The NPWS reiterated its concern regarding the Moycullen Bog NHA, that dewatering of the 'Galway Granite batholith' within cutting areas during construction and operation of the proposed N6 GCRR may result in a lowering of the peatland water table with peat subsidence and consequent negative impact on the ecology of the bog

- Comments were raised on the number of habitats that would be permanently lost and where significant residual impacts are likely, including calcareous springs, dry-humid acid grasslands, poor fen and flush, mixed broadleaved woodland, hedgerows and treelines. Comment was also made regarding clearly setting out the area for woodland, treeline and hedgerow being provided for in the landscape design

- The NPWS noted the summary of residual Annex I habitat loss after compensatory measures have been implemented. The NPWS reiterated its view that some of these losses are to be compensated by translocating habitat from one location (donor site) to another (receptor site)

- Clarification around habitat compensation was requested with regard to the Material Deposition Areas

- The NPWS reiterated the need for compensatory long-term habitat management for Barn owl

- Comments were raised in relation to the potential for impacts to Peregrine falcon and wintering birds at Ballindooley Lough arising from the blasting activity at Lackagh Quarry (and Castlegar)

- The NPWS raised concerns regarding possible loss of habitat in 'favourable management' which could affect Marsh fritillary species. The NPWS also raises concern in relation to the mitigation measures proposed for this Annex II species

- Comments were raised regarding the Lesser horseshoe bat populations and information to be provided in relation to core sustenance zones (CSZ)
- The NPWS notes the clarification in relation to habitat connectivity for Pine marten, Squirrel and Common lizard

As evident throughout this updated EIAR, these observations and comments have been taken on board and implemented throughout the examination and analysis of this updated EIAR.

Prior to the submission of the 2018 EIAR to An Bord Pleanála in October 2018 as part of the Section 51 Application, six meetings were held with the NPWS: on 2 July 2014, 26 March 2015, 24 February 2016, 29 March 2017, 18 April 2017 and 03 August 2017. A formal consultation response related to the informal EIS Scoping Report was received from the Department of Arts, Heritage and the Gaeltacht on the 10 August 2016 and two documents related to the draft EIAR and draft NIS on the 16 and 18 January 2018 (Ref. G Pre00241/2016 – a copy of this is included in Appendix A.8.2).

The consultation and discussions with the NPWS were broad-ranging, covering general requirements and processes relating to scoping and preparation of the 2018 EIAR and 2018 NIS, the ecological baseline surveys and findings, valuing ecological receptors, mitigation, impact assessment, conservation objectives, derogation licences, supporting land use plans and transportation strategies and the Lough Corrib SAC boundary and QIs. The NPWS made the following comments/observations relevant to the preparation of the 2018 EIAR and the appropriate assessment process, and also provided notes on a draft of the EIAR:

- The EIAR must address likely significant effects on European sites. The EIAR may align with and cross-reference or reflect content of the Natura Impact Statement but may not omit, overlook or exclude consideration of the likely effects on European sites. Issues which were raised by the NPWS specifically of relevance to Appropriate Assessment are listed separately in the Natura Impact Statement and are not repeated here. This has been addressed in Section 8.5.4.1 of this chapter.
- The EIAR must assess likely significant effects on Natural Heritage Areas and proposed Natural Heritage Areas which are selected for certain ecological features and these should be used to inform the scope of the scientific assessment and analysis in the EIAR. It must also assess likely significant effects on non-statutory sites such as local biodiversity areas. This has been addressed in Section 8.5.4.2 for Natural Heritage Areas, and in Section 8.5.13 for local biodiversity areas.
- Existing guidance on EIA should be followed when preparing the EIAR, while also being cognisant of changes in interpretation and application of the EU Nature Directives and national legislation arising from case law. Terminology used should align with the legislation and case law, and in particular the specific tests of the assessment process. This has been completed and referenced throughout this chapter.
- The EIAR should consider key ecological receptors and should present data, information and analysis specific and relevant to the Project, including characterisation of habitats as Annex I/Annex I priority habitat types (or not as the case may be) with scientific justification and supporting evidence (such as vegetation community data) to support conclusions reached. Botanic surveys should survey for presence of protected or rare species known from or potentially occurring within the locality (e.g. *Pseudorchis albida* and *Allium schoenoprasum*). Assessment of impacts on Annex I habitat types should assess the likely effects on habitat structure and function and should assess whether habitat loss could result in unfavourable or worsening national conservation status. This has been completed in Section 8.3.5 and 8.5.5 of this chapter.
- The EIAR must include a full and detailed description of all elements of the proposed N6 GCRR. This has been included in Section 8.4 of this chapter, and in Chapter 5 of this updated EIAR.
- The EIAR must assess potential cumulative impacts, in particular on existing and permitted proposed developments, along with the details of any mitigation measures that apply. The assessment of cumulative impacts should examine effects arising from existing or historic developments which may have resulted in impacts since the date from which EIA requirements existed. This has been included in Section 8.8 of this chapter.
- Full details of mitigation measures should be provided and shown on maps. The likely effects of mitigation measures themselves should also be assessed and mitigated where necessary. Mitigation

measures should be demonstrated to be effective in addressing the effects arising and should be demonstrated to be feasible within the specific characteristics and constraints of the proposed development site. Mitigation measures are mapped on Figures XX Volume 3 of this updated EIAR.

- Appropriate specialist supervision should be proposed as necessary to ensure the correct implementation of mitigation measures at all stages of the proposed N6 GCRR, including advance works contract stages. This is included in Section 8.6 of this chapter.
- The assessments in the EIAR should suffice to support any application for licences or derogations that may be necessary to disturb strictly protected or protected species and their breeding or resting places. The NPWS granted a Bat Derogation Licence for the proposed N6 GCRR in April 2024, the information of which is included in this chapter in Sections 8.3.8.2, 8.5.7.2, 8.6.5.2, 8.7.5.2, 8.8.5, and 8.9.2, and in the 2025 Bat Derogation Licence application (see Appendix A.8.25 Part 2 of this updated EIAR).
- The NPWS are in the process of updating the digital mapping datasets into the ITM projection on modern OSI mapping. For European sites where this has not yet been completed, presenting the boundary of European sites on mapping included in the EIAR/NIS should be based upon an interpretation of its location relative to its intended location on the official 6" mapping (relative to the topographical features it follows on that mapping dataset). As noted above, the mapping has since been revised by the NPWS and the final boundaries have been incorporated into this updated EIAR.

These observations and comments have been taken on board and implemented throughout the 2018 EIAR and this updated EIAR.

Inland Fisheries Ireland (IFI)

Following the detailed consultations with IFI to discuss value of watercourses to inform the 2018 EIAR and 2018 NIS, as detailed below, no further consultation for this updated EIAR was necessary with IFI as the proposed River Corrib bridge design and associated surrounding works had not changed since 2018 to an extent that would alter the potential impacts to the River Corrib. The specialist aquatic ecologists did contact the IFI to inform the department of their intentions to electro-fish sites on watercourses in the vicinity of the Project in August and September 2023 following notification to Inland Fisheries Ireland, under the conditions of a Department of the Environment, Climate and Communications (DECC) licence. The survey was undertaken in accordance with best practice (CEN, 2003; CFB, 2008) and Section 14 licencing requirements.

As per the 2018 EIAR and 2018 NIS, two meetings were held with IFI to discuss the fisheries value of watercourses crossed by the proposed N6 GCRR: the first on 14 August 2014 and the second on 15 September 2016.

During these meetings, and in correspondence related to same, IFI made the following observations.

- Overall the area which the proposed N6 GCRR falls within avoids the more sensitive and important areas for fisheries
- The River Corrib is a nationally important river system for Atlantic salmon. The Bearna Stream supports Sea trout and Atlantic salmon and this watercourse would be one of the main sites for these species in the locality, and other than the River Corrib, is the most important stream affected by the proposed N6 GCRR. IFI undertook improvement works to the Bearna Stream, particularly for Sea trout. The Sea trout spawning area in the Bearna Stream is downstream of the proposed N6 GCRR. The Knocknacarra Stream supports Sea trout and the Newpark Stream (north of Tonabrocky) has trout spawning habitat. The Terryland River has poor habitat for salmonids and has been heavily drained in recent times as part of flood prevention measures. Electrofishing of this watercourse found little or no salmonids or eels present. The Terryland River does have Pike
- IFI had no records of spawning grounds for salmonids at any of the proposed watercourse crossing points along the proposed N6 GCRR
- The banks of the River Corrib have lamprey spawning sites. IFI have observed Sea lamprey scaling the Salmon Weir and spawning in the upper catchment at Cong – this contradicts some published sources which state that the species was thought to be restricted below the Salmon Weir in Galway City

- Eels are present in good numbers in the River Corrib and may be present in other affected watercourses in smaller numbers. Eel passage has successfully been provided at Salmon Weir to facilitate migration since the 1950s. Any barriers to migration of eel would be of concern
- Ballindooley Lough does not support salmonids or lamprey but is used for coarse fishing (i.e. Perch, Roach, Bream and Pike). This waterbody is sensitive from an angling rather than ecological perspective in terms of fisheries
- Angling and navigation on the River Corrib is of importance. The Coolagh Lakes are not widely fished
- White-clawed crayfish are present in Lough Corrib (there are small numbers in the Clare River north of the proposed N6 GCRR) and could also be present in the River Corrib
- Bio-security protocols will be very important for the proposed N6 GCRR. *Lagarosiphon major* and the Zebra Mussel are significant problems in the Corrib system. IFI guidelines on biosecurity will need to be followed for both surveys for the EIAR and at construction stage for the Project
- Japanese knotweed and Himalayan balsam are present on both the Terryland River and River Corrib
- IFI's long term aim is to improve the quality of streams and rivers. The proposed N6 GCRR should not impede the achievement of this aim. The Sea trout population in watercourses along the western section of the proposed N6 GCRR have collapsed and the long term aim is to restore the species in this area
- Stormwater discharges, in particular direct discharges to watercourses, are of concern. This should be addressed in both the design and construction methodology for the proposed N6 GCRR
- Fish passage should be provided by burying culverts below bed level, ensuring flow levels are not increased, including bristles or baffles, with maintenance of same where necessary
- Habitat restoration/reinstatement following instream works will be required
- IFI have requested to be present on-site during construction and in particular for any stream diversions. Electrofishing may be required to move any captured fish downstream of construction works
- IFI have requested a detailed method statement from the contractor in advance of instream works
- Instream works will only be permitted between 1 July and end of September in accordance with IFI guidelines (IFI, 2016)
- Access to the River Corrib should be maintained on both the eastern and western banks at the River Corrib crossing location
- Section 50 approval has been granted by OPW for the proposed culverts. These culverts are box culverts with 300mm gravel in the stream bed
- The proposed systems for treatment of surface water from the proposed N6 GCRR are noted by IFI to generally work well

These requirements from IFI are unchanged since 2018, as no further consultation with IFI has been undertaken or is necessary regarding the potential fisheries impacts associated with the Project, and have been incorporated into this updated EIAR.

8.2.5 Scheme Study Area and Baseline Data Collection

8.2.5.1 Scheme Study Area

The term "Scheme Study Area", when used in this chapter, refers to the wider study area at which ecological constraints were initially identified for the constraints and route selection studies for the proposed N6 GCRR (see Figures 8.1.1 and 8.1.2). This is the geographic scale at which many of the EIA level ecological surveys were initially carried out. For many of the ecological receptors, surveys were also carried out within a more

restricted study area, focussed on assessing potential impacts within the Zone of Influence (ZoI)[24] of the Project. Section 8.2.5.2 below, describes the study area(s) for each ecological receptor and, where relevant, these study areas are also shown on the accompanying Figures 8.1.1 to 8.39.15.

8.2.5.2 Field Surveys

This section outlines the various ecological survey methodologies used to collate baseline ecological information in the preparation of this chapter. The surveys carried out are summarised below in Table 8.2 with the full description of the survey methodologies presented in Appendix A.8.1. Surveys were undertaken between 2022 and 2024 to confirm the baseline results from previous surveys and identify any changes and these surveys informed this updated EIAR.

The scoping exercise undertaken for the constraints and route selection studies for the proposed N6 GCRR identified numerous sensitive ecological receptors within the Scheme Study Area that could potentially have been impacted by the proposed N6 GCRR. As a result, EIA level surveys for many of these ecological receptors were undertaken at the route selection stage of the proposed N6 GCRR in order to inform the selection of the emerging preferred route corridor for the proposed N6 GCRR, as due to their ecological value they were highly likely to affect the ranking of route options. However, many of these surveys were carried out over the larger Scheme Study Area (see also Section 8.2.5.1) and at a resolution appropriate to gathering information to inform the constraints and route selection studies, hence the requirement to carry out additional surveys to inform the 2018 EIAR in subsequent seasons/years to supplement the information already gathered and fill any gaps, spatially, in the ecological baseline datasets. Under each section below, where different surveys relating to a particular ecological receptor (e.g. habitats) were undertaken over a number of survey seasons or covering different geographic locations along the route of the Project, each of the surveys undertaken are described in chronological order. As detailed in subsequent sections of this chapter, although it was not necessary to repeat some surveys there is no gap in the baseline information gathered to support the impact assessment presented in this updated EIAR. The reason why it was not necessary to repeat some surveys is explained in the relevant parts of Section 8.3.

Table 8.2 Ecological Surveys and Survey Dates between 2013 and 2023

Ecological Surveys and Survey Dates		
Survey	**Survey Date(s)**	**Surveyor(s)**
Habitat Surveys[25]:		Botanical, Environmental & Conservation (BEC) Consultants Ltd., Scott Cawley Ltd. and various independent botanists including Dr Joanne Denyer, Dr John Conaghan, Dr Janice Fuller, Katharine Duff. Eamon O'Sullivan, Roger Goodwillie, Dr Cilian Roden, Michelle O'Neill and Mary O'Connor.
Lough Corrib SAC – Selected Locations (RS)	July to September 2013	
Petrifying springs survey (RS)	March to June 2014	
Lough Corrib Special Area of Conservation (SAC) Study Area (RS)	May to September 2014	
Ecological Sites [26] (RS)	June to October, 2014	
Aquatic habitats (RS)	June to September, 2014	
Lackagh Quarry Petrifying spring survey (EIA)	June 2015	

[24] The 'zone of influence' for a development is the area over which ecological features may be subject to significant impacts as a result of the proposed development and associated activities (CIEEM, 2016) – see Section 8.3.1 for more detail on the ZoI as it relates to the Project.

[25] Some ecological surveys were carried out during the constraints and route selection studies for the proposed N6 GCRR in 2014 and were carried out at a different spatial scale and without reference to any ZoI as it would relate to Assessment Boundary. These surveys later informed the EIA ecological surveys and for ease of reference are denoted with RS in parenthesis in Table 8.2. Those surveys carried out specific to the EIA assessment and its ZoI are denoted with EIA in parenthesis.

[26] Ecological Sites, in this case, are sites of potential ecological value for the habitats present: i.e. determined to be at least of a Local Importance (higher value) (refer to National Roads Authority, 2009 for more detail). The boundaries of the Ecological sites 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.

Ecological Surveys and Survey Dates		
Survey	**Survey Date(s)**	**Surveyor(s)**
	July 2023	
EIA Habitat surveys (EIA)	September to December 2015 July to October 2016 May 2017 to January 2018	
	July to October 2023	Scott Cawley Ltd., John Conaghan and Eamonn Delaney
Habitat Survey (Relevés)	July to October 2019	Scott Cawley Ltd.
Aquatic Habitat and Aquatic Vegetation Surveys: Lough Corrib SAC – Selected Locations	August – October 2023	Nick Stewart and Ross Macklin
Protected Plant Species Surveys:		
Slender naiad Najas flexilis (RS)	June to September, 2014	Dr Cilian Roden
Varnished hook-moss Hamatocaulis vernicosus (RS)	September 2014	Dr Rory Hodd
Mammal Surveys (Non-volant):		
Otter survey (River Corrib and Coolagh Lakes) (RS)	April and May 2014	Scott Cawley Ltd.
Otter survey[27] (River Corrib and Coolagh Lakes) (EIA)	August and September 2023/October and November 2023	Triturus Environmental Ltd./ Scott Cawley Ltd.
Mammal survey (excluding bats)	April to June and October/November 2015 October 2016 October/November 2017	Scott Cawley Ltd. and Dr Chris Peppiatt
	October and November 2023	Scott Cawley Ltd.
Bat Surveys:		
Building surveys (RS and EIA)	July to October 2014 August/September 2015 July/August 2016 June/July 2017 August 2018	Scott Cawley Ltd. and independent bat specialists including Conor Kelleher, Brian Keeley, Isobel Abbott, Barbara McInerney, Caroline Shiel and Barry Ryan
	May to September 2023	Scott Cawley Ltd., Arup, and independent bat specialists Barbara McInerney, and Caroline Shiel
Winter hibernation surveys (RS and EIA)	March 2014 & February 2015 & 2016, January 2018	
Tree surveys (EIA)	April to November 2015	Scott Cawley Ltd.

[27] Additional data from the Aquatic survey from August - September 2023 incorporated as necessary

Ecological Surveys and Survey Dates		
Survey	**Survey Date(s)**	**Surveyor(s)**
	April 2023	
Walked transect surveys (RS)	June/July 2014	Scott Cawley Ltd. and independent bat specialists including Conor Kelleher, Brian Keeley, Isobel Abbott, Barbara McInerney, Caroline Shiel and Barry Ryan
	May to September 2023	Scott Cawley Ltd., Arup
Automated detector activity surveys (RS and EIA)	August to November 2014 July to October 2015 July to August 2017 May 2018	Scott Cawley Ltd.
	February to October 2023	
Marking studies (EIA)	July 2014 to August 2016 May 2023 August 2023	Geckoella Ltd. (Tagging); Scott Cawley Ltd. (search for ringed bats)
Vehicle transect surveys (RS) (Not repeated in 2023)	June/July 2014	Scott Cawley Ltd.
Radio-tracking studies (RS and EIA) (Not repeated in 2023)	July/August 2014 August 2014 September 2014 May 2015	Greena Ecological Consultancy Ltd., Geckoella Ltd.
Bird Surveys:		
Breeding bird surveys (EIA)	May and June 2015 June 2016	Dr Chris Peppiatt, Gerry Murphy, John Small
	April to June 2023	Scott Cawley Ltd.
Wintering bird survey (RS and EIA)	September 2014 to March, 2015	Scott Cawley Ltd., Dr Chris Peppiatt, Gerry Murphy, John Small and Tom Cuffe.
	December 2022 - March 2023 & September 2023 to March 2024	Scott Cawley Ltd.
Barn owl survey (RS and EIA)	June and July 2014 July 2015 June and July 2016 May to September 2018	BirdWatch Ireland
	May and December 2023	J L Ecology
Peregrine falcon survey (EIA)	June and July 2016	BirdWatch Ireland

Ecological Surveys and Survey Dates		
Survey	**Survey Date(s)**	**Surveyor(s)**
	May to September 2018	
	May and December 2023	J L Ecology
Red grouse survey (RS and EIA)	June to August, 2014	Dr Chris Peppiatt
	March 2023	Scott Cawley Ltd.
Woodcock survey (EIA)	May/June 2015 & June 2016	Dr Chris Peppiatt
	May and June 2023	Scott Cawley Ltd.
Hen Harrier survey	December 2022 - March 2023 & September 2023 to March 2024	Scott Cawley Ltd.
Amphibian and Reptile Surveys:		
Amphibian survey (EIA)	April to June 2015 June 2016	Scott Cawley Ltd. and Dr Chris Peppiatt
	April to June 2023 (smooth newt) & February to October 2023 (Amphibian habitat suitability)	Scott Cawley Ltd.
Reptile survey (EIA)	September/October 2015	Scott Cawley Ltd.
	August and September 2023	Scott Cawley Ltd.
Fish Surveys:		
Fisheries surveys (including assessment of biological water quality status) (EIA)	September 2015 August and September 2023	Triturus Environmental Services Ltd.
Invertebrate Surveys:		
Molluscan surveys (includes Freshwater pearl mussel and Vertigo snail species surveys) (RS)	August 2014 October 2017 (two additional molluscan sites)	Dr Evelyn Moorkens and Dr Ian Killeen
Marsh fritillary surveys (RS and EIA)	September 2013 September/October 2014 September 2015 September 2016	Woodrow Environmental Consultants Ltd.
	August and September 2023	Scott Cawley Ltd.
White-clawed crayfish survey	September, 2014	Scott Cawley Ltd. and Dr Julian Reynolds
	August and September 2023	Triturus Environmental Ltd.

Surveys for the following species/species groups were not repeated in 2023: Slender naiad, Varnished hook moss, Freshwater pearl mussel and molluscan surveys. In the case of the Slender naiad and Varnished hook moss, neither species was recorded within the ZoI of the Project and given their rarity and specific habitat

niches would not be expected to establish populations within the ZoI in the intervening period. For Freshwater pearl mussel, surveys were not repeated in 2023 as the 2014-2018 data remains valid as the conditions within the watercourses that could be affected by the Project remain unsuitable for the establishment of Freshwater pearl mussel populations. Repeat molluscan surveys were not undertaken in 2023, as the baseline conditions of the habitats suitable for these species within the ZoI of the Project remain unchanged from the 2018 EIAR.

8.2.6 Impact Assessment Methodology

The biodiversity and ecological impacts of the Project have been assessed using the following guidelines which include new guidelines since 2018, as explained in Section 8.2.2 above, and the methodology has been updated to reflect the most current guidelines:

- Environmental Impact Assessment of Projects, Guidance on the preparation of the Environmental Impact Assessment Report (European Commission *et al.*, 2017)
- Guidelines on the Information to be Contained in Environmental Impact Assessment Reports (European Commission *et al.*, 2017)
- Guidelines on the Information to be Contained in Environmental Impact Assessment Reports (Environmental Protection Agency EPA 2022)
- Guidance on Integrating Climate Change and Biodiversity into Environmental Impact Assessment (European Commission, Directorate-General for Environment, 2013)
- Guidelines for Ecological Impact Assessment in the UK and Ireland version 1.3 (CIEEM, 2018 – updated 2024)
- Environmental Guidelines Series for Planning and Construction of National Roads (Transport Infrastructure Ireland, 2005-2009)
- Guidelines for Assessment of Ecological Impacts of National Road Schemes (National Roads Authority, 2009)

Valuing the Ecological Receptors

As per the 2018 EIAR, biodiversity receptors (including identified sites of biodiversity importance) have been valued with regard to the ecological valuation examples set out in the TII guidelines (National Roads Authority, 2009). Cognisance has also been taken of the ecological assessment undertaken by the Inspector appointed by An Bord Pleanála (ABP) and presented in their report dated 22 June 2021.

All Annex I habitats that lie outside of European sites, are valued as being of national importance, given that these habitats are of high conservation concern. However, priority Annex I habitat types are valued as being of international importance given that they are of the highest conservation concern at a European level (i.e. natural habitat types in danger of disappearance[28]).

Habitat areas within SACs are considered in the context of assessing impacts on the conservation objectives and site integrity of a given European site with regard to the Appropriate Assessment tests set out in Article 6(3) of the Habitats Directive. All European sites are valued as internationally important.

In accordance with TII guidelines (National Roads Authority, 2009), biodiversity features within the Zone of Influence (ZoI) of the Project which are "both of sufficient value to be material in decision making and likely to be affected significantly" are deemed to be 'Key Ecological Receptors' (KERs). These are the biodiversity receptors which may be subject to likely significant effects from the Project, either directly or indirectly. KERs are those biodiversity receptors with an ecological value of Local Importance (Higher Value) or greater.

[28] From the definition of "priority natural habitat types" in Article 1(d) of the Habitats Directive

Characterising and Describing the Impacts

The parameters considered in characterising and describing the magnitude or scale of the potential impacts of the Project are outlined in Table 8.3 below.

Table 8.3 Parameters used to Characterise and Describe the Magnitude or Scale of Potential Impacts

Parameter	Categories
Type of impact	Positive/Neutral/Negative May also include Cumulative Effects, 'Do Nothing Effects', 'Do Minimum Effects', Indeterminable Effects, Irreversible Effects, Residual Effects, Synergistic Effects, Indirect Effects and/or Secondary Effects
Extent	The size of the affected area/habitat and/or the proportion of a population affected by the effect
Duration	The period of time over which the effect will occur[29]
Frequency and Timing	How often the effect will occur; particularly in the context of relevant life-stages or seasons
Reversibility	Permanent/Temporary Will an impact reverse; either spontaneously or as a result of a specific action

The likelihood of an impact occurring, and the predicted effects, are also an important consideration in characterising impacts. The likelihood of an impact occurring is assessed as being certain, likely or unlikely; in some cases it may be possible to definitively conclude that an impact will not occur.

Professional judgement is used in considering the contribution of all relevant criteria in determining the overall magnitude of an impact.

Impact Significance

In determining impact significance, the NRA (2009) and CIEEM (2018) guidelines were followed, which requires examination of the following two key elements and this is unchanged from the 2018 EIAR:

- Impact on the integrity of the ecological feature
- Impact on its conservation status within a given geographical area

Integrity

The term "integrity" should be regarded as the coherence of ecological structure and function, across the entirety of a site that enables it to sustain all of the biodiversity or ecological resources for which it has been valued (National Roads Authority, 2009).

The term 'integrity' is most often used when determining impact significance in relation to designated areas for nature conservation (e.g. SACs, SPAs or pNHA/NHAs) but can often be the most appropriate method to use for non-designated areas of biodiversity value where the component habitats and/or species exist with a defined ecosystem at a given geographic scale.

An impact on the integrity of an ecological site or ecosystem is considered to be significant if it moves the condition of the ecosystem away from a favourable condition: removing or changing the processes that support the sites' habitats and/or species; affect the nature, extent, structure and functioning of component habitats; and/or, affect the population size and viability of component species.

[29] The following terms/definitions for describing the duration of impacts are provided in the Environmental Protection Agency guidelines (2022): Momentary Effects - effects lasting from seconds to minutes; Brief Effects - effects lasting less than a day; Temporary Effects - effects lasting less than a year; Short-term Effects - effects lasting one to seven years; Medium-term Effects - effects lasting seven to fifteen years; Long-term Effects - effects lasting fifteen to sixty years; Permanent Effects - effects lasting over sixty years.

Conservation Status

The definitions for conservation status given in the EU Habitats Directive 92/43/EEC, in relation to habitats and species, are also used/referenced in the CIEEM (2018) and NRA (2009) guidance and this is unchanged from the 2018 EIAR:

- For natural habitats, conservation status means the sum of the influences acting on the natural habitat and its typical species, that may affect its long-term distribution, structure and functions as well as the long-term survival of its typical species, at the appropriate geographical scale
- For species, conservation status means the sum of influences acting on the species concerned that may affect the long-term distribution and abundance of its populations, at the appropriate geographical scale

An impact on the conservation status of a habitat or species is considered to be significant if it will result in a change in conservation status.

After the definitions provided in the EU Habitats Directive 92/43/EEC, the conservation status of a habitat is favourable when:

- Its natural range and area it covers within that range are stable or increasing
- The specific structure and functions which are necessary for its long-term maintenance exist and are likely to continue to exist for the foreseeable future
- The conservation status of its typical species is favourable as defined below under species

and, the conservation status of a species is favourable when:

- Population dynamics data on the species concerned indicate that it is maintaining itself on a long-term basis as a viable component of its natural habitats
- The natural range of the species is neither being reduced nor is likely to be reduced for the foreseeable future
- There is, and will probably continue to be, a sufficiently large habitat to maintain its populations on a long-term basis

According to the TII/CIEEM methodology, as per the 2018 EIAR, if it is determined that the integrity and/or conservation status of an ecological feature will be impacted on, then the level of significance of that impact is related to the geographical scale at which the impact will occur (i.e. local, county, national, international). In some cases an impact may not be significant at the geographic scale at which the ecological feature has been valued but may be significant at a lower geographical level. For example, a particular impact may not be considered likely to have a negative effect on the overall conservation status of a species which is considered to be internationally important. However, an impact may occur at a local level on this internationally important species. In this case, the impact on an internationally important species is considered to be significant at only a local, rather than an international level.

8.3 Receiving Environment

The following section describes the receiving ecological environment and biodiversity within the Zone of Influence (ZoI) of the Project. The results of the surveys undertaken between 2022 and 2024 to inform this updated EIAR have been incorporated into the receiving environment, noting where it has changed from 2018.

The Project extends around the north of Galway City from the Coast Road (R336), west of Bearna, to the existing N6 at Coolagh, Briarhill. There are four significant structures included in the design of the proposed N6 GCRR, namely the River Corrib Bridge, Menlough Viaduct, Lackagh Tunnel and Galway Racecourse Tunnel. A full description of the Project is presented in Chapter 5 of this updated EIAR.

The nature of the local receiving environment is heavily influenced by the underlying geology. Lands to the west of the N59 Moycullen Road are underlain by granite and are characterised by a mosaic of peatland habitats set amongst the local road network and associated linear residential development. This area slopes towards Galway Bay to the south and is drained by a network of small streams including Sruthán na Líbeirtí,

the Trusky Stream, the Bearna Stream, the Tonabrocky Stream and the Knocknacarra Stream. Lands to the east of the N59 Moycullen Road are underlain by limestone which gives rise to a karst landscape. The University of Galway (UoG) Sporting Campus lies on the western side of the River Corrib. Moving east from the River Corrib, the landscape is characterised by a mosaic of semi-natural woodland, scrub and exposed limestone rock as far as Lackagh Quarry. East of here, these habitats exist in more isolated patches amongst the improved agricultural fields and industrial/commercial developments that fringe the eastern edge of Galway City. In the eastern part of the study area the River Corrib (and its tributary the Terryland River) are the only watercourses present. There are two wetland complexes associated with freshwater lake systems, Coolagh Lakes and Ballindooley Lough, both of which are influenced by the underlying karst groundwater regime.

Section 8.3.1 provides an overview of the changes in the ecological baseline since 2018 and Section 8.3.2 establishes the ZoI of the Project. Section 8.3.3 summarises the results of the desk study and consultations undertaken in the preparation of this updated EIAR. Section 8.3.4 to Section 8.3.14 describe the ecological baseline as it relates to the ecological receptors recorded, including the results from the 2022 to 2024 surveys, or known from the study area under the following headings: habitats, rare and protected plant species, non-native invasive plant species, mammals (excluding bats), bats, invertebrate species, bird species, amphibian species, reptiles and fish. Section 8.3.15 provides a summary of the ecological valuation of each ecological receptor potentially affected by the Project and identifies those which are Key Ecological receptors (KERs) and subject to impact assessment.

8.3.1 Changes to the Baselines since 2018 EIAR

In general, the distribution and extent of habitats, and the distribution and abundance of flora and fauna species, is broadly consistent with that recorded previously to inform the impact assessment presented in the 2018 EIAR.

Since October 2018, the NPWS has updated the spatial data for designated areas, particularly affecting Lough Corrib SAC, the only European site intersected by the Project. The site's boundary has been slightly revised, reducing the overlap with the Project from approximately 4 hectares in 2018 to about 3.8 hectares in 2024.

In 2019, the Special Conservation Interests (SCIs) for Inner Galway Bay SPA were modified to include black-throated diver and exclude shoveler. In March 2024, bottlenose dolphin and harbour porpoise were added as qualifying interests at 16 marine and coastal SACs, with the closest to the Project being Inishmore Island SAC and Kilkieran Bay and Islands SAC.

Overall, the hydrological and hydrogeological conditions supporting the conservation of habitats and species have remained unchanged. Minor habitat baseline changes occurred in Lough Corrib SAC, but there have been no alterations to the location or extent of qualifying habitats. Fauna baseline updates show minor changes, but the distribution and abundance of qualifying species remain consistent with 2018 data.

The habitat baseline has been updated and, in general, the changes comprise relatively minor and expected changes in habitat classifications and extents given the four-year period between the last habitat survey in 2019 and the most recent survey in 2023. Habitat changes have arisen as a result of factors including land use change, development or natural succession. Land use changes observed included reduced intensity or abandonment of agricultural management, increased intensification or resumption of agricultural use, and vegetation clearance (e.g. scrub). Site clearance and construction activities associated with development projects continues to result in semi-natural habitat loss around the margins of Galway City. Areas of former bare ground have naturally developed vegetation cover over time and, where land management is absent or significantly reduced, grasslands have become overgrown and bracken/scrub cover has increased, often to the detriment of surrounding or enclosed semi-natural habitat. Changes in the habitat baseline are described and shown on Figures 8.20.1 to 8.20.15 and the following is a summary of some of the key changes that have occurred:

- Abandoned or less intensively managed grassland fields developing into rank Dry meadows and grassy verges (GS2) habitat and/or becoming encroached by Dense bracken (HD1) or Scrub (WS1)
- Grassland or scrub habitats developing, or buildings/artificial surfaces constructed, on former areas of bare or recolonising bare ground

- Vegetation clearance creating new areas of Spoil and bare ground (ED2) or Recolonising bare ground (ED3), or resulting in losses of habitat areas/features such as Hedgerows (WL1), Treelines (WL2) grasslands, woodland and scrub
- Small area losses of Annex I habitats – Dry heaths [4030], Wet heaths [4010], Calcareous grassland [6210], Limestone pavement [*8240] and Alkaline fens [7230]
- The largest single area of habitat change (c.11.9ha) relates to the reclassification of Lackagh Quarry from an Active quarry (ED4) to Spoil and bare ground (ED2) given the timeframe that has elapsed since the quarry site was last actively worked
- The River Corrib has been reclassified as corresponding to the Annex I Vegetation of flowing waters [3260] habitat

Three additional non-native invasive plant species were recorded in 2023, within the survey area but outside of the Assessment boundary, the first two of which are listed on the Third Schedule of the European Communities (Birds and Natural Habitats) Regulations, 2011: Three cornered garlic *Allium triquetrum*, Giant rhubarb *Gunnera tinctoria* and Old man's beard *Clematis vitalba*.

No additional rare or protected plant species were recorded in 2023.

The distribution of Otter holts and activity is consistent with that presented in the 2018 EIAR.

The number of bat species present, and their distribution across the survey area, is consistent with that presented in the 2018 EIAR. There were minor changes to the location of, and species composition and numbers occupying, bat roosts. These changes are described in Section 8.3.8.2 of Chapter 8 of the updated EIAR and Section 5.2 of the Bat Derogation Licence application included in Appendix A.8.25 of the updated EIAR. As noted above in Section 8.2.2, the 2024 Bat Derogation Licence expired on 31 December 2024 and a new bat derogation licence application was submitted to the NPWS on 1 April 2025 (included in Appendix A.8.25 Part 2 of this updated EIAR).

The distribution of Badger activity is consistent with that presented in the 2018 EIAR. Seven additional Badger setts were recorded in 2023; one of which is located within the Assessment Boundary, identified as a rock mound with anecdotal evidence of Badger usage.

There has been a reduction in the distribution and extent of suitable Marsh fritillary habitat within, and in the vicinity of, the Assessment Boundary in 2023, compared with previous years.

An additional six wintering bird species of highest conservation concern and considered to be Key Ecological Receptors (KERs)[30], were recorded within the wintering bird survey area between 2022 and 2024: Gadwall, Little egret, Red grouse, Redwing, Ringed plover and Whooper swan.

An additional four breeding bird species of conservation concern and considered to be Key Ecological Receptors (KERs)[31],were recorded within the survey area in 2023: Common gull, Little egret, Snipe and Tree sparrow.

No additional Barn owl breeding sites were confirmed in 2023 but there were two new occupied, non-breeding sites confirmed. Only one of those is in near proximity to the Project, in the Doughiska/Ardaun/Roscam area.

An additional Peregrine falcon nest site was confirmed locally in 2023. The nest site is located to the north of Bearna but lies beyond the zone of influence of the Project.

[30] Special Conservation Interests (SCIs), for a wintering population, of nearby SPAs, species listed under Annex I of the Birds Directive (2008/144/EC), and/or Red and Amber species listed for their wintering populations from *Birds of Conservation Concern in Ireland 4: 2020–2026* (Gilbert *et al.* 2020)

[31] Special Conservation Interests (SCIs), for a breeding population, of nearby SPAs, species listed under Annex I of the Birds Directive (2009/147/EC), and/or Red and Amber species listed for their breeding populations from *Birds of Conservation Concern in Ireland 4: 2020–2026* (Gilbert *et al.* 2020)

The baseline with respect to fish is consistent with that presented in the 2018 EIAR, with the exception of recording of the presence of the invasive species Zebra mussel at Coolagh Lakes and recording European eel in Ballindooley Lough by employing eDNA sampling techniques in 2023.

The baseline with respect to White-clawed crayfish, Freshwater pearl mussel, Red grouse, Woodcock, Common frog, Smooth newt and Common lizard is consistent with that presented in the 2018 EIAR; noting that a greater number of Common lizard were recorded in 2023 compared with 2015, and across a greater number of survey sites, including east of the River Corrib where Common lizard were not recorded in 2015.

8.3.2 Zone of Influence

As per the 2018 EIAR, the Zone of Influence (ZoI), or distance over which a likely significant effect may occur will differ across the Key Ecological Receptors, depending on the potential impact pathway(s). The results of both the desk study and the suite of ecological field surveys undertaken has established the habitats and species present along the Project. The ZoI is then informed and defined by the sensitivities of each of the ecological receptors present, in conjunction with the nature and potential impacts associated with the Project. The ZoI from the 2018 EIAR has been reviewed and updated to take account of the modifications to the extents of the Project detailed in Chapter 5 of this updated EIAR.

For consistency with the approach taken by An Bord Pleanála to assess European sites, the potential for increased recreational pressure associated with the operation of the Project (and the subsequent possible associated risk of a potential increase in recreational pressure on QIs and SCIs as a result of increased visitor numbers), and the potential for construction traffic impacts to arise on the wider road network (specifically along the R458, N67, and M18), have been considered with respect to designated areas for nature conservation and the ZoI updated accordingly.

The ZoI of the Project in relation to terrestrial habitats is generally limited to the footprint of the Project, and the immediate environs (to take account of shading or other indirect impacts, such as air quality). Hydrogeological/hydrological linkages (e.g. rivers or groundwater flows) between impact sources and wetland/aquatic habitats can often result in impacts occurring at significant distances. The unmitigated hydrogeological ZoI for the Project is shown on Figure 10.6.101 to 10.6.115 and 10.8.101 to 10.8.115. In the western part of the study area, it generally follows the Assessment Boundary plus a buffer of up to c.100m in places. East of the N59 Moycullen Road, the ZoI is more expansive, given the underlying karst geology and the potential for groundwater impacts within those groundwater bodies traversed by the Project.

With regard to hydrological impacts, the distances over which water-borne pollutants are likely to remain in sufficient concentrations to have a likely significant effect on receiving waters and associated wetland/terrestrial habitats is difficult to quantify and highly site-specific and related to the predicted magnitude of any potential pollution event. Evidently, it will depend on volumes of discharged waters, concentrations and types of pollutants (in this case sediment, hydrocarbons, and heavy metals), volumes of receiving waters, and the sensitivity of the ecology of the receiving waters. In the case of the Project, this includes all freshwater habitat downstream of the proposed watercourse crossings and Galway Bay.

The ZoI of air quality effects is generally local to the proposed road edge and not greater than a distance of 200m.

The ZoI for small mammal species, such as the Pygmy shrew, would be expected to be limited to no more than 100m from the Assessment Boundary due to their small territory sizes and sedentary lifecycle. The ZoI for Otter, Badger, Stoat, and Hedgehog may extend over greater distances than small mammal and bird species due to their ability to disperse many kilometres from their natal site. The ZoI of impacts for significant disturbance impacts to Badger and Otter breeding/resting places is 150m from the Assessment Boundary.

The ZoI of potential impacts to bat roosts would not be expected to exceed 200m in most cases but as effects are dependent on many factors (such as species, roost type, surrounding habitat, commuting routes etc.), this is assessed on a case-by-case basis and the ZoI may increase/decrease from this distance accordingly. Given the large foraging ranges for some species[32], the ZoI of potential landscape scale impacts, such as habitat loss

[32] Leisler's bats have been recorded foraging up to 13km from maternity roost sites (Shiel *et al*., 1999)

and severance, could extend for several kilometres from the Project but the most significant effects are likely to occur within 1km of important roost sites (e.g. maternity roosts).

The ZoI of the Project in relation to likely significant effects on most breeding bird species is generally limited to habitat loss within the footprint of the Project, and disturbance/displacement during construction and disruption in territorial singing due to noise during operation. Disturbance effects may extend for several hundred metres from the Project.

The ZoI in relation to direct impacts to wintering birds could extend up to 300m from the Project for general construction activities, and as far as 800m where prolonged blasting will be carried out, as many species are highly susceptible to disturbance from loud and unpredictable noise during construction. However, as many estuarine bird species use inland habitat areas at distances from the coast, the ZoI for ex-situ impacts could extend a considerable distance from the Project. In the case of the Project, impacts to wintering birds within this 300m band could affect the use of potential ex-situ sites for bird species listed as Special Conservation Interests of the nearby Lough Corrib SPA and Inner Galway Bay SPA.

The ZoI in relation to amphibian species is likely to be limited to direct habitat loss with the Assessment Boundary and/or indirect impacts to water quality in wetland habitats hydrologically connected to the Project.

The ZoI in relation to the Common lizard is likely to be limited to direct habitat loss with the Assessment Boundary and disturbance/displacement effects in the immediate vicinity during construction.

The ZoI for impacts to aquatic species, such as Atlantic salmon and lamprey species, is limited to those watercourses crossed by the Project or waterbodies to which runoff from the Project could drain during construction (i.e. Coolagh Lakes). However, impacts could occur at significant distances downstream depending on the magnitude and duration of any pollution event; potentially even affecting species in Galway Bay.

The ecological ZoI of the Project is shown on Figure 8.17.1 and Figure 8.18.1.

8.3.3 Desk Study

The results of the desktop review, undertaken to inform the 2018 EIAR and reviewed and updated for this updated EIAR, are provided in Appendix A.8.18 and are incorporated into the sections below under each heading, as relevant. Additional discussion on local biodiversity areas from the draft Galway City Biodiversity Action Plan 2014-2024 is also provided below.

8.3.3.1 Local Biodiversity Areas

The Galway City Development Plan 2023-2029 and the most recent draft of the Galway City Biodiversity Action Plan 2014–2024 include reference to a local network of biodiversity areas in the city. These areas are derived from sites identified in the Galway City Habitats Inventory (Natura, 2005) and were defined based upon habitat areas of high biodiversity value.

Some of these local biodiversity areas lie within the zone of influence of the Project and, where relevant, the habitats present within these areas are discussed further below in Section 8.3.45 and the potential impacts assessed in Section 8.5.5. Changes in habitat extent and distribution since the 2018 EIAR are also identified and shown in Figures 8.20.1 to 8.20.15. The relevant local biodiversity areas are:

- Rusheen Bay – Barna Woods – Illaunafamona
- Cappagh – Ballymoneen
- Ballagh – Barnacranny Hill
- River Corrib and adjoining wetlands
- Menlough to Coolough Hill
- Ballindooley – Castlegar (which is linked to the River Corrib by the Terryland River)
- Galway Racecourse, Ballybrit

- Doughiska
- Mutton Island and nearby shoreline

Local biodiversity areas provide habitat for a range of species with the River Corrib corridor providing an important link between Galway Bay and the mosaic of habitats surrounding the city, which includes the wetland complex associated with Lough Corrib. Important fauna species noted in the Galway City Biodiversity Action Plan 2014-2024 include Pine marten *Martes martes*, Wood mouse *Apodemus sylvaticus*, Irish stoat *Mustela erminea hibernica*, Irish hare *Lepus timidus hibernicus*, Hedgehog *Erinaceus europaeus*, Pygmy shrew *Sorex minutus*, Harbour seal *Phoca vitulina*, Fox *Vulpes vulpes*, Bank vole *Myodes glareolus*, Otter *Lutra lutra*, Badger *Meles meles*, Lesser horseshoe bat *Rhinolophus hipposideros*, Leisler's bat *Nyctalus leisleri*, Common pipistrelle bat *Pipistrellus pipistrellus*, Soprano pipistrelle bat *Pipistrellus pygmaeus*, Brown long-eared bat *Plecotus auritus*, Daubenton's bat *Myotis daubentonii*, Natterer's bat *Myotis nattereri* and the Whiskered bat *Myotis mystacinus*. These species are discussed further below in Section 8.3.8and the potential impacts assessed in Section 8.5.7. The Flora (Protection) Order, 2022 listed species Slender cottongrass *Eriophorum gracile* and the Small white orchid *Pseudorchis albida* are also noted in the plan and are discussed further below in Section 8.3.6and the potential impacts assessed in Section 8.5.6.

8.3.4 Designated Areas for Nature Conservation

8.3.4.1 European Sites

Special Areas of Conservation (SAC) are designated under the EC Habitats Directive (92/43/EEC) as amended, which is transposed into Irish law through a variety of legislation including the Birds and Habitats Regulations and the Planning Acts, for the protection of habitats listed on Annex I and/or species listed on Annex II of the Directive.

Special Protection Areas (SPAs) are designated under the Birds Directive (2009/147/EC) for the protection of protected bird species listed on Annex I of the Directive, regularly occurring populations of migratory species (such as ducks, geese or waders), and areas of international importance for migratory birds.

The Project traverses through, and adjacent to, the Lough Corrib SAC and there are three other European sites nearby (Lough Corrib SPA is upstream of the Project and Galway Bay Complex SAC, and Inner Galway Bay SPA are downstream) with a number of other European sites located at a greater distance from the Project. There are 23 European sites (SACs or SPAs) located within or in the vicinity of the ZoI of the Project (Figure 8.18.1). Table 8.4 below lists these sites, their distance from the Assessment Boundary, and the sites' Qualifying Interests/Special Conservation Interests.

Table 8.4 European Sites (SACs and SPAs) within, and in the vicinity of, the Project

Site Name	Distance[33]	Reasons for Designation – Qualifying Interests (QIs) or Special Conservation Interests (SCIs)
Special Areas of Conservation		
Lough Corrib SAC [000297]	Crossed by the proposed N6 GCRR	[1029] Freshwater pearl mussel Margaritifera margaritifera [1092] White-clawed crayfish Austropotamobius pallipes [1095] Sea lamprey Petromyzon marinus [1096] Brook lamprey Lampetra planeri [1106] Atlantic salmon Salmo salar (only in fresh water) [1303] Lesser horseshoe bat Rhinolophus hipposideros [1355] Otter Lutra lutra

[33] Distance in km/m from the Assessment Boundary

Site Name	Distance[33]	Reasons for Designation – Qualifying Interests (QIs) or Special Conservation Interests (SCIs)
		[1393] Varnished hook-moss Drepanocladus (Hamatocaulis) vernicosus [1833] Slender naiad Najas flexilis [3110] Oligotrophic waters containing very few minerals of sandy plains (Littorelletalia uniflorae) [3130] Oligotrophic to mesotrophic standing waters with vegetation of the Littorelletea uniflorae and/or of the Isoëto-Nanojuncetea [3140] Hard oligo-mesotrophic waters with benthic vegetation of Chara spp. [3260] Water courses of plain to montane levels with the Ranunculion fluitantis and Callitricho-Batrachion vegetation [6210] Semi-natural dry grasslands and scrubland facies on calcareous substrates (Festuco Brometalia) (*important orchid sites) [6410] Molinia meadows on calcareous, peaty or clayey-silt-laden soils (Molinion caeruleae) [7110] * Active raised bogs [7120] Degraded raised bogs still capable of natural regeneration [7150] Depressions on peat substrates of the Rhynchosporion [7210] * Calcareous fens with Cladium mariscus and species of the Caricion davallianae [7220] * Petrifying springs with tufa formation (Cratoneurion) [7230] Alkaline fens [8240] * Limestone pavements [91A0] Old sessile oak woods with Ilex and Blechnum in the British Isles [91D0] * Bog woodland S.I. No. 384/2022 - European Union Habitats (Lough Corrib Special Area of Conservation 000297) Regulations 2022. NPWS (2017a) Conservation Objectives: Lough Corrib SAC 000297. Version 1. National Parks and Wildlife Service, Department of Arts, Heritage, Regional, Rural and Gaeltacht Affairs.
Galway Bay Complex SAC [000268][34]	145m	[1140] Mudflats and sandflats not covered by seawater at low tide [1150] Coastal lagoons* [1160] Large shallow inlets and bays [1170] Reefs [1220] Perennial vegetation of stony banks [1230] Vegetated sea cliffs of the Atlantic and Baltic coasts [1310] Salicornia and other annuals colonising mud and sand [1330] Atlantic salt meadows (Glauco-Puccinellietalia maritimae) [1355] Otter Lutra lutra [1365] Harbour seal Phoca vitulina [1410] Mediterranean salt meadows (Juncetalia maritimi) [3180] Turloughs*

[34] Inner Galway Bay is also a Ramsar site, under the Ramsar Convention (Ramsar site No. 838) and is a marine protected site under the OSPAR Convention - Galway Bay Complex MPA (O-IE-0002969)

Site Name	Distance[33]	Reasons for Designation – Qualifying Interests (QIs) or Special Conservation Interests (SCIs)
		[5130] Juniperus communis formations on heaths or calcareous grasslands [6210] Semi-natural dry grasslands and scrubland facies on calcareous substrates (Festuco Brometalia) (*important orchid sites) [7210] Calcareous fens with Cladium mariscus and species of the Caricion davallianae* [7230] Alkaline fens [8240] Limestone Pavements S.I. No. 548/2021 - European Union Habitats (Galway Bay Complex Special Area of Conservation 000268) Regulations 2021. NPWS (2013a) Conservation Objectives: Galway Bay Complex SAC 000268. Version 1. National Parks and Wildlife Service, Department of Arts, Heritage and the Gaeltacht.
Connemara Bog Complex SAC [002034]	6.02km	[1065] Marsh fritillary butterfly Euphydryas (Eurodryas, Hypodryas) aurinia [1106] Atlantic salmon Salmo salar (only in fresh water) [1150] * Coastal lagoons [1170] Reefs [1355] Otter Lutra lutra [1833] Slender naiad Najas flexilis [3110] Oligotrophic waters containing very few minerals of sandy plains (Littorelletalia uniflorae) [3130] Oligotrophic to mesotrophic standing waters with vegetation of the Littorelletea uniflorae and/or Isoeto-Nanojuncetea [3160] Natural dystrophic lakes and ponds [3260] Water courses of plain to montane levels with the Ranunculion fluitantis and Callitricho-Batrachion vegetation [4010] Northern Atlantic wet heaths with Erica tetralix [4030] European dry heaths [6410] Molinia meadows on calcareous, peaty or clayey-silt-laden soils (Molinion caeruleae) [7130] Blanket bogs (* if active only) [7140] Transition mires and Quakingquaking bogs [7150] Depressions on peat substrates of the Rhynchosporion [7230] Alkaline fens [91A0] Old sessile oak woods with Ilex and Blechnum in the British Isles S.I. No. 549/2023 - European Union Habitats (Connemara Bog Complex Special Area of Conservation 002034) Regulations 2023. NPWS (2015a) Conservation Objectives: Connemara Bog Complex SAC 002034. Version 1. National Parks and Wildlife Service, Department of Arts, Heritage and the Gaeltacht.
Ross Lake and Woods SAC [001312]	10.35km	[1303] Lesser horseshoe bat Rhinolophus hipposideros [3140] Hard oligo-mesotrophic waters with benthic vegetation of Chara spp. S.I. No. 656/2019 - European Union Habitats (Ross Lake and Woods Special Area of Conservation 001312) Regulations 2019.

Site Name	Distance[33]	Reasons for Designation – Qualifying Interests (QIs) or Special Conservation Interests (SCIs)
		NPWS (2018) Conservation Objectives: Ross Lake and Woods SAC 001312. Version 1. National Parks and Wildlife Service, Department of Culture, Heritage and the Gaeltacht.
Black Head-Poulsallagh Complex SAC/ [000020]	10.53km	[1170] Reefs [1220] Perennial vegetation of stony banks [2130] Fixed coastal dunes with herbaceous vegetation (grey dunes) [1395] Petalwort Petalophyllum ralfsii [3260] Water courses of plain to montane levels with the Ranunculion fluitantis and Callitricho-Batrachion vegetation [4060] Alpine and Boreal heaths [5130] Juniperus communis formations on heaths or calcareous grasslands [6210] Semi-natural dry grasslands and scrubland facies on calcareous substrates (Festuco Brometalia) (*important orchid sites) [6510] Lowland hay meadows (Alopecurus pratensis, Sanguisorba officinalis) [7220] Petrifying springs with tufa formation (Cratoneurion) [8240] Limestone pavements [8330] Submerged or partially submerged sea caves S.I. No. 758/2021 - European Union Habitats (Black Head-Poulsallagh Complex Special Area Of Conservation 000020) Regulations 2021 NPWS (2014a) Conservation Objectives: Black Head-Poulsallagh SAC 000020. Version 1. National Parks and Wildlife Service, Department of Arts, Heritage and the Gaeltacht
Lough Fingall Complex SAC [000606]	11.17km	[1303] Lesser horseshoe bat Rhinolophus hipposideros [3180] * Turloughs [4060] Alpine and Boreal heaths [5130] Juniperus communis formations on heaths or calcareous grasslands [6210] Semi-natural dry grasslands and scrubland facies on calcareous substrates (Festuco Brometalia) (*important orchid sites) [7210] * Calcareous fens with Cladium mariscus and species of the Caricion davallianae [8240] * Limestone pavements NPWS (2019d) Conservation Objectives: Lough Fingall Complex SAC 000606. Version 1. National Parks and Wildlife Service, Department of Culture, Heritage and the Gaeltacht.
Rahasane Turlough SAC [000322]	12.77km	[3180] * Turloughs S.I. No. 503/2017 - European Union Habitats (Rahasane Turlough Special Area of Conservation 000322) Regulations 2017. NPWS (2020) Conservation Objectives: Rahasane Turlough SAC 000322. Version 1. National Parks and Wildlife Service, Department of Housing, Local Government and Heritage.
Moneen Mountain SAC [000054]	13.25km	[1065] Marsh fritillary butterfly Euphydryas (Eurodryas, Hypodryas) aurinia [1303] Lesser horseshoe bat Rhinolophus hipposideros

Site Name	Distance[33]	Reasons for Designation – Qualifying Interests (QIs) or Special Conservation Interests (SCIs)
		[3180] * Turloughs [4060] Alpine and Boreal heaths [5130] Juniperus communis formations on heaths or calcareous grasslands [6130] Calaminarian grasslands of the Violetalia calaminariae [6210] Semi-natural dry grasslands and scrubland facies on calcareous substrates (Festuco Brometalia) (*important orchid sites) [7220] * Petrifying springs with tufa formation (Cratoneurion) [8240] * Limestone pavements S.I. No. 518/2021 - European Union Habitats (Moneen Mountain Grassland Special Area of Conservation 000054) Regulations 2021 NPWS (2021b) Conservation Objectives: Moneen Mountain SAC 000054. Version 1. National Parks and Wildlife Service, Department of Arts, Heritage and the Gaeltacht
East Burren Complex SAC [001926]	13.46km	[1065] Marsh fritillary butterfly Euphydryas (Eurodryas, Hypodryas) aurinia [1303] Lesser horseshoe bat Rhinolophus hipposideros [1355] Otter Lutra lutra [3140] Hard oligo-mesotrophic waters with benthic vegetation of Chara spp. [3180] * Turloughs [3260] Water courses of plain to montane levels with the Ranunculion fluitantis and Callitricho-Batrachion vegetation [4060] Alpine and Boreal heaths [5130] Juniperus communis formations on heaths or calcareous grasslands [6130] Calaminarian grasslands of the Violetalia calaminariae [6210] Semi-natural dry grasslands and scrubland facies on calcareous substrates (Festuco Brometalia) (*important orchid sites) [6510] Lowland hay meadows (Alopecurus pratensis, Sanguisorba officinalis) [7210] * Calcareous fens with Cladium mariscus and species of the Caricion davallianae [7220] * Petrifying springs with tufa formation (Cratoneurion) [7230] Alkaline fens [8240] * Limestone pavements [8310] Caves not open to the public [91E0] * Alluvial forests with Alnus glutinosa and Fraxinus excelsior (Alno-Padion, Alnion incanae, Salicion albae) S.I. No. 463/2023 - European Union Habitats (East Burren Complex Special Area of Conservation 001926) Regulations 2023. NPWS (2022b) Conservation Objectives: East Burren Complex SAC 001926. Version 1. National Parks and Wildlife Service, Department of Housing, Local Government and Heritage.
Gortnandarragh Limestone Pavement SAC [001271]	13.48km	[8240] * Limestone pavements S.I. No. 492/2018 - European Union Habitats (Gortnandarragh Limestone Pavement Grassland Special Area of Conservation 001271) Regulations 2018

Site Name	Distance[33]	Reasons for Designation – Qualifying Interests (QIs) or Special Conservation Interests (SCIs)
		NPWS (2019e) Conservation Objectives: Gortnandarragh Limestone Pavement SAC 001271. Version 1. National Parks and Wildlife Service, Department of Arts, Heritage and the Gaeltacht
Kiltiernan Turlough SAC [001285]	13.85km	[3180] * Turloughs S.I. No. 547/2023 - European Union Habitats (Kiltiernan Turlough Special Area of Conservation 001285) Regulations 2023. NPWS (2021c) Conservation Objectives: Kiltiernan Turlough SAC 001285. Version 1. National Parks and Wildlife Service, Department of Housing, Local Government and Heritage.
Castletaylor Complex SAC [000242]	13.96km	[3180] * Turloughs [4060] Alpine and Boreal heaths [5130] Juniperus communis formations on heaths or calcareous grasslands [6210] Semi-natural dry grasslands and scrubland facies on calcareous substrates (Festuco Brometalia) (*)(*important orchid sites) [8240] * Limestone pavements S.I. No. 73/2018 - European Union Habitats (Castletaylor Complex Special Area of Conservation 000242) Regulations 2018. NPWS (2021d) Conservation Objectives: Castletaylor Complex SAC 000242. Version 1. National Parks and Wildlife Service, Department of Housing, Local Government and Heritage.
Ballyvaughan Turlough SAC [000996]	15.00km	[3180] * Turloughs S.I. No. 205/2019 - European Union Habitats (Ballyvaughan Turlough Special Area of Conservation 000996) Regulations 2019 NPWS (2021e) Conservation Objectives: Ballyvaughan Turlough SAC 000996. Version 1. National Parks and Wildlife Service, Department of Housing, Local Government and Heritage.
Ardrahan Grassland SAC [002244]	15.07km	[4060] Alpine and Boreal heaths [5130] Juniperus communis formations on heaths or calcareous grasslands [6210] Semi-natural dry grasslands and scrubland facies on calcareous substrates (Festuco-Brometalia) (* important orchid sites) [8240] * Limestone pavements S.I. No. 522/2019 - European Union Habitats (Ardrahan Grassland Special Area of Conservation 002244) Regulations 2019. NPWS (2024a) Conservation Objectives: Ardrahan Grassland SAC 002244.Version 2. National Parks and Wildlife Service, Department of Housing, Local Government and Heritage.
Kilkiernan Bay and Island SAC [002111]	25.42km	[1140] Mudflats and sandflats not covered by seawater at low tide [1150] Coastal lagoons [1160] Large shallow inlets and bays [1170] Reefs [1351] Harbour Porpoise Phocoena phocoena [1355] Otter Lutra lutra [1365] Harbour Seal Phoca vitulina

Site Name	Distance[33]	Reasons for Designation – Qualifying Interests (QIs) or Special Conservation Interests (SCIs)
		[1833] Slender Naiad Najas flexilis [1330] Atlantic salt meadows (Glauco-Puccinellietalia maritimae) [1410] Mediterranean salt meadows (Juncetalia maritimi) [21A0] Machairs (* in Ireland) [3130] Oligotrophic to mesotrophic standing waters with vegetation of the Littorelletea uniflorae and/or Isoeto-Nanojuncetea [6510] Lowland hay meadows (Alopecurus pratensis, Sanguisorba officinalis) S.I. No. 144/2024 - European Union Habitats (Kilkieran Bay and Islands SAC 002111) Regulations 2024 NPWS (2014b) Conservation Objectives: Kilkieran Bay and Islands SAC 002111. Version 1. National Parks and Wildlife Service, Department of Arts, Heritage and the Gaeltacht
Inishmore Island SAC [000213]	29.19km	[1014] Narrow-mouthed Whorl Snail Vertigo angustior [1150] Coastal lagoons [1170] Reefs [1220] Perennial vegetation of stony banks [1230] Vegetated sea cliffs of the Atlantic and Baltic coasts [1351] Harbour Porpoise Phocoena phocoena [2110] Embryonic shifting dunes [2120] Shifting dunes along the shoreline with Ammophila arenaria (white dunes) [2130] Fixed coastal dunes with herbaceous vegetation (grey dunes) [2170] Dunes with Salix repens ssp. argentea (Salicion arenariae) [2190] Humid dune slacks [21A0] Machairs (* in Ireland) [4030] European dry heaths [4060] Alpine and Boreal heaths [6210] Semi-natural dry grasslands and scrubland facies on calcareous substrates (Festuco-Brometalia) (* important orchid sites) [6510] Lowland hay meadows (Alopecurus pratensis, Sanguisorba officinalis) [8240] Limestone pavements [8330] Submerged or partially submerged sea caves NPWS (2024b) Conservation Objectives: Inishmore Island SAC 000213. Version 2. National Parks and Wildlife Service, Department of Housing, Local Government and Heritage.
Maumturk Mountains SAC [002008]	31.57km	[1106] Salmon Salmo salar [1833] Slender Naiad Najas flexilis [3110] Oligotrophic waters containing very few minerals of sandy plains (Littorelletalia uniflorae) [4010] Northern Atlantic wet heaths with Erica tetralix [4060] Alpine and Boreal heaths [7130] Blanket bogs (* if active bog) [7150] Depressions on peat substrates of the Rhynchosporion

Site Name	Distance[33]	Reasons for Designation – Qualifying Interests (QIs) or Special Conservation Interests (SCIs)
		[8220] Siliceous rocky slopes with chasmophytic vegetation S.I. No. 431/2021 - European Union Habitats (Maumturk Mountains Special Area of Conservation 002008) Regulations 2021 NPWS (2017b) Conservation Objectives: Maumturk Mountains SAC 002008. Version 1. National Parks and Wildlife Service, Department of Arts, Heritage and the Gaeltacht
The Twelve Bens / Garraun Complex SAC [002031]	44.70km	[1029] Freshwater Pearl Mussel Margaritifera margaritifera [1106] Salmon Salmo salar [1355] Otter Lutra lutra [1833] Slender Naiad Najas flexilis [3110] Oligotrophic waters containing very few minerals of sandy plains (Littorelletalia uniflorae) [3130] Oligotrophic to mesotrophic standing waters with vegetation of the Littorelletea uniflorae and/or Isoeto-Nanojuncetea [4060] Alpine and Boreal heaths [7130] Blanket bogs (* if active bog) [7150] Depressions on peat substrates of the Rhynchosporion [8110] Siliceous scree of the montane to snow levels (Androsacetalia alpinae and Galeopsietalia ladani) [8210] Calcareous rocky slopes with chasmophytic vegetation [8220] Siliceous rocky slopes with chasmophytic vegetation [91A0] Old sessile oak woods with Ilex and Blechnum in the British Isles S.I. No. 548/2023 - European Union Habitats (Twelve Bens/Garraun Complex Special Area of Conservation 002031) Regulations 2023 NPWS (2017c) Conservation Objectives: Twelve Bens/Garraun Complex SAC 002031. Version 1. National Parks and Wildlife Service, Department of Arts, Heritage and the Gaeltacht
Special Protection Areas		
Lough Corrib SPA [004042]	66m	Greenland White-fronted Goose (Anser albifrons flavirostris) [A395] - wintering Gadwall (Anas strepera) [A051] - wintering Shoveler (Anas clypeata) [A056] - wintering Pochard (Aythya ferina) [A059] - wintering Tufted Duck (Aythya fuligula) [A061] - wintering Common Scoter (Melanitta nigra) [A065] - breeding Hen Harrier (Circus cyaneus) [A082] – post-breeding/roost Coot (Fulica atra) [A125] - wintering Golden Plover (Pluvialis apricaria) [A140] - wintering Black-headed Gull (Chroicocephalus ridibundus) [A179] - breeding Common Gull (Larus canus) [A182] - breeding Common Tern (Sterna hirundo) [A193] - breeding Arctic Tern (Sterna paradisaea) [A194] - breeding Wetlands & Waterbirds [A999]

Site Name	Distance[33]	Reasons for Designation – Qualifying Interests (QIs) or Special Conservation Interests (SCIs)
		S.I. No. 455/2012 - European Communities (Conservation of Wild Birds (Lough Corrib Special Protection Area 004042)) Regulations 2012. NPWS (2023a) Conservation Objectives: Lough Corrib SPA 004042. Version 1. National Parks and Wildlife Service, Department of Housing, Local Government and Heritage.
Inner Galway Bay SPA [004031]	1.06km at Oranmore Bay and Rusheen Bay	Black-throated Diver Gavia arctica [A002] - wintering Great Northern Diver (Gavia immer) [A003] - wintering[35] Cormorant (Phalacrocorax carbo) [A017] - breeding Grey Heron (Ardea cinerea) [A028] - wintering Light-bellied Brent Goose (Branta bernicla hrota) [A046] - wintering Wigeon (Anas penelope) [A050] - wintering Teal (Anas crecca) [A052] - wintering Red-breasted Merganser (Mergus serrator) [A069] - wintering Ringed Plover (Charadrius hiaticula) [A137] - wintering Golden Plover (Pluvialis apricaria) [A140] - wintering Lapwing (Vanellus vanellus) [A142] - wintering Dunlin (Calidris alpina) [A149] - wintering Bar-tailed Godwit (Limosa lapponica) [A157] - wintering Curlew (Numenius arquata) [A160] - wintering Redshank (Tringa totanus) [A162] - wintering Turnstone (Arenaria interpres) [A169] - wintering Black-headed Gull (Chroicocephalus ridibundus) [A179] - wintering Common Gull (Larus canus) [A182] - wintering Sandwich Tern (Sterna sandvicensis) [A191] - breeding Common Tern (Sterna hirundo) [A193] - breeding Wetlands & Waterbirds [A999] S.I. No. 515/2019 - European Union Conservation of Wild Birds (Inner Galway Bay Special Protection Area 004031) Regulations 2019 NPWS (2013b) Conservation Objectives: Inner Galway Bay SPA 004031. Version 1. National Parks and Wildlife Service, Department of Arts, Heritage and the Gaeltacht.
Cregganna Marsh SPA [004142]	4.4km	Greenland White-fronted Goose (Anser albifrons flavirostris) [A395] - wintering S.I. No. 514/2019 - European Union Conservation of Wild Birds (Cregganna Marsh Special Protection Area 004142) Regulations 2019. NPWS (2023b) Conservation Objectives: Cregganna Marsh SPA 004142. Version 1. National Parks and Wildlife Service, Department of Housing, Local Government and Heritage.

[35] A recently listed QI for Inner Galway Bay SPA with no specific published conservation objective, attributes or targets. There are no other EU sites for which the species is listed in Ireland. The conservation objectives, attributes and targets listed for the Black-throated diver (both are wintering species with similar behaviours and habitat / forage needs

Site Name	Distance[33]	Reasons for Designation – Qualifying Interests (QIs) or Special Conservation Interests (SCIs)
Connemara Bog Complex SPA [004181]	9.27km	Cormorant (Phalacrocorax carbo) [A017] - breeding Merlin (Falco columbarius) [A098] - breeding Golden Plover (Pluvialis apricaria) [A140] - breeding Common Gull (Larus canus) [A182] - breeding S.I. No. 390/2021 - European Union Conservation of Wild Birds (Connemara Bog Complex Special Protection Area 004181) Regulations 2021 NPWS (2023c) Conservation Objectives: Connemara Bog Complex SPA 004181. Version 1. National Parks and Wildlife Service, Department of Housing, Local Government and Heritage.
Rahasane Turlough SPA [004089]	12.75km	Whooper Swan (Cygnus cygnus) [A038] - wintering Wigeon (Anas penelope) [A050] - wintering Golden Plover (Pluvialis apricaria) [A140] - wintering Black-tailed Godwit (Limosa limosa) [A156] - wintering Greenland White-fronted Goose (Anser albifrons flavirostris) [A395] - wintering Wetlands & Waterbirds [A999] S.I. No. 311/2012 - European Communities (Conservation of Wild Birds (Rahasane Turlough Special Protection Area 004089)) Regulations 2012. NPWS (2023d) Conservation Objectives: Rahasane Turlough SPA 004089. Version 1. National Parks and Wildlife Service, Department of Housing, Local Government and Heritage.

A summary of the biodiversity baseline for those European sites within the immediate vicinity of the Assessment Boundary is provided below, with more detailed baseline information on individual European sites that lie within the ZoI of the Project presented in Section 9 of the updated NIS.

Lough Corrib SAC

The proposed N6 GCRR and as such the Project and its boundary overlaps with, i.e. traverses through or adjacent to one European site, namely Lough Corrib SAC at four locations: at the termination of the proposed drainage outfall from the N59 Link Road North at Kentfield; at the site of the proposed River Corrib Bridge between Dangan and Menlough; to the west of the Coolagh Lakes (Ch. 9+850 to Ch. 10+100); and, to the west and north of Lackagh Quarry where the Project will consist of a tunnel (Lackagh Tunnel) and approach road infrastructure.

The full results of the habitat surveys carried out in Lough Corrib SAC in 2014 are presented in N6 Galway City Transport Project – Habitat mapping and assessment of a section of Lough Corrib cSAC and surrounding areas (Barron *et al.*, 2017), which is included in Appendix A.8.5.

In summary, a total of 18 Annex I habitats, covering c.155.2 ha within Lough Corrib SAC and extending outside of the Assessment Boundary, were recorded during the survey:

- Hard water lakes [3140]
- Dystrophic lakes [3160]
- Vegetation of flowing waters [3260]
- Wet heaths [4010]
- Dry heaths [4030]

- Alpine and Boreal heaths [4060]
- Calcareous grasslands [6210]
- Orchid-rich calcareous grasslands [*6210]
- Molinia meadows [6410]
- Hydrophilous tall-herb communities [6430]
- Cladium fens [*7210]
- Blanket bog (inactive) [7130]
- Blanket bog (active) [*7130]
- Transition mires and quaking bogs [7140]
- Alkaline fens [7230]
- Limestone pavement (exposed) [*8240]
- Limestone pavement (wooded) [*8240]
- Alluvial forests [*91E0]

The majority of these habitat types form part of, and are supported by, the wetland complex along the River Corrib corridor and associated with the Coolagh Lakes. The drier heath, grassland and exposed limestone rock habitats are predominantly located on the slopes of an elevated hill to the north of the Coolagh Lakes (the Coolagh Lakes also supports smaller areas of these habitat types beyond the SAC boundary).

The River Corrib itself was classified as a Depositing/lowland river (FW2) as part of aquatic habitat surveys carried out in 2014 (Appendix A.8.5). Depositing lowland rivers can correspond with two Annex I habitat types, in an Irish context: Watercourses of plain to montane levels with the *Ranunculion fluitantis* and *Callitricho-Batrachion* vegetation (or Vegetation of flowing waters) [3260]; and, Rivers with muddy banks with *Chenopodion rubri* p.p. and *Bidention* p.p. vegetation [3270]. In parts of Europe the habitat is interpreted as covering only rivers where Water crowfoots *Ranunculus* species are a significant component of the vegetation. In the vicinity of the Project and further downstream, the River Corrib does support *Ranunculus* communities, but they are rare. The aquatic habitat along the length of the River Corrib is, on a precautionary basis, considered Annex I habitat type, Vegetation of flowing waters [3260] based on aquatic habitat assessments, despite the rare occurrence of *Ranunculus* communities. The River Corrib channel in the vicinity of the Project lacks the muddy bank habitat and the vegetation/plant species associated with the [3270] Annex I habitat type.

Downstream of the proposed River Corrib Bridge, and beyond the Assessment Boundary, the habitats present within Lough Corrib SAC along the river banks consists of a mosaic of Wet grassland (GS4) and Reed swamp (FS1). Scrub (WS1), Dry calcareous and neutral grassland (GS1) and woodland (WD1, WN2 and WN6) are also present between the proposed crossing point off the River Corrib Bridge and the Coolagh Lakes. Many of these habitat types correspond with the Annex I habitat types[36] Calcareous grassland [6210], Residual alluvial forests [*91E0], Cladium fen [*7210], Hydrophilous tall herb [6430] and Transition mires [7140]. Although only Calcareous grassland and Cladium fen are QI habitats for Lough Corrib SAC, many of the other wetland habitats are likely to provide a supporting role to these habitats within this mosaic.

The proposed drainage outfall from the N59 Link Road North will discharge to a drainage ditch in Lough Corrib SAC at Kentfield. Habitats in this area included Treeline (WL2), Scrub (WS1) and Dry meadows and grassy verges (GS2), Wet grassland and Reed and large sedge swamp/Tall-herb swamp/Wet grassland (FS1/FS2/GS4). A patch of *Phragmites australis* Reed swamp (FS1) and an area of Rich fen and flush (PF1)

[36] Where abbreviated Annex I habitat names are used throughout this report, nomenclature follows that of NPWS (2019a)

are immediately to the east of the Assessment Boundary. The fen area corresponds with the PF1_RFLU1a[37] vegetation community (*Carex viridula oedocarpa - Pinguicula vulgaris - Juncus bulbosus* flush; brown moss sub-community) of the Annex I habitat type Alkaline fens [7230].

The drainage ditch, to which the drainage outfall discharges, drains to the north-west for c. 380m before turning north-east where it connects with the River Corrib after a further c. 130m. Along or close to the drainage ditch, within the boundary of Lough Corrib SAC, are Wet grassland (GS4), Wet heath (HH3), Transition mire (PF3) and Wet willow-alder-ash woodland (WN6) habitats. Some of these correspond with Annex I habitat types: Molinia meadow [6410], Wet heath [4010], Transition mire [7140] and Residual alluvial forests [*91E0], respectively.

The Coolagh Lakes correspond with the Annex I Hard water lakes [3140] habitat type and support a wetland complex of Wet grassland (GS4), Wet heath (HH3), Fen (PF1 and PF2), Reed swamp (FS1), and Tall-herb swamps (FS2). Many of these habitat types correspond with the Annex I habitat types[38] (Perrin *et al*., 2014), Residual alluvial forests [*91E0], Cladium fen [*7210], Alkaline fen [7230], Hydrophilous tall herb [6430], Molinia meadow [6410], Wet heath [4010] and Transition mires [7140]. Although only Calcareous grassland and Cladium fen are QI habitats for Lough Corrib SAC, many of the other wetland habitats are likely to provide a supporting role to these habitats within this mosaic.

The area to the west of the Coolagh Lakes and to the north and east towards Lackagh Tunnel consisted of a mosaic of Exposed calcareous rock (ER2), Dry calcareous and neutral grassland (GS1), Oak-Ash-Hazel Woodland (WN2) and Scrub (WS1). Some of these areas corresponded with the Annex I habitats Calcareous grassland [*6210/6210] and Limestone pavement [*8240]. For the Annex I habitat types recorded, the majority are well defined by recent national studies co-ordinated by the NPWS (refer to publications referenced in Table 8.4 of this updated EIAR) and for the purposes of this assessment, were identified and classified in accordance with those publications, where available.

Otter use the River Corrib Corridor (although no holt or couch sites were present in the vicinity of the Project). The River Corrib is an important salmonid watercourse, supporting both Atlantic salmon and Brown trout. There are records of Sea lamprey spawning below the salmon weir in Galway City (O'Connor, 2007) and the species has also been recorded by IFI spawning in the upper catchment in Cong, Co. Mayo. Brook lamprey have been recorded widely throughout the River Corrib catchment (O'Connor, 2007). No suitable lamprey ammocoete nursery habitat was recorded in the vicinity of the proposed River Corrib Bridge, or the proposed drainage outfalls to the river.

Whilst there are no records of Atlantic salmon or Sea lamprey at the proposed River Corrib Bridge crossing, the River Corrib provides important habitat for Atlantic salmon, and both lamprey species, particularly in the context of its function as a migration corridor from the sea to the spawning areas for Atlantic salmon and Sea lamprey.

Galway Bay Complex SAC

The Project does not traverse the Galway Bay Complex SAC and, given that it lies downstream of the Project, the description here is focussed on the downstream coastal and marine habitats, and the QI species they support, which are the QIs which fall within the zone of influence of the Project. The descriptions are based upon the information presented in the conservation objectives for Galway Bay Complex SAC, and the relevant supporting documents, and presents summary of the site as a whole.

Galway Bay is classified as the Annex I habitat Large shallow inlets and bays [1160], associated with which are Reefs [1170], Tidal mudflats [1140], Lagoons [*1150], Salicornia mud [1310], Perennial vegetation of stony banks [1220] and Atlantic salt meadows [1330]. These habitats are also supported by a network of other habitat types including the freshwater rivers and streams that flow into the bay, the transitional waters of the estuary and terrestrial habitat along the coastline.

[37] Alkaline fen vegetation community classification (Perrin *et al*., 2014)

[38] Where abbreviated Annex I habitat names are used throughout this report, nomenclature follows that of NPWS (2019a)

Rusheen Bay, to which some of the rivers/streams crossed by the Project will drain (Bearna Stream catchment and the Knocknacarragh Stream), comprises a mosaic of most of these habitat types: Large shallow inlets and bays [1160], associated with which are Reefs [1170], Tidal mudflats [1140], Perennial vegetation of stony banks [1220] and Atlantic salt meadows [1330].

The habitats within Galway Bay also support Qualifying Interests (QI) populations of Otter and Harbour seal.

Lough Corrib SPA

Lough Corrib SPA is a vast site comprising Lough Corrib, most of its islands, and much of the wetland habitat that surrounds the lake margin. The Project does not traverse the Lough Corrib SPA. However, the closest areas of such wetland habitat to the Project are at Tonacurragh and Coolanillaun where there is a wetland mosaic of bog, heath, reed swamp, marsh and wet grassland habitats.

Although this SPA lies outside, and upstream of, the Project, many bird species listed as Special Conservation Interests (SCIs) of the SPA were recorded at winter bird survey sites across the Assessment Boundary. The habitat types associated with these sites ranged from natural/semi-natural lakes and wetland complexes (Ballindooley Lough, Coolagh Lakes and Lough Inch), the River Corrib, and upland mosaics of bog, heath, wet and acid grasslands, to improved and intensively managed habitats such as agricultural fields and amenity areas within Galway City (e.g. UoG Sporting Campus).

There were three bird species recorded during the various breeding bird surveys which are SCIs of Lough Corrib SPA for their breeding population: Common tern and Black-headed gull (2014 and 2023 breeding season surveys) and the Common gull (2023 breeding surveys). This is generally consistent with the findings of the surveys carried out along the River Corrib corridor in 2005/2006 for the N6 Galway City Outer Bypass Scheme (Appendix G of the updated NIS) where these species were recorded frequently over the summer months along the river, but in low numbers. All three species are known to breed on islands and rock outcroppings in both Galway Bay and Lough Corrib.

The following bird species, which are listed as wintering SCI species for Lough Corrib SPA were recorded at winter bird survey sites within the ZoI of the Project: Black-headed gull, Common gull, Coot, Golden plover, Gadwall, Hen harrier, Shoveler and Tufted duck.

Inner Galway Bay SPA

As Inner Galway Bay SPA covers approximately the same area as Galway Bay Complex SAC, refer to the habitat description above in Section 8.3.4. The habitats within the SPA support the SCI bird species, providing nesting, foraging and roosting sites which include open water, intertidal and terrestrial habitats.

As noted above for Lough Corrib SPA, bird species listed as winter SCI species of the Inner Galway Bay SPA were recorded at many of the winter bird survey sites across the Assessment Boundary, the majority of which are remote from the SPA itself.

There were two bird species recorded during the 2015 breeding bird surveys which are listed as SCIs of Inner Galway Bay SPA for their breeding population: Common tern (along the River Corrib) and Cormorant (flying overhead in the vicinity of the River Corrib corridor and in the western part of the Scheme Study Area). Both species were confirmed in the 2023 breeding surveys: the Common tern (flying over the River Corrib) and various Cormorant sightings (all flying overhead in the vicinity of the River Corrib corridor and Coolagh Lakes and in the western part of the Scheme Study Area; one individual observed east of River Corrib near Ballindooley Lough).

These results are generally consistent with the findings of the surveys carried out along the River Corrib corridor in 2005/2006 for the N6 Galway City Outer Bypass project (RPS, 2006), where these species were recorded frequently over the summer months along the river, but in low numbers.

The following bird species which are listed as winter SCI species for Inner Galway Bay SPA were recorded within winter bird survey sites within the ZoI of the Project: Bar-tailed godwit, Black-headed gull, Common gull, Cormorant, Curlew, Dunlin, Golden plover, Great northern diver, Grey heron, Lapwing, Light-bellied brent goose, Red-breasted merganser, Redshank, Ringed plover, Turnstone, Teal and Wigeon.

8.3.4.2 Natural Heritage Areas & proposed Natural Heritage Areas

National Heritage Areas (NHAs) are designations under Section 16 of the Wildlife Acts to protect habitats, species or geology of national importance.

In addition to NHAs there are proposed NHAs (referred to as pNHAs), which are also sites of significance for wildlife and habitats and were published on a non-statutory basis in 1995, but have not since been statutorily proposed or designated. Proposed NHAs are offered protection in the interim period under the county or city development plans which requires that planning authorities give due regard to their protection in planning policies and decisions[39].

Many of the pNHA sites, and some of the NHAs, in Ireland overlap with the boundaries of European sites.

Only one of these, Lough Corrib pNHA is crossed by the proposed N6 GCRR, and as such by the Project. There are three NHAs and 34 pNHAs located within, or in the vicinity of, the Assessment Boundary (Figure 8.17.1). Table 8.5 below lists these sites, their distance from the Assessment Boundary, and the ecological features for which the sites are designated/proposed. For a number of pNHAs below (i.e., Mason Island Machair pNHA, Mweenish Island Machair pNHA, Finish Island Machair pNHA, Duck Island pNHA, Inishmuskerry pNHA, Ardmore Point pNHA, Eagle Rock pHNA, Geabhrog island pNHA, Oilean Na Ngeabhrog (Glencoh Rock) pNHA, Kinvarra Saltmarsh pNHA, Oilean Na Ngeabhrog (Illaungurraig) pNHA)) site synopses are not available[40] as they are subsites within the Kilkieran Bay and Islands SAC.

Table 8.5 Natural Heritage Areas & proposed Natural Heritage Areas within, and within the vicinity of, the Project

Natural Heritage Areas		
Site Name	**Distance[41]**	**Features of Interest**
Moycullen Bogs NHA [002364]	80m at Na Foraí Maola Thiar Immediately adjacent to the Assessment Boundary at Ballagh	Peatland [T010]
Cregganna Marsh NHA [000253]	4km	Birds [12] - see Cregganna Marsh SPA above
Oughterard District Bog NHA [002431]	15km	Peatland [T010]
Proposed Natural Heritage Areas		
Site Name	**Distance**	**Description**
Lough Corrib pNHA [000297]	Crossed by the proposed N6 GCRR	See above under Lough Corrib cSAC and Lough Corrib SPA
Galway Bay Complex pNHA [000268]	190m	See above under Galway Bay Complex cSAC and Inner Galway Bay SPA
Furbogh Wood pNHA [001267]	2.3km	Oak woodland
Kiltullagh Turlough pNHA [000287]	2.2km	Turlough feature

[39] For example, Policy 4.2 of the *Galway City Development Plan 2017-2023* includes a commitment to "Protect, conserve and promote the nationally designated sites of ecological importance, including existing and proposed Natural Heritage Areas (NHAs and pNHAs) in the city".

[40] As communicated by the NPWS via email communication 4 October 2024

[41] Distance in km/m from Project

Proposed Natural Heritage Areas		
Site Name	**Distance**	**Description**
Ballycuirke Lough pNHA [000228]	4.6km	Lake and associated wetland habitats - part of Lough Corrib SAC
Connemara Bog Complex pNHA [002034]	6km	See above under Connemara Bog Complex SAC and Connemara Bog Complex SPA
Killarainy Lodge, Moycullen pNHA [002083]	7.2km	Natterer's bat nursery roost
Drimcong Wood pNHA [001260]	8.2km	Mixed broadleaved and coniferous woodland
Ross Lake and Woods pNHA [001312]	10.2km	See above under Ross Lake and Woods SAC
Black Head-Poulsallagh Complex pNHA [000020]	10.6km	See above under Black Head-Poulsallagh Complex SAC
Lough Fingall Complex pNHA [000606]	11.1km	See above under Lough Fingall Complex SAC
Rahasane Turlough pNHA [000322]	13.3km	See above under Rahasane Turlough SAC and Rahasane Turlough SPA
Gortnandarragh Limestone Pavement pNHA [001271]	13.4km	See above under Gortnandarragh Limestone Pavement SAC
Moneen Mountain pNHA [000054]	13.3km	See above under Moneen Mountain SAC
East Burren Complex pNHA [001926]	13.5km	See above under East Burren Complex SAC
Kiltiernan Turlough pNHA [001285]	13.9km	See above under Kiltiernan Turlough SAC
Castletaylor Complex pNHA [000242]	14km	See above under Castletaylor Complex SAC
Turloughcor pNHA [001788]	15km	Wetland site supporting wintering bird populations
Ballyvaughan Turlough pNHA [000996]	15km	See above under Ballyvaughan Turlough SAC
Inishmore Island pNHA [000213]	29.19km	See above under Inishmore Island SAC
Maumturk Mountains pNHA [0002008]	31.57km	See above under Maumturk Mountains SAC
The Twelve Bens/ Garraun Complex pNHA [002031]	44.70km	See above under The Twelve Bens/Garraun Complex SAC

Proposed Natural Heritage Areas		
Site Name	**Distance**	**Description**
Mason Island Machair pNHA [001302]	46.8km	See above under Kilkieran Bay and Islands SAC
Mweenish Island Machair pNHA [001306]	43.9km	See above under Kilkieran Bay and Islands SAC
Finish Island Machair pNHA [001266]	41.5km	See above under Kilkieran Bay and Islands SAC
Duck Island pNHA [000264]	44km	See above under Kilkieran Bay and Islands SAC
Inishmuskerry pNHA [001974]	42.4km	See above under Kilkieran Bay and Islands SAC
Ardmore Point pNHA [001126]	39.6km	See above under Kilkieran Bay and Islands SAC
Geabhrog island pNHA [000269]	31.4km	See above under Kilkieran Bay and Islands SAC
Oilean Na Ngeabhrog (Glencoh Rock) pNHA [000315]	30.1km	See above under Kilkieran Bay and Islands SAC
Kinvarra Saltmarsh pNHA [002075]	25.7km	See above under Kilkieran Bay and Islands SAC
Oilean Na Ngeabhrog (Illaungurraig) pNHA [000314]	32.5km	See above under Kilkieran Bay and Islands SAC
Eagle Rock pNHA [001261]	40.7km	See above under Kilkieran Bay and Islands SAC

8.3.5 Habitats

8.3.5.1 Overview

In general, the distribution and extent of habitats, and the distribution and abundance of flora species, is broadly consistent with that recorded previously to inform the impact assessment presented in the 2018 EIAR. The habitat baseline has been updated and, in general, the changes comprise relatively minor and expected changes to habitat classifications and extents given the four year period between the last habitat survey in 2019 and the most recent survey in 2023. The habitat changes have arisen as a result of factors including land use change, development or natural succession. Where changes have occurred these have been noted under the relevant subheadings below.

Habitat surveys were undertaken in 2023 to verify the results of the previous surveys and inform this updated EIAR. Where changes were identified these have been incorporated into the baseline set out below and informed the impact assessment for this updated EIAR.

The results of the habitat surveys are described by habitat type, after Fossitt (2000), see also Appendix A.8.6, and where relevant include a description of any corresponding Annex I habitat types that are present (see also Appendix A.8.19 and Appendix A.8.20 for results of habitat surveys).

The habitats described below relate to habitat polygons within or adjacent to the Project, as shown on Figures 8.19.1 to 8.19.15 and Figures 8.22.1 to 8.22.15 along with the full habitat survey results. Full species lists for each habitat type are provided in Appendix A.8.19. In general, habitats are described from east to west under the headings below. Habitat changes since the 2018 EIAR are shown on Figures 8.20.1 to 8.20.15 and Figures 8.23.1 to 8.23.15.

The results and summary of the findings of the aquatic habitat surveys have been incorporated into the relevant habitat descriptions below. A full description and species lists are provided in Appendix A.8.20.

The habitat types recorded within the Assessment Boundary are as follows:

- Flower beds and borders (BC4)
- Stone walls and other stonework (BL1) (new since the 2018 EIAR)
- Buildings and artificial surfaces (BL3)
- Exposed sand, gravel or till (ED1) (new since the 2018 EIAR)
- Spoil and bare ground (ED2)
- Recolonising bare ground (ED3)
- Exposed siliceous rock (ER1)
- Exposed calcareous rock (ER2), including the priority Annex I habitat *8240
- Limestone/marl lakes (FL3), including the Annex I habitat 3140
- Mesotrophic lakes (FL4)
- Eutrophic lakes (FL5)
- Turloughs (FL6), which corresponds with the priority Annex I habitat *3180
- Other artificial lakes and ponds (FL8)
- Calcareous springs (FP1), including the priority Annex I habitat *7220
- Reed and large sedge swamps (FS1), including the priority Annex I habitats *7210 and the Annex I habitat 6430
- Tall-herb swamps (FS2), including the Annex I habitats 6430/*7210
- Eroding/upland rivers (FW1)
- Depositing/lowland rivers (FW2) including the Annex I habitat 3260 (the habitat was reassessed and reclassified as Annex I habitat since the 2018 EIAR)
- Drainage ditches (FW4)I
- Improved agricultural grassland (GA1)
- Amenity grassland (improved) (GA2)
- Marsh (GM1)
- Dry calcareous and neutral grassland (GS1), including the priority Annex I habitat *6210/Annex I habitat 6210
- Dry meadows and grassy verges (GS2), including the Annex I habitat 6510
- Dry-humid acid grassland (GS3), including the priority Annex I habitat *6230
- Wet grassland (GS4), including the Annex I habitat 6410
- Dense bracken (HD1)
- Dry siliceous heath (HH1), which corresponds with the Annex I habitat 4030
- Dry calcareous heath (HH2), which corresponds with the Annex I habitat 4030
- Wet heath (HH3), which corresponds with the Annex I habitat 4010

- Lowland blanket bog (PB3), including the Annex I habitat *7130 (new since the 2018 EIAR)
- Rich fen and flush (PF1), including the Annex I habitats 7230/*7210
- Poor fen and flush (PF2)
- Transition mire and quaking bog (PF3), including the Annex I habitat 7140 (new since the 2018 EIAR)
- (Mixed) broadleaved woodland (WD1)
- Mixed broadleaved/conifer woodland (WD2)
- (Mixed) conifer woodland (WD3)
- Conifer Plantation (WD4) (new since the 2018 EIAR)
- Scattered trees and parkland (WD5)
- Hedgerows (WL1)
- Treelines (WL2)
- Oak-ash-hazel woodland (WN2), including the priority Annex I habitat *8240
- Wet willow-alder-ash woodland (WN6), including the priority Annex I habitat *91E0
- Scrub (WS1), including the priority Annex I habitat *8240
- Ornamental/non-native shrub (WS3)
- Recently-felled woodland (WS5)

The following habitats were present in the 2018 NIS but no longer present on site:

- Active quarries and mines (ED4) – the quarry is no longer an active quarry and has been reassigned to the category Spoil and Bare Ground (ED2)
- Immature woodland (WS2)

8.3.5.2 Summary of Underlying Geology and Habitat Type

As a consequence of the underlying geology, with the western part of the study area underlain by granite and the eastern by limestone, the nature of the habitats present across the study area are generally acidic west of the N59 Moycullen Road and calcareous to the east.

West of the River Corrib, the habitats generally consist of a mosaic of agricultural fields, peatland/heath habitats, and scrub, separated into distinct habitat blocks of varying sizes by the local road network and the associated linear residential development. The character of the agricultural fields varies from intensively managed farmland through to abandoned fields overgrown with scrub and bracken. The peatland habitat blocks consist of predominantly wet heath, dry heath and bog mosaics, with those habitat patches closest to the Project either the edges of larger peatland habitat blocks or smaller, more isolated, remnant patches. Small areas of fen and transition mire are also present. Given the close proximity of Galway City there are also large expanses of urban and residential development adjacent to the Project, particularly around the Ballyburke/Rahoon area and where the proposed N6 GCRR crosses the N59 Moycullen Road at Dangan.

East of the River Corrib, there are two distinct habitat zones; from the River Corrib to the N84 Headford Road comprises a patchwork of semi-natural woodland, limestone pavement, scrub and calcareous grassland fields; and east of the N84 Headford Road is predominantly improved agricultural grasslands surrounded by residential and industrial development in Parkmore, Ballybrit, Briarhill and Doughiska. There are also two wetland complexes of note in this section: the Coolagh Lakes and Ballindooley Lough. There are also some isolated patches of semi-natural habitats, calcareous grassland and limestone pavement, in the Coolagh/Doughiska area.

8.3.5.3 Flower beds and borders (BC4)

This habitat type is widespread across the study area and includes ornamental planting associated with residential gardens, commercial developments or industrial complexes/ business parks. The majority of this habitat type is captured on the habitat map by the Residential classification (see Section 8.3.5.36 below for detailed description of this classification). The species list varies substantially between land parcels, but tends to be dominated by exotic non-native plant species.

Flower beds and borders (BC4) are valued as being of Local Importance (Lower Value) as they comprise highly managed and modified habitats dominated by exotic species with low botanical/biodiversity value.

Since the 2018 EIAR there has been a small increase in the area of this habitat arising from land use change. Refer to Figures 8.20.1 to 8.20.15 for locations of habitat changes.

8.3.5.4 Stone walls and other stonework (BL1)

Stone walls are generally present as either field or property boundaries. In the western part of the study area, many of the stone wall field boundaries are overgrown with scrub and bracken.

Plant species associated with the stone walls include: *Asplenium trichomanes*, *Hedera helix*, *Polypodium vulgare*, *Frullania dilatata*, the moss species *Brachythecium rutabulum*, *Dicranum scoparium*, *Homalothecium sericeum*, *Hypnum cupressiforme*, *Isothecium myosuroides*, *Mnium hornum*, *Racomitrium fasciculare* and *lichens* such as *Cladonia spp*. and other crustose lichens.

Stone walls and other stonework are valued as being of Local Importance (Lower Value) as from a botanical perspective the habitat supports a small number of common species, and as the habitat is widespread in the context of the locality.

This habitat type has been described in its own right in this updated EIAR in contrast to the 2018 EIAR where it was classified/included under the description of other linear features such as scrub, hedgerows and treelines.

8.3.5.5 Buildings and artificial surfaces (BL3)

This classification includes buildings (domestic, commercial and industrial), roads, car parks, artificial recreation surfaces (e.g. Astroturf pitches) and other concrete/hard standing areas (e.g. quarrying infrastructure at Lackagh Quarry). Aside from residential properties/developments, the largest expanses of this habitat type within, or adjacent to, the Assessment Boundary are associated with the business parks at Ballybrit, Parkmore and Briarhill, and at the Galway Racecourse. In the case of residential properties, the majority of this habitat type is captured on the habitat map by the Residential classification (see Section 8.3.5.36 below for detailed description of this classification).

Buildings and Artificial Surfaces habitats (BL3) are valued as being of Local Importance (Lower Value) as it is a widespread and common habitat that supports a low diversity of common flora species, and is closely associated with development.

Since the 2018 EIAR there has been a small increase in the area of this habitat arising from land use change and development in the Galway City environs. Refer to Figures 8.20.1 to 8.20.15 for locations of habitat changes.

8.3.5.6 Exposed sand, gravel or till (ED1)

This habitat was not identified and mapped across the study area in 2018 and therefore was not included in the 2018 EIAR and is new to the baseline for this updated EIAR.

This classification includes natural or artificial exposures of unconsolidated coarse or mixed sediment. Till, or boulder clay, is an unsorted mixture of pebbles, cobbles or boulders in a matrix of finer material such as sand, silt or clay. Most exposures of these sediments are associated with sand and gravel pits, or with excavated glacial landscape features such as eskers, drumlins or moraines, and include road cuttings or construction sites.

Deposits of sand, gravel or till may also be exposed through natural forces of erosion along river banks, and on some lake shores. Depending on their nature, these sediments may support a wide range of broadleaved herbs and grasses.

Exposed sand, gravel or till (ED1) is valued as being of Local Importance (Lower Value) as it is a widespread and common habitat that supports a low diversity of common flora species, and is closely associated with development.

8.3.5.7 Spoil and bare ground (ED2)

Across the study area, this habitat type consists of small areas of bare ground associated with access tracks (either permanent and maintained lanes, or recently cleared ground) or, in the case of the larger expanses at Ballyburke and adjacent to the N59 Link Road North near Bushypark, lands which have been cleared for development.

Lackagh Quarry was classified as ED4 (11.92 ha) in the 2018 EIAR and was re-classified as ED2 as a result of the survey undertaken in 2023 and in this updated EIAR. Lackagh Quarry also contains several calcareous springs which are discussed separately under Calcareous springs (FP1) below.

Habitat ED2 occurs in mosaic with the Annex I habitat Dry Heaths [4030] at Ballagh, albeit the Annex I habitat is described in detail under Siliceous dry heath (HH1).

Spoil and bare ground (ED2) is valued as being of Local Importance (Lower Value) as it is a widespread habitat type that support a small number of common species.

Since the 2018 EIAR there has been an increase in the area of this habitat in Lackagh Quarry arising from its continued disuse, in addition to other small additional areas arising from land use change and development in the Galway City environs. Refer to Figures 8.20.1 to 8.20.15 for locations of habitat changes.

8.3.5.8 Recolonising bare ground (ED3)

Generally, small areas of disturbed ground are present along the route of the Project, but there are a number of larger areas associated with development sites or larger scale scrub clearance of agricultural fields.

Along the western part of the study area, the cover and composition of recolonising bare ground vegetation varies widely, dependant on the soil type and surrounding drainage. Species included tree/shrub species such as Salix cinerea and Ulex europaeus; the grasses Agrostis capillaris, Agrostis stolonifera, Holcus lanatus and Poa annua; rush and sedge species such as Juncus effusus and Carex disticha; and herb species including Achillea millefolium, Anagallis arvensis, Centaurea nigra, Cirsium arvense, Daucus carota, Hypericum pulchrum, Hypochaeris radicata, Lotus corniculatus, Plantago lanceolata, Plantago major, Potentilla anserina, Senecio jacobaea and Tussilago farfara.

Along the eastern part of the study area, recolonising bare ground includes the following species, many of which reflect the calcareous nature of the surrounding habitats in this area: the grasses Agrostis canina, Anthoxanthum odoratum, Arrhenatherum elatius, Cynosurus cristatus, Dactylis glomerata, Festuca rubra and Poa pratensis; and herb species such as Achillea millefolium, Centaurium erythraea, Euphrasia officinalis agg., Hypericum perforatum, Lotus corniculatus, Leontodon autumnalis, Leucanthemum vulgare, Linum catharticum, Medicago lupulina, Odontites verna, Potentilla reptans, Primula veris, Prunella vulgaris, Ranunculus repens, Senecio jacobaea, Succisa pratensis, Tussilago farfara and Ulex europaeus.

Recolonising bare ground (ED3) is valued as being of Local Importance (Lower Value) as it is a widespread and common habitat that supports a low diversity of common flora species, and is closely associated with development.

Since the 2018 EIAR there has been a small increase in the area of this habitat arising from land use change and development in the Galway City environs. Refer to Figures 8.20.1 to 8.20.15 for locations of habitat changes.

8.3.5.9 Exposed siliceous rock (ER1)

Outcropping granite has been recorded along the western sections of the study area; most often in association with patches of dry heath on higher ground but also found on raised ground in less intensively managed agricultural fields, and in some residential gardens.

Where it is present in a mosaic with heath habitats, it is mapped and valued as the associated Annex I habitats. Where associated with improved grasslands or exposed rock slabs in residential gardens, it is valued as being of a local importance (lower value).

Exposed siliceous rock (ER1) is valued as being of Local Importance (Lower Value). Although it generally occurs as natural outcropping, the habitat is of relatively low botanical value due to the low number of species it supports and as it is relatively common in the context of the study area.

Since the 2018 EIAR there has been a small increase in the area of this habitat arising from land use change and development in the Galway City environs. Refer to Figures 8.20.1 to 8.20.15 for locations of habitat changes.

8.3.5.10 Exposed calcareous rock (ER2)

Exposed limestone is widespread widely across the eastern part of the study area. The highest concentrations are present in the areas between Menlough Village, Coolough Village, Coill Uachtair and the area surrounding Lackagh Quarry. There is also a relatively large area adjacent to the southern boundary of the Roadstone Quarry at Twomileditch with more isolated, scattered patches in the local area between here and the existing N6 – the most notable of which lies to the southeast of the existing Coolagh Junction.

At all locations, bar the area at Business Park Junction 2 associated with the proposed N6 GCRR, these areas correspond with the exposed limestone pavement group of the priority Annex I habitat Limestone pavements [*8240]. The exposed calcareous rock at Business Park Junction 2 associated with the proposed N6 GCRR comprises vertical limestone rock faces in a small abandoned quarry and therefore, are not Annex I habitat type.

Limestone pavement [*8240] consists of both ‘block’ and ‘shattered’ variants of Limestone pavement [*8240] as defined in Wilson & Fernandez (2013), with the shattered type being most frequent.

The exposed variant of Limestone pavement [*8240] also includes areas which are being invaded by scrub (almost invariably Corylus avellana) which is not yet forming a continuous canopy and is less than 3m in height. The main vascular species encountered in this habitat include scattered low-growing woody species (e.g. Hedera helix, Rosa spinosissima or Rubus fruticosus agg., or immature Corylus avellana or Ilex aquifolium) and herbaceous species like Carex flacca, Carlina vulgaris, Geranium robertianum, Mycelis muralis, Senecio jacobaea, Sesleria caerulea and Teucrium scorodonia. A suite of calcicole ferns is frequent comprising Asplenium ruta-muraria, Ceterach officinarum and, in the deeper grykes, the shade-loving Phyllitis scolopendrium. Characteristic bryophytes are Ctenidium molluscum, Neckera crispa and Tortella tortuosa.

Exposed calcareous rock (ER2) - Limestone pavement [*8240] is valued as being of International Importance as it is a priority Annex I habitat, meaning the habitat is in danger of disappearance, and as its status in Ireland is ‘Inadequate’ (NPWS, 2019) arising from ongoing habitat loss pressures.

Exposed calcareous rock (ER2) – non-annex types is of Local Importance (Lower Value) as it is relatively common and is not associated with a rich flora.

The exposed variant of the Annex I Limestone pavement [*8240] habitat type (LPE) within the ZoI of the Project is summarised below in Table 8.6 below.

Since the 2018 EIAR there has been a small decrease in the area of this habitat arising from land use change and development in the Galway City environs. Refer to Figures 8.20.1 to 8.20.15 for locations of habitat changes.

Table 8.6 Areas of the exposed variant of the Annex I habitat Limestone pavement [*8240] within the potential ZoI of the Project

Area	Vegetation Community
South of Bóthar Nua at Ch. 10+040 on the proposed N6 GCRR (outside of any European site)	LPE_1b Teucrium scorodonia - Sesleria caerulea pavement
North of Bóthar Nua at Ch. 10+200 – Ch. 10+250 on the proposed N6 GCRR (outside of any European site)	LPE_1b Teucrium scorodonia - Sesleria caerulea pavement
Within Lough Corrib SAC Western and northern boundaries of Lackagh Quarry between Ch. 10+900 and Ch. 11+800 on the proposed N6 GCRR	LPE_1b Teucrium scorodonia - Sesleria caerulea pavement LPE_1d Mycelis muralis - Fissidens dubius pavement 1e Corylus avellana - Neckera crispa pavement
Along the eastern boundary of Lackagh Quarry (outside of any European site)	LPE_1b Teucrium scorodonia - Sesleria caerulea pavement
South-east of the Coolagh Junction (between N6 and R446) (outside of any European site)	LPE_1e Corylus avellana - Neckera crispa pavement

8.3.5.11 Limestone/marl lakes (FL3)

There are two distinct lake complexes present in the vicinity of the Project: Coolagh Lakes and Ballindooley Lough. All of the lakes that make up the Coolagh Lakes complex, and the main waterbody at Ballindooley, correspond with this habitat classification and the Annex I habitat type Hard-water lake habitat [3140].

Since the 2018 EIAR there have been no changes in area of these features.

The full description and aquatic plant species lists for these lakes – and all others surveyed as part of the aquatic habitat survey – are provided in Appendix A.8.20.

Coolagh Lakes

The upper lake contains 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 dominate most of the euphotic zone.

The lower lake also contains large stands of Chara hispida and Chara rudis, but flowering plants are 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 include Potamogeton lucens, Sparganium sp., Myriophyllum spicatum and Utricularia cf. vulgaris. Two other species of charophyte, Chara contraria and Chara vulgaris occur in small quantities. The lower lake, however, is considered to be the borderline eutrophic type FL5 (and not an exceptionally good example of the habitat type), due to the increased presence of Elodea canadensis and Lemna trisulca (most likely as a result of eutrophication) and the presence of the non-native invasive Zebra mussel Dreissena polymorpha.

Eutrophication pressures are evident in the upper lake with abundant filamentous algae on submerged marginal vegetation and abundant Lemna trisulca. Cladium mariscus is present in the channel connecting the upper and lower lakes.

Ballindooley Lough

The sub-littoral vegetation is dominated by charophyte algae. Chara rudis is exceptionally abundant from 0-3m with some other species occurring in very shallow water including Chara aspera, Chara aculeolata and Chara curta. Flowering plants are rare, as is often the case in marl lakes, with only Elodea canadensis and Utricularia cf. vulgaris observed.

The lake is bordered by fen habitat supporting typical species such as Schoenus nigricans, Comarum palustre, Carex nigra, Cladium mariscus, Lythrum salicaria, Potentilla erecta, Succisa pratensis, Mentha aquatica and Parnassia palustris.

The lake condition (in relation to indicators of water quality) has improved between 2018 and 2023 but the area of habitat has not changed between 2018 and 2023. In 2018, the complete dominance of Chara rudis however, indicated some degrees of eutrophication. The rather turbid lake water at the time supported this conclusion. Most of the lake was deeper than the euphotic depth of about 4m and no plants were found. In 2023, the Eutrophication pressures are no longer evident with floating duckweeds and algae largely absent.

Overall, Limestone/marl lakes (FL3) - Hard-water lakes [3140] are valued as being of National Importance. This habitat is under pressure at a national level, with a national conservation status of 'Bad', arising from ongoing issues with eutrophication and pollution which negatively affect species diversity of this habitat type.

8.3.5.12 Mesotrophic lakes (FL4)

The smaller circular pond (531194 728778 ITM) at Ballindooley – the northernmost of the three small lakes present – corresponds with this habitat type. It has floating plant species present including Potamogeton natans, Nymphaea alba and Sparganium natans. Sublittoral species include abundant Chara virgata and Utricularia cf. vulgaris.

There is also a more transient small lake along the eastern edge of the main lake complex at the Coolagh Lakes. The aquatic plant species Typha latifolia and Hippuris vulgaris are present. The full description and aquatic plant species lists for these lakes – and all others surveyed as part of the aquatic habitat survey – are provided in Appendix A.8.20.

Mesotrophic lakes (FL4) are valued as being of County Importance as the examples in the study area are good examples and as the habitat is under pressure more broadly from pollution and eutrophication.

Since the 2018 EIAR there have been no changes in area of these features.

8.3.5.13 Eutrophic lakes (FL5)

Two of the small lakes at Ballindooley correspond with this habitat type. The oval shaped pool nearest the residential houses (ITM grid reference 531244 728619) is shallow with a sublittoral flora of Elodea canadensis, Lemna trisulca and Fontinalis antipyretica. Floating species include Nymphaea alba. The abundance of Lemna and Elodea indicate a eutrophic pond.

The smallest water body, directly south of the main lake (531473 728626 ITM), has Potamogeton natans, Hippuris vulgaris, Elodea canadensis, Alisma plantago-aquatica and Ranunculus trichophyllus present; suggestive of eutrophic conditions.

The full description and aquatic plant species lists for these lakes – and all others surveyed as part of the aquatic habitat survey – are provided in Appendix A.8.20.

Eutrophic lakes (FL5) are valued as being of County Importance as the examples in the study area are good examples and as the habitat is under pressure more broadly from pollution and nutrient enrichment.

Since the 2018 EIAR there have been no changes in area of these features.

8.3.5.14 Turloughs (FL6)

There is one turlough feature within the ZoI of the Project: between Bóthar Nua and Seanbóthar in the Menlough area at Ch. 10+320. Turloughs are depressions, generally in limestone areas, which are intermittently inundated with groundwater and support wetland habitats.

The turlough feature at Menlough corresponds with the priority Annex I habitat type Turloughs [*3180] and the Potentilla anserina-Carex nigra vegetation community (Waldren, 2015, Ed.). The vegetation is typical turlough marsh vegetation including the following species: Potentilla anserina, Apium inundatum, Eleocharis palustris, Caltha palustris, Rumex crispus, Agrostis stolonifera, Ranunculus repens, Senecio aquaticus, Prunella vulgaris, Myosotis aquatica, Persicaria amphibia, Mentha aquatica, Glyceria fluitans, Filipendula ulmaria, Urtica dioica, Persicaria maculata, Rumex obtusifolius, Equisetum palustre and Veronica catenata.

Although not associated directly with the ground vegetation, the moss species Cinclidotus fontinaloides – a characteristic turlough species – is present on stone walls within the turlough feature.

Turloughs (FL6) - Turloughs [*3180] are valued as being of International Importance as they are a priority Annex I habitat, meaning the habitat is in danger of disappearance, and as its status in Ireland is 'Inadequate' (NPWS, 2019) arising from ongoing habitat loss and land management pressures.

The Turlough habitat within the ZoI of the Project is summarised below in Table 8.7 below.

Since the 2018 EIAR there have been no changes in area of these features.

Table 8.7 Areas of the Annex I Habitat Turloughs [*3180] within the Potential ZoI of the Project

Area	Vegetation Community[42]
Between Bóthar Nua and Seanbóthar in the Menlough/Coolough area at Ch. 10+320 on the proposed N6 GCRR outside a European site	6b Wet Carex nigra vegetation community (Goodwillie, 1992) Potentilla anserina-Carex nigra vegetation community (Waldren, 2015, Ed.)

8.3.5.15 Other artificial lakes and ponds (FL8)

Artificial ponds are located at the proposed Coolagh Junction of the proposed N6 GCRR (road drainage attenuation ponds) and in Lackagh Quarry (associated with the gravel washout area). The plant species associated with the attenuation ponds are described below under the FS1 habitat descriptions; there was no vegetation associated with the gravel washout ponds at Lackagh Quarry.

Other artificial lakes and ponds (FL8) are valued as being of Local Importance (Lower Value). These habitats are locally important but are widespread, are not semi-natural and frequently do not support a semi-natural floral assemblage.

Since the 2018 EIAR there have been no changes in area of these features.

8.3.5.16 Calcareous springs (FP1)

A total of 29 calcareous springs/seepage lines are present in Lackagh Quarry, an increase from the 27 presented in the 2018 EIAR. All 29 had vegetation associated with the seepage line.

The most frequently recorded vascular plant species associated with the springs/seepage lines at Lackagh Quarry are Tussilago farfara, Leontodon hispidus, Carex flacca, Epilobium parviflorum, Festuca rubra, Sonchus oleraceus, Holcus lanatus, Lotus uliginosus and Sesleria caerulea; the most frequently recorded moss species are Dicranella varia, Didymodon tophaceus, Fissidens adianthoides and Pellia endiviifolia.

Six of the springs/seepages (all located on the quarry walls) conform to the priority Annex I habitat Petrifying springs [*7220], as the following indicator species for the Annex I habitat type are growing in conjunction with tufa deposits on the cliff faces: Didymodon tophaceus, Pellia endiviifolia, Festuca rubra[43]. The Petrifying springs present are generally species-poor and considered marginal examples of the habitat type, lacking many of the key indicative species and generally limited in extent; in some cases, occurring only in the immediate vicinity of cushions of Didymodon tophaceus. They are also only present due to human activity, with the quarrying of limestone resulting in the creation of suitable habitat for their formation.

The full results of the Petrifying spring survey at Lackagh Quarry are provided in Appendix A.8.20.

Calcareous springs (FP1) - Petrifying springs [*7220] is valued as being of International Importance as it is a priority Annex I habitat, meaning the habitat is in danger of disappearance, and as its status in Ireland is

[42] The vegetation communities are assigned based upon the plant species recorded and with reference to the vegetation types described in *Turloughs over 10 ha: vegetation survey and evaluation* (Goodwillie, R., 1992) and *Turlough Hydrology, Ecology and Conservation* (Waldren, S. 2015, Ed.)

[43] Although these indicator species are not listed as such in the *Interpretation manual of European Union Habitats* EUR28 (CEC, 2013), in an Irish context they are considered by the NPWS to be indicator species for [*7220] (NPWS, 2013b)

'Inadequate' (NPWS, 2019) arising from ongoing pressures. The habitat's condition is deteriorating at a national level (NPWS, 2019).

Calcareous springs (FP1) Non-Annex I habitat type are valued as being of Local Importance (Higher Value) as it is a relatively uncommon habitat type that tends to be restricted in distribution and of limited area.).

Since the 2018 EIAR there have been small changes in the distribution, number and area of springs arising from reassessment of classification and from succession and natural change. Refer to Figures 8.20.1 to 8.20.15 for locations of habitat changes.

8.3.5.17 Reed and large sedge swamps (FS1)

Along the western part of the study area, there are scattered small patches of species-poor reed and large sedge swamp (FS1); mostly located along the margins of peatland areas. The vegetation is typically dominated by Phragmites australis.

Along the banks of the River Corrib and around parts of the Coolagh Lakes, reed and large sedge swamp (FS1) habitat is typically dominated by Phragmites australis with species such as Phalaris arundinacea, Typha latifolia, Sparganium erectum, Equisetum fluviatile, Menyanthes trifoliata, Epilobium hirsutum, Calystegia sepium, Lycopus europaeus, Lysimachia vulgaris, Mentha aquatica, Angelica sylvestris, Valeriana officinalis, Filipendula ulmaria and Lythrum salicaria also present.

Where Cladium mariscus is more dominant, reed swamps correspond with the priority Annex I habitat type Cladium fens [*7210]. This habitat is abundant around the Coolagh Lakes, but is also present to a lesser extent along the backwater to the east of Jordan's Island and in small patches along the banks of the River Corrib. Other plant species associated with this Annex I habitat type included: Phragmites australis, Calystegia sepium, Equisetum fluviatile, Lysimachia vulgaris, Epilobium hirsutum, Mentha aquatica and Schoenus nigricans.

At Ballindooley Lough, Phragmites australis, Schoenoplectus lacustris and Cladium mariscus are the typical species in the reed swamp habitat around the lakes' margins. As above, the Cladium mariscus swamp, which is present at two locations at Ballindooley Lough, corresponds with the priority Annex I Cladium fen [*7210] habitat type.

The existing N6 attenuation ponds at Briarhill support a relatively species rich wetland for such a man-made feature, including: Phragmites australis, Typha latifolia, Sparganium erectum, Schoenoplectus lacustris, Apium nodiflorum, Nasturtium officinale, Lemna minor and Epilobium hirsutum.

The total area of FS1 habitat within the Assessment Boundary identified during the 2023 surveys was 2.01ha.

Reed and large sedge swamps (FS1) - Cladium fen [*7210] are valued as being of International Importance as they are a priority Annex I habitat type that is at risk of disappearance, and as their national conservation status is 'Inadequate' (NPWS, 2019).

Reed and large sedge swamps (FS1) - and Non-Annex I habitat variants are valued as being of Local Importance (Higher Value) as notwithstanding being a relatively common habitat in the context of the study area and often relatively species poor, they form part of a wider mosaic of high value wetland habitats.).

Since the 2018 EIAR there has been a small decrease in the area of this habitat arising from land use change and vegetation succession. Refer to Figures 8.20.1 to 8.20.15 for locations of habitat changes.

8.3.5.18 Tall-herb swamps (FS2)

The majority of the Tall-herb swamp (FS2) is located along the banks of the River Corrib and around the margins of the Coolagh Lakes – where larger areas are present in the wetland extending north from the lakes, either side of Bóthar Nua.

In the western part of the Assessment Boundary (Ch. 3+400 on the proposed N6 GCRR), there is also a vegetated drain, with Apium nodiflorum, Iris pseudacorus and Epilobium hirsutum, near An Chloch Scoilte Junction which falls within the FS2 classification.

The most frequently recorded species are Carex disticha, Epilobium hirsutum, Equisetum fluviatile, Filipendula ulmaria, Calliergonella cuspidata, Festuca arundinacea, Lysimachia vulgaris, Phragmites australis, Mentha aquatica, Valeriana officinalis and Galium palustre. Other typical species present include Calystegia sepium, Iris pseudacorus, Menyanthes trifoliata, Sparganium erectum, Angelica sylvestris, Berula erecta and Lythrum salicaria.

The majority of the Tall-herb swamps (FS2) areas correspond with the Annex I habitat type Hydrophilous tall-herb swamp [6430].

Tall-herb swamps (FS2) - Hydrophilous tall herb [6430] are valued as being of National Importance as they have a relatively restricted national distribution and range, small total area, and have a conservation status of 'Bad' at the national level (NPWS, 2019).

Tall-herb swamps (FS2) - Non-Annex variants are valued as being of Local Importance (Higher Value) as notwithstanding being a relatively common habitat in the context of the Study Area and often relatively species poor, they form part of a wider mosaic of high value wetland habitats).

Since the 2018 EIAR there has been a small decrease in the area of this habitat arising from reassessment of vegetation cover. Refer to Figures 8.20.1 to 8.20.15 for locations of habitat changes.

8.3.5.19 Eroding/upland rivers (FW1)

The following are the eroding upland rivers crossed by the proposed N6 GCRR and as such the Project: Sruthán na Líbeirtí (Liberty Stream), Trusky Stream, the Bearna Stream (and tributary), Tonabrocky Stream and the Knocknacarra Stream.

Many of these streams are seasonal in their upper reaches, where they are crossed by the Project. Instream vegetation is generally absent, and in the vicinity of the proposed crossings for the proposed N26 GCRR, is overgrown with scrub and rank vegetation from the adjacent terrestrial habitats. Where present, coverage is limited and includes the following species: Apium nodiflorum, Fontinalis antipyretica, Fontinalis squamosa, Hyocomium armoricum, Mentha aquatica, Nasturtium officinale and Ranunculus flammula.

The physical characteristics of the various stream/river channels are described in the fisheries report in Appendix A.8.17. Details of the fisheries value of these watercourses are discussed in Section 8.3.13 below and presented in Appendix A.8.17.

Eroding/upland rivers (FW1) are valued as being of Local Importance (Higher Value) as they host a range of locally important aquatic flora species, and are relatively restricted in their area/extents.

Since the 2018 EIAR there have been no changes in the area of these features.

8.3.5.20 Depositing/lowland rivers (FW2)

Two of the watercourses present within the Assessment Boundary are classified as depositing/lowland rivers (FW2): the River Corrib and the Terryland River. Since the 2018 EIAR there have been no changes in area of these features.

River Corrib, from Tonacurragh to Menlo Castle

The vegetation in this section of the river is dominated by charophyte algae in many places, especially Chara rudis. In the upper river near the junction of the Friar's Cut, the shore includes backwaters dominated by reed and large-sedge swamp and open water with Chara curta, Chara virgata annulata and cyanobacterial crust on stones, as on the shore of Lough Corrib and other calcareous lakes. In deeper water (1m) Chara rudis is dominant with emergent vegetation including Schoenoplectus lacustris and Phragmites australis. Chara rudis extends to 2m depth along with Zannichella palustris, Potamogeton lucens, a little Potamogeton crispus and Myriophyllum spicatum, while Chara globularis extends 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 is present.

Midway between the Friar's cut and Menlo Pier the river is 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[44].

The shallower western channel, to a depth of 2m, contains reed swamp followed by Chara virgata annulata, Lemna trisulca, Elodea canadensis and Nuphar lutea in 1m depth water, and Potamogeton perfoliatus beds at 2m. In places, bare areas of mud are colonised by Nitella opaca. The main channel shelves very steeply with Potamogeton perfoliatus, Lemna trisulca, and Elodea canadensis, followed by bare ground with Zebra mussels.

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

Below Menlo Pier the river narrows and deepens 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 is cut into white marl which exceeds 8m depth in places. Vegetation is largely confined to water less than 4m, but Zebra mussels occur deeper than this. A variety of flowering plants are present, especially Potamogeton spp. Nearly all shallow areas of any extent are occupied by Schoenoplectus and Phragmites reed and large-sedge swamp (FS1).

Since the 2018 EIAR there have been no changes in area of these features.

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

In-stream vegetation in the River Corrib in the vicinity of Menlo Castle is considered to be the Annex I habitat Floating river vegetation [3260].

The River Corrib is valued as being of international importance as it forms part of a European site that has been designated for its aquatic, riparian and fringing habitats. The example of Annex I habitat floating river vegetation [3260] within the River Corrib is of international importance as it is a qualifying interest for which the Lough Corrib SAC has been designated.

Since the 2018 EIAR there have been no changes in area of these features, however the feature has been reassessed with respect to its relationship with the Annex I habitat Floating river vegetation [3260] and has been classified as the Annex I habitat in this updated EIAR, in contrast to the 2018 EIAR.

In this section of the river, vegetation is largely confined to shallow areas along the bank and is only found in depths of <2m; mainly as either reed and large-sedge swamp (FS1) of Phragmites australis or Equisetum fluviatile, with some stands of Potamogeton natans and Carex rostrata. Chara rudis and some Chara virgata are common in the shallow sublittoral. Species composition is similar to, but less diverse than, the section upstream.

Backwater on the east side of Jordan's Island

This section consists of small pools and channels cut through extensive Phragmites australis, Schoenoplectus lacustris and Cladium mariscus reed and large-sedge swamp (FS1). The area contains a diverse flora, especially of charophytes, but demonstrates 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. is common, suggesting eutrophication.

Terryland River

The Terryland River discharges to the River Corrib at a location that is within the designated area of the Lough Corrib SAC.

The Terryland River has a limited aquatic flora including Potamogeton natans, Callitriche sp., Alisma plantago aquatica, Chara hispida/rudis, Myriophyllum spicatum, Sparganium sp. and Elodea canadensis.

[44] Note that these species are provided here for information and do not appear in Appendix A.8.20 as they were associated with the island habitat

Large areas of bare mud and extensive development of blanket weed, Cladophora sp. indicates significant eutrophication and water quality is poor (see Section 8.3.13 and Appendix A.8.17 for the results of the macro-invertebrate water quality monitoring on the Terryland River). No flora or fauna species for which Natura 2000 sites have been designated have been recorded in previous surveys.

The Terryland River is valued as being of Local Importance (Higher Value).

Since the 2018 EIAR there have been no changes in area of these features.

8.3.5.21 Drainage ditches (FW4)

Drainage ditches are associated with agricultural fields, the margins of peatland sites, within and surrounding the Coolagh Lakes, at Ballindooley Lough, and at Galway Racecourse.

Along the western part of the study area, drainage ditches include species such as Angelica sylvestris, Potamogeton polygonifolius, Ranunculus flammula and Ranunculus repens.

Plant species associated with the drainage ditches surrounding the Coolagh Lakes included: Apium nodiflorum, Lemna sp., Filipendula ulmaria and Lythrum salicaria. The main channel connecting the Coolagh Lakes with the River Corrib is classified as a drainage ditch, fringed by very dense stands of Phragmites australis and Cladium mariscus (refer to Reed and large-sedge swamps (FS1), above). It is 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 and large-sedge swamp (FS1) on the channel edge.

Based on observations of surveyors, the drainage ditches at Ballindooley Lough are likely to be regularly dredged and contain a limited flora of Chara virgata, Chara aspera, Chara aculeolata, Chara rudis, Potamogeton coloratus and Lemna trisulca.

The drainage ditches at Galway Racecourse support a diverse range of plant species including, Equisetum fluviatile, Carex rostrata, Apium nodiflorum, Agrostis stolonifera, Potamogeton natans, Nasturtium officinale, Juncus articulatus, Typha latifolia, Glyceria fluitans, Sparganium erectum, Eleocharis palustris, Ranunculus flammula, Mentha aquatica, Galium uliginosum and Samolus valerandi.

Drainage ditches are valued as being of Local Importance (Higher Value) as they contain a diverse assemblage of flora species that are common at the local level.

Since the 2018 EIAR there have been no changes in area of these features.

8.3.5.22 Improved agricultural grassland (GA1)

Improved agricultural grassland is present throughout the study area, with larger areas located at Cappagh, between the Ballymoneen Road and Knocknabrona, around the Rahoon Road Junction, at Bushypark, in the vicinity of Bóthar Nua and Seanbóthar (Menlough/Coolough), and from the N84 Headford Road through to the existing Coolagh Junction.

This is a species-poor and common habitat. Characteristic species include the grasses Lolium perenne, Agrostis stolonifera, Dactylis glomerata, Holcus lanatus, Poa annua, Poa trivialis and Cynosurus cristatus; and herb species including Trifolium repens, Trifolium pratense, Bellis perennis, Urtica dioica, Plantago lanceolata, Plantago major, Cerastium fontanum, Cerastium glomeratum, Cirsium arvense, Potentilla anserina, Ranunculus repens, Rumex obtusifolius, and Taraxacum officinale agg.

Improved Agricultural grasslands are valued as being of Local Importance (Lower Value). It is a widespread and common habitat type that is not at risk, and is relatively species-poor and dominated by a few very common grass species.

Since the 2018 EIAR there has been a small decrease in the area of this habitat arising from land use change and development in the Galway City environs. Refer to Figures 8.20.1 to 8.20.15 for locations of habitat changes.

8.3.5.23 Amenity grassland (improved) (GA2)

Other than amenity grasslands associated with residential gardens and landscaped areas in commercial/industrial complexes, the two largest areas of this habitat type are the playing fields at the UoG Sporting Campus and the racetrack at Galway Racecourse. Typical grass species include Agrostis stolonifera, Agrostis capillaris, Cynosurus cristatus, Holcus lanatus and Lolium perenne, along with the following herb species: Bellis perennis, Cirsium arvense, Cirsium palustre, Cirsium vulgare, Plantago lanceolata, Plantago major, Potentilla anserina, Ranunculus repens, Rumex crispus, Rumex obtusifolius, Senecio jacobaea, Sonchus asper, Taraxacum officinale agg. and Trifolium pratense. This habitat type is very similar to GA1 grassland, albeit it is not subject to management by grazing.

Amenity grasslands are valued as being of Local Importance (Lower Value). It is a widespread and common habitat type that is relatively species-poor and of low botanical interest.

Since the 2018 EIAR there has been an increase in the area of this habitat arising from land use change and development in the Galway City environs. Refer to Figures 8.20.1 to 8.20.15 for locations of habitat changes.

8.3.5.24 Marsh (GM1)

The two small Marsh (GM1) areas at Na Foraí Maola Thoir (Ch. 1+100 of the proposed N6 GCRR) are characterised by Filipendula ulmaria, Lythrum salicaria, Juncus effusus with Ranunculus acris, Potentilla anserina, Mentha aquatica, Typha latifolia, Scrophularia auriculata and Angelica sylvestris also present.

There is a small area of Marsh (GM1) marsh habitat at Ballard West (Ch. 3+100). Typical Marsh (GM1) marsh species such as Lythrum salicaria, Mentha aquatica, Potentilla palustris, Myosotis scorpioides, and Hydrocotyle vulgaris are present along with Juncus articulatus, Carex panicea, Ranunculus acris, Leontodon autumnalis, Solidago virgaurea and Hypericum perforatum.

To the north of Bearna Woods (c.55m east of the proposed N6 GCRR at Ch. 3+900) there is a Marsh (GM1) near the east bank of the Tonabrocky Stream. Species present include Holcus lanatus, Festuca rubra, Molinia caerulea, Anthoxanthum odoratum, Filipendula ulmaria, Angelica sylvestris, Lythrum salicaria, Carex disticha, Carex nigra, Equisetum fluviatile, Valeriana officinalis, Potentilla palustris, Potentilla erecta, Calliergonella cuspidata and Juncus acutiflorus.

The Marsh (GM1) area near the Rahoon Road Junction (west of Ch. 1+900 along the N59 Link Road South of the proposed N6 GCRR) is characterised by the following species: Juncus effusus, Hydrocotyle vulgaris, Juncus acutiflorus, Agrostis stolonifera, Epilobium hirsutum, Typha latifolia, Epilobium palustre, Lotus pedunculatus, Filipendula ulmaria, Calliergonella sp.

The Marsh (GM1) area at Castlegar (Ch. 13+000 of the proposed N6 GCRR) is characterised by the following species: Juncus acutiflorus, Agrostis stolonifera, Galium palustre, Carex nigra, Mentha aquatica, Comarum palustre, Calliergonella cuspidata, Epilobium palustre and Potentilla anserina. Locally there is Carex disticha, Carex panicea, Carex echinata and Carex rostrata while Cirsium palustre is frequent throughout. Other species include Juncus effusus, Luzula campestris, Menyanthes trifoliata, Hypericum tetrapterum, Filipendula ulmaria, Carex hirta, Molinia caerulea, Salix aurita, Anthoxanthum odoratum, Hydrocotyle vulgaris, Persicaria amphibia, Eleocharis palustris, Glyceria fluitans, Apium nodiflorum, and Ranunculus repens. At the edges Centaurea nigra, Briza media, Knautia arvensis, Leucanthemum vulgare and Ilex aquifolium occurred.

Marsh (GM1) is valued as being of Local Importance (Higher Value) as it is a species-rich habitat type that is often a part of larger wetland mosaics, albeit the habitat does not correspond to any Annex I habitat type.

Since the 2018 EIAR there has been an increase in the area of this habitat arising from natural succession. Refer to Figures 8.20.1 to 8.20.15 for locations of habitat changes.

8.3.5.25 Dry calcareous and neutral grassland (GS1)

There are scattered patches of neutral grassland present along the route of the proposed N6 GCRR to the east of the River Corrib, generally associated with agricultural lands that are not intensively managed and subject to low intensity grazing. Typical grass species present include Agrostis stolonifera, Agrostis capillaris, Holcus lanatus, Cynosurus cristatus, Anthoxanthum odoratum, Lolium perenne and Dactylis glomerata. Herb species include Achillea millefolium, Centaurea nigra, Prunella vulgaris, Lotus corniculatus, Trifolium

repens, Trifolium pratense, Rumex acetosa, Urtica dioica, Senecio jacobaea, Ranunculus repens, Prunella vulgaris, Plantago lanceolata and Taraxacum officinalis agg.

Given the underlying geology east of the River Corrib, this habitat is much more widespread to the east of the river and this is reflected in the greater species diversity, and in particular calcicole species, present in land parcels east of the river.

The majority of calcareous grassland areas do not correspond with the Annex I habitat type (*Orchid-rich) calcareous grassland [*6210/6210], due the lack of sufficient indicator species in the sward. Typical species present include Cynosurus cristatus, Holcus lanatus, Festuca rubra, Dactylis glomerata, Agrostis stolonifera, Lolium perenne, Daucus carota, Lotus corniculatus, Galium verum, Linum catharticum, Centaurea nigra, Plantago lanceolata, Cirsium arvense, Senecio jacobaea, Prunella vulgaris, Trifolium repens, Ranunculus acris, Trifolium pratense and Taraxacum officinale agg.

In many areas the calcareous grasslands correspond with the Annex I Calcareous grassland habitat type due to the presence of sufficient high quality positive/positive indicator species (after O'Neill *et al*., 2013). High-quality indicator species present in Calcareous grassland within the ZoI of the Project are Antennaria dioica, Anthyllis vulneraria, Asperula cynanchica, Briza media, Campanula rotundifolia, Carex caryophyllea, Carlina vulgaris, Koeleria macrantha and Linum catharticum. Positive indicator species present are Carex flacca, Ctenidium molluscum, Daucus carota, Galium verum, Avenula pubescens, Leontodon hispidus, Lotus corniculatus, Pilosella officinarum, Ranunculus bulbosus, Sesleria caerulea, Thymus polytrichus and Trisetum flavescens.

Within Lough Corrib SAC, calcareous grassland is present at three locations within the ZoI of the Project: on the east bank of the proposed River Corrib Bridge crossing (Ch. 9+400 – Ch. 9+475 of the proposed N6 GCRR), along the spring/valley leading to the Coolough Lakes (Ch. 9+950 of the proposed N6 GCRR), and to the north and west of Lackagh Quarry (Ch. 11+000 – Ch. 11+800 of the proposed N6 GCRR) - see Figure 8.19.7 and Figure 8.19.8

On the east bank of the proposed River Corrib Bridge crossing the grassland is of the Cynosurus cristatus – Trifolium repens (3c) vegetation community (westernmost field) and the Cynosurus cristatus – Trifolium pratense (3d) vegetation community (easternmost field) and does not correspond with any Annex I habitat types. There is an area of the Annex I habitat type (*Orchid-rich) calcareous grassland [*6210/6210] to the southeast.

Along the spring/valley leading to the Coolough Lakes (the Lough Corrib SAC boundary is adjacent to the Project) at this location the grassland is of the Holcus lanatus – Lolium perenne grassland (2c) vegetation community and does not correspond with any Annex I habitat types.

Around the margins of Lackagh Quarry and west to Ch. 11+000 of the proposed N6 GCRR, the grasslands are of the Briza media – Thymus polytrichus grassland (3a) vegetation community. In many cases, particularly to the north and west of the quarry boundary, the Briza media – Thymus polytrichus grassland corresponds with both the priority and non-priority classifications of the Annex I Calcareous grassland habitat type. The thin soils support a highly diverse sward typically containing Briza media, Carex flacca, Sesleria caerulea, Potentilla erecta, Succisa pratensis, Centaurea nigra, Galium verum and Leucanthemum vulgare. Bryophytes include Scleropodium purum and Ctenidium molluscum.

Dry calcareous and neutral grassland (GS1) - Calcareous grassland [*6210/6210] is valued as being of International/National Importance. The priority variant is of international importance due to its scarcity at a European and national level, and as it is at risk of disappearance being a priority Annex I habitat. The non-priority Annex variant is of national importance as it is less species-rich and more common than the priority variant. Both Annex variants have a conservation status of 'Bad' in Ireland (NPWS, 2019) with a deteriorating trend arising from ongoing reductions in area from agricultural intensification and changes to land management.

Dry calcareous and neutral grassland (GS1) - Non-Annex I calcareous grassland variant is valued as being of Local Importance (Higher Value). The habitat type varies substantially from site to site in terms of species composition and species-richness; however these grasslands are generally less intensively managed than other agricultural grassland types and host an important assemblage of flora species including many flowering plants.

Dry calcareous and neutral grassland (GS1) - Non-Annex I neutral grassland variant is valued as being of Local Importance (Lower Value). Ecologically it is species-poor and is generally a continuum of improved agricultural grassland (GA1), being dominated by a small suite of grass species but where the forb component is greater than GA1 grassland. It is a common and widespread habitat with low botanical interest.

The Dry calcareous and neutral grassland (GS1) - Calcareous grassland [*6210/6210] habitat within the ZoI of the Project is summarised below in Table 8.8 below.

Since the 2018 EIAR there has been a slight increase in the area of this habitat arising from land use change and succession. Refer to Figures 8.20.1 to 8.20.15 for locations of habitat changes.

Table 8.8 Areas of the Annex I Habitat Calcareous Grassland [*6210/6210] within the Potential ZoI of the Project

Area	Vegetation Community[45]
Within Lough Corrib SAC c.27m south of the proposed N6 GCRR along the east bank of the River Corrib	3a Briza media – Thymus polytrichus grassland [6210]
Within Lough Corrib SAC c.20m south of the proposed N6 GCRR between Ch. 11+050 and Ch. 11+150	3a Briza media – Thymus polytrichus grassland [6210]
Within Lough Corrib SAC above the proposed Lackagh Tunnel (Ch. 11+300 of the proposed N6 GCRR) and along the western and northern boundary of Lackagh Quarry between Ch. 11+000 and Ch. 11+800 of the proposed N6 GCRR	3a Briza media – Thymus polytrichus grassland [*6210]
Adjacent to the proposed fenceline of the proposed N6 GCRR at Ch. 12+000	3a Briza media – Thymus polytrichus grassland [6210]
West of the N84 Headford Road Ch. 12+075 – Ch. 12+125 of the proposed N6 GCRR	3a Briza media – Thymus polytrichus grassland [6210]
Along proposed fenceline of the proposed N6 GCRR at access road AR 12/02	3a Briza media – Thymus polytrichus grassland [6210]
Adjacent to the south-western end of the existing N6 Coolagh Junction	3a Briza media – Thymus polytrichus grassland [6210]
Adjacent to southern boundary of the existing N6 Coolagh Junction	3a Briza media – Thymus polytrichus grassland [6210]

8.3.5.26 Dry meadows and grassy verges (GS2)

This habitat type is present across the study area and includes abandoned agricultural fields, fields managed for silage/hay, neglected grassed areas associated with residential gardens or waste ground, and roadside verges.

Typical grass species include: Arrhenatherum elatius, Dactylis glomerata, Holcus lanatus, Festuca rubra, Phleum pratense, Alopecurus pratensis, Agrostis stolonifera, Anthoxanthum odoratum and Lolium perenne. Herb species include Centaurea nigra, Heracleum sphondylium, Calystegia sepium, Urtica dioica, Plantago lanceolata, Cirsium arvense, Ranunculus repens, Ranunculus acris, Rumex acetosa subsp. acetosa, Rumex obtusifolius, Cerastium fontanum, Potentilla anserina, and Scorzoneroides autumnalis.

Across the eastern part of the study area, in some instances this habitat type corresponds with the Annex I habitat Hay meadows [6510]. However, none of these areas are within the ZoI of the Project.

[45] The vegetation communities are assigned based upon the plant species recorded and with reference to the vegetation types described in *National survey of limestone pavement and associated habitats in Ireland. Irish Wildlife Manuals, No. 73* (Wilson, S. and Fernández, F., 2013)

Dry meadows and grassy verges (GS2) - Hay meadows [6510] are valued as being of National Importance as they are relatively scarce but species-rich habitats under pressure from changes to land management, as they have a relatively restricted range in Ireland (NPWS, 2019) and as their conservation status in Ireland is 'Bad' (NPWS, 2019).

Dry meadows and grassy verges (GS2) - Non-Annex I variants are valued as being of Local Importance (Higher - Lower Value). More species-rich variants are of Local Importance (Higher Value), as they generally host a range of flowering plant species, while more species-poor variants tend to be dominated by a few grass species such as Arrhenatherum elatius to the exclusion of forb species and for this reason are of Local Importance (Lower Value).

Since the 2018 EIAR there has been an increase in the area of this habitat arising from land use change and succession. Refer to Figures 8.20.1 to 8.20.15 for locations of habitat changes.

8.3.5.27 Dry-humid acid grassland (GS3)

Dry-humid acid grassland is widespread in the western part of the study area in less intensively managed agricultural fields, often on the margins of peatland/heath sites, and frequently in a mosaic with wet grassland (GS4). In many cases, the grasslands are species-poor, likely arising from of grazing. Characteristic species include: the grasses, Agrostis capillaris, Cynosurus cristatus, Anthoxanthum odoratum, Lolium perenne, Nardus stricta and Festuca rubra; herb species such as Rumex acetosa, Succisa pratensis, Potentilla erecta, Galium saxatile, Veronica officinalis, Achillea millefolium, Trifolium pratense and Juncus articulatus; and moss species such as Hylocomium splendens, Hypnum cupressiforme, Rhytidiadelphus squarrosus and Pleurozium schreberi. Of note is a record of Botrychium lunaria, a species listed as Near Threatened on the Irish Red List for Vascular Plants (Wyse Jackson *et al*., 2016) from Knocknabrona/Knocknafroska in 2015, in an area outside of the Assessment Boundary.

At one location within the Assessment Boundary – Carrach, between Bearna Village and Bearna Woods – Dry-humid acid grassland (GS3) corresponds with the priority Annex I habitat type Species-rich Nardus grassland [*6230]. However, this area is not within the ZoI of the Project.

Dry-humid acid grassland (GS3) – Species-rich Nardus grassland [*6230] are valued as being of National Importance. The examples identified in the study area are within the favourable reference range of the Annex I habitat in Ireland (NPWS, 2019), however the conservation status of the habitat is 'Bad' nationally and it is subject to ongoing decline (NPWS, 2019).

Dry-humid acid grassland (GS3) - Non-Annex I variants are valued as being of Local Importance (Higher - Lower Value) as they are an important component of the wet heath/bog/wet grassland mosaic that forms much of the semi-natural habitats in the west of the study area, albeit the habitat itself is relatively species-poor).

Since the 2018 EIAR there has been an increase of the area of this habitat arising from land use change and succession. Refer to Figures 8.20.1 to 8.20.15 for locations of habitat changes.

8.3.5.28 Wet grassland (GS4)

Wet grassland is present across the study area but more frequently west of Ballindooley Lough. It ranges in quality from species-poor variants associated with lands managed for agriculture through to more diverse and species-rich areas associated with the River Corrib/Coolagh Lakes and at Ballindooley Lough.

In the vicinity of the Project, the more improved wet grassland fields, managed for agriculture, are generally rush-dominated with species such as Juncus effusus, Juncus articulatus and Juncus conglomeratus, grass species including Agrostis stolonifera, Arrhenatherum elatius, Holcus lanatus, and Lolium perenne, and with a low-diversity forb component. Herb species recorded in wet grassland include Angelica sylvestris, Carex flacca, Carex panicea, Cirsium palustre, Filipendula ulmaria, Galium palustre, Hydrocotyle vulgaris, Iris pseudacorus, Lotus pedunculatus, Lythrum salicaria, Mentha aquatica, Potentilla anserina, Potentilla erecta, Ranunculus acris, Ranunculus repens, Ranunculus flammula, Stachys palustris and Succisa pratensis. Typical moss species include Calliergonella cuspidata and Rhytidiadelphus squarrosus.

A wet grassland type, dominated by Molinia caerulea, is also recorded in the western part of the study area and is associated with the margins of some of the peatland areas in the vicinity of the Project – at Na Foraí

Maola Thiar (at Ar 0/04 for the proposed N6 GCRR), at Troscaigh Thiar (Ch. 2+350 of the proposed N6 GCRR) and at Knocknabrona/Knocknafroska (Ch. 7+750 of the proposed N6 GCRR). These grasslands correspond with the 1d Molinia caerulea – Potentilla erecta grassland vegetation community (O'Neill *et al.*, 2013). At the Foraí Maola Thiar site, Potentilla erecta, Succisa pratensis, Anthoxanthum odoratum, Ranunculus acris, Ranunculus repens, Cirsium vulgare and Vicia sepium are present in the sward but in low amounts. At Troscaigh Thiar, Juncus acutiflorus is abundant in the sward with Sphagnum fallax, Succisa pratensis, Hylocomium splendens, Potentilla erecta, Anthoxanthum odoratum, Rhytidiadelphus loreus, Thuidium sp., Rumex acetosa and Calluna vulgaris (rare) also present. At Knocknabrona/Knocknafrosca, Juncus acutiflorus, Sphagnum fallax, Carex panicea, Potentilla erecta, Succisa pratensis, Erica tetralix (rare), Lythrum salicaria and Calluna vulgaris (rare) are also present.

At two locations within the footprint of the proposed N6 GCRR – at Na Foraí Maola Thiar and Ballindooley Lough – wet grassland corresponds with the Annex I habitat type Molinia meadows [6410]. There is also an area of Molinia meadow [6410] habitat adjacent to the Assessment Boundary at Ch. 3+800 of the proposed N6 GCRR.

At Na Foraí Maola, the Molinia meadows [6410] is characterised by the following indicator species for this Annex I habitat type: Juncus conglomeratus, Carex echinata, Carex flacca, Filipendula ulmaria, Galium palustre, Juncus articulatus, Lotus pedunculatus, Molinia caerulea, Potentilla erecta and Mentha aquatica.

Ballindooley Lough is surrounded by a band of wet grassland which corresponds with Molinia meadows [6410]. The vegetation is characterised by the high-quality positive/positive indicator species Carex pulicaris, Cirsium dissectum, Achillea ptarmica, Carex echinata, Carex panicea, Carex nigra, Filipendula ulmaria, Juncus articulatus, Molinia caerulea and Potentilla erecta. Calliergonella cuspidata is the main bryophyte species, but Climacium dendroides and Rhytidiadelphus squarrosus are also present towards the grazed habitat edges. At the edges of the wet meadows, where Molinia caerulea is very sparse or absent, other species occurring more frequently include Potentilla anserina, Carex nigra, Holcus lanatus, Ranunculus repens, Galium palustre, Festuca arundinacea and Eleocharis palustris. In these areas the grassland does not correspond to the Annex I habitat type. The absence of grazing at the southern end has resulted in patches of Molinia caerulea becoming very tussocky and the habitat less species diverse. Drainage and drying out of the peat is also likely to be affecting the habitat composition around the lake to a degree.

Wet grassland (GS4) - Molinia meadows [6410] are valued as being of National Importance. This is a species-rich habitat type that often forms a continuum with fen habitats and other higher value wetland habitats. It is relatively uncommon, with a range concentrated in the west and northwest of the country and its national conservation status is 'Bad' with a deteriorating trend (NPWS, 2019).

Wet grassland (GS4) - Non-Annex I habitat types are valued as being of Local Importance (Higher Value) to Local Importance (Lower Value). Examples that contain a relatively high forb component but which do not meet the criteria for the Annex I habitat Molinia meadows [6410] are of higher value, whilst those examples that are dominated by Juncus spp. and with a depauperate forb component are widespread common habitats that are of lower value as they hold low botanical interest.

The Molinia meadows [6410] habitat within the ZoI of the Project is summarised below in Table 8.9.

Since the 2018 EIAR there has been a decrease in the area of this habitat arising from land use change and succession. Refer to Figures 8.20.1 to 8.20.15 for locations of habitat changes.

Table 8.9 Areas of the Annex I Habitat Molinia Meadow [6410] within the Potential ZoI of the Project

Area	Vegetation Community[46]
Na Foraí Maola Thiar at Ch. 0+900	1c Molinia caerulea – Succisa pratensis grassland
North of Bearna Woods Ch. 3+800	1c Molinia caerulea – Succisa pratensis grassland[47]
Ballindooley Lough Ch. 12+250 – Ch. 12+400	1d Molinia caerulea – Potentilla erecta grassland

8.3.5.29 Dense bracken (HD1)

This habitat type is most prevalent along the western part of the study area, associated with Pteridium aquilinum dominating abandoned agricultural fields (in conjunction with bramble cover in many instances), the margins of less intensively managed agricultural fields, and around the edges of peatland sites in conjunction with dense Ulex europaeus cover.

Small areas of Dense bracken (HD1) occur in mosaic with heath and correspond to either the Annex I habitat Wet heaths [4010] or Dry Heaths.

Dense bracken (HD1) where it corresponds to the Annex I habitat Wet heath [4010] or Dry heath [4030] is valued as National Importance. Non-annex variants of the habitat are valued as being of Local Importance (Lower Value) as it is a widespread habitat dominated by a single species.

Since the 2018 EIAR there has been an increase in the area of this habitat arising from succession. Refer to Figures 8.20.1 to 8.20.15 for locations of habitat changes.

8.3.5.30 Dry siliceous heath (HH1)

Patches of dry siliceous heath (HH1) are present all along the route of the proposed N6 GCRR to the west of the N59 Moycullen Road, generally relatively small in area, and most often in association with, or forming mosaics with, Wet heath (HH3), Lowland blanket bog (PB3) and Dry-humid acid grassland (GS3). All areas of dry heath vegetation communities recorded within the ZoI of the Project correspond with the Ulex gallii - Erica cinerea dry heath (DH1) vegetation community, characterised by the presence of Ulex gallii along with Erica cinerea or Calluna vulgaris.

Typical dry heath species present include the vascular plant species Ulex gallii, Calluna vulgaris, Erica cinerea, Molinia caerulea, Daboecia cantabrica, Potentilla erecta, Arctostaphylos uva-ursi, Pteridium aquilinum, Carex binervis, Carex panacea, Carex echinata, along with the moss species Rhytidiadelphus squarrosus, Hypnum cupressiforme, Hypnum jutlandicum, and Pseudoscleropodium purum, and the lichen Cladonia cf portentosa. Other species present include Agrostis capillaris, Succisa pratensis, Teucrium scorodonia, Hylocomium splendens, Solidago virgaurea, Viola sp., Dicranum scoparium and Campylopus introflexus.

All instances of dry siliceous heath correspond with the Annex I habitat type Dry heaths [4030]. The Dry heaths [4030] habitat within the ZoI of the Project is summarised below in Table 8.10. In several locations the Annex I habitat occurs as a mosaic with the Annex I habitat Wet heaths [4010].

Dry siliceous heath (HH1) - Dry heath [4030] is valued as being of National Importance. Although it is a very common habitat type in Ireland, it is restricted largely to upland areas and is subject to ongoing pressures from land conversion, intensification and grazing, and has a national conservation status of 'Bad' (NPWS, 2019).

Since the 2018 EIAR there has been a decrease in the area of this habitat arising from development, land use change and succession. Refer to Figures 8.20.1 to 8.20.15 for locations of habitat changes.

[46] The vegetation communities are assigned based upon the plant species recorded and with reference to the vegetation types described in *National survey of limestone pavement and associated habitats in Ireland. Irish Wildlife Manuals, No. 73* (Wilson, S. and Fernández, F., 2013)

[47] This area is outside of the Assessment Boundary but directly adjacent.

Table 8.10 Areas of the Siliceous Variant of the Annex I Habitat Dry Heath [4030] within the Potential ZoI of the Project

Area	Vegetation Community[48]
Bearna West Roundabout/R336 between Ch. 0+000 and Ch. 0+050 of the proposed N6 GCRR	DH1 Ulex gallii - Erica cinerea dry heath
North of Bearna West Roundabout between Ch. 0+175 and Ch. 0+450 of the proposed N6 GCRR	DH1 Ulex gallii - Erica cinerea dry heath
Na Foraí Maola Thiar between Ch. 0+625 and Ch. 0+700 of the proposed N6 GCRR	DH1 Ulex gallii - Erica cinerea dry heath
Na Foraí Maola Thiar between Ch. 0+900 and Ch. 1+000 of the proposed N6 GCRR	DH1 Ulex gallii - Erica cinerea dry heath
Na Foraí Maola Thiar at Ch. 1+075 of the proposed N6 GCRR	DH1 Ulex gallii - Erica cinerea dry heath
Na Foraí Maola Thoir between Ch. 1+175 and Ch. 1+550 of the proposed N6 GCRR	DH1 Ulex gallii - Erica cinerea dry heath
Troscaigh Thiar between Ch. 1+700 and Ch. 2+400 of the proposed N6 GCRR	DH1 Ulex gallii - Erica cinerea dry heath
Ballard East between Ch. 3+450 and Ch. 3+550 of the proposed N6 GCRR	DH1 Ulex gallii - Erica cinerea dry heath
Ballard East between Ch. 3+750 and Ch. 3+850 of the proposed N6 GCRR	DH1 Ulex gallii - Erica cinerea dry heath
Cappagh between Ch. 4+725 and Ch. 5+250 of the proposed N6 GCRR	DH1 Ulex gallii - Erica cinerea dry heath
N59 Link Road North between Ch. 0+550 and Ch. 0+600 of the proposed N6 GCRR	DH1 Ulex gallii - Erica cinerea dry heath
Knocknafroska between Ch. 7+800 and Ch. 7+975 of the proposed N6 GCRR	DH1 Ulex gallii - Erica cinerea dry heath

8.3.5.31 Dry calcareous heath (HH2)

Dry calcareous heath is present in the Menlough/Coolough area; sometimes in larger distinct habitat patches but most often in a mosaic with outcropping limestone, scrub and/or calcareous grassland. The two larger areas are to the north of An Seanbóthar and on higher ground near to the eastern shore of the northernmost of the Coolagh Lakes. Typical plant species present include the vascular plants Calluna vulgaris, Molinia caerulea, Sesleria caerulea, Rubus fruticosus agg., Carex panicea, Carex flacca, Carex pulicaris, Succisa pratensis, Rosa spinosissima, Potentilla erecta, Hedera helix, and mosses such as Thuidium tamariscinum, Breutelia chrysocoma and Scleropodium purum.

This habitat corresponds with the Calluna vulgaris – Antennaria dioica dry heath (DH5) vegetation community of the Annex I habitat type Dry heaths [4030]. The Calcareous dry heath (HH2) Dry heaths [4030] within the ZoI of the Project is summarised below in Table 8.11.

[48] The vegetation communities are assigned based upon the plant species recorded and with reference to the vegetation types described in *Guidelines for a national survey and conservation assessment of upland vegetation and habitats in Ireland. Version 2.0. Irish Wildlife Manuals, No. 79* (Perrin *et al.*, 2014)

Dry calcareous heath (HH2) – Dry heaths [4030] – and its mosaics are valued as being of National Importance. Although it is a very common habitat type in Ireland, it is restricted largely to upland areas and is subject to ongoing pressures from land conversion, intensification and grazing and has a national conservation status of 'Bad' (NPWS, 2019).

There has been no change in the area of this habitat since the 2018 EIAR.

Table 8.11 Areas of the Calcareous Variant of the Annex I Habitat Dry Heath [4030] within the Potential ZoI of the Project

Area	Vegetation Community
North of Seanbóthar between Ch. 10+450 and Ch. 10+650 of the proposed N6 GCRR	DH5 Calluna vulgaris – Antennaria dioica dry heath
Coolagh Lakes	DH5 Calluna vulgaris – Antennaria dioica dry heath

8.3.5.32 Wet heath (HH3)

Wet heath occurs predominantly across the western part of the study area; with only a few small patches of this habitat type present east of the River Corrib around the margins of the Coolagh Lakes. Typical vascular plant species in those areas in the vicinity of the Project include Calluna vulgaris, Erica tetralix, Schoenus nigricans, Trichophorum germanicum, Ulex gallii, Eriophorum angustifolium, Eriophorum vaginatum, Myrica gale, Potentilla erecta, Succisa pratensis and Juncus articulatus. Typical moss species include Cladonia cf portentosa, Hylocomium splendens, Sphagnum rubellum, Sphagnum cuspidatum, Sphagnum denticulatum, Sphagnum tenellum, Pleurozia purpurea, Sphagnum compactum and Diplophyllum albicans.

In all cases this habitat corresponds with the Annex I habitat type Wet heaths [4010]. The Wet heath [4010] habitat within the ZoI of the Project is summarised below in Table 8.12. In many instances Wet heath occurs as a mosaic with Blanket bog (*if active bog) [730] and/or Dry heath [4030], or Molinia meadows [6410] (refer to Table 8.12 and Table 8.13).

Wet heath (HH3) - Wet heath [4010] and its mosaics are valued as being of National Importance. Although it is a very common habitat type in Ireland, it is largely restricted to upland areas and is subject to ongoing pressures from land conversion, intensification and grazing and has a national conservation status of 'Bad' (NPWS, 2019).

The Wet heaths [4010] within the ZoI of the Project is summarised below in Table 8.12.

Since the 2018 EIAR there has been a decrease in the area of this habitat arising from development, land use change and succession. Refer to Figures 8.20.1 to 8.20.15 for locations of habitat changes.

Table 8.12 Areas of the Annex I Habitat Wet Heath [4010] within the Potential ZoI of the Project

Area	Vegetation Community[49]
Na Foraí Maola Thiar between Ch. 0+600 and Ch. 0+700 of the proposed N6 GCRR	WH7 Molinia caerulea – Ulex gallii wet heath
Na Foraí Maola Thoir between Ch. 0+900 and Ch. 1+400 of the proposed N6 GCRR	WH3 Calluna vulgaris – Molinia caerulea - Sphagnum capillifolium wet/damp heath
Troscaigh Thiar – Ch. 1+850 – Ch. 2+400 of the proposed N6 GCRR	WH3 Calluna vulgaris – Molinia caerulea - Sphagnum capillifolium wet/damp heath

[49] The vegetation communities are assigned based upon the plant species recorded and with reference to the vegetation types described in *Guidelines for a national survey and conservation assessment of upland vegetation and habitats in Ireland. Version 2.0. Irish Wildlife Manuals, No. 79* (Perrin *et al.*, 2014)

Area	Vegetation Community[49]
Ballard West – Ch. 2+900 – Ch. 3+025 of the proposed N6 GCRR	WH3 Calluna vulgaris – Molinia caerulea - Sphagnum capillifolium wet/damp heath
Ballard East – Ch. 3+450 – Ch. 3+825 of the proposed N6 GCRR	WH3 Calluna vulgaris – Molinia caerulea – Sphagnum capillifolium wet/damp heath
Cappagh – Ch. 4+650 – Ch. 5+125 of the proposed N6 GCRR	WH4b Trichophorum germanicum – Eriophorum angustifolium wet heath: Calluna vulgaris sub-community
Coolagh Lakes	WH6 Schoenus nigricans – Molinia caerulea – Myrica gale wet heath

8.3.5.33 Lowland blanket bog (PB3)

Lowland blanket bog (PB3) is found across the western part of the study area, largely to the north of the footprint of the proposed N6 GCRR. The Lowland blanket bog (PB3) at Na Foraí Maola Thiar (Ch. 0+650 – Ch. 0+850 of the proposed N6 GCRR) (Ballagh - Forramoyle West) forms a mosaic with Wet heath (HH3), Dry siliceous, Dry heath (HH1) and Scrub (WS1) at the southern extent of a much larger peatland site within Moycullen Bogs NHA. Approximately 10% of this habitat area corresponds with the Fossitt (2000) Lowland blanket bog (PB3) classification; although this habitat type does not occur within the footprint of the Project.

Typical vascular plant species present include Calluna vulgaris, Molinia caerulea, Schoenus nigricans, Rhynchospora alba, Erica tetralix, Carex panicea, Eriophorum angustifolium, Eriophorum vaginatum, Narthecium ossifragum, Trichophorum germanicum, Drosera rotundifolia and Potentilla erecta. Typical moss species include Sphagnum rubellum, Sphagnum papillosum, Sphagnum tenellum, Sphagnum cuspidatum, Aulacomnium palustre and Odontoschisma sphagni.

Lowland blanket bog (PB3) habitat corresponds with the Annex I habitat type Blanket bogs (*where active bog) [7130]. The Blanket bog habitat and their mosaics within the ZoI of the Project is summarised below in Table 8.13.

Lowland blanket bog (PB3) - Blanket bogs (*where active bog) [7130] are valued as being of National to International Importance. The inactive variant (e.g. where peat is not actively accruing) is valued as National importance as it is not a priority Annex I habitat type. The variant where peat is actively accruing/forming is of International importance as it is a priority Annex I habitat type and is at risk of disappearance. Although it is widespread in Ireland, it is under pressure from land intensification, inappropriate grazing and management regimes and from drainage, and it has a conservation status of 'Bad' (NPWS, 2019).

There has been no change in the area of this habitat since the 2018 EIAR.

Table 8.13 Areas of the Annex I Habitat Blanket Bog [*7130] within the Potential ZoI of the Project

Area	Vegetation Community[50]
Na Foraí Maola Thiar between Ch. 0+650 and Ch. 0+750 of the proposed N6 GCRR	BB3 Eriophorum vaginatum – Sphagnum papillosum bog
Na Foraí Maola Thiar at Ch. 1+400 of the proposed N6 GCRR	BB3 Eriophorum vaginatum – Sphagnum papillosum bog

[50] The vegetation communities are assigned based upon the plant species recorded and with reference to the vegetation types described in *Guidelines for a national survey and conservation assessment of upland vegetation and habitats in Ireland. Version 2.0. Irish Wildlife Manuals, No. 79* (Perrin *et al.*, 2014)

Rich fen and flush (PF1)

There is a large Rich fen (PF1) complex at Kentfield with one of the fen areas immediately adjacent to the proposed drainage outfall for the N59 Link Road North. This fen polygon corresponds with the RFLU1a vegetation community (Carex viridula oedocarpa - Pinguicula vulgaris - Juncus bulbosus flush; brown moss sub-community) of the Annex I habitat type Alkaline fens [7230]. Carex panicea and Carex viridula are the most abundant plant species present with Molinia caerulea, Juncus bulbosus and Succisa pratensis also frequent. Other species present include Hydrocotyle vulgaris, Agrostis stolonifera, Anagallis tenella, Calliergonella cuspidata, Carex flacca, Festuca rubra, Potentilla erecta, Prunella vulgaris, Anthoxanthum odoratum, Carex echinata and Drepanocladus cossonii.

There are also areas of Rich fen amongst the fringing aquatic vegetation surrounding the Coolagh Lakes (along with a few isolated patches along the banks of the River Corrib, downstream of the proposed River Corrib Bridge) characterised by species such as: Calliergonella cuspidata, Agrostis stolonifera, Carex nigra, Trifolium repens, Carex panicea, Potentilla anserina, Mentha aquatica, Festuca arundinacea, Filipendula ulmaria, Carex ovalis, Anthoxanthum odoratum, Cardamine pratensis, Epilobium palustre, Galium palustre, Juncus articulatus, Lythrum salicaria, Ranunculus flammula, Vicia cracca, Rhytidiadelphus squarrosus, Senecio aquaticus, Carex echinata and Equisetum fluviatile. A number of these polygons correspond with the RFEN1a vegetation community of the Annex I Alkaline fen [7230] habitat type due to the presence of the positive indicator species Campylium stellatum, Carex panicea, Carex rostrata, Carex viridula subsp. brachyrrhyncha, Drepanocladus revolvens and Scorpidium scorpioides[51]. Some Rich fen (PF1) areas here correspond with the priority Annex I habitat type Cladium fens [*7210], characterised by Schoenus nigricans, Cladium mariscus, Campylium stellatum, Drepanocladus revolvens, Fissidens adianthoides, Molinia caerulea, Ctenidium molluscum, Filipendula ulmaria, Phragmites australis, Succisa pratensis and Carex panicea.

At Ballindooley Lough, one of the areas of Rich fen (PF1) corresponds with the RFLU4 vegetation community (Schoenus nigricans – Scorpidium scorpioides flush) of the Annex I Alkaline fen [7230] habitat type characterised by the following species: Schoenus nigricans, Juncus subnodulosus, Molinia caerulea, Hydrocotyle vulgaris, Carex panacea, Carex lepidocarpa, Juncus articulatus, Ranunculus flammula, Cirsium dissectum, Parnassia palustris, Drosera anglica, Calliergonella cuspidata, Scorpidium scorpioides, Scorpidium cossonii, Campylium stellatum and Myrica gale. Some Rich fen (PF1) areas here also correspond with the priority Annex I habitat type Cladium fens [*7210].

Rich fen and flush (PF1) - Alkaline fens [7230] / Cladium fen [*7210] are valued as being of International Importance. They are high diversity habitats, and form mosaics with other wetland habitats. The conservation status of Cladium fen [*7210] is ‘Inadequate’ in Ireland, although its status has remained stable (NPWS, 2019). Alkaline fen [7230] is of ‘Bad’ conservation status. It is threatened primarily by overgrazing, drainage and pollution. The examples of the habitats within the Assessment Boundary are high quality and part of an internationally important wetland mosaic associated with Lough Corrib SAC.

Rich fen and flush (PF1) - Non-Annex I habitat type is valued as being of Local Importance (Higher value) to County Importance. These habitats, while they do not correspond to any Annex I types, are species-rich and tend to be relatively small in size and restricted in distribution.

The Alkaline fen and Cladium fen habitat within the ZoI of the Project is summarised below in Table 8.14.

Since the 2018 EIAR there has been a decrease in the area of this habitat arising from change in land practices and succession. Refer to Figures 8.20.1 to 8.20.15 for locations of habitat changes.

[51] Guidelines for a national survey and conservation assessment of upland vegetation and habitats in Ireland. Version 2.0. *Irish Wildlife Manuals, No. 79* (Perrin *et al.*, 2014)

Table 8.14 Areas of the Annex I Habitat Alkaline Fen [7230] and Cladium Fen [*7210] within the Potential ZoI of the Project

Area	Vegetation Community
Coolagh Lakes	RFEN1a Carex rostrata fen; brown moss sub-community [7230] also Cladium fen [*7210]
Ballindooley Lough	RFLU4 Schoenus nigricans – Scorpidium scorpioides flush [7230] also Cladium fen [*7210]

8.3.5.34 Poor fen and flush (PF2)

There is an area of Poor fen (PF2) at Na Foraí Maola Thiar (Ch. 0+700 – Ch. 0+800 of the proposed N6 GCRR) characterised by the following species: Juncus effusus, Juncus articulatus, Sphagnum denticulatum, Ranunculus flammula, Potamogeton polygonifolius, Juncus bulbosus, Philonotis fontana, Agrostis stolonifera, Lythrum salicaria, Calliergonella cuspidata and Sphagnum palustre. This corresponds with the Juncus effusus - Sphagnum cuspidatum/palustre flush vegetation community (PFLU2). A second area to the north (near the proposed access track on the proposed N6 GCRR) is characterised by Carex echinata, Juncus effusus, Juncus conglomeratus, Calliergonella cuspidata, Eriophorum angustifolium, Potentilla palustris, Angelica sylvestris, Sphagnum papillosum, Holcus lanatus, Anthoxanthum odoratum and Agrostis stolonifera.

At Knocknafroska (Ch. 7+800 to Ch. 7+975 of the proposed N6 GCRR) there are two areas of Poor fen (PF2). The smaller area corresponds with the SW1 Potamogeton polygonifolius soakway vegetation community. Other species present include Sphagnum spp., Polytrichum commune, Carex panicea, Juncus effusus, Juncus bulbosus, Ranunculus flammula, Anagallis tenella, Menyanthes trifoliate and Hydrocotyle vulgaris. The larger area to the north is heavily grazed and dominated by Juncus effusus with a layer of Sphagnum spp. underneath (including Sphagnum palustre). Other species included Calliergonella cuspidata, Holcus lanatus and Rumex acetosa.

An area of approximately 0.11ha of Poor fen and flush (PF2) habitat recorded within the Assessment Boundary has transitioned to Dry-humid acid grassland (GS3) between 2018 and 2023; likely due to natural processes.

Poor fen and flush (PF2) is valued as being of Local Importance (Higher Value) to County Importance. This habitat type tends to be restricted in its distribution and area. The species richness of the sward determines the level of importance of the various land parcels of this habitat across the study area.

Since the 2018 EIAR there has been a very slight increase of the area of this habitat arising from succession. Refer to Figures 8.20.1 to 8.20.15 for locations of habitat changes.

8.3.5.35 Transition mire and quaking bog (PF3)

This is a habitat that was not described in the 2018 EIAR.

Transition mires and quaking bogs (PF3) are extremely wet peat-forming systems with 46 characteristics that are intermediate between Rich fens and flush (PF1) and Poor fen and flush (PF2). While considered as a separate habitat, they may occur within, or on the fringes of other peat-forming systems. Transition mires and quaking bogs (PF3) are usually associated with the wettest parts of a bog or fen and can be found in wet hollows, infilling depressions, or at the transition to areas of open water. Vegetation frequently forms a floating mat or surface scraw over saturated, spongy or quaking peat. Standing water may occur in pools or along seepage zones.

The vegetation typically comprises species that are characteristic of bog, fen and open water habitats. Small to medium sedges, mainly Carex spp. (particularly Carex diandra, C. lasiocarpa, C. limosa and C. viridula), usually dominate and may occur together with Rhynchospora alba, Eriophorum angustifolium, and the much rarer E. gracile, Agrostis stolonifera, Molinia caerulea, and a range of broadleaved wetland herbs such as Menyanthes trifoliata), Hydrocotyle vulgaris, Ranunculus flammula, Potentilla palustris and Pedicularis

palustris. Extensive moss cover is characteristic; Sphagnum spp., Calliergon spp. and Scorpidium scorpioides are usually abundant.

Transition mire and quaking bog (PF3) - Transition mires and quaking bogs [7140] is valued as being of National Importance. Its conservation status in Ireland is 'Bad' and like other wetland habitats it is subject to ongoing pressures from pollution, and unsympathetic management as well as conversion to other land use types (NPWS, 2019).

Transition mire and quaking bog (PF3) - Non-Annex I type is valued as being of Local Importance (Higher Value) - County Importance. Although not an Annex I habitat, it is considered to be important as it tends to form a mosaic and integral part of other wetland habitats.

As mentioned above, this habitat was not described in the 2018 EIAR and is new in this updated EIAR.

8.3.5.36 Residential

This non-Fossitt classification is used to represent residential properties along the Project and generally consist of a mosaic of buildings and artificial surfaces (BL3), amenity grassland (GA2), flower beds and borders (BC4) and ornamental shrubs (WS3), with unmanaged rank grassland areas also occasionally present (GS2).

Residential Habitat is valued as being of Local Importance (Lower Value). It is generally of low botanical diversity and dominated by exotic plant species with low biodiversity value.

Since the 2018 EIAR there has been an increase in the area of this habitat arising from land use change and development in the Galway City environs. Refer to Figures 8.20.1 to 8.20.15 for locations of habitat changes.

8.3.5.37 (Mixed) broadleaved woodland (WD1)

There are small stands of broadleaved woodland (WD1) scattered along the proposed N6 GCRR from the western end of the Project to the woodlands at Menlough. The largest area is at the UoG Sporting Campus, where most of the woodland is planted for amenity purposes, and the woodlands at Menlough, which are long established (dating back to the 1800s).

At Na Foraí Maola Thiar (Ch. 0+800 – Ch. 1+000 of the proposed N6 GCRR) there is a band of planted trees surrounding a residential garden which include Acer pseudoplatanus, Fagus sylvatica, Quercus robur, Salix sp., Alnus cordata, Alnus glutinosa, Corylus avellana, Crataegus monogyna and Prunus sp.

Along the eastern edge of the Na Foraí Maola Road is a stand of woodland comprising Acer pseudoplatanus, Salix cinerea, Fagus sylvatica, Quercus robur, Alnus cordata, Alnus glutinosa, Sorbus aria, Lonicera periclymenum, Hedera helix, Dryopteris filix-mas, Urtica dioica, Blechnum spicant and Phyllitis scolopendrium.

At An Chloch Scoilte Junction (Ch. 3+300 – Ch. 3+400 of the proposed N6 GCRR) the woodland species comprise Fraxinus excelsior, Acer pseudoplatanus, Rubus fruticosus agg., Phyllitis scolopendrium, Hedera helix, Heracleum sphondylium, Crataegus monogyna, Cotoneaster sp., Urtica dioica, Dryopteris filix-mas, Polypodium vulgare and Symphoricarpos albus.

At the UoG Sporting Campus (Ch. 8+725 – Ch. 9+250 of the proposed N6 GCRR) there are many stands of maturing amenity broadleaved woodland planting including tree species such as Acer pseudoplatanus, Fraxinus excelsior, Fagus sylvatica, Tilia cordata, Aesculus hippocastanum and Ulmus glabra. The field layer contained species such as Hedera helix, Geum urbanum, Vicia sepia, Torilis japonica, Rubus fruticosus agg., Arrhenatherum elatius and Brachypodium sylvaticum.

There are two areas of Mixed broadleaved woodland within the boundary of Lough Corrib SAC, on the eastern bank of the River Corrib (Ch. 9+475 – Ch. 9+650 of the proposed N6 GCRR). The main species that make up the woodland flora in the main block are Fagus sylvatica, Fraxinus excelsior, Ilex aquifolium and Thamnobryum alopecurum. Also present were Arum maculatum, Hedera helix, Isothecium alopecuroides, Kindbergia praelonga, Neckera complanata, Radula complanata, Lejeunea cavifolia, Metzgeria furcata, Rhynchostegiella tenella and Tortella tortuosa. The narrow linear strip to the east, at Ch. 9+500 of the proposed N6 GCRR, is comprised of Fagus sylvatica with an Ilex aquifolium understory.

The linear strips of woodland at the City East Business Park Junction associated with the proposed N6 GCRR comprises Fraxinus excelsior, Acer pseudoplatanus, Fagus sylvatica, Rubus fruticosus agg. and Urtica dioica.

Mixed broadleaved woodland (WD1) is valued as being of Local Importance (Higher Value). It is a modified woodland type that contains a large composition of non-native and naturalised species, but nonetheless has some botanical interest.

Mixed broadleaved woodland (WD1) is value as being of Local Importance (Higher Value) as it is a modified woodland type with many naturalised and exotic species in the canopy, but which nonetheless is relatively uncommon in the locality and nationally, and which supports a diversity of native species.

Since the 2018 EIAR there has been a very slight increase in the area of this habitat arising largely from succession. Refer to Figures 8.20.1 to 8.20.15 for locations of habitat changes.

8.3.5.38 Mixed broadleaved/conifer woodland (WD2)

A small area of Mixed broadleaved/conifer is present adjacent to the proposed N6 GCRR at School Road in Castlegar (Ch. 13+150). Tree species included Acer pseudoplatanus, Fraxinus excelsior, Betula sp., Prunus sp., Pinus sp., Cupressus sp. and Rhododendron ponticum.

Mixed broadleaved/conifer woodland (WD2) is valued as being of Local Importance (Higher Value). It is a modified woodland type that contains a large composition of non-native and naturalised species, but nonetheless has some botanical interest.

Mixed broadleaved/conifer woodland (WD2) is valued as being of Local Importance (Higher Value) as it is a modified woodland type with many naturalised and exotic species in the canopy, but which nonetheless is relatively uncommon in the locality and nationally, and which supports a diversity of native species.

Since the 2018 EIAR there has been a decrease in the area of this habitat arising from development. Refer to Figures 8.20.1 to 8.20.15 for locations of habitat changes.

8.3.5.39 Conifer Planation (WD4)

This habitat was not described in the 2018 EIAR as it was previously classified as Treeline (WL2) but has increased in area such that it is now classified as woodland.

This category is used for areas that support dense stands of planted conifers where the broadleaved component is less than 25% and the overriding interest is commercial timber production. Conifer plantations are characterised by even-aged stands of trees that are usually planted in regular rows, frequently within angular blocks. Species diversity is low and single species stands are common. The majority of planted conifers are non-native species such as Picea sitchensis, Pinus contorta, Picea abies and Larix spp. Conifer plantations may be fringed with narrow bands of broadleaved trees, most of which are also planted.

In a field in Forramoyle West, at Ch. 1+400 of the proposed N6 GCRR, there is a small Conifer Plantation stand of approximately 0.029ha (285.6m^2) in area.

Conifer plantation (WD4) is valued as being of Local Importance (Lower Value). It is a modified woodland type that is relatively species-poor, is dominated by non-native species, and has low botanical interest.

This habitat type was not identified in 2018 as noted above and the increase in area arises from natural succession/natural processes.

8.3.5.40 Scattered trees and parkland (WD5)

This habitat category includes areas of scattered trees, standing alone or in small clusters, cover less than 30% of the total area under consideration but are a prominent structural or visual feature of the habitat. This usually occurs in areas of cultivated grassland, particularly amenity areas, parklands or parks which originate from former planting and landscaping, the proportion of non-native trees is typically high.

Although present in areas adjacent to the Assessment Boundary, there are no areas of WD5 within the ZoI of the Project.

Scattered trees and parkland is valued as being of Local Importance (Lower Value). It is a modified woodland type that contains a large composition of non-native and naturalised species, but nonetheless has some botanical interest.

Since the 2018 EIAR there has been a very slight decrease in the area of this habitat arising from succession. Refer to Figures 8.20.1 to 8.20.15 for locations of habitat changes.

8.3.5.41 Hedgerows (WL1)

Along the western part of the study area, hedgerow features not associated with residential properties are scarce as most field boundaries are stone walls or form the edge of larger scrub patches. Many of the hedgerows recorded are overgrown stone walls dominated by Rubus fruticosus agg. The hedgerows here are generally quite species-poor. Typical species include Prunus spinosa, Crataegus monogyna, Fraxinus excelsior, Rubus fruticosus agg., Urtica dioica, Hedera helix, Calystegia sepium, Pteridium aquilinum, Lonicera periclymenum, Epilobium hirsutum, Filipendula ulmaria, Germanium robertianum and Phyllitis scolopendrium.

Hedgerows are much more abundant along the eastern part of the study area and include some older more mature hedges. Hedgerows here are often associated with stone walls and where associated with agricultural fields are often dominated by Rubus fruticosus agg. Crataegus monogyna, Prunus spinosa, Hedera helix and Rubus fruticosus agg. are the most abundant hedgerow species. Other common species include Ilex aquifolium, Fraxinus excelsior, Salix cinerea, Corylus avellana, Urtica dioica, Calystegia sepium, Lonicera periclymenum, Pteridium aquilinum, Lathyrus pratensis and Rosa canina; and Sorbus aria, Viburnum opulus, Euonymus europaeus, Salix caprea and Quercus robur are occasional.

Hedgerows (WL1) are valued as being of Local Importance (Higher Value). They vary substantially in their composition but are often the only remnant woodland feature in many landscapes.

Since the 2018 EIAR there has been a decrease in the area of this habitat arising from development and land use change. Refer to Figures 8.20.1 to 8.20.15 for locations of habitat changes.

8.3.5.42 Treelines (WL2)

Along the western part of the study area, treelines are generally scarce and where present the majority are associated with planting along residential property boundaries. Tree species include Fraxinus excelsior, Acer pseudoplatanus, Alnus glutinosa, Alnus cordata, Populus sp., Cupressus sp., Pinus sp. (including Pinus contorta), Picea sitchensis, Sorbus aucuparia and Fagus sylvatica.

Treelines are also present along the eastern part of the study area but much less frequently, as most field boundaries consist of stone walls or hedgerows.

Treelines (WL2) are valued as being of Local Importance (Higher Value). They vary substantially in their composition but are generally the only remnant woodland feature in many landscapes. The total area of WL2 habitat within the Assessment Boundary identified in 2023 was 6.95ha.

Treelines (WL2) are valued as being of Local Importance (Higher Value). As for Hedgerows (WL1) they vary substantially in their composition but are often the only remnant woodland feature in many landscapes.

Since the 2018 EIAR there has been a decrease in the area of this habitat arising from development and land use change. Refer to Figures 8.20.1 to 8.20.15 for locations of habitat changes.

8.3.5.43 Oak-ash-hazel woodland (WN2)

The majority of oak-ash-hazel woodland is located along the eastern part of the study area, with the most extensive area present between the River Corrib and Lackagh Quarry and large areas also located adjacent to and outside of the footprint of the proposed N6 GCRR (Ch. 13+200 – Ch. 13+900), south of the Roadstone Quarry. Many woodland blocks are small and isolated outside of these areas with only a few patches of oak-ash-hazel woodland (WN2) present along the western part of the study area, including areas of amenity planting at the UoG Sporting Campus.

Along with Fraxinus excelsior and Corylus avellana, woody species present in these woodlands include Euonymus europaeus, Crataegus monogyna, Prunus spinosa, Ilex aquifolium, Sorbus aria agg., Sorbus aucuparia, Quercus robur, Populus tremula, Hedera helix, Lonicera periclymenum, and Rubus fruticosus agg. The field layer contained species such as Fragaria vesca, Circaea lutetiana, Geranium robertianum, Potentilla sterilis, Sesleria caerulea, Primula vulgaris, Geum urbanum, Rumex sanguineus, Viola spp., Phyllitis scolopendrium and Arum maculatum.

In some instances, most notably in the Menlough area, oak-ash-hazel (WN2) woodland corresponds to the wooded variant of the priority Annex I habitat Limestone pavement [*8240] (refer to Table 8.15 below for locations of this habitat). In the Wooded limestone pavement [*8240] habitats, soil is generally present but thin (< 2cm deep) and variable in depth). Rocks are sometimes completely covered by bryophytes such as Eurhynchium striatum, Neckera crispa and Thamnobryum alopecurum, but soil is typically lacking or very thin underneath the moss growth. These areas often occur in mosaic with non-Annex I WN2 woodland.

Oak-ash-hazel woodland (WN2) – Wooded limestone pavement [*8240] is valued as International Importance as it is a priority Annex I habitat, meaning the habitat is in danger of disappearance, and as its status in Ireland is ‘Inadequate’ (NPWS, 2019) arising from ongoing habitat loss pressures.

Oak-ash-hazel woodland (WN2) – non annex variants are valued as being of Local Importance (Higher Value). Woodland habitats are relatively rare in Ireland, and this habitat type is relatively species-rich.

The Wooded limestone pavement habitat [*8240] within the ZoI of the Project is summarised below in Table 8.15.

Since the 2018 EIAR there has been a decrease in the area of this habitat arising from clearance and from succession to other woodland types. Refer to Figures 8.20.1 to 8.20.15 for locations of habitat changes.

Table 8.15 Areas of the Wooded Variant of the Annex I Habitat Wooded Limestone Pavement [*8240] within the Potential ZoI of the Project

Area	Vegetation Community[52]
Menlough between Ch. 9+840 and Ch. 9+900 of the proposed N6 GCRR	LPW_2b Fraxinus excelsior - Plagiomnium undulatum woodland
Menlough at Ch. 9+975 of the proposed N6 GCRR	LPW_2a Corylus avellana - Ctenidium molluscum low woodland
Within Lough Corrib SAC Adjacent to the proposed Project between Ch. 9+950 and Ch. 10+050 of the proposed N6 GCRR	LPW_2a Corylus avellana - Ctenidium molluscum low woodland
South of Bóthar Nua at Ch. 10+100 of the proposed N6 GCRR	LPW_2a Corylus avellana - Ctenidium molluscum low woodland
Bóthar Nua to Seanbóthar between Ch. 10+150 and Ch. 10+500 of the proposed N6 GCRR	LPW_2b Fraxinus excelsior - Plagiomnium undulatum woodland
Within Lough Corrib SAC Along the proposed development boundary to the west and north of Lackagh Quarry between Ch. 10+800 and Ch. 11+800 of the proposed N6 GCRR	LPW_2a Corylus avellana - Ctenidium molluscum low woodland LPW_2b Fraxinus excelsior - Plagiomnium undulatum woodland

[52] The vegetation communities are assigned based upon the plant species recorded and with reference to the vegetation types described in *National survey of limestone pavement and associated habitats in Ireland. Irish Wildlife Manuals, No. 73* (Wilson, S. and Fernández, F., 2013)

Area	Vegetation Community[52]
Within/adjacent to the proposed Project between Ch. 13+200 and Ch. 13+550 of the proposed N6 GCRR	LPW_2b Fraxinus excelsior - Plagiomnium undulatum woodland
Adjacent to the proposed development boundary between Ch. 13+800 and Ch. 13+875 of the proposed N6 GCRR	LPW_2a Corylus avellana - Ctenidium molluscum low woodland
Coolagh Junction between Ch. 15+900 and Ch. 16+250 of the proposed N6 GCRR	LPW_2a Corylus avellana - Ctenidium molluscum low woodland

8.3.5.44 (Mixed) conifer woodland (WD3)

At the Troscaigh Road L5387 (Ch. 1+550 – Ch. 1+600 of the proposed N6 GCRR) there is a small stand of Pinus sp. and Cupressus sp. mixed conifer woodland; Rhododendron ponticum, a non-native invasive plant species listed on the Third Schedule of the European Communities (Birds and Natural Habitats) Regulations, 2011, is also present here.

In a field south of the N59 Moycullen Road (Ch. 8+500 of the proposed N6 GCRR) there is a small mixed Picea sp. conifer stand. It is a modified woodland type that contains a large composition of non-native and naturalised species, but nonetheless has some botanical interest.

(Mixed) conifer woodland (WD3) is valued as being of Local Importance (Higher Value) as it is a modified woodland type with many naturalised and exotic species in the canopy, but which nonetheless is relatively uncommon in the locality and nationally, and which supports a diversity of native species.

Since the 2018 EIAR there has been a slight increase in the area of this habitat arising from succession. Refer to Figures 8.20.1 to 8.20.15 for locations of habitat changes.

8.3.5.45 Wet willow-alder-ash woodland (WN6)

Along the western bank of the River Corrib at the UoG Sporting Campus (Ch. 9+275 of the proposed N6 GCRR) there is a narrow linear band of Salix cinerea wet woodland (WN6-3c Alnus glutinosa – Filipendula ulmaria group, Salix cinerea – Equisetum fluviatile vegetation type). Rubus fruticosus agg. and Centaurea nigra are also prominent species in this section of woodland. This area of woodland does not correspond with the priority Annex I habitat type Alluvial woodland [*91E0]. This is distinct from the large area of wet woodland (WN6_3e Alnus glutinosa – Filipendula ulmaria group, Betula pubescens – Mentha aquatica vegetation type) further downstream which corresponds with the priority Annex I habitat type Alluvial woodland [*91E0].

A small patch of Salix cinerea wet woodland (WN6-3c Alnus glutinosa – Filipendula ulmaria group, Salix cinerea – Equisetum fluviatile vegetation type) is present within the footprint of the proposed N6 GCRR at Ch. 9+850 – Ch. 9+900; and immediately adjacent to the boundary of Lough Corrib SAC. The woodland here corresponds with Alluvial woodland [*91E0]. The woodland is dominated by Salix cinerea subsp. oleifolia, with Fraxinus excelsior, Agrostis stolonifera, Rubus fruticosus agg., Filipendula ulmaria and Eurhynchium striatum recorded frequently. Other species present included: Juncus effusus, Hedera helix, Lythrum salicaria, Galium palustre, Geranium robertianum, Crataegus monogyna, Prunus spinosa, Galium aparine, Rumex sanguineus, Equisetum fluviatile, Epilobium hirsutum, Corylus avellana, Ranunculus repens and the moss species Calliergonella cuspidatum, Eurhynchium striatum, Kindbergia praelonga and Thamnobryum alopecurum.

Wet willow-alder-ash woodland (WN6) – Alluvial woodland [*91E0] is valued as international importance, as it is a priority Annex I habitat and in danger of disappearance. The habitat type in Ireland tends to present itself as very small stands or patches of woodland that are fragmented from one another, and its national area is very small. Its conservation status in Ireland is ‘Bad’ with a declining trend (NPWS, 2019).

Wet willow -alder-ash woodland (WN6) – Non-annex variants are valued as Local Importance (Higher Value) as woodland habitats are relatively scarce in Ireland and as the examples are relatively species-rich and natural in terms of their species assemblages.

The Alluvial woodland [*91E0] habitat within the ZoI of the Project is summarised below in Table 8.16.

Since the 2018 EIAR there has been a small increase in the area of this habitat largely arising from changes to species composition and succession. Refer to Figures 8.20.1 to 8.20.15 for locations of habitat changes.

Table 8.16 Areas of the Annex I Habitat Residual Alluvial Forests [*91E0] within the Potential ZoI of the Project

Area	Vegetation Community[53]
Downstream of the proposed N6 GCRR on west bank of River Corrib Ch. 9+250 – just outside the south-eastern edge of the Assessment Boundary	WN6-3c Alnus glutinosa – Filipendula ulmaria group, Salix cinerea – Equisetum fluviatile vegetation type
Adjacent to the proposed N6 GCRR between Ch. 9+800 and Ch. 9+900	WN6-3c Alnus glutinosa – Filipendula ulmaria group, Salix cinerea – Equisetum fluviatile vegetation type

8.3.5.46 Immature woodland (WS2)

There was one area of young planted Alnus glutinosa woodland near the Boleybeg Bóithrín (Ch. 4+650 of the proposed N6 GCRR) that corresponds to this habitat type.

Immature Woodland (WS2) is valued as being of Local Importance (Higher Value).

Since the 2018 EIAR there has been a decrease in the area of this habitat arising largely from clearance. Refer to Figures 8.20.1 to 8.20.15 for locations of habitat changes.

8.3.5.47 Ornamental/non-native shrub (WS3)

There was one area of recently felled Corylus avellana woodland in close proximity to the proposed N6 GCRR at Ballindooley (Ch. 12+450 to Ch. 12+500) and within the footprint of the proposed N6 GCRR in Menlo at Ch. 9+750 to Ch. 9+850. The former corresponds to the priority Annex I habitat Wooded limestone pavement [*8240], while the latter does not.

Recently-felled woodland (WS5) – Limestone pavement [*8240] is valued as International Importance as it is a priority Annex I habitat, meaning the habitat is in danger of disappearance, and as its status in Ireland is 'Inadequate' (NPWS, 2019) arising from ongoing habitat loss pressures. Recently-felled woodland (WS5) – non-annex variants are of Local Importance (Higher Value).

Since the 2018 EIAR there has been an increase in the area of this habitat arising largely from land clearance. Refer to Figures 8.20.1 to 8.20.15 for locations of habitat changes.

8.3.5.48 Recently-felled woodland (WS5)

There was one area of recently felled Corylus avellana woodland in close proximity to the proposed N6 GCRR at Ballindooley (Ch. 12+450 to Ch. 12+500) and within the footprint of the proposed N6 GCRR in Menlo at Ch. 9+750 to Ch. 9+850. The former corresponds to the priority Annex I habitat Wooded limestone pavement [*8240], while the latter does not.

Recently-felled woodland (WS5) – Limestone pavement [*8240] is valued as International Importance as it is a priority Annex I habitat, meaning the habitat is in danger of disappearance, and as its status in Ireland is 'Inadequate' (NPWS, 2019) arising from ongoing habitat loss pressures. Recently-felled woodland (WS5) – non-annex variants are of local importance (higher value).

Since the 2018 EIAR there has been an increase in the area of this habitat arising largely from land clearance. Refer to Figures 8.20.1 to 8.20.15 for locations of habitat changes.

[53] The vegetation communities are assigned based upon the plant species recorded and with reference to the vegetation types described in *Results of monitoring survey of old sessile oak woods and alluvial forests. Irish Wildlife Manuals, No. 71* (O'Neill, F.H. & Barron, S.J., 2013)

8.3.5.49 Clusters of important habitats

Appendix 4 of ABP's Inspectors Report dated 22 June 2021 identifies clusters of important habitats within the Assessment Boundary, as higher value habitat parcels along the route of the proposed N6 GCRR are generally small, clustered and intermixed, sometimes with apparently lower value habitats, forming a mosaic which together have a value potentially greater than each parcel individually. These habitat parcels were grouped into 12 clusters that are located geographically from west to east, and each was evaluated in accordance with TII guidance. They are described as follows within ABP's Inspectors Report dated 22 June 2021:

- *"Cluster 1 Forramoyle (Ch. 0+000 to Ch. 1+6001 of the proposed N6 GCRR) mixed area of 4010/HH3 dry heath, 4030/HH1 wet heath, *7130/PB3 lowland active peat bog, GS3 acid grassland, GS4 wet grassland, WS1 scrub and HD1 bracken, includes Sruthan na Libeirti (a stream), extends eastwards from Knockhagteana to the Troscaigh Road L5387 to, south to Bearna and northwards where it connects directly with Moycullen Bogs. It is likely to be of county value.*

- *Cluster 2 Troscaigh (Ch. 1+600 to Ch. 2+800 of the proposed N6 GCRR), large areas of 4010 HH3 wet heath, 4030/HH1 dry heath *7130/PB3 active lowland blanket bog with WS1 scrub, GS4 wet grassland and HD1 bracken, it is a continuation of Cluster 1 extending from Troscaigh Road L5387 eastwards to Trusky East (Bearna to Moycullen Road). This area is of at least national value as it supports three rare types of plants.*

- *Cluster 3 Cloughscoltia (Ch. 2+800 to Ch. 4+400 of the proposed N6 GCRR, partly within unnamed Local Biodiversity Area (LBA), but mostly outside the Galway City area), large areas of GS4 wet grassland including 6410 Molinia meadows, with areas of 4010/HH3 wet heath, 4030/HH1 dry heath and WS1 scrub, with some HD1 bracken. The Trusky and Bearna Streams pass through this area from north to south. The area extends from Trusky East (Bearna to Moycullen Road) to the Cappagh Road i.e, it is a continuation of Cluster 2. It is likely to be of county value.*

- *Cluster 4 Cappagh Road to Ballymoneen Road (Ch. 4+400 to Ch. 5+600 of the proposed N6 GCRR, appears to be part of the Cappagh – Ballymoneen LBA), comprising comparatively large areas of 4010/HH3 wet heath, *7130/PB3 active lowland blanket bog and HD1bracken, plus smaller areas of 4030/HH1 dry heath, WS1 scrub, GS4 wet grassland and 6410 Molinia meadows on peatysoils (Molinion caeruleae), plus the Tonabrocky Stream. This area extends southwards to developed residential land and northwards to Boleybeg East/Rahoon Road (with apparently similar habitats beyond). Active lowland blanket bog in particular is a high value habitat, which along with wet heath could be considered irreplaceable, making this one of the most important areas of base-poor habitats within the Galway City area, although more extensive areas occur outside the city area boundary (it is basically an extension of Moycullen Bog). This area is of at least county value.*

- *Cluster 5 East of Ballymoonen Road (Ch. 5+750 to Ch. 5+950 of the proposed N6 GCRR, part within an unnamed LBA 2), mostly WS1 scrub with GS4 wet grassland, and towards the south patches of 4030/HH1 dry heath, 4010/HH3 wet heath, GS3 acid grassland, GS4 wet grassland and bracken, located between the Ballymoonen Road and Keeraun Bothrin extending southwards to developed land (Ard Fraoigh) of Galway City, it is relatively isolated from areas of similar habitats by residential developments and roads. This area is likely to be of county value, although it does include wet heath which is regarded as an irreplaceable habitat.*

- *Cluster 6 Knocknabrona/Knocknafrosca (Ch. 7+700 to Ch. 8+300 of the proposed N6 GCRR, included in the Ballagh – Barnacranny Hill LBA), mainly the Molinia dominated variety of GS4 wet grassland, and WS1 scrub, plus smaller areas of 4030 European dry heaths/HH1 dry siliceous heath, GS3 dry-humid acid grassland, GS2 dry meadows (and grassy verges), PF2 poor fen and flush and HD1 dense bracken. It extends from an area of improved grassland east of the Letteragh Road north eastwards to the southwestern edge of the developments along the N59 Moycullen Road, and westwards as far as Moycullen Bogs NHA. This area is likely to be of county value.*

- *Cluster 7 Menlough (Ch. 9+600 to Ch. 10+450 of the proposed N6 GCRR, included in the Menlough LBA), in contrast to Clusters 1 to 6, the Menlough area is base-rich and therefore supports a completely different set of habitats and flora, with *8240 Limestone pavement mostly wooded with WN2 oak-ash-hazel woodland, plus a small *3180/FL6 turlough, *6210 calcareous grassland, GS1 calcareous*

grassland, WS1 scrub and WD1 mixed broadleaved woodland, from the River Corrib to Monument Road excluding land within the Lough Corrib SAC, The eastern part of this area includes the same habitats as within the Lough Corrib SAC although the limestone pavement is a little more wooded, there is no clear reason why this area was excluded from the SAC. It provides a link between two parts of the SAC and supports three priority Annex I habitats of the same type and quality as included in the SAC, it is therefore likely to be of international value.

- *Cluster 8 Lackagh (Ch. 11+800 to Ch. 12+100 of the proposed N6 GCRR, included in unnamed LBA 3) another area of *8240 Limestone pavement including wooded with WN2 oak-ash-hazel woodland, interspersed with *6210 Semi-natural dry grasslands and scrubland facies on calcareous substrates (Festuco-Brometalia) with orchids, WS1 scrub and GS1 calcareous grassland, to the east of Lackagh Quarry and west of the N84. This area is probably of county value.*

- *Cluster 9 Ballindooley Lough and surrounding land (Ch. 12+300 to Ch. 12+500 of the proposed N6 GCRR, included in the Ballindooley – Castlegar LBA), comprising the Lough 3140 Hard oligomesotrophic waters with benthic vegetation of Chara spp /FL3/FS1, with smaller areas of *7210 Calcareous fens with Cladium mariscus and species of the Caricion davallianae and 7230 Alkaline fens, surrounded by substantial areas of 6410 Molinia meadows on calcareous, peaty or clayey-silt laden soils (Molinion caeruleae)/GS4 , and smaller parcels of WN2 oak-ash-hazel woodland, WS5 recently felled woodland, GS2 dry meadows, ER2 exposed calcareous rock, PF1 Rich Fen and Flush and WS1 Srub, located to east of N84 and extending from the Lough southwards to Bathar an Choiste. This area is of at least national value.*

- *Cluster 10 Castlegar (Ch. 13+500 of the proposed N6 GCRR at nearest point, included in the Ballindooley - Castlegar LBA), centred on large area of *8240 Limestone pavement some wooded with WN2 oak-ash-hazel woodland, plus 6510 Lowland hay meadows and smaller areas of scrub, dry calcareous (and neutral) grassland and dry meadows (and grassy verges), stretching from the N83 Tuam Road in the east to Ballindooley Lough in the west, somewhat fragmented due to agricultural improvements and the limestone pavement is a remnant of a larger area which has been quarried. Due to the large area of exposed limestone pavement present, and unimproved lowland hay meadow, this area is probably of international value.*

- *Cluster 11 Briarhill (Ch. 15+900 to Ch. 16+300 of the proposed N6 GCRR, not included in an LBA), with a relatively equal mix of *8240 Limestone pavement, 6210 calcareous grassland, calcareous grassland, scrub, and oak-ash-hazel woodland, plus stone walls and treelines, with the cluster divided into three blocks separated by existing road infrastructure. Supports spring gentian (Gentiana verna) which is classified as Vulnerable in the Irish Red List and a rare species in northern Europe, making this area of international value.*

- *Cluster 12 Arduan (Ch. 16+950 to Ch. 17+150 of the proposed N6 GCRR, not included in an LBA) a mix of 6210 calcareous grassland, GS1 calcareous grassland and WS1 scrub, to the east of Cluster 2 alongside and south of existing N6, likely to be of county value.*

The total area of high value semi-natural habitats, mostly within the 12 clusters described above within the Assessment Boundary is approximately 135ha, which is just under half of the total land within the Assessment Boundary. Outside of the clusters described above, the land is generally more improved for agriculture and in some parts e.g. around Galway Racecourse is more sub-urban in character. Patches of semi-natural habitats are present but, due to small size and isolation, these are not as valuable as the those included in the clusters."

Within the Assessment Boundary, these habitat clusters contain a mixture of higher value habitats, intermixed with lower value habitats. Clusters 1-6 lie in the western section of the Assessment Boundary and are underlain by granite bedrock and are this characterised by acid habitats including peatland habitat mosaics. By contrast, clusters 7-12 lie to the east of the River Corrib and are underlain by limestone and thus are characterised by calcareous habitat mosaics. These habitat clusters are described (west to east) as follows:

- Cluster 1 Forramoyle (Ch. 0+000 to Ch. 1+600 of the proposed N6 GCRR) encompasses a mixed area of 4030/HH3 dry heath, 4010/HH1 wet heath, *7130/PB3 lowland active peat bog, with a small area of 6410/GS4 *Molinia* meadows. Non-annex GS4 wet grassland, GS3 acid grassland, WS1 scrub and HD1 bracken, and the Sruthán na Libeirtí Stream occur within this cluster as described within ABP's Inspectors Report dated 22 June 2021. Additional habitats occurring within this habitat cluster include PF2 poor fen and flush, GM1 marsh, GS1 neutral-calcareous grassland, GS2 dry meadows and grassy verges, WD1 mixed broadleaved woodland and WD4 conifer plantation as well as linear habitat features WL1 hedgerows, WL2 treelines and BL1 stone walls. These areas of higher value habitat clusters are intermixed with habitats of lower biodiversity value: BL3 buildings and artificial surfaces, ED2 spoil and bare ground, ED3 recolonising bare ground, ER1 exposed siliceous rock, GA1 improved agricultural grassland, GA2 improved amenity grassland, WS3 ornamental/non-native shrubs and Residential areas. Each individual habitat is described and valued as per Section 8.3.5 above. This habitat cluster supports two species the ecological inspector appointed by An Bord Pleanála included within their report dated 22 June 2021: Imbricate bog-moss *Sphagnum affine* (in relevé EC12_R2) and Red bog-moss *Sphagnum capillifolium* subsp. *capillifolium* (now referrable to *Sphagnum capillifolium*)[54] (in relevé 735_R1). These species are described in Section 8.3.6 below. This cluster has connectivity to a more extensive network of peatland habitats that lies outside of the Assessment Boundary, with Moycullen Bogs NHA occurring to the north of this cluster.

- Cluster 2 Troscaigh (Ch. 1+600 to Ch. 2+800 of the proposed N6 GCRR) is a continuation of Cluster 1 and contains a similar range of habitats. There is a cluster of a number of small patches of 4010/HH3 wet heath and 4030/HH1 dry heath between Ch. 1+900 and Ch. 2+400 of the proposed N6 GCRR which occur within a larger mosaic of higher value habitats: GS4 wet grassland, GS3 acid grassland, PF2 poor fen and flush and WS1 scrub. Other habitats that occur within this cluster are GS1 neutral-calcareous grassland, GS2 dry meadows and grassy verges, HD1 dense bracken, WD2 mixed broadleaved/conifer woodland and WD3 conifer woodland as well as the linear habitat feature BL1 stone walls. Similarly to Cluster 1, BL3 buildings and artificial surfaces, ED2 spoil and bare ground, ED3 recolonising bare ground, GA1 improved agricultural grassland, GA2 improved amenity grassland and Residential areas all occur within Cluster 2. Each individual habitat is described and valued as per Section 8.3.5 above. This cluster has connectivity to a more extensive network of peatland habitats that lies outside of the assessment boundary directly north of the section between Ch. 1+750 and Ch. 2+400 of the proposed N6 GCRR.

- Cluster 3 Cloughscoltia (Ch. 2+800 to Ch. 4+400 of the proposed N6 GCRR) continues from Cluster 2. This area lies to the north of the Rusheen Bay – Barrna Woods – Illaunafamona Local Biodiversity Area (LBA). Similarly to the adjacent previous areas, Cluster 3 contains 4010/HH3 wet heath, 4030/HH1 dry heath and 6410 *Molinia* meadow habitats. Other habitats that occur in this cluster are GS4 wet grassland, GS3 acid grassland, GS1 neutral-calcareous grassland, GM1 marsh, ER1 exposed siliceous rock, PF1 rich fen and flush, PF2 poor fen and flush, HD1 dense bracken, WD1 mixed broadleaved woodland, WS1 scrub, WL1 hedgerows, WL2 treelines and BL1 stone walls. The Trusky and Bearna Streams (FW1) pass through this area from north to south. BL3 buildings and artificial surfaces, ED2 spoil and bare ground, ED3 recolonising bare ground, GA1 improved agricultural grassland, GA2 improved amenity grassland and Residential areas also occur within Cluster 3. Each individual habitat is described and valued as per Section 8.3.5 above. This habitat cluster supports one species the ecological inspector appointed by An Bord Pleanála included within their report dated 22 June 2021: Woodsy thyme moss *Plagiomnium cuspidatum* (in relevés 2680_R1 and 2527_R1). This species is described in Section 8.3.6 below. This cluster lies to the south of a more extensive network of peatland habitats outside of the assessment boundary in the Lough Inch and Aille townlands, and north of a smaller cluster of peatland habitats outside the Assessment Boundary.

- Cluster 4 Cappagh Road to Ballymoneen Road (Ch. 4+400 to Ch. 5+600 of the proposed N6 GCRR) is a continuation of Clusters 1 – 3 and lies within the Cappagh – Ballymoneen LBA. This area contains the Tonabrocky Stream and 4010/HH3 wet heath, 4030/HH1 dry heath, GS1 neutral-calcareous grassland, GS2 dry meadows and grassy verges, GS4 wet grassland, HD1 dense bracken, WD2 mixed

[54] *Sphagnum capillifolium* subsp. *capillifolium* is now referrable to *Sphagnum capillifolium,* and will be referred to by its updated species name for the remainder of the document.

broadleaved/conifer woodland, WN2 oak-ash-hazel woodland and WS1 scrub habitats. Linear habitat features WL1 hedgerows, WL2 treelines, FW4 drainage ditches and BL1 stone walls all occur within this cluster. BL3 buildings and artificial surfaces, ED3 recolonising bare ground, GA1 improved agricultural grassland and Residential areas are habitats of lower biodiversity value that occur within Cluster 4. Each individual habitat is described and valued as per Section 8.3.5 above. This habitat cluster supports one species the ecological inspector appointed by An Bord Pleanála included within their report dated 22 June 2021: Downy oat-grass *Helictotrichon pubescens* (in relevés 5890_R7, 5884_R1, 1201_R1, 2447_R2, 2458_R1 and 2458_R3; This species is now referrable to *Avenula pubescens*). This species is described in Section 8.3.6 below. This cluster lies to the south of a more extensive network of peatland habitats outside of the Assessment Boundary bounded by the Cappagh and Ballymoneen roads.

- Cluster 5 East of Ballymoneen Road (Ch. 5+750 to Ch. 5+950 of the proposed N6 GCRR) is a small cluster that lies directly east of Cluster 4 and contains the habitats GS3 acid grassland, GS2 dry meadows and grassy verges, GS4 wet grassland, WS1 scrub, ER1 exposed siliceous rock, FW4 drainage ditches, WL2 treelines and BL1 stone walls, as well as BL3 buildings and artificial surfaces, ED2 spoil and bare ground, ED3 recolonising bare ground, and Residential areas. Small fragments of 4030/HH1 dry heath and 4010/HH3 wet heath lie to the north and south of this cluster, outside of the Assessment Boundary. Each individual habitat is described and valued as per Section 8.3.5 above.

- Cluster 6 Knocknabrona/Knocknafrosca (Ch. 7+700 to Ch. 8+300 of the proposed N6 GCRR) contains a both 4010/HH3 wet heath and 4030/HH1 dry heath habitats, and is within the Ballagh – Barnacranny Hill LBA.Other habitats present include PF2 poor fen and flush, GS3 acid grassland, GS4 wet grassland, GS2 dry meadows and grassy verges, HD1 dense bracken, WS1 scrub, BL1 stone walls, WL1 hedgerows, WL2 treelines and FW4 drainage ditches. BL3 buildings and artificial surfaces, GA1 improved agricultural grassland, GA2 amenity grassland and Residential areas also occur in this cluster. Each individual habitat is described and valued as per Section 8.3.5 above. This habitat cluster supports one species the ecological inspector appointed by An Bord Pleanála included within their report dated 22 June 2021: Downy oat-grass *Avenula pubescens* (in relevé 4733_R1). This species is described in Section 8.3.6 below. This cluster lies directly to the east of the section of Moycullen bogs NHA that lies between Letteragh road and Bushypark lawns, and thus is connected to a larger area of peatland habitat outside of the Assessment Boundary.

- Cluster 7 Menlough (Ch. 9+600 to Ch. 10+450 of the proposed N6 GCRR) occurs east of the River Corrib, and is underlain by limestone bedrock, and thus supports a different habitat assemblage. This cluster lies within the Menlough-Coolough LBA but excludes habitats within the adjacent Lough Corrib SAC. This cluster contains both the wooded and exposed limestone variants of the priority Annex I habitat *8240 limestone pavement, as well as a small *3180 turlough (at Ch. 10+300) and a section of residual alluvial woodland *91E0 (between Ch. 9+850 and Ch. 9+900 of the proposed N6 GCRR). The Annex I habitat 6210 calcareous grassland occurs in a mosaic with *8240 limestone pavement, but the priority variant of this habitat (i.e. *6210 orchid-rich calcareous grassland) does not occur in this cluster. Other habitats that occur within this cluster include the Non-Annex GS1 calcareous grassland, GS2 dry meadows and grassy verges, GS4 wet grassland, HD1 dense bracken, WD1 mixed broadleaved woodland, WN2 oak-ash-hazel, WS5 recently-felled woodland. Other habitats present in this cluster include FW4 drainage ditches, BL1 stone walls, WL1 hedgerows, WL2 treelines, GA1 improved agricultural grassland and Residential areas. Each individual habitat is described and valued as per Section 8.3.5 above. This habitat cluster supports one species the ecological inspector appointed by An Bord Pleanála included within their report dated 22 June 2021: Lesser striated feathermoss *Plasteurhynchium striatulum*, (in relevés 4422_R1, 5507_R1 and 3790b_R1). This species is described in Section 8.3.6 below. This habitat cluster is bounded by Lough Corrib SAC to the south, southeast and north, and has connectivity to larger areas of *8240 limestone pavement and associated habitats.

- Cluster 8 Lackagh (Ch. 11+800 to Ch. 12+100 of the proposed N6 GCRR) lies to the east of Lackagh Quarry, and lies along the eastern edge of the Menlough-Coolough LBA as defined by the Galway City Development Plan 2023-2029 and Natura Environmental Consultants (2005)[55]. This cluster is relatively small and contains an area of 6210/GS1 calcareous grassland (at Ch. 12+100 of the proposed N6 GCRR). Other habitats present include GS1 calcareous grassland, GS2 dry meadows and grassy verges, WN2 oak-ash-hazel woodland, WS1 scrub, WL1 hedgerows, as well as BL3 buildings and artificial surfaces and Residential areas. Each individual habitat is described and valued as per Section 8.3.5 above. Small clusters of *8240 Limestone pavement and *6210 orchid-rich calcareous grassland occur to the north and south of this cluster outside of the Assessment Boundary.

- Cluster 9 Ballindooley Lough and surrounding land (Ch. 12+300 to Ch. 12+500 of the proposed N6 GCRR) partially overlaps the Ballindooley – Castlegar LBA. This cluster contains an area of 6410/GS4 *Molinia* meadow habitat at the south of the Ballindooley Lough wetland complex, as well as PF1 rich fen and flush, FS1 reed and large sedge swamp and FL5 eutrophic lakes. This area also contains WN2 oak-ash-hazel woodland, WS1 scrub, WL1 hedgerows and WL2 treelines, as well as GA1 improved agricultural grassland and BL3 built land and artificial surfaces. Each individual habitat is described and valued as per Section 8.3.5 above. Outside of the Assessment Boundary, to the north of this habitat cluster, Ballindooley Lough complex contains 6410/GS4 *Molinia* meadow, 7230/PF1 alkaline fen, *7210/FS1 *Cladium* fen, *91E0/WN6 alluvial woodland, and Ballindooley Lough: 3410 hard water lakes. A small area of *8240/ER2 limestone pavement, non-Annex ER2 exposed calcareous rock, GS1 calcareous grassland, GS2 dry meadows, and WS1 Scrub are located to the south of the Assessment Boundary below this cluster.

- Cluster 10 Castlegar (Ch. 13+500 of the proposed N6 GCRR) as described by ABP's Inspectors Report dated 22 June 2021 lies completely outside of the Assessment Boundary. Within the Assessment Boundary, the habitats GA1 improved agricultural grassland and WL1 hedgerows are present. These habitats are described and valued as per Section 8.3.5 above. The area to the north of this section of the Assessment Boundary is within the Ballindooley - Castlegar LBA and contains a large area of *8240 Limestone pavement, some of which is wooded with WN2 oak-ash-hazel woodland. To the north, at Polkeen, there are areas of 6510 Lowland hay meadows. Smaller areas of WS1 scrub, GS1 dry calcareous (and neutral) grassland and GS2 dry meadows (and grassy verges) habitats stretch from the N83 Tuam Road in the east to Ballindooley Lough in the west.

- Cluster 11 Briarhill (Ch. 15+900 to Ch. 16+300 of the proposed N6 GCRR) contains mosaics of the wooded (WN2 oak-ash -hazel woodland) and exposed limestone pavement (ER2 exposed calcareous rock) variants of the priority Annex I habitat exposed limestone pavement *8240. Other habitats within this cluster are BL1 stone walls, GS1 calcareous grassland, GS2 dry meadows and grassy verges, HD1 dense bracken, WL1 hedgerows, WL2 treelines, WD1 mixed broadleaved woodland, WN2 oak-ash-hazel woodland and WS1 scrub. The areas of GS1 calcareous grassland is not considered to be of Annex quality due to the high cover of scrub and bracken, and a lack of sufficient indicator species. BL3 built land and artificial surfaces, ED3 recolonising bare ground, GA1 improved agricultural grassland and GA2 improved amenity grassland are also present. These habitats are described and valued as per Section 8.3.5 above. This area partially overlaps with the Doughishka LBA. This habitat cluster was described as supporting spring gentian (*Gentiana verna*) by ABP's Inspectors Report dated 22 June 2021. However, the closest records of this species occurs in two relevés (EC56 R1 and EC56 R2) which lie outside of the Assessment Boundary (see Section 8.3.6 below), c.200m southeast of this habitat cluster. These records lie to the northwest and southeast of the existing Coolagh Roundabout.

- Cluster 12 Ardaun (Ch. 16+950 to Ch. 17+150 of the proposed N6 GCRR) partially overlaps with Doughishka LBA. This cluster contains GS1 calcareous grassland, GS2 dry meadows and grassy verges (some of which occurs in a mosaic with ER2 exposed calcareous rock), WS1 scrub (some of which occurs in a mosaic with HD1 dense bracken), BL1 stone walls, WL1 hedgerows and WL2 treelines. The habitats GA1 improved agricultural grassland and BL3 built land and artificial surfaces also occur within this cluster. These habitats are described and valued as per Section 8.3.5 above. The Annex I habitats

[55] https://www.galwaycity.ie/development-plan-2023-2029

Natura Environmental Consultants. (2005) Galway City Habitat Inventory. Galway City Council.

*6210/GS1 orchid-rich calcareous grassland and 6210/GS1 calcareous grassland occur to the south of this habitat cluster outside of the Assessment Boundary.

8.3.6 Rare and protected plant species

Slender cottongrass *Eriophorum gracile* is the only protected plant species recorded and presented in the 2018 EIAR and this is unchanged in the results of the surveys from 2023 and the information presented in this updated EIAR. It is present 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 for the species. Neither location is within the ZoI of the Project.

The Small white orchid *Pseudorchis albida* was not recorded at the Doughiska site during the habitat surveys in June of 2014 and July 2023.

Both of the above species are protected under the Flora (Protection) Order, 2022.

The presence of the Flora (Protection) Order, 2022 (FPO) listed bryophyte species *Hamatocaulis vernicosus* was confirmed at Gortachalla, over 9km to the north of the Assessment Boundary. This plant species is listed on Annex II of the Habitats Directive and listed as a qualifying interest species of Lough Corrib SAC.

The ecological inspector appointed by An Bord Pleanála included four 'rare' bryophyte species listed on Ireland Red List No. 8: Bryophytes (Lockhart *et al*., 2012), and two vascular plant species listed on Ireland Red List No. 10: Vascular Plants (Wyse Jackson *et al*., 2016), within their report dated 22 June 2021, that were recorded during the 2019 surveys and are present within the Assessment Boundary (Inspector's Report, 2021). These species were not individually included in the assessment set out in the 2018 EIAR, as they are classified as either Near Threatened, Vulnerable, or Data Deficient, and it was not considered necessary to include these species. In light of the approach taken in Appendix IV of ABP's Inspector's Report dated 22 June 2021, and out of an abundance of caution, these species are now included in this updated EIAR. These species are:

- Woodsy thyme moss *Plagiomnium cuspidatum,* classified as Near Threatened was recorded in three relevés within the Assessment Boundary at; 2527_R1[56], 2354_R1, and 2680_R1 on both sides of the River Corrib, during surveys undertaken in 2019
- Lesser striated feathermoss *Plasteurhynchium striatulum*, classified as Near Threatened was recorded in six relevés during surveys in 2019 within the Assessment Boundary all east of the River Corrib; 4033_R1, 3790b_R1, 5507_R1, 3941_R1, 4422_R1, and 3857_R1
- Imbricate bog-moss *Sphagnum affine*, classified as Vulnerable, was recorded within one relevé during the surveys in 2014 within the Assessment Boundary; EC12 R2
- Red bog-moss *Sphagnum capillifolium* subsp. *Capillifolium* (now referrable to *Sphagnum capillifolium*)[57], classified as Data Deficient (i.e. expected to be added to the red list when more is known about the species), was recorded within one relevé during surveys in 2019 within the Assessment Boundary, in 735_R1

The two vascular plant species listed on Ireland Red List No. 10: Vascular Plants (Jackson *et al*., 2016) recorded within the Scheme Study Area, include:

- Spring gentian *Gentiana verna*, classified as Near Threatened, was recorded within four relevés from surveys in 2014 outside of the Assessment Boundary; BEC 142, BEC 122, EC56 R1, EC56 R2, and in one relevé within the Assessment Boundary from surveys in 2019; 3322_R1
- Brown beak-sedge *Rhynchospora fusca*, classified as Near Threatened, was only recorded outside of the Assessment Boundary within one relevé during surveys in 2014; EC25_R3

[56] The reference numbers for the listed relevés are shown on Appendix A.8.19 and associated drawings, Figure 8.2.1

[57] Originally referred to as *Sphagnum capillifolium* subsp. *capillifolium* from survey data from the 2018 EIAR and in Appendix IV of ABP's Inspector's Report dated 22 June 2021, this species will be referred to as the updated name *Sphagnum capillifolium* for the remainder of this updated EIAR.

The above six red list species were valued within Appendix 4 of ABPs' Inspector's Report dated 22 June 2021 as being of National Importance "*due to sparce records across Ireland".*

An Bord Pleanála also included three other 'rare' vascular plant species that are listed as Least Concern (Wyse Jackson *et al*., 2016) and were recorded within the Assessment Boundary during the surveys undertaken in 2019 (Appendix 4 of ABP's Inspectors Report dated 22 June 2021), and include:

- Fern grass *Catapodium rigidum*, was recorded in two relevés within the Assessment Boundary during surveys undertaken in 2019
- Eyebright *Euphrasia artica*, was recorded in nine relevés within the Assessment Boundary during surveys undertaken in 2019; in 4270_R1, 2582_R1, 2986_R1, 2794_R3, 2786_R3, 5807_R1, 5811_R1, 5810_R1, and 5810_R3
- Downy oat-grass *Helictotrichon pubescens* (now referrable to *Avenula pubescens*)[58], was recorded in 25 relevés within the Assessment Boundary during surveys undertaken in 2019; in 3088_R4, 3322_R1, 3322_R2, 3322_R3, 3322_R4, 3322_R5, 3513_R1, 3513_R2, 5283_R1, 4940_R1, 2867_R2, 4733_R1, 255_R1, 255_R2, 4551_R1, 4555_R1, 4550_R1, 2447_R2, 2458_R1, 2458_R3, 5556_R1, 3028_R1, 5884_R1, 5890_R7, 1201_R1. Two additional relevés were also noted to have this species within, 4308_R1 and 3382_R1, however both locations are outside of the Assessment Boundary

These three species were valued by ABP as being of Local Importance (higher value) *"due to being locally uncommon species",* as reported in Appendix 4 of ABP's Inspectors Report dated 22 June 2021.

Two other species that were identified during relevé surveys in 2014, Meadow oat-grass *Helictotrichion pratense* (now referrable to *Helictochloa pratensis*)[59] and Marsh valerian *Valeriana dioica*, are not listed on Irelands Red List as they are generally not thought to be present in Ireland. Meadow oat-grass was recorded in a number of relevés within the Scheme Study Area, but only recorded in one relevé within the Assessment Boundary, i.e. LQ-N84 R2. Marsh valerian was not recorded within the Assessment Boundary. As noted in Appendix 4 of ABP's Inspectors Report dated 22 June 2021 native populations of these species would be valued as being of National Importance. However, it is likely that these records were errors or non-native populations, and as such have not been assigned a valuation.

Records of all rare and legally protected plant species known from the Scheme Study Area, or recorded during the field surveys, are shown on Figure 8.2.1.

No additional rare or protected plant species were recorded during the 2023 surveys.

No other rare and protected plant species were recorded within the ZoI of the Project, and as they are not a key ecological feature, they have not been assigned a valuation, and as such are not considered in impact assessment presented in Section 8.5.

8.3.7 Non-native invasive species

Three additional non-native invasive flora species were recorded in 2023, within the survey area but outside of the Assessment boundary, the first two of which are listed on the Third Schedule of the European Communities (Birds and Natural Habitats) Regulations, 2011: three cornered garlic Allium triquetrum, Giant rhubarb Gunnera tinctoria and old man's beard Clematis vitalba.

Two additional non-native invasive fauna species were recorded in 2023: Zebra mussel *Dreissena polymorpha* and Roach *Rutilus rutilus*. Both species are listed on the Third Schedule of the European Communities (Birds and Natural Habitats) Regulations, 2011. All records of both species occur within Lough Corrib SAC. Zebra mussel *Dreissena polymorpha* occurs in the River Corrib near the location of the proposed crossing of the proposed N6 GCRR, downstream of the Project at Jordan's Island and in the Coolagh Lakes. Roach *Rutilus rutilus* occurs in the Coolagh lakes.

[58] Originally referred to as *Helictotrichon pubescens* from survey data from the 2018 EIAR and in Appendix IV of ABP's Inspector's Report 22 dated June 2021, this species will be referred to as the updated name *Avenula pubescens* for the remainder of this updated EIAR.

[59] Originally referred to as *Helictotrichon pratense* from survey data from the 2018 EIAR and in Appendix IV of ABP's Inspector's Report dated 22 June 2021, this species will be referred to as the updated name *Helictochloa pratensis* for the remainder of this updated EIAR.

There are five non-native invasive plant species listed on the Third Schedule of the European Communities (Birds and Natural Habitats) Regulations, 2011 present within the survey area. The locations of these non-native invasive plant species, and the non-native invasive fauna species are summarised below in Table 8.17 and shown on Figures 8.22.1 to 8.22.15.

Table 8.17 Summary of Non-native Invasive Species Recorded along or adjacent to the Project

Common Name (Scientific Name)	Location
Japanese knotweed* *(Reynoutria japonica)*	2023 Findings: • The nearest infestation to the Lough Corrib SAC boundary: Still present in 2023 as per the 2015-2017 surveys in woodland/scrub, between Ch. 8+800 and Ch. 8+950 of the proposed N6 GCRR at the UoG Sporting Campus, adjacent to the Assessment Boundary • Still present in 2023 as per the 2015-2017 surveys, with additional new records in area of scrub, north of Bóthar Diarmuida Junction, within and adjacent the Assessment Boundary between Ch. 1+800 and Ch. 1 + 900 along the N59 Link Road South • Still present in 2023 as per the 2015-2017 surveys along the Coolough Road, and a new record at Carraig Bán adjacent to the Assessment Boundary • Still present in 2023 as per the 2015-2017 surveys, with two additional new records in an area of rough grassland, within the Assessment Boundary between Ch. 12+200 and Ch. 12+250 of the proposed N6 GCRR at the N84 Headford Road Junction • New record identified in 2023 from along eastern side of the Troscaigh Road (L5387) at Ch. 1+575 of the proposed N6 GCRR • New record identified in 2023 in a field approximately 680 m southeast of the proposed N6 GCRR near Knocknacarra Community Centre between Ch. 4+750 and Ch. 4+950 of the proposed N6 GCRR • New record identified in 2023 between hedge and fence, *c.* 20 west of previously recorded location along Rahoon Road, 200m west of the Assessment Boundary, near Bóthar Stiofáin Junction Ch. 2+200 (N59 Link Road South) • New record identified in 2023 in residential area within the Assessment Boundary between Ch. 0+200 and Ch. 0+250 along the N59 Link Road North • New records identified in 2023 from within and just outside the Assessment Boundary near Bushypark Junction between Ch. 0+150 and Ch. 0+250 on the N59 Link Road North • New records identified in 2023 on cycle/footpath margin, and grassy verge just outside the Assessment Boundary at Lynch Junction between Ch. 15+800 and 15+850 on the proposed N6 GCRR
	2018 Findings (not confirmed during 2023, but cannot be excluded from prior locations): • Along farm track, south of proposed Bearna West Roundabout, adjacent to the proposed N6 GCRR (c. 14m outside Assessment Boundary) at Ch. 0+010 • In rough grassland field with scrub outside of Sli Geal residential estate, near Ballyburke, c.45m outside of the Assessment Boundary. Southeast of Ch. 5+275 of the proposed N6 GCRR • South of the proposed N6 GCRR. Located along minor watercourse. This watercourse is downstream of the proposed N6 GCRR but is crossed further downstream by the proposed N59 South Link Road. Adjacent to residential property located east of the proposed drainage outfall at Rahoon. Approximately 85m outside of the Assessment. Boundary Ch. 6+840 of the proposed N6 GCRR • At Rahoon Road, 180m west of the Assessment Boundary, near Bóthar Stiofáin Junction Ch. 2+200 (N59 Link Road South) • In area of recolonising bare ground within the Assessment Boundary. Ch. 8+370 of the proposed N6 GCRR • Beside an area of scrub at Ballinfoyle off the N84, approximately 30m south of the Assessment Boundary. Ch. 12+375 of the proposed N6 GCRR
Himalayan knotweed* *(Persicaria wallichii)*	2023 Findings: • Still present in 2023, but there is an increase in area since 2015-2017 surveys. Located *c.* 80m (east) and *c.* 135m (west) from the proposed N6 GCRR between Knocknafroska and the N59 Moycullen Road
	2018 Findings (not confirmed during 2023, but cannot be excluded from prior locations): • South of the proposed N6 GCRR, c.41m from the Assessment Boundary at Ch. 8+330

Common Name (Scientific Name)	Location
Rhododendron* *(Rhododendron ponticum)*	2023 Findings: • Still present in 2023 as per 2015-2017 surveys, in woodland within the proposed fenceline for the proposed N6 GCRR along eastern side of the Troscaigh Road (L5387) at Ch. 1+600
	2018 Findings (not confirmed during 2023, but cannot be excluded from prior locations): • Recorded in woodland along the eastern side of the Troscaigh Road (L5387), north of the proposed N6 GCRR (Ch. 1+580), directly adjacent to Assessment Boundary (within 3m) • South of the proposed N6 GCRR (Ch. 6+800), located along a minor watercourse. This watercourse is downstream of the mainline for the proposed N6 GCRR but is crossed further downstream by the proposed N59 South Link Road. It is adjacent to a residential property located east of the proposed drainage outfall at Rahoon. Approximately 85m outside of the Assessment Boundary
Three cornered garlic* *(Allium triquetrum)*	• Only recorded in 2023, approximately 100m due east of the proposed drainage outfall at AR 0/05 between Ch. 0+850 and Ch. 1+000 on the proposed N6 GCRR
Giant rhubarb* *(Gunnera tinctoria)*	• Only recorded in 2023 along a farm track, approximately 7m north of the proposed N6 GCRR, near Aughnaurra, at Ch. 8+200 • In field *c.* 420m southwest of the River Corrib and c.320m west of the proposed N6 GCRR, near N59 Moycullen Road, north of the Bushypark Junction
Old man's beard† *(Clematis vitalba)*	• Only recorded once in 2023, in a reedy excavated attenuation pond just north of the existing Coolagh Roundabout to west side of M6/N6 junction. c. Ch. 16 +500 on the proposed N6 GCRR)
Butterfly bush† (*Buddleia sp.*)	• Species recorded at more than 68 locations around study area and is a common species
Zebra mussel* *(Dreissena polymorpha)*	• Only recorded in 2023, in the River Corrib near the location of the proposed crossing of the proposed N6 GCRR c. Ch. 9+350 • Recorded in Coolagh Lakes (upper and lower) • Recorded *c.* 2km downstream of the project at Jordan's Island
Roach* *(Rutilus rutilus)*	• Only recorded in 2023, in Coolagh Lakes (upper and lower)

* Non-native Invasive Species Listed in the Third Schedule of the Birds and Habitats Regulations

†Identified as requiring management on road schemes by Transport Infrastructure Ireland (TII 2020a) and identified as posing a threat to Annex I habitats with European sites as recommended by the Inspector's appointed ecologist, Dr. Arnold.

8.3.8 Mammals

8.3.8.1 Otter

The distribution of otter holts and activity is consistent with that presented in the 2018 EIAR.

Otter, and their breeding and resting places, are protected under the Wildlife Acts. Otter are also listed on Annex II and Annex IV of the EU Habitats Directive.

During the respective dedicated mammal surveys in 2014 and 2023, evidence of Otter Lutra lutra activity was abundant and widespread along the River Corrib corridor and the southeastern shore of Lough Corrib. Otter were also recorded in the catchment of the Bearna Stream and the Tonabrocky Stream.

The desktop reviews undertaken to inform both the 2018 EIAR and this updated EIAR found that otter have been recorded along the River Corrib corridor between the coast and Lough Corrib, along the coastline from Bearna to Oranmore, and at Ballindooley Lough[60].

[60] At Ballindooley Lough, the mammal survey area focussed on the southern section of this wetland complex (refer to Figure 8.4.9) and Otter were not recorded in this area during the survey.

Most records were concentrated on the River Corrib and coastal areas (NPWS, EPA & NBDC data).

Aside from the River Corrib corridor, the other watercourses in the vicinity of the Project are typically small upland eroding channels which had been heavily modified (straightened and or deepened) historically, often resulting in poor quality fisheries and aquatic habitats.

One potential Otter holt and eight Otter couch sites were recorded within the surveys undertaken between 2014 and 2018. The potential holt site, and the majority of the couch sites, were recorded at Coolanillaun, along the southern shore of Lough Corrib and along the east bank of the River Corrib. Couch sites were also recorded at the Coolagh Lakes and on Jordan's Island. The status, description and distance from the Project of each of these features are provided below in Table 8.18, results of the Otter surveys are shown on Figures 8.5.1 to 8.5.15.

The Survey Area for Otter in 2023 was reduced relative to the surveys conducted in 2014-2018 (the Survey Area in 2014-2018 extended beyond the potential Zone of Influence of the Project on Otter). No Otter holts or Otter couches were recorded within Assessment Boundary during 2023 surveys. The status, description and distance from the Assessment Boundary of each of these resting places are provided below in Table 8.18. The results of the Otter surveys are shown on Figures 8.4.1 to 8.4.15.

An otter print was recorded along the southern bank of the River Corrib, close to the UoG GAA pitches, with feeding signs (fish bones) present on the opposite northern bank, in the Menlo area. Otter spraints were recorded in numerous areas, on both sides of the River Corrib, between the areas of Menlo Castle and Menlo Pier.

No holts or couches were identified in the vicinity of any of the survey sites in 2023. Away from the River Corrib, despite habitat suitability at numerous survey sites (e.g. lake sites, River Corrib, Bearna Stream), otter signs (spraints) were recorded at a single site on the Trusky Stream (site D5). The paucity of signs was considered to mainly reflect the poor quality of the fisheries and aquatic habitats within many of the survey watercourses, leading to sub-optimal foraging opportunities for otter. Furthermore, the close proximity of the survey area to more extensive habitats and more profitable foraging areas such as Lough Corrib (to the north) and Galway Bay (to the south) reduced the likelihood of regular otter utilisation of many of the smaller order watercourses.

As the population of otter within the Assessment Boundary is likely to be part of the QI population for Lough Corrib SAC, the population of Otter are valued as being of International Importance. This is consistent with the 2018 EIAR valuation for the local otter population, however it is noted that Appendix 4 of ABP's Inspectors Report dated 22 June 2021 valued otter as being of Local Importance.

Table 8.18 Otter Resting Places Identified

Ref. No.	Feature	Status and description
H1	Couch site	Active couch site along river bank >1km from the Assessment Boundary
H2	Couch site	Active couch site along river bank >1km from the Assessment Boundary
H3	Couch site	Active couch site along river bank c.450m from the Assessment Boundary
H4	Potential natal holt	Dense scrub patch with abundant Otter signs surrounding and in the vicinity, well-worn and used trails leading into scrub – evidence suggestive of juvenile Otter being present >1km from the Assessment Boundary
H5	Couch site	Active couch site along river bank >1km from the Assessment Boundary
H6	Couch site	Active couch site along river bank

Ref. No.	Feature	Status and description
		>1km from the Assessment Boundary
H7	Couch site	Active couch site along river bank >1km from the Assessment Boundary
H8	Couch site	Active couch site along river bank >1km from the Assessment Boundary
H9	Couch site	Active couch site along river bank c.600m from the Assessment Boundary

8.3.8.2 Bats

Bats, and their breeding and resting places, are protected under the Wildlife Acts. All bat species are also listed on Annex IV of the EU Habitats Directive; with the Lesser horseshoe bat also listed on Annex II.

Significant bat surveys were carried out in the preparation of this updated EIAR, and the results of these are set out below. The results of these surveys are also presented in Figures 8.25.1 to 8.25.15 and Figures 8.27.1, 8.28.1, 8.30.1, 8.32.1, 8.34.1 and 8.36.1.

Separate reports on the results of the radio-tracking studies undertaken in 2014 and 2015 are provided in Appendix A.8.7, Appendix A.8.9 and Appendix A.8.10. A separate report on the full results of the static detector monitoring undertaken in 2014 are detailed in Appendix A.8.8.

The structure of this section is such that each bat species is described in turn. The results of the various surveys are presented to allow an understanding of each species in terms of its distribution across the Scheme Study Area.

The overall findings of the 2023 surveys is that the number of bat species present, and their distribution across the survey area, is consistent with that presented in the 2018 EIAR. There were minor changes to the location of, and species composition and numbers occupying, bat roosts (refer to Table 8.21 for further details). These changes are described in this Section 8.3.8.2 of this updated EIAR and in Section 5.2 of the Bat Derogation Licence application included in Appendix A.8.25 – Part 2 of this updated EIAR.

Lesser horseshoe bat Rhinolophus hipposideros

The results of the bat surveys as they relate to the Lesser horseshoe bat are shown on Figure 8.28.1.

Historical records

Prior to the commencement of the 2014 surveys to inform the constraints and option selection studies for the proposed N6 GCRR, there were a small number of records of Lesser horseshoe bats in the study area. They comprised records of the bat roosts at Menlo Castle, suspected night roosts at a barn in Menlough Village and two sheds in Coolagh collected as part of the EIAR prepared for the Galway City Outer Bypass (RPS, 2006). Menlo Castle has been regarded to be a key maternity colony for the area since it was identified in August 2000 and has since been monitored annually by the NPWS. Ad-hoc observations during other bat surveys (e.g. BATLAS 2010) also noted Lesser horseshoe bat activity on the western side of the River Corrib at Daingean.

Surveys carried out for previous environmental assessments recorded Lesser horseshoe bats at University of Galway (McCarthy, Keville and O'Sullivan, 2014a) and Killarainy near Moycullen (RPS, 2013a).

The general lack of historical roost records and ad-hoc observations for this species did not necessarily suggest their low density or absence from specific areas. It is more likely to have been due to both the lack of targeted surveys for this species and the tendency for it to be overlooked due to its very quiet and narrowly-focused echolocation calls, which allows it to be detected only at very close range.

Identification of locations used for winter hibernation

Unlike other Irish bat species, the Lesser horseshoe bat hibernates in the open, hanging from the ceiling of caves, cellars and other structures kept cool in winter. Therefore, it is much easier to find than other bat species at this time of year.

Following the collation of the historical data at the end of 2014, the examination of historical maps and records of caves and underground structures provided a list of locations that could be potential sites used for hibernation. Figure 8.29.1 shows these locations. These included:

- Menlo Castle
- Merlin Castle
- Ballybrit Castle
- Roscam Round Tower
- Cooper's Cave
- Newry's Cave
- Dangan Ice House
- Souterrain in the townland of Lydican

2014 – 2018

The interior of Ballybrit Castle and Merlin Castle were inaccessible for the winter surveys that were undertaken in 2014 and therefore use of these castles by this species could not be ruled out. Evidence of Lesser horseshoe bats was only found in the rear of Cooper's Cave near Castlegar, where a small number of fresh droppings characteristic of this species were recorded, suggesting recent use.

Daytime visual inspections of accessible locations were also undertaken in February and March 2015. Six Lesser horseshoe bats were recorded within Cooper's Cave on the February 2015 visit. All bats were in a state of hibernation. It was noted that two of the bats were ringed. The ring numbers (which could be read without disturbing the bats) 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 used the cave as a hibernation site, and that bats using Cooper's Cave in summer months also used the cave as a hibernation site.

Cooper's Cave was also checked again on 24 February 2016 and four Lesser Horseshoe bats were recorded in a state of hibernation. None of these bats were ringed. Surveys in January 2018 recorded six hibernating Lesser horseshoe bats present on the 8 January and three on the 11 January (including one ringed bat).

No bats were seen or otherwise recorded within Newry's Cave in Merlin Woods in 2015 and 2016. It became evident during visits in 2015 that this site floods via underground springs up to ceiling level and therefore would be unsuitable for hibernating bats.

Since Lesser horseshoe bats are known to travel outside their summer ranges to reach hibernation sites, it was necessary to examine similar potential hibernation sites outside of the Scheme Study Area. Checks for bats (and particularly ringed bats) using other known underground sites were carried out in 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 but this may be used at other times of year. In 2018, winter surveys at Moycullen Cave and at Cloonnabinnia Cave recorded three Lesser horseshoe bats which were found hibernating at each location.

Attempts were made to gain access to land where the cave curiously named "Rhinolophus Retreat" is located; however, entry to lands was not possible. A souterrain near Athenry was also visited but found to be probably unsuitable for use by Lesser horseshoe bats as the entrance was blocked.

The results of the surveys of potential hibernation sites for this species of bat indicated that Cooper's Cave and Menlo Castle provide winter hibernation conditions, for several individuals, in the vicinity of the Project.

However, both sites are vulnerable to human disturbance or changes within the roosts due to rockfall. There is also the possibility that other concealed voids in limestone features could also host hibernating bats.

2023

It was not possible to access a number of locations during the first visit in February 2023. This was due to either health and safety concerns, or as they were inaccessible during the first visit, and therefore they were not resurveyed during the second visit in March 2023. It was only possible to survey Ballybrit Castle externally during both survey visits as the main entrance is boarded up. It was possible to partially view the inside of the ground floor of the Castle through the open windows, but no evidence of Lesser horseshoe bat was identified. The Castle is very exposed and in the middle of a field, with no connectivity to the surrounding landscape, and therefore unlikely to be used by lesser horseshoe bat for roosting or hibernating.

Cloonnabinnia Cave was surveyed during the February and March 2023 visits, with four lesser horseshoe bats identified hibernating on both surveys. Coopers Cave was also surveyed in February and March 2023, nine live bats were recorded in February 2023, and three live bats were recorded in March 2023. During the March 2023 survey, temperatures were very low (<4°C). The bats that were seen during the March 2023 visit were very far back into the Cave, compared to the February 2023 visit. It is likely that more bats were present further into the Cave where it was not possible to fully inspect. Bat droppings were noted in Cloonnabinnia Cave and Coppers Cave on both occasions.

During the February 2023 visit, internal access to Menlo Castle was not possible due to access issues. In March 2023, the internal of the Castle was inspected for lesser horseshoe bat. No bats were identified during this visit, however; the chimney void where bats are known to roost within, is not fully viewable from ground level.

An attempt was made to survey Newry's Cave in Rosshill Park Woods, however a locked gate and health and safety concerns prevented access to the sunken depression area in the woods where the Cave is present. It was not feasible to completely determine species; nevertheless, according to the hibernation characteristics of Lesser horseshoe bats (i.e. caves, cellars, mines, and other vast open spaces), it was concluded that the species hibernating within the tree hollow was not lesser horseshoe bat.

A souterrain near Claregalway was visited during both site visits in February and March 2023. The internal of the structure was inspected as much as was safely possible from the entrance, but it was not possible to fully inspect due to health and safety concerns. No signs or live bats were found during either visit.

An icehouse in Galway City, adjacent to the University of Galway in Upper Newcastle was inspected during February and March 2023. It was deemed unlikely to be a hibernation roost for lesser horseshoe bats due to the exposed and likely frequently disturbed nature of the structure. No evidence of bats was identified.

A small tunnel in Bearna Woods that extends slightly under Bearna Road was inspected in February 2023, as a single Lesser horseshoe bat had been identified here in 2016. The size of the tunnel did not allow for access. No bats were present, and due to its size and frequent exposure, this site is unlikely to serve as a hibernation roost for lesser horseshoe bats.

A railway tunnel that was previously a lesser horseshoe bat roost in Galway City Centre, is now beneath the Dean Hotel on Prospect Hill. Access was permitted to inspect the tunnel, which had been sealed in behind the gym in the basement of the Hotel. The tunnel was flooded, and it was not possible or safe to travel further into the tunnel due to this. However, an effort was made to identify where the other end of the tunnel may exit in Galway City Centre, which was not successful. It is assumed the tunnel is fully sealed on both sides.

Another previously identified Lesser horseshoe bat roost consisting of a man-made tunnel (PBR159) beyond Moycullen was searched for, but was not found. Works are ongoing adjacent to this site, and a very high wall and steep slope prevented any further searches of the area for the roost site.

The structures and trees which were inspected as part of the winter hibernation roost survey in 2023 are displayed in Table 8.19 below.

Table 8.19 Structures and Trees Inspected as part of the Winter Hibernation Roost Survey

Ref. No.	Name	Notes on Access and Automated Detector Deployment	Known LHB Roost	Inspection 1	Inspection 2
PBR50	Ballybrit Castle	External access only	No	23/02/2023	09/03/2023
PBR160	Cloonnabinnia Cave	Internal access to cave	Yes	23/02/2023	08/03/2023
PBR112	Coopers Cave	Internal access to cave	Yes	22/02/2023	09/03/2023
PBR06	Menlo Castle	Accessed internal part of castle on second visit only, albeit no access / visibility inside chimney	Yes	09/03/2023	29/03/2023
N/A	Tree Cavity, Rosshill Park Woods (Treeroost)	No internal access granted	No	22/02/2023	-
PBR136	Newry's Cave	No access due to locked gate and H&S risk to surveyor	Yes	22/02/2023	-
PBR113	Souterrain Lydican	Not accessible due to H&S risk to surveyor. access granted to internal parts of structure	No	23/02/2023	08/03/2023
PBR114	Ice house, University of Galway Campus	Accessed and surveyed	No	22/02/2023	08/03/2023
PBR124	Tunnel in Barna Woods	Internal access possible but surveyor could not access due to size of space	Yes (summeronly)	23/02/2023	-
PBR137	Railway Tunnel	Accessed via Dean Hotel gym in basement.	No	22/02/2023	-
PBR159	Man-made tunnel	Could not find on first survey	Yes	28/02/2023	-

Identification of Summer roosts

2014 – 2018

Evidence of Lesser horseshoe bats was recorded at 15 structures, including Menlo Castle (PBR06) during the summer roost surveys in 2014 and 2015. Most roosts were located in the vicinity of Menlough and Castlegar. Outside these two areas, a day roost (PBR178) containing 9 bats, including 5 juvenile bats, was located in the garage of a house in the Aughnacurra residential estate, on the western side of the River Corrib, adjacent to

the University of Galway Sporting Campus. In August 2018, two counts were undertaken at this roost: twelve Lesser horseshoe bats were recorded on the first night, and ten on the second. Two of the Lesser horseshoe bats present at the Aughnacurra roost on the 28 August 2018 were ringed, confirming the link between the roost sites at Menlo Castle, Cooper's Cave and this satellite roost[61].

A night roost was also found in another garage in this estate (PBR210) (refer to Figure 8.29.1 for these locations).

Other Lesser horseshoe bat roosts found on the western side of the city and surrounding environs included two night roosts in vicinity of Bearna Woods (PBR124, PBR115), north of Bearna (PBR217) and a roost in the townland of Aubwee just off the N59 Moycullen Road to the northwest of the city (PBR44). All "night roosts" were confirmed as such, when Lesser horseshoe bat droppings were recorded but the structure was deemed to be unsuitable as a day roost and no bats were seen in-situ.

On the eastern side of the city and surrounding environs, one Lesser horseshoe bat night roost (PBR21) was located adjacent to the Corinthian's Rugby Club off the N83 Tuam Road to the northeast of the city, while a day roost with a single bat was found in a disused bungalow adjacent to Ballindooley Lough (PBR25).

Lesser horseshoe bats at Menlo Castle (PBR06) were monitored from 2006-2017 by the NPWS and more recently by surveyors from Scott Cawley Ltd. (see Table 8.20 for count results). Lesser horseshoe bats can be very difficult to count on emergence as they tend to fly in and out of the roost entrance. Monitoring of the roost in 2016, 2017 and 2018 used infra-red cameras and reflects the most accurate count for this roost.

2023

Overall, fifteen roosts of Lesser horseshoe bat were identified in 2023: The identification of these roosts arose from a combination of building/structure inspection surveys, roost emergence surveys, and data generated in the period 2014-2018.

The roosts are overwhelmingly concentrated in the area between Castlegar Village demarcated by the N83 Tuam Road in the east, the River Corrib in the west, and the N6 to the south. Two outliers are located west of the River Corrib, in Aughnacurra housing estate and further west in Ballard West in the vicinity of Barna Woods:

- PBR06, Menlo Castle. This building is a known maternity roost for Lesser horseshoe bat and appears to be the largest and most important roost in the study area, with a peak count of 46 no. bats observed emerging from the structure during an emergence survey in mid-August 2023. Numbers observed emerging from the building varied between 36 early in the season (mid-June) to 40 mid-season (mid-July) and up to 46 in August 2023 as mentioned already.
- PBR83, a timber clad building in Menlo, which is a mixed species roost with common pipistrelle bats. No observations of Lesser horseshoe bat were made at this building in 2023, however the evidence supporting its identification as a roost was on foot of radio tracking surveys completed in 2014 and 2015 which were not repeated in 2023. The building continues to be suitable for occupation by roosting Lesser horseshoe bats, and is considered a roost for the species.
- PBR112, Coopers Cave, a limestone cave north of the existing N6 and west of the Bar Aille housing estate. This was identified as an important satellite roost to Menlo Castle in 2014 and 2015, and continues to be used by Lesser horseshoe bats in small numbers year-round. The cave was visited three times during the summer season and a maximum of 5 no. bats were observed emerging from the cave in mid-June 2023.
- PBR128, a derelict residential building in Castlegar north of an area of commercial development which was previously identified hosting a single Lesser horseshoe bat in 2014-2018. No bats were observed emerging from this building in 2023, however given its ongoing suitability as a Lesser horseshoe bat

[61] To the best of the authors' knowledge, at the time of writing, the only Lesser horseshoe bat ringing programme undertaken locally in recent years was that undertaken in 2014 and 2015 as part of the proposed N6 GCRR surveys, where bats captured at Menlo Castle and Cooper's Cave were ringed (see Appendix A.8.1 – Part 1, Section 1.4.8). Therefore, the ringed Lesser horseshoe bats observed at Aughnacurra are individuals ringed during the 2014/2015 studies at Menlo Castle and Cooper's Cave.

roost, and the presence of high quality foraging and commuting habitat in the vicinity, for the purposes of this assessment it is considered to be a roost.

- PBR129, a building in Menlo. Emergence surveys were not conducted at this building in 2023, however it is considered to be suitable for roosting Lesser horseshoe bat, is situated within the core sustenance zone of the Menlo Castle roost (PBR06), and was identified as a day/night roost in 2014-2018. For these reasons it still considered to be a roost in 2023.

- PBR153, an old stable/farm outbuilding. This was identified as a day/night roost for Lesser horseshoe bat based on radio-tracking studies conducted in 2014 and 2015. It continues to be suitable for this species and notwithstanding the absence of observations of bats emerging from the building in 2023, it is considered to be a roost.

- PBR156, a castellated gate in Menlo, which is a mixed species roost with common pipistrelle bat. The building continues to be suitable for roosting Lesser horseshoe bat and is considered to be a roost (likely used as a day / night roost) based on information generated from radio-tracking surveys in 2014 and 2015 and notwithstanding the absence of observations of bats in 2023.

- PBR158, a residential dwelling in Coolough which was identified as a Lesser horseshoe bat night/day roost during radio tracking surveys in 2014 and 2015. Access was denied by the owner/occupiers of the building to surveyors in 2023, however it remains suitable for roosting bats based on appraisal of the exterior from the nearest publicly accessible lands. For this reason it is considered to be a roost.

- PBR210, a known Lesser horseshoe bat roost based on radio-tracking surveys conducted in 2014 and 2015. Internal and external inspection surveys and emergence surveys were undertaken in mid-August and late- September 2023. A single unidentified bat was observed returning to roost at the building during the September survey. This bat could not be identified to species based on analysis of call characteristics, but is highly likely to be Lesser horseshoe bat on account of the status of the building as a known roost.

- PBR218, open crevices identified as a day/night roost for Lesser horseshoe bat in 2014 and 2015. This natural structure was surveyed three times in late June, and late September 2023. A single bat was observed emerging on the second survey in late June, and a peak of 10 no. bats were observed emerging during the last survey in late September 2023. Based on results of the survey this is likely to be an important satellite roost to the roost in Menlo Castle.

- PBR241, a roost identified in 2014-2018 and again based on observations of emergence surveys in 2023. This complex of buildings was visited twice in June 2023, with a single bat emerging from the structure on the second survey visit.

Three roosts, previously identified in 2014 but not re-surveyed in 2023, were retained as ‘present’, under a conservative approach:

- PBR82, an outbuilding and archway in Menlough. Identified initially as a night roost for Lesser horseshoe bats (1 bat) in 2014 during radio-tracking, but also present were Brown-long eared bats and Natterer’s bats. Remains suitable and notwithstanding absence of any evidence of use in 2023 is conservatively being assigned as a night roost for Brown long-eared bats and the other bat species previously identified as present in the roost.

- PBR85 – Live bat radio-tracked in 2014 to a shed with ridge tiles and loose corrugated iron and open doorway at Coolagh. Identified as a night roost for Lesser horseshoe bats (1 bat). Remains suitable and notwithstanding absence of any evidence of use in 2023 is conservatively being assigned as a night roost.

- PBR219 – A night roost for Lesser horseshoe bats in a void within a natural limestone structure located within Menlough Woods, identified during the radio-tracking session in 2015. Linked with the maternity roost in Menlo Castle (PBR06).

Additionally, PBR178 on the Aughnacurra Housing Estate, previously a known Lesser horseshoe bat satellite roost to Menlo Castle (PBR06), has been retained as ‘present’, taking a conservative approach. The roost area is within a sub-optimal building (garage) in terms of the preferred building type for this species, and its occupation by bats may be a reflection of the lack of availability of better roost opportunities in the area.

Historically, there is evidence that this was a Lesser horseshoe maternity roost, however the low to negligible levels of Lesser horseshoe activity at the property recorded in the 2023 surveys, indicates that this has since changed and is perhaps intermittently used by Lesser horseshoe bats as a day roost.

Samples of droppings found were taken (analysis result pending) during the 2023 season, as records show Myotis spps. are also present at the property.

Figure 8.28.1 shows the location of the Lesser horseshoe bat roosts identified in 2023.

Table 8.20 Numbers of Lesser Horseshoe Bats Recorded Emerging from Menlo Castle

Date	Count	Source	Comments
Unknown	12	NPWS	Date/Year of count absent from NPWS LHB Database
16/06/2006	2	NPWS	-
24/06/2009	26	NPWS	-
07/07/2009	38	NPWS	-
02/03/2011	21	NPWS	-
29/06/2012	23	NPWS	-
02/07/2012	27	NPWS	-
13/06/2013	21	NPWS	-
04/06/2014	18	NPWS	-
18/06/2014	35	NPWS	-
08/07/2014	27	Scott Cawley Ltd.	-
18/05/2015	5	Scott Cawley Ltd.	Disposable barbeque found in fireplace suggesting disturbance
21/05/2015	12	Scott Cawley Ltd.	-
02/06/2015	22	NPWS	-
29/06/2015	32	Scott Cawley Ltd. / NPWS	-
09/07/2015	29	Scott Cawley Ltd/NPWS	Inclement weather
20/08/2015	28	Scott Cawley Ltd. / NPWS	Two bats did not emerge
07/06/2016	28	NPWS	-
22/06/2016	41	NPWS	-
29/08/2016	35	Scott Cawley Ltd.	Counted from infra-red videocamera footage. 2-3 bats may have remained in the roost
15/06/2017	34	NPWS	-
11/08/2017	43	Scott Cawley Ltd.	Counted from infra-red videocamera footage. 1 bat exited from small chimney
06/06/2018	34	NPWS	-
21/06/2018	42	NPWS	-

Date	Count	Source	Comments
22/08/2018	20	Scott Cawley Ltd.	Counted from infra-red videocamera footage
27/08/2018	15	Scott Cawley Ltd.	Counted from infra-red videocamera footage
19/06/2019	34	NPWS	-
08/06/2020	27	NPWS	-
29/06/2020	29	NPWS	-
29/06/2022	37	NPWS	-
31/05/2023	35	NPWS	-
13/06/2023	38	Scott Cawley Ltd.	Counted from infra-red videocamera footage
21/06/2023	47	NPWS	-
11/07/2023	40	Scott Cawley Ltd.	Counted from infra-red videocamera footage
15/08/2023	46	Scott Cawley Ltd.	Counted from infra-red videocamera footage

The roost numbers showed variability in the counts but have averaged 29 bats over the last eighteen years (2006 – 2024).

This variability may be explained by bats using different (unknown) exit points on some nights, difficulties in counting in low light conditions and weather conditions in preceding nights which may have forced some bats to use alternative roosts. Infra-red footage in 2016 and 2023 suggested that bats fly out quickly at very low levels and could have been easily overlooked by conventional emergence monitoring techniques.

Radio-tracking 2014 and 2015

Additional data on the roosts used by this species was collected during the radio-tracking in 2014 and 2015. Thirteen Lesser horseshoe bats were captured and fitted with radio-transmitters in the first radio-tracking session in August 2014. Ten of these (seven females and three males) were caught at the Menlo Castle roost (PBR06) and three (all males) were caught at Cooper's Cave (PBR).

Five bats were captured and fitted with radio-transmitters in the September session; one (female) was caught in Menlough Woods and four (three males and one female) were captured at Cooper's Cave (PBR112).

The radio-tracking in August 2014 resulted in the identification of six day roosts and 11 night roosts for this species (Figure 8.29.1 shows these locations). Three of the six daytime roosts and seven of the night roosts had already been identified as Lesser horseshoe roosts from the building inspections undertaken in 2014.

Nine additional daytime roosts and eight additional night roosts were subsequently identified in the September 2014 session of radio-tracking. Only three roosts (Menlo Castle PBR06, Cooper's cave PBR112 and a shed in Angliham Quarry PBR126) 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.

The 2014 surveys found Lesser horseshoe bats using several roosts in the daytime in summer including those consistently used, such as Menlo Castle and Cooper's Cave. Inspections of other structures and radio-tracking recorded other day roosts and a network of night roosts.

Eborhall House and Ballymaglancy Cave, located to the north of Lough Corrib, are both important roost sites for breeding and hibernating Lesser horseshoe bats respectively. Eborhall House is the "qualifying" roost for the Lough Corrib SAC whilst the nearby Ballymaglancy Cave is a SAC in its own right (No. 000474) and is thought to provide hibernation roosts for the bats from Eborhall House.

Marking Studies (Rings) 2014 – 2015

No previous ringing study covering Lesser horseshoe bats had been undertaken in the area of interest prior to 2014. Scott Cawley carried out monitoring of bat activity in combination with emergence surveys and roosts inspections prior to the 2014 and 2015 ringing and radio-tracking studies by Greena in order to provide information on bat colonies present in the area of interest.

Monitoring of specific roost sites has been extended beyond the duration of the 2014 and 2015 study to provide additional data on linkage between sites.

A twin session ringing study was carried out by Greena Ecological Consultancy in May 2023 and August 2023.

This session, together with the results from 2014 and 2015, aimed to help understand potential seasonal shift in activity patterns of Lesser horseshoe bats while avoiding interference during the most sensitive period of bat life cycle when females give birth and lactate (suckle their young).

In 2014 and 2015 base silver coloured rings were used.

Marking Studies (Rings) 2023

In 2023, colour anodised rings were prepared and used, green at Menlo Castle (PBR06) and blue at Coopers Cave (PBR112).

A licence to carry out bat trapping (licence to catch with harp/mist net/by hand no. no.C147/2023) plus a licence to disturb roosts (DER/BAT 2023-48) was obtained from the NPWS and authorisation to access the land involved was obtained from landowners in advance of commencing fieldwork by Scott Cawley.

Red rings were going to be used at Aughnacurra garage (PBR178), but no Lesser horseshoe bats were present on either session.

Greena Ecological Consultancy captured 11 Lesser horseshoe bats (Rhinolophus hipposideros) during the May 2023 session, eight at Menlo Castle and three at Coopers Cave, seven of them females and four males all 11 were ringed.

19 were captured in August 2023, all at Menlo Castle, 11 were females and eight were males. 17 were ringed, 10 of them females and seven were males. The licence only permitted 30 bats in total to be handled so trapping ended once total was reached.

In August 2023, one male bat had previously been ringed at the castle in 2014 and four females ringed at the castle in May 2023 were recaught. The 2014 male had previously been radio-tracked in August 2014 (bat no. 6). (See Appendix A.8.7).

No ringed bats from the study area were recorded during the four summer inspections and two daytime winter inspections at Eborhall House (Summer roost), Ballymaglancy cave (Summer/Winter roost), Kelly's Cave (Winter roost), Bunnadober Mill (Summer, Maternity roost), Ross Castle (Summer roost), and Cloonnabinnia Cave (Summer/Winter) by Scott Cawley during the 2023 season (See Table 8.20 above for dates).

See Figure 8.28.1 for 2023 Bat Ringing locations.

Evidence of bat activity

2014 - 2018

This section summarises the results of the various surveys that recorded Lesser horseshoe bat activity across the Scheme Study Area (Figure 8.28.1). Survey methods included vehicle transects, walked transects and use of automated detectors at fixed locations in 2014 and 2015 covering both summer, autumn and winter seasons. The results of the radio-tracking surveys are also summarised separately in this section.

Lesser horseshoe bats were not recorded during the vehicle transect surveys but would not normally be expected to be easily detected using that survey methodology, due to their quiet and directional echolocation calls. However, the walked transect surveys recorded this species at Menlo Castle and Cooper's Cave. Static

bat detectors deployed during the walked transects recorded them by a culvert on the existing N6 (where the Terryland River flows under the road), by the Coolagh Lakes and by Ballindooley Lough.

The static bat detectors deployed in 2014 (Figure 8.37.1), recorded Lesser horseshoe bats at 14 (out of a total of 24) locations. Automated detectors S5, S6 and S21 recorded the highest amount of activity for this species, which reflects their proximity to Menlo Castle (see summary of radio-tracking studies below). Beyond the Menlough area, Lesser horseshoe bats 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 northwestern edge of Galway City (S11, S13 and S15), the outskirts of Bearna Village (S19), and two sites on the northeastern edge of Galway City just to the north of Galway Technology Park (S1, S24).

The automated detectors deployed in 2015 along the route of the proposed N6 GCRR (at that time) recorded Lesser horseshoe bats at 15 locations. Activity was recorded within the known foraging area of the Menlough roost as suggested by the radio-tracking results (see below), including along the woodland edges, south of Menlo Castle, within the limestone pavement area between Menlough and the N84 Headford Road, Lackagh Quarry and on field boundaries north of Castlegar Village, into the area south of Castlegar Village where Cooper's Cave is located.

Lesser horseshoe bat activity was also recorded within the grounds of University of Galway, east of Galway Racecourse at Ballybrit and on the Bearna Stream, north of Bearna Woods.

For the crossing point surveys, possible recordings of Lesser horseshoe bats that were made on both microphones, that could suggest bats flying across the Assessment Boundary, were recorded at 2 (out of a total of 21) sites for Lesser horseshoe bat: CP7 and CP9. CP7 had one potential crossing record, while CP9 had 35 potential crossing records.

In order to record and assess bat activity within the lands proposed for habitat enhancement, four SM2BAT+ ultrasound detectors were placed along hedgerows from 28 July - 11 August 2017. Detectors were also placed in hedgerows on the bóithrín at Menlo which is crossed by the proposed N6 GCRR. Lesser horseshoe bats were recorded at both locations with 132 recordings made in the proposed habitat enhancement lands and 81 recordings made along the bóithrín.

An SM2BAT+ detector was also deployed from 2 – 15 May 2018 at one of the same locations within the lands proposed for habitat enhancement and two detectors were also deployed in the field to the south toward the River Corrib in order to measure usage of different areas over the same time period. On this second occasion, Lesser horseshoe bats were recorded at all three locations with 102 recordings made by the two detectors in the fields to the south and only 12 recordings in the proposed habitat enhancement lands.

These results demonstrated that the proposed habitat enhancement area was accessible for Lesser horseshoe bats and is a suitable area for increasing the amount of foraging habitat within it.

Monitoring of bat activity at Cooper's Cave, Newry's Cave and the City Centre Railway Tunnel took place in the autumn of 2014 and late winter in 2015. A small number of Lesser horseshoe bat calls were recorded on the 26 and 28 September 2014 in Newry's Cave. A large number of Lesser horseshoe bat calls were recorded throughout September 2014 and October 2014 in Cooper's Cave, which would suggest that Cooper's Cave is used in the mating season by this species. Lesser horseshoe bat activity was recorded at Cooper's Cave and Menlo Castle but not at any of the other locations during the late winter activity seasons in 2015. Therefore, based on these emergence/re-entry surveys undertaken after the radio-tracking studies it was concluded overall that Lesser horseshoe bats use Menlo Castle and Cooper's cave throughout the year – Menlo Castle for breeding and hibernation and Cooper's Cave for mating and hibernation.

The radio-tracking surveys allowed the patterns of foraging and flight paths to be identified for this species. In August 2014, the maximum foraging distance from Menlo Castle 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. See Figure 57 in Appendix A.8.7.

In September 2014, the maximum foraging distance from the roost ranged from 1.11km up to 4.4km with the average maximum distance of foraging from the roost being 3.39km. On average, males foraged a maximum distance from the roost of 2.88km, while females averaged a maximum distance of 4.16km. See Figure 58 in Appendix A.8.7.

The overall foraging area in August 2014 comprised 21.75km^2 (MCP[62]) or 13.7km^2 (MLP[63]), whilst it was 56.10km^2 (MCP) or 26.46km^2 (MLP) in September 2014. Foraging areas recorded in both August and September 2014, overlapped in woodland and field boundaries in the Menlo Castle and Menlough Village areas; suggesting that these areas were core foraging areas. The area of overlapping areas from August and September 2014 was 11.96km^2 (MCP) or 8.1km^2 (MLP). Field systems and quarries northeast and east of Menlo Castle and field systems north of Cooper's Cave also served as foraging areas. See Figures 57 and 58 in Appendix A.8.7.

The majority of Lesser horseshoe bat foraging areas in August and September 2014 overlapped in the area of the River Corrib, field boundaries and woodland around Menlo Castle and Menlough Village, limestone pavement, woodland, scrub and lake around Coolough and Menlough Village, field boundaries and scrub around Castlegar and Ballindooley Lough, and a disused quarry in Angliham.

None of the foraging areas recorded in 2014 extended south of the existing N6, towards Galway City.

In May 2015, four bats were captured and tagged. Two of the bats had been captured, tagged and ringed in 2014. Rings were placed on the new bats.

Three day roosts were identified during the radio-tracking session in 2015. Three out of the four bats consistently used the maternity roost in Menlo Castle (PBR06). One bat utilised a previously-unknown roost in a boulder field located in an abandoned quarry just south of Coolagh Lakes (PBR218) over several days before returning back to Menlo Castle (PBR06). Another bat used a void within a natural limestone structure located within Menlough Woods to roost (PBR219). All of these daytime roosts were also used for short periods of resting at night.

The overall foraging area of Lesser horseshoe bats tracked in 2015 covered 16km^2 (MCP) or 10.22km^2 (MLP). The core foraging area of all bats extended over 1.25km^2. The majority of foraging areas overlapped in the area of Menlo Castle, Menlough Woods and Menlough Village in a similar pattern recorded in 2014. This was considered to be the core foraging area from where bats travelled both north towards Lough Corrib and south following the River Corrib. See Figure 58 in Appendix A.8.7.

The overall foraging area in 2015 was smaller than recorded in the late summer/early autumn tracking periods in 2014. It is likely that the low night-time temperatures in 2015 resulted in shorter foraging periods and shorter travel distances.

Based on the results of the radio-tracking studies carried out in 2014 and 2015, 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 (including Lackagh Quarry and Angliham Quarry) appeared to be of importance to Lesser horseshoe bats with records of bats spending time both feeding and night roosting there. Areas used both during the 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 bat population.

The radio-tracking studies confirmed a strong link between the maternity roost present at Menlo Castle (PBR06) and Cooper's Cave (PBR112). Although there was a direct connection between both sites via the River Corrib and Terryland River, the radio-tracked bats tended not to utilise this potential commuting route and instead travelled overland via Lackagh Quarry to the Terryland River Valley, via a small area of green

[62] MCP = Minimum convex polygon

[63] MLP = Multilateral polygon

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

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.

Radio-tracking data also suggested that Cooper's Cave (PBR112) is an important roosting site for male Lesser horseshoe bats in summer and an important autumn mating site in the area, as well as a hibernation site, for this species.

2023

Walked transects in 2023 recorded Lesser horseshoe bats at two (out of a total of 15) transect locations along the route of the proposed N6 GCRR. The highest levels of activity were recorded at Menlo/River Corrib (T9). Lesser horseshoe bat calls were also recorded at Castlegar (T12).

The automated detectors deployed in 2023 recorded Lesser horseshoe bats at 24 (out of a total of 50) locations along the route of the proposed N6 GCRR.

The highest levels of activity were recorded at Castlegar (L44) Lackagh Quarry (L33 and L34) and Ballinfoyle area (L36).

Lesser horseshoe bats were also recorded during Winter Hibernation statics placed at Menlo Castle PBR06, Cooper's Cave PBR112, and Cloonnabinnia Cave PBR160.

Analysis of the relative importance of Menlo Castle

Counts of Lesser horseshoe bats made at Menlo Castle were compared to other roost counts in County Galway and beyond to determine the level of importance of Menlo Castle. Based on counts from 2006 - 2016, the maternity roost at Menlo Castle makes up approximately 0.6% (min 0.1% - max 0.6%) of the summer population of Lesser horseshoe bats for the national population of this species and 6% (min 2% - max 6%) of the County Galway summer population. Therefore, while the roost at Menlough does not meet the threshold of representing 1% of the national population to make it of National Importance (National Roads Authority, 2009), it does exceed this threshold at the county level and therefore is regarded to be of County Importance.

Based on the distribution of maternity roosts in the range of this species in Ireland, the Menlo Castle maternity roost and the local population it supports meets the criteria of being of National Importance, whereby "*a smaller population may qualify as nationally important where the population forms a critical part of a wider population or the species is at a critical phase of its life cycle."* (National Roads Authority, 2009).

There are only six known maternity roosts in and around Lough Corrib, with the majority of roosts concentrated on the northern shores near Cong. Only two roosts are located on the southern end: Ross Lake Gatehouse and Menlo Castle. These southern roosts may be an important stepping-stone for long-term movements and gene flow between bat populations in North Galway and Mayo and populations in South Galway and Clare. Recent counts from Ross Lake Gate House have shown that this roost has undergone significant deterioration resulting in decline in numbers from 150 bats in 1994 to five bats in 2011 (Rebecca Teesdale pers. comm., 2014 and p44 in Roche *et al*., (2015)). A decline in the Ross Lake roost could potentially increase the relative importance of the roost at Menlo Castle as a stepping stone roost as it would be the only significant maternity colony at the southern end of Lough Corrib. There is no evidence to suggest that Menlo Castle Lesser horseshoe bat population is connected to the Eborhall Lesser horseshoe bat population, which is the qualifying interest (QI) population for Lough Corrib SAC. Any predicted impacts on Lesser horseshoe bats associated with the Project will not affect the conservation objectives of the Lough Corrib SAC's QI Lesser horseshoe bat population, nor the QI Lesser horseshoe bat populations of any other European sites.

The numbers of bats using Cooper's Cave (PBR112) is hard to quantify due to the lack of access to roosting areas underground and the seasonal and gender specific variability in its use. It clearly is used by males and females some of which roost there in summer and also use it for mating. The cave system also supported a small population of hibernating Lesser horseshoe bats (usually averaging 4 bats) although the cave system could not be accessed in its entirety, so more bats could have been present further underground. The surveys have indicated that Menlo Castle and Cooper's Cave provide hibernation conditions for the local population although since both locations cannot be fully accessed to count individuals, the population size cannot be

fully determined. Given the lack of other maternity roosts in the locality which could otherwise be a source of additional bats to occupy hibernacula, it is very unlikely that the winter roost population differs from the summer roost population in the Menlo Castle-Cooper's Cave complex.

Leisler's bat Nyctalus leisleri

The results of the bat surveys as they relate to Leisler's bat are shown on Figures 8.30.1 and 8.31.1.

Historical records

Leisler's bats have been recorded across the Scheme Study Area as bat detector records and have also been recorded using bat boxes in Rusheen Bay, which are the only previous roost records for this species. Detector records include University of Galway (A.P. McCarthy Planning Consultants (2007a), McCarthy, Keville & O'Sullivan (2014a) McCarthy, Keville & O'Sullivan (2014b)), Moycullen and Ballycuirke Lough (Galway County Council/Roscommon National Roads Design Office (2011). Since this bat can travel long distances from its roost each night, detector records do not necessarily suggest that bats are roosting nearby.

Identification of Roosts

2014 – 2018

No winter roost sites were recorded in any of the surveys for the Project. Radio-tracking of three bats captured in 2014 and 2015 provided locations of four day roosts (PTR45, PB134, PBR139, PBR146). See Figure 8.26.7 and Figure 8.30.1 for locations of these roosts for this species.

In 2014, a single male Leisler's bat was captured and tagged in Menlough Woods. Radio-tracking indicated that the maximum distance that this individual was recorded travelling was 4.85km over a foraging area of 8.96km^2 that encompassed the southern area of Lough Corrib, the River Corrib and the Menlough area. Two roosts used by this individual were also located; a large modern house along the N84 Headford Road near Ballinfoyle and an Ash tree at the edge of Menlough Woods (PTR45) (within the footprint of the proposed N6 GCRR). See Figure 44 in Appendix A.8.7.

Another two male Leisler's bats were captured, ringed and tagged in Bearna Woods in the second session in 2014. However, data was only collected for one of these bats as the second could not be located. The bat that could be tracked was found to roost during the day at two modern dwelling houses on the Cappagh Road (PBR139, PBR146). Refer to Figure 3l in Appendix A.8.9. This bat had a recorded foraging area of 13.62km^2 (MCP) that encompassed the southern area of Lough Corrib, along the River Corrib corridor and the Menlough area.

2023

Six Leisler's bat roosts were identified across the study area. The identification of these roosts arose from a combination of building/structure inspection surveys, roost emergence surveys, and data generated in the period 2014-2018.

- PBR196, a bungalow on the N84 Road, was identified as a roost for Leisler's bat based on the completion of emergence surveys in late May, late June and mid-September 2023. Access was denied to the internal part of this building by the owners and therefore survey data generated arose from emergence and external inspections only. A single Leisler's bat was observed returning to roost at the building during the September survey. This building was identified as a mixed roost of common pipistrelle bat, soprano pipistrelle bat and Leisler's bat in the period 2014-2018. Based on results from 2023 it appears that this roost is not currently used by pipistrelle species but continues to be used by Leisler's bat albeit intermittently by small numbers of the species. It is likely to be a transitional roost.

- PBR226, a building/structure in the grounds of University of Galway, was surveyed three times in late June, late July and late September 2023. A single Leisler's bat was observed emerging from and/or returning to roost at this building on each survey visit.

- PBR73, St. James' Church Bushypark. This building was identified as a mixed Leisler's bat and Natterer's bat Myotis naterreri roost in 2014-2018, albeit no observations/records of Natterer's bats were logged in 2023. The building was subject to three separate emergence surveys in early June, late July and mid-September 2023, and the exterior of the building was inspected for signs of roosting bats. Internal access to the building for survey purposes was refused by the owners. Bats were observed emerging from

the bell tower of the building on each survey visit, with 1 no. bat emerging in June and July, and 5 no. bats emerging in September 2023. Based on the higher number of emergences in September 2023 it is possible that the building is more important as a transitional/autumn roost for this species.

- PBR134 and PBR255 have been described under the subsection Soprano pipistrelle bat Pipistrellus pygmaeus above. Both roosts are mixed Soprano pipistrelle and Leisler's bat roosts. No Leisler's bats were observed emerging from PBR134 in 2023, however the building remains suitable for roosting bats, contained signs of roosting bats based on internal inspection, and it is considered prudent to continue to treat this building as a Leisler's bat roost based on information generated between 2014 and 2018. A single Leisler's bat was observed emerging from PBR255 on one emergence survey undertaken in mid-August 2023.
- PBR139 – In 2014, a single bat was radio-tracked to a day roost at a modern residential bungalow on the Cappagh Road.

No confirmed winter roost sites for Leisler's bat were identified during surveys completed during the 2023 survey season, however, Leisler's bats were recorded during Winter Hibernation statics placed at Menlo Castle PBR06 and Ballybrit Castle PBR50.

Evidence of bat activity

2014 - 2018

Leisler's bats were recorded widely across the study area during the walked transect surveys. However, few calls were recorded within the urban habitats in the more developed areas in Galway City. During the surveys conducted between 2014 - 2018, the species was recorded at every automated detector location which reflects this widespread and far-ranging species during its foraging activities.

No winter roost sites were recorded in any of the surveys for the Project. Radio-tracking of three bats captured in 2014 and 2015 provided locations of four day roosts (PTR45, PB134, PBR139, PBR146). See Figure 8.26.7 and Figure 8.30.1 for locations of these roosts for this species.

In 2014, a single male Leisler's bat was captured and tagged in Menlough Woods. Radio-tracking indicated that the maximum distance that this individual was recorded travelling was 4.85km over a foraging area of 8.96km^2 that encompassed the southern area of Lough Corrib, the River Corrib and the Menlough area.

Two roosts used by this individual were also located; a large modern house along the N84 Headford Road near Ballinfoyle (PBR134) and an ash tree at the edge of Menlough Woods (PTR45) (within the footprint of the proposed N6 GCRR). See Figure 44 in Appendix A.8.7.

Another two male Leisler's bats were captured, ringed and tagged in Bearna Woods in the second radio-tracking session in 2014. However, data was only collected for one of these bats as the second could not be located. The bat that could be tracked was found to roost during the day at two modern dwelling houses on the Cappagh Road (PBR139, PBR146). Refer to Figure 3l in Appendix A.8.9. This bat had a recorded foraging area of 13.62km^2 (MCP) that encompassed the southern area of Lough Corrib, along the River Corrib corridor and Menlough area.

The automated detectors deployed in 2015 recorded Leisler's bats at 32 (out of a total of 42) locations along the route of the proposed N6 GCRR. The highest levels of activity were recorded over the River Corrib and Lackagh Quarry (see Figure 8.31.1).

During the crossing point surveys, indications of potential crossings were recorded at 6 (out of a total of 21) sites for Leisler's bat; CP5, CP6, CP8, CP10, CP14, CP15. It is reasonable to assume that the approach taken for detecting bat crossings is not effective for this species. The Leisler's bat loud echolocation calls would be received by both microphones simultaneously and therefore crossings could not be confirmed. However, since this is a fast and high-flying bat it is regarded to be less impeded by severance of features at ground level (an "open airspace species" according to Elmeros *et al.*, 2016).

2023

Walked transects in 2023 recorded Leisler's bats at 13 (out of a total of 15) transect locations along the route of the proposed N6 GCRR. The highest levels of activity were recorded at Rahoon Road (T5), Lackagh Quarry (T11), and the Menlo/River Corrib areas (T9).

The automated detectors deployed in 2023 recorded Leisler's bats at 50 (out of a total of 50) locations along the route of the proposed N6 GCRR. The highest levels of activity were recorded at Lackagh Quarry (L33) and Letteragh Road (L14) (see Figure 8.30.1).

Leisler's bats are valued as being of Local Importance (Higher Value), due to being a species of 'Least Concern', a species recorded frequently across the Assessment Boundary, and the availability of suitable habitat in the wider environment.

Common pipistrelle bat Pipistrellus pipistrellus

The results of the bat surveys as they relate to the Common pipistrelle bat are shown on Figure 8.34.1 and Figure 8.35.1.

Historical records

Common pipistrelle bats have been recorded across the Scheme Study Area including the grounds of University of Galway (A.P. McCarthy Planning Consultants (2007a), McCarthy, Keville & O'Sullivan (2014a) McCarthy, Keville & O'Sullivan (2014b)). None of these would appear to be records of roost sites and are generally records from bat detector surveys.

Identification of locations used in summer

2014 – 2018

Building inspections carried out in 2014 and 2015 identified four roosts used by Common pipistrelle bats. One was located in an outbuilding in the Ballindooley area (PBR07), a small roost of 3-4 bats was found in a large shed adjacent to the N83 Tuam Road in Cappanabornia (PBR228) and single bats were observed at the stable block in Galway Racecourse in Ballybrit (PBR205) and an abandoned bungalow to the north of Bearna Village (PBR220). (Refer to Figure 8.35.1).

Six Common pipistrelle bats were captured during the radio-tracking session in 2014; two at University of Galway, two at the University of Galway Sporting Campus, and two at Menlough Woods. The male and female bats captured were tagged, ringed and tracked to their day roosts. The female was found to roost in two modern buildings in a housing estate at Ballymoneen (PBR141, PBR147) on the northwestern edge of the city, while the male was found to roost in two modern agricultural barns in Cloonacauneen (PBR148, PBR149), to the north of the Roadstone Quarry. Refer to Figure 3F and 3G in Appendix A.8.9.

2023

Three small Common pipistrelle roosts were recorded during roost emergence surveys in 2023. Both buildings are located in Menlo and were previously recorded as Lesser horseshoe bat night roosts in the period 2014-2018.

The first building, PBR156 is a prominent castellated gate structure where seven Common pipistrelle bats were observed returning to roost in June 2023 during the first of two survey visits. No bats were recorded emerging or returning to roost on the second visit and it is likely that this is a small satellite or transitional roost for this species.

The second building, PBR83 is a distinctive timber-clad modern dwelling, which was also identified in 2014 as a Lesser horseshoe bat night roost. Three Common pipistrelle bats were counted emerging from this building on a second of two survey visits in late June 2023. This building is also likely to be a small satellite or transitional summer roost for this species.

The third building is a shed in Lackagh quarry, PBR252. A single Common pipistrelle bat was observed flying into this building and was not later observed emerging from the building. For this reason, the building is assumed to be used as a roost, and is likely to be a night roost/feeding roost for the species.

No confirmed winter roosts for this species have been recorded in 2023, however pipistrelle bats are known to roost in extremely small crevices and non-destructive identification of their winter hibernation roosts is often not possible or extremely difficult. It is considered appropriate to treat summer roosts as potential winter hibernation roosts and mitigate as such. Common Pipistrelles were recorded during Winter Hibernation by statics placed at Menlo Castle PBR06, Ballybrit Castle PBR50, and Cloonnabinnia Cave PBR160.

Evidence of bat activity

2014 - 2018

During the surveys conducted between 2014 – 2018, Common pipistrelle bats were recorded widely across the Scheme Study Area during the walked and vehicle 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 all 24 automated detector locations in 2014. Refer to Figure 8.37.1 for these locations.

The automated detectors deployed in 2015 along the Project recorded Common pipistrelle bats at 34 (out of a total of 42) locations. The highest level of activity was recorded in Lackagh Quarry (RS13), a hedgerow in a field adjacent the N83 Tuam Road (RS26), a hedgerow adjacent to the Coolagh Roundabout (RS29) and along a hedgerow bordering the Aille Road, north of Bearna Village (RS40). Refer to Figure 8.37.1 for the locations of these transects.

During the crossing point surveys, possible crossing records were recorded at 16 (out of a total of 21) sites for Common pipistrelle bats. Seven sites recorded more than 10 possible crossings for this species; CP6, CP9, CP10, CP11, CP14, CP15, CP16. Relatively high number of possible crossings were recorded at CP9 (88 possible crossings) and CP10 (630 possible crossing records). Refer to Figure 8.37.1 for the locations of these records.

2023

Walked transects in 2023 recorded Common pipistrelle bats at 15 (out of a total of 15) transect locations along the route of the proposed N6 GCRR. The highest levels of activity were recorded at Cappagh Road (north of Cappagh Park) (T3), Coolough (to the west of Lackagh Quarry) (T10), and Rahoon Road (T4).

The automated detectors deployed in 2023 recorded Common Pipistrelle at 50 (out of a total of 50) locations along the route of the proposed N6 GCRR. The highest levels of activity were recorded at Ballybrit (Galway Racecourse) (L48), Cappagh Road (L8), Briarhill (L50), Ballard West (L5), and Forramoyle West (L1).

Refer to Figure 8.36.1 for the locations of these records.

Common pipistrelle is valued as being of Local Importance (Higher Value), to being a species of ‘Least Concern’, a species recorded frequently across the Assessment Boundary, and the availability of suitable habitat in the wider environment.

Soprano pipistrelle bat Pipistrellus pygmaeus

The results of the bat surveys as they relate to the Soprano pipistrelle bat are shown on Figure 8.34.1 and Figure 8.35.1.

Historical records

This species has been previously recorded across the Scheme Study Area and included records at Dangan, (A.P. McCarthy Planning Consultants, 2007a), Merlin Park (Browne and Fuller, 2009), Bearna Woods (Browne *et al*, 2009), Ballyquirke (Galway County Council/Roscommon National Roads Design Office, 2011) and University of Galway (McCarthy, Keville and O'Sullivan, 2009a, 2014a, 2014b). A historical record was also provided by the NPWS of a roost from Menlough Village in 2014 (R. Teasdale, pers. comm, 2015) a single bat was known to roost in Menlo Castle in 2000 (RPS, 2006)

Identification of locations used in summer

2014 – 2018

Fourteen Soprano pipistrelle roosts were identified across the study area between 2014 and 2018. The identification of these roosts arose from a combination of building/structure inspection surveys, roost emergence surveys, and data generated in the period 2014-2018.

Building inspections carried out in 2014, 2015 and 2016 identified 13 roosts of this species. These were located in Aubwee, Ballybrit, Ballindooley, Letteragh, Gortacleva, Roscam, Bearna Woods, Bearr Aile, Truskey West, Aughnacurra and Coolagh. Seven of these roost sites were at locations with unoccupied farm buildings and houses (PBR196, PBR205, PBR237, PBR241, PBR42, PBR44, PBR49), and roosts were found in occupied buildings in Bearna Woods (PBR222), Aughnacurra residential estate (PBR177, PBR255) and Coolagh (PBR179).

A single Soprano pipistrelle bat was observed emerging from an oak tree (PTR40) in a field located to the south of Menlo Castle in the summer of 2015.

Refer to Figure 8.24.1 for locations referred to above.

2023

Fifteen Soprano pipistrelle roosts were identified across the study area in 2023.

Two buildings, PBR225, a mid-twentieth century bungalow surrounded by a grove of conifers in Troscaigh Thiar, Bearna, and PBR222, located adjacent to Bearna Woods in Knocknacarra could not be surveyed in 2023 as the owners of these buildings refused access to surveyors. Both buildings were identified as soprano pipistrelle roosts by Scott Cawley based on surveys conducted between 2014 and 2018: PBR225 was identified as a potential maternity roost; PBR222 as a small transitional roost of 1-2 bats. Based on appraisal of these buildings from the closest publicly accessible lands in 2023, they remain relatively unchanged and remain suitable for roosting bats, and for these reasons have been counted as roosts.

- PBR267: A traditional bungalow off the Ballymoneen Road north of Fána Buí estate was identified conservatively as a soprano pipistrelle bat roost in 2023. This building was surveyed twice in early August and mid-September 2023 and although no soprano pipistrelle bats were observed emerging from it, it was recorded as a roost in 2014-2018 and retains its suitability to act as a small roost for this species.

Three buildings were identified as Soprano pipistrelle roosts in 2023 on the basis of external inspections and emergence surveys:

- PBR145: A traditional bungalow in Castlegar Village. Surveyors were denied access by the owners to conduct an internal inspection of this building. Three emergence surveys were conducted at this building, with 10 bats emerging on the first survey in early July, nine bats emerging in mid-July and no bats emerging in mid-September. This building is likely to be a small maternity or summer roost on the basis of these surveys results.

- PBR261: A modern residential dwelling in Na Foraí Maola Thiar. Surveyors were denied access by the owners to conduct an internal inspection of this building. A single soprano pipistrelle bat was observed returning to roost under flashing in the southwest corner of this building on a survey conducted in late June 2023. No bats were observed emerging on the second survey visit in late June, and the building is likely to act as a night/day roost or transitional roost.

- PBR238: An abandoned/derelict traditional farmhouse on the Ballymoneen Road surrounded by a copse of trees. Internal inspection of the interior of this building was not completed for health and safety reasons. A single soprano pipistrelle bat was observed emerging from this building during a single emergence survey conducted in early August 2023.

Nine buildings were identified as Soprano pipistrelle roosts in 2023 on the basis of external and internal inspections of those building as well as the completion of emergence surveys:

- PBR53: A castle building in Castlegar Village. Three separate emergence counts were conducted on this building in mid-June, early July, and early September 2023. Two bats were observed emerging from the structure during the June 2023 visit.

- PBR134: A modern residential dwelling on the western side of the N84 near Cairéal Mór. A single bat was observed emerging during the first of two surveys conducted on this building in mid-August and

early September 2023. Droppings were also identified in the building, and it was identified as a Leisler's bat roost in the period 2014-2018.

- PBR179: A modern residential dwelling on the Coolough Road in Menlo. Three soprano pipistrelle bats were observed emerging from this building during a single emergence survey conducted in early September 2023. This building was recorded as a bat roost in the period 2014-2018 and is likely to be a maternity roost for soprano pipistrelle bats.
- PBR248: A thatched cottage on a boreen North of Castlegar Village. A small number of bats were observed emerging from this building.
- PBR250: An abandoned bungalow on the N84 Headford Road. Three emergence surveys were conducted on this building in late mid-July, late July and mid-September 2023. Three bats were observed emerging from the building in September 2023 and on this basis it is likely to be a small day/night or transitional roost.
- PBR255: A modern bungalow west of the University of Galway campus in the Aughnacurra housing estate. This building was subject to one emergence survey, during which five bats (4 no. soprano pipistrelle and 1 no. Leisler's bat Nyctalus leisleri) were observed emerging from the building.
- PBR256: A modern bungalow west of the University of Galway campus on the N59 Clifden Road. This building was previously identified as a Brown long-eared bat Plecotus auritus roost in 2014-2018. Two emergence surveys were conducted at this building in 2023 in late July and mid-August 2023, respectively. Small numbers of soprano pipistrelle bats were observed emerging from the buildings on each occasion (1 no. bat in July, 2 no. bats in August).
- PBR288: A farm outhouse in the townland of Troscaigh Thiar. A single bat was observed emerging during a single visit in late August 2023.
- PBR177: A residential building on Aughnacurra estate. A single bat was observed emerging during a single visit in September 2023. This building was previously identified as a Soprano pipistrelle roost in 2014-2018 (Emergence and Re-Entry of 12 bats).

No confirmed winter hibernation observations of this species were observed during hibernation surveys, although as per common pipistrelle bat, this species is known to roost in locations that are inaccessible to surveyors by non-destructive methods, e.g. between cavity block walls and under roof tiles.

These roosts can often be in the same building as a summer roost. For this reason, any building that is listed as a soprano pipistrelle roost is being conservatively treated as a potential hibernation roost for the species.

Soprano pipistrelle bats were also recorded during Winter Hibernation by statics placed at Menlo Castle PBR06 and Ballybrit Castle.

Refer to Figure 8.35.1 for locations referred to above.

Evidence for bat activity

2014 - 2018

During the surveys conducted between 2014 – 2018, Soprano pipistrelle bats were recorded widely across the Scheme Study Area during the walked and vehicle transect surveys. However, very few calls were recorded within the more developed areas within Galway City apart from areas adjacent to the River Corrib. This species was recorded at all 24 automated detector locations deployed in 2014.

The automated detectors deployed in 2015 recorded soprano pipistrelle bats at 37 (out of a total of 42) locations along the route of the proposed N6 GCRR. The highest levels of activity were recorded near the River Corrib (RS1 and RS2), in proximity to a confirmed roost in Aughnacurra Housing Estate (RS8) and a hedgerow adjacent to the existing Coolagh Roundabout (RS29). Figure 8.37.1 shows the locations of these surveys.

During the crossing point surveys, bat activity, suggesting possible crossings, was recorded at all 21 survey locations for soprano pipistrelle bats. Thirteen sites along the route of the proposed N6 GCRR recorded more than 10 possible crossing records for this species.

Refer to Figure 8.37.1 for locations referred to above.

2023

Walked transects in 2023 recorded Soprano pipistrelle bats at 15 (out of a total of 15) transect locations along the route of the proposed N6 GCRR. The highest levels of activity were recorded at Menlo/River Corrib (T9), Coolough (west of Lackagh Quarry) (T10), and Lackagh Quarry (T11).

The automated detectors deployed in 2023 recorded Soprano pipistrelles at 50 (out of a total of 50) locations along the route of the proposed N6 GCRR. The highest levels of activity were recorded at Dangan (L21) (near Greenfields Hockey Club), Menlo/River Corrib (L23), and Briarhill L50 (near Coolagh Roundabout).

Significant activity for Soprano pipistrelles was also recorded north of Cappagh Park (L6), Ballinfoyle (L37 & L38) (east of Lackagh Quarry), and Castlegar (L40 in 2023).

Refer to Figure 8.36.1 for locations referred to above.

Soprano pipistrelle is valued as being of Local Importance (Higher Value), due to being a species of 'Least Concern', a species recorded frequently across the Assessment Boundary, and the availability of suitable habitat in the wider environment.

Nathusius' pipistrelle bat Pipistrellus nathusii

The results of the bat surveys as they relate to Nathusius' pipistrelle bat are shown on Figure 8.32.1 and Figure 8.33.1.

Historical records

This is the only bat species that had not been previously recorded in the Scheme Study Area. Only one record exists at a county level for an ad-hoc observation made in Oughterard in 2007, according to the Bat Conservation Ireland database.

No roosts were found for this species.

Evidence for bat activity

2014 - 2018

During the surveys conducted between 2014 – 2018, Nathusius' pipistrelle bats were recorded during the walked and vehicle transect surveys in 2014 but on a much rarer basis than the other two Pipistrellus species. They were recorded in an area of farmland east of Galway Technology Park, Bearna Woods, Coolagh Lakes and Letteragh.

The species was recorded at 20 (out of a total of 24) automated detector locations in 2014, although they again were much less frequent than the other Pipistrellus species but suggested that the species was more widespread than was shown by the walked and vehicle transects. Sites with highest numbers of calls included S20, S16, S21 and S06, which were located around the River Corrib. See Figure 8.37.1 for the locations of these records.

The automated detectors deployed in 2015 along the route of the proposed N6 GCRR recorded Nathusius' pipistrelle bats at one (out of a total of 42) location, in Lackagh Quarry (RS13), where two calls were recorded.

During the crossing point surveys, evidence for Nathusius' pipistrelle bats crossing the route of the proposed N6 GCRR was recorded at CP14 and CP20 (2 out of a total of 21). Only single "passes" were recorded.

2023

Walked transects in 2023 recorded Nathusius' pipistrelle bats at four (out of a total of 15) transect locations along the route of the proposed N6 GCRR. The highest levels of activity were recorded at Dangan/University of Galway Sports Ground (T8), and Lackagh Quarry (T10 and T11).

The automated detectors deployed in 2023 recorded Nathusius' pipistrelle bats at 41 (out of a total of 50) locations along the route of the proposed N6 GCRR. The highest levels of activity were recorded during Winter Hibernation by a static placed at Menlo Castle PBR06. All the other 50 statics deployed recorded single-digit figures of Nathusius' pipistrelle bats, the highest levels of activity were recorded at north of Lettereragh Road (L17), Coolough (L28 & 27), and Menlo/Coolough area (L26) near the River Corrib. See Figure 8.36.1 for the locations of these records.

No roosts for this species have been recorded in 2023, however as noted above, Nathusius' calls were recorded during Winter Hibernation at the static placed at Menlo Castle PBR06.

Within Appendix 4 of ABP's Inspectors Report dated 22 June 2021, Nathusius' pipistrelle is valued as being of County Importance, "*due to scattered population estimates of this species in Ireland*". This species was valued as being of Local Importance (Higher Value) in the 2018 EIAR. It is the professional opinion of the authors, that Nathusius' pipistrelle should still be valued as such, i.e. as Local Importance (Higher Value), due to being a species of 'Least Concern', a species recorded across the majority of the Assessment Boundary, and the availability of suitable habitat in the wider environment.

Unidentified Pipistrelle Species Pipistrellus sp.

The results of the bat surveys as they relate to Pipistrelle bats, not identified to species level, are shown on Figure 8.34.1 and Figure 8.35.1.

Common pipistrelle bats have their peak echolocation call strength at 45kHz and Soprano pipistrelle bats at 55kHz. Pipistrelle bat species that echolocate between 48 and 52kHz cannot be accurately identified by their calls and are described as "unidentified" Pipistrelle bat species.

Identification of locations used in summer

2014 - 2018

No winter roosts for this species were recorded.

Two unidentified Pipistrelle bat roosts were recorded during building inspections in 2014 and 2015. A roost of unknown number was found in a farm house to the west of Bearna Village (PBR224) during an internal survey whilst an old unidentified Pipistrelle bat dropping was found in a bungalow within the grounds of Galway Racecourse in Ballybrit (PBR242).

An unidentified Pipistrelle bat was observed with an endoscope in a crevice in an ash tree (PTR54) in hazel scrub on limestone pavement located to the north of Coolagh Lakes in 2015.

Figure 8.35.1 shows the locations of these records.

2023

Five unidentified pipistrelle bat roosts were recorded during roost emergence surveys in 2023.

- PBR229: a traditional bungalow off Ballymoneen Road was identified as a roost for Pipistrelles based on emergence surveys conducted in mid-June, early August and mid-September 2023. A single Pipistrelle bat returned to roost at the bungalow in September 2023. This roost is considered to be a transitional roost for Pipistrelles.
- PBR50: Ballybrit Castle was identified as a roost for Pipistrelle species, based on emergence surveys conducted in June 2023.
- PBR205_ST1, PBR205_ST10, and PBR205_ST9 at Galway Racecourse Stables Block were identified as roosts for Pipistrelle species, based on emergence surveys conducted between June - August 2023.

No confirmed winter roosts for this species were recorded however as mentioned previously, pipistrelle species are known to hide in inaccessible parts of buildings that also act as summer roosts, and therefore all summer roosts are treated as potential hibernation roosts.

Common Pipistrelles were recorded during Winter Hibernation by statics placed at Menlo Castle PBR06, Ballybrit Castle PBR50 (no. 8) and Cloonnabinnia Cave PBR160.

Soprano pipistrelle bats were also recorded during Winter Hibernation by statics placed at Menlo Castle PBR06 and Ballybrit Castle.

The highest levels of Nathusius' pipistrelle bats activity were recorded during Winter Hibernation by the static placed at Menlo Castle PBR06.

Figure 8.34.1 shows the locations of these records.

Evidence for bat activity

2014 - 2018

During the surveys conducted between 2014 – 2018, bat calls that could not be assigned to either Common or Soprano pipistrelle bats were recorded widely across the study area during the walked and vehicle transects undertaken in 2014. The highest activity was recorded near the River Corrib (RS1), Lackagh Quarry (RS13) and along a hedgerow near Castlegar Village (RS19). See Figure 8.37.1 for the locations of these records.

The automated detectors deployed in 2015 recorded unidentified Pipistrelle bats at 32 locations (out of a total of 42) along the route of the proposed N6 GCRR. The highest activity was recorded near the River Corrib (RS1), Lackagh Quarry (RS13) and along a hedgerow near Castlegar Village (RS19). See Figure 8.37.1 for the locations of these records.

The automated detectors deployed in 2015 recorded unidentified Pipistrelle bats at 32 (out of a total of 42) locations along the route of the proposed N6 GCRR. During the crossing point surveys, bat activity suggesting possible crossings were recorded at 14 (out of a total of 21) sites for unidentified Pipistrelle bat species. Two sites recorded more than 10 possible crossing records for this species group: CP9 and CP10.

2023

Walked transects in 2023 recorded unidentified pipistrelle species at one (out of a total of 15) transect location(s) along the route of the proposed N6 GCRR. The activity was recorded at Coolough, west of Lackagh Quarry (T10).

The automated detectors deployed in 2023 recorded unidentified pipistrelle species at 1 (out of a total of 50) location(s) along the route of the proposed N6 GCRR. The activity was recorded at Dangan/University of Galway Sportsground (L22) (all in September 2023).

Figure 8.36.1 shows the locations of these records.

Brown long-eared bat Plecotus auritus

The results of the bat surveys as they relate to the Brown long-eared bat are shown on Figures 8.32.1 and 8.33.1.

Historical records

Baseline data, presented in documentation supporting planning applications in the Scheme Study Area, have recorded a Brown long-eared bat roost of more than 20 bats in Menlo Castle (RPS, 2006) although this was not recorded during the current series of surveys. This commonly-occurring and widespread species is known to occur in Merlin Woods (Browne and Fuller, 2009), University of Galway Campus (McCarthy, Keville and O'Sullivan. (2014a)), Clydagh Bridge and Ballyquirke (north of the Scheme Study Area) (Galway County Council/Roscommon National Roads Design Office. (2011). Bat Conservation Ireland records for this species show a small number of records in the Scheme Study Area.

Identification of roosts

2014 – 2018

27 roosts of this species were recorded during the building inspections in 2014-2017. Seven of the roosts could support maternity colonies; a period house on the Letteragh Road (PBR49), Merlin Castle (PBR51), an abandoned bungalow on the R338 to Oranmore (PBR89), a barn on the R399 east of Ballybrit (PBR100), the attic of two houses in Aughnacurra Housing Estate (PBR178, PBR256) and a modern house in the Heath Housing Estate (PBR173).

Twelve additional roosts were also classified as night roosts, while the remaining eight were not classified. The night roosts were found in the following locations; an abandoned house adjacent to the Corinthians RFC (PBR21), an abandoned house in Rockmount (PBR15), three abandoned outbuildings near Ballindooley Lough (PBR17, PBR25, PBR111), an outbuilding and archway in Menlough (PBR82, PBR156), an unfinished modern house in Gortacleva (PBR138), a shed in Barr Aile (PBR217), a shed in Garraun (PBR194) and a cottage in Ballintemple (PBR105).

During the radio-tracking in August 2014, four brown long-eared bats were captured; two bats at Bearna Woods, one bat at Menlough Woods, and one bat at Cooper's Cave. The female brown long-eared captured at Cooper's Cave was fitted with a radio transmitter and tracked to its daytime roost; a bungalow in Castlegar (PBR145). 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 2014 radio-tracking session and was found to repeatedly roost in the same bungalow. On one night the bat was recorded night roosting in a stone arch between Menlough Village and Menlo Castle (PBR156) during heavy rain. The maximum commuting distance recorded for this individual in a single night was approximately 4.07km. The foraging area of 2.18km^2 (MCP) mainly encompassed the valley where Cooper's Cave was located but also around Ballindooley Lough. Refer to Figure 3A in Appendix A.8.9 and Figure 46 in Appendix A.8.7.

Figure 8.33.1 shows the locations of these roost records.

2023

Seven roosts of this species were identified in 2023. The identification of these roosts arose from a combination of building/structure inspection surveys, roost emergence surveys, and data generated between 2014 - 2018:

- PBR173, a modern house in the Heath Housing Estate (PBR173). Brown Long-eared bat droppings (confirmed by DNA sequencing)/large amount suspected maternity roost, were confirmed in surveys conducted during 2014 - 2018.
- PBR192, a modern residential building north of the N83 Tuam Road, was identified as a Brown long-eared bat roost based on the discovery of droppings during internal inspections of the building in 2014 - 2018. The owners of the building refused access to surveyors to conduct emergence, external or internal inspections of the building in 2023, and the building could not be surveyed from adjacent areas of publicly accessible lands due to its large setback from the roadside. Based on review of the property using aerial imagery and google street maps, it appears to remain in similar condition to 2018 and therefore it is assumed that it remains a roost for brown long-eared bats.
- PBR204, a derelict bungalow on the eastern side of the N84 Headford Road was identified as a Brown long-eared bat Plecotus auritus roost in 2014 - 2018 based on the identification of droppings in the interior of the building. Three separate emergence surveys were completed in late May, late June and late September 2023, with a single brown long-eared bat observed emerging during the June survey.
- PBR215, a hayshed south of PBR215 in Troscaigh Thiar which was subject to three surveys in late August 2023 including internal and external building inspection and emergence surveys. The building is surrounded by dense scrub vegetation on its southern side and this limited visibility of all parts of the building. Nonetheless, the building was identified as a mixed brown long-eared bat/Myotis species roost based on the emergence of two bats during the first survey visit.
- PBR216, a small outbuilding to the rear of a residential property in Troscaigh Thiar. A single Brown long-eared bat was observed returning to roost on the first of two surveys conducted at this building in late August 2023.
- PBR267, a traditional bungalow is a mixed roost of brown long-eared bat and soprano pipistrelle bat and is described under subsection Soprano pipistrelle bat Pipistrellus pygmaeus above. This is a small roost and a single brown-long-eared bat was observed roosting under a barge board at the rear of the building.
- PBR82, an outbuilding and archway in Menlough. Identified initially as a night roost for Lesser Horseshoe bats (1 bat) in 2014 during radio-tracking, but also present were Brown-long eared bats and Natterer's bats. Remains suitable and notwithstanding absence of any evidence of use in 2023 is

conservatively being assigned as a night roost for Brown long-eared bats and the other bat species previously identified as present in the roost.

No winter hibernation roosts for this species were observed in 2023, however, Brown long-eared bats were recorded during Winter Hibernation by statics placed at Cloonnabinnia Cave PBR160.

Figure 8.32.1 shows the locations of these records.

Evidence for bat activity

2014 - 2018

During the surveys conducted between 2014 – 2018, Brown long-eared bats were only recorded at two locations during the walked and vehicle transects but these results are typical for this bat species which echolocates very quietly and is therefore difficult to pick up on a heterodyne bat detector on a moving transect. However, they were recorded at 18 (out of a total of 24) automated detector locations in 2014, indicating that the species is quite widespread in the Scheme Study Area, consistent with the findings of the summer roost surveys.

The automated detectors deployed in 2015 recorded brown long-eared bats at only two (out of a total of 42) sites along the route of the proposed N6 GCRR, adjacent to the River Corrib (RS1 and RS7).

2023

Walked transects in 2023 recorded no Brown long-eared bats across all 15 transect locations along the route of the proposed N6 GCRR.

However, the automated detectors deployed in 2023 recorded Brown long-eared bats at 47 (out of a total of 50) locations along the route of the proposed N6 GCRR. The highest levels of activity were recorded at Ballinfoyle/Castlegar (L38 and L37) and Lackagh Quarry (L32 and L33).

Figure 8.36.1 shows the locations of these records.

Within Appendix 4 of ABPs' Inspector's Report dated 22 June 2021, Brown long-eared bat is valued as being of County Importance "*due to a likely higher population in Galway County compared to other areas of the country".* This species was valued as being of Local Importance (Higher Value) in the 2018 EIAR. It is the professional opinion of the authors, that Brown long-eared bat should still be valued as such, i.e. as Local Importance (Higher Value), due to being a species of 'Least Concern', as it is a commonly recorded species across Ireland, and the availability of suitable habitat in the wider environment.

Myotis bat species

The results of the bat surveys, as they relate to bats identified to the Myotis genus level, are shown on Figures 8.32.1 and 8.33.1.

The Myotis genus includes three bat species resident in Ireland: Daubenton's bat Myotis daubentonii, Natterer's bat M. nattereri and the Whiskered bat M. mystacinus. There can be difficulty in differentiating between the bats using their echolocations calls as there can be similarity between them. Therefore, they have been grouped together for the purposes of reporting these results.

Historical records

Previous bat studies have reported in excess of 20 Daubenton's bats recorded roosting in the southern façade of Menlo Castle in 2000. There was no roost recorded in 2005 and 2006, but bats were recorded foraging. Less than 30 Natterer's bats were recorded roosting in outbuildings of Menlo Castle in 2000 but no roost was recorded in 2005 and 2006 ((RPS, 2006). Myotis bats were recorded on the University of Galway Sporting Campus (McCarthy, Keville & O'Sullivan (2014). There was also an historical record of a roost of Natterer's bats at St James's Church, Bushypark. Natterer's bats were also recorded as part of the surveys carried out for the proposed R336 to N59 Road Scheme (RPS, 2013a). Daubenton's bats have been recorded on the River Corrib from the University of Galway lands (McCarthy, Keville and O'Sullivan. (2014a, 2014b)) and also in most watercourses within the city and around its environs. This species is regularly sighted around the Galway Cathedral during bat walks by Galway Bat Group (C. Carlin, pers comm 2015).

Whiskered bats are rarely recorded across the area and only ad-hoc records from Bat Conservation Ireland exist.

Identification of roosts

2014 – 2018

Four Natterer's bat roosts were recorded during the inspections of buildings in 2015 (PBR17, PBR20, PBR64, PBR82). These roosts were confirmed based on the presence of droppings, which were analysed using DNA sequencing to confirm the species identity.

An emergence survey of Menlo Castle (PBR06), carried out on the 8 July 2014, found Daubenton's bats to be still roosting in the castle. Numbers of bats were estimated to be less than 20 bats.

During the radio-tracking in August 2014, nine Daubenton's bats (one female and eight males) were captured in Menlough Woods and a single male Daubenton's bat was captured at Cooper's Cave. One of the male Daubenton's bats captured in Menlough Woods was tagged and tracked. It was found to roost in a stonewall structure on the eastern bank of the River Corrib (PBR133). An emergence count undertaken shortly after recorded 25 Daubenton's bats to be roosting in the wall, suggesting that this was likely to be a maternity roost for this species.

During the second radio-tracking session in August, ten Daubenton's bats were captured (one from Merlin Wood, three from University of Galway, and six from Menlough Woods) and four were tagged (one female from Merlin Wood, two females and one male from University of Galway). Roosting information was recorded for three of the Daubenton's bats tracked during the second August session. They were found to roost in three buildings (PBR142, PBR143, PBR144) and two bridges (PBR150, PBR152) in Galway City Centre. Foraging data was recorded in the September 2014 tracking session for two Daubenton's bats that were captured during the second August session in 2014. One bat travelled a maximum distance of 1.06km and had a foraging area of 0.26km^2 (MCP) encompassing Merlin Woods and the Coolagh Lakes. The other had a maximum distance of 2.48km and had a foraging area of 0.55km^2 (MCP) encompassing the River Corrib from Menlo Castle into Galway City Centre. Refer to Figures 48, 49 in Appendix A.8.7 and Figure 2, 3B, 3D, 3E of Appendix A.8.9.

Two male whiskered bats were captured and tagged during the second radio-tracking session in August 2014 (one from University of Galway and one from Merlin Woods). However, the bat caught in Merlin Woods could not be relocated after tagging. The other Whiskered bat was found to roost in two modern dwelling houses (PBR140, PBR151) in a residential estate by the Sports Centre, near Bearna Woods. Foraging data for this individual was gathered during the September radio-tracking session. The maximum distance this bat travelled was 3.71km and had a foraging area of 2.02km^2, encompassing areas of scrub and rough grassland in the Bearna area. Refer to Figure 47 in Appendix A.8.7 and Figures 2 and 3C in Appendix A.8.9.

A Natterer's bat was captured in Menlough Woods in August 2014 but was not prioritised for tracking at that time and hence not fitted with a radio-tag. Another male Natterer's bat was captured, ringed and tagged in Menlough Woods during the September 2014 radio-tracking session; however, no data was recorded from this bat, possibly due to the bat leaving the area, or transmitter failure.

Figure 8.33.1 shows the locations of these roost records.

2023

Seven roosts of Myotis bat species were identified: The identification of these roosts arose from a combination of building/structure inspection surveys, roost emergence surveys, and data generated in the period 2014-2018 and 2023:

- PBR73, St. James' Church, Bushypark. The building was identified as a roost for Myotis species, based on historical record of Myotis bats in St. James' Church (Myotis naterreri) and emergence of bats recorded during surveys conducted between June – September 2023
- PBR199, a building on the eastern side of the N84 in Ballindooly that was subject to external inspection and emergence surveys (access was denied to internal parts of the building by the owners/occupants). The building was identified as a small roost for Myotis species bats based on emergence surveys. Three surveys were completed in late May, late June, and mid-September 2023. A single bat was observed

returning to roost at the building during the September survey. Based on observations, this is likely to be a night roost or day roost for Myotis. The building is adjacent to high quality riparian habitat (Ballindooly Lough) which Myotis species are particularly strongly associated with

- PBR215, a hayshed in Troscaigh Thiar as already described under subsection Brown long-eared bat. Plecotus auratus above. A single Myotis bat was observed roosting at this building in August 2023
- PBR140, a residential building in the Lios Mór housing estate was identified as a roost for Whiskered bat Myotis mystacinus based on data collected in 2014 only (observation of a live bat in the building). Surveys were not conducted at this building in 2023 as the owner refused access to the building by surveyors. As the building remains in a similar condition to 2018, out of an abundance of caution, the building is assumed to continue to provide roosting opportunities to whiskered bat and has been treated as a whiskered bat roost
- PBR151, another residential building in the Lios Mór housing estate. Again surveyors were denied access for bat surveys in 2023, and therefore the identification of this building as a roost relies solely on data collected between 2014-2018 (observation of a live whiskered bat Myotis mystacinus in the building)
- PBR178, a residential building in the Aughnacurra housing estate off the N59 Moycullen Road. The garage to this building was previously identified as a Lesser horseshoe bat roost Rhinolophus hipposideros. The observations of Myotis bats in 2023 relates to the house proper, with a single bat observed emerging from the building on the first two of three survey visits in mid-June, mid-July, and mid-August 2023
- PBR82, an outbuilding and archway in Menlough. Identified initially as a night roost for Lesser Horseshoe bats (one bat) in 2014 during radio-tracking, but also present were Brown-long eared bats and Natterer's bats. Remains suitable and notwithstanding absence of any evidence of use in 2023 is conservatively being assigned as a night roost for Brown long-eared bats and the other bat species previously identified as present in the roost

Figure 8.32.1 shows the locations of these roost records.

Evidence of bat activity

2014 - 2018

During the surveys conducted between 2014 – 2018, on the walked and vehicle transect surveys and the automated detector surveys in 2014 and 2015, the majority of Myotis calls were not identified by species due to the overlap in call characteristics between species when analysed. However, on a number of occasions, Myotis species were confirmed by visual observations coinciding with echolocation calls. Natterer's bats were recorded at Bearna Woods and Daubenton's bats were seen foraging on the River Corrib and the Terryland River. The majority of Myotis bat calls were recorded along the River Corrib and Terryland River during the walked and vehicle transects but were infrequently recorded across the rest of the Scheme Study Area. Figure 8.37.1 shows the locations of these detector records.

Myotis calls were recorded across all 24 automated detector locations in 2014, 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 the known Daubenton's maternity roost.

The automated detectors deployed in 2015 along the route of the proposed N6 GCRR recorded Myotis bats at 25 (out of a total of 42) locations. Activity levels for this species at static locations along the route of the proposed N6 GCRR were low for this species group but the highest activity was recorded along the River Corrib (RS1), Lackagh Quarry (RS13), an area of woodland adjacent to the N84 Headford Road near Ballindooley and along a stream surrounded by fields and scrub in Ballard East.

During the crossing point surveys, possible crossing records were recorded at 7 (out of a total of 21) sites for Myotis bat species, with 1-3 possible crossings recorded at each of these sites.

2023

Walked transects in 2023 recorded Myotis species at three (out of a total of 15) transect locations along the route of the proposed N6 GCRR. The highest levels of activity were recorded at River Corrib/Menlo (T9). The other transects were north of Bearna Road (T1) at the western-end of the proposed N6 GCRR and Lackagh Quarry (T11).

The automated detectors deployed in 2023 recorded Myotis species at 47 (out of a total of 50) locations along the route of the proposed N6 GCRR. The highest levels of activity were recorded at Dangan/Greenfields Hockey Club (L21), Cappagh Road area (L8), and Menlo/River Corrib area (L25).

Significant activity of Myotis species was also recorded at Coolough/Menlo area (L27), Lackagh Quarry (L32); and Dangan University of Galway Sportsground (L22).

Myotis species were also recorded during Winter Hibernation by statics placed at Menlo Castle (PBR06) and Cloonnabinnia Cave (PBR160). Figure 8.36.1 shows the locations of these detector records.

Within Appendix 4 of ABP's Inspector's Report dated 22 June 2021, Whiskered bat and Natterer's bat are valued as being of National Importance "*due to both species being rare in Ireland".* These species were valued as being of Local Importance (Higher Value) in the 2018 EIAR. It is the professional opinion of the authors, that all Myotis species (including Daubenton's bat) should still be valued as such, i.e. as Local Importance (Higher Value), due to being species of 'Least Concern', as their wide distribution throughout Ireland, and the availability of good habitat within the surrounding and wider environments.

Changes in Roost Locations and Species across the Study Area between 2018 and 2023

A summary of the overall changes in locations of bat roosts within the overall project area are detailed below in Table 8.21 (For full details refer to Appendix A.8.25 Bat Derogation Licence Application - Part 2; Appendix B thereof).

Table 8.21 Changes in Roost Locations and Species across the Study Area between 2018 and 2023

Label	Change between 2023 and 2018 (Y/N)	Details of Change(s) between 2023 and 2018 - 2014
PBR06	Y	Species Change - just Lesser Horseshoe bats, not Daubenton's bats
PBR112	N	N/A
PBR114	N	N/A
PBR115	Y	No longer a roost
PBR124	Y	No longer a roost
PBR128	Y	Change in PRF from Medium to Low
PBR129	Y	Change in PRF from Low to High
PBR130	Y	No longer a roost
PBR133	Y	No longer a roost
PBR134	Y	Species Change - now Soprano Pipistrelles and Leisler's bats. Change in PRF from Low to High
PBR139	Y	Confirmed in 2023 as Transitional roost
PBR140	N	N/A
PBR145	Y	Species Change - now Soprano Pipistrelles, not Brown Long-eared bats. Confirmation of PRF as Low
PBR146	Y	No longer a roost
PBR151	N	N/A

Label	Change between 2023 and 2018 (Y/N)	Details of Change(s) between 2023 and 2018 - 2014
PBR153	Y	Confirmation of PRF as High
PBR154	Y	No longer a roost
PBR156	Y	Species Change - now Soprano Pipistrelles and Lesser horseshoe bats, not Brown Long-eared bats and Lesser horseshoe bats. Confirmation of PRF as Moderate
PBR157	Y	No longer a roost
PBR158	N	N/A
PBR166	N	N/A
PBR167	N	N/A
PBR168	N	N/A
PBR169	N	N/A
fPBR170	N	N/A
PBR171	N	N/A
PBR172	N	N/A
PBR173	N	N/A
PBR174	N	N/A
PBR175	N	N/A
PBR176	N	N/A
PBR177	N	N/A
PBR178	Y	Species Change - now Myotis Species and Lesser horseshoe bats, not Brown long-eared and Lesser horseshoe bats
PBR179	Y	Species Change - now just Soprano Pipistrelle, not Brown long-eared and Soprano Pipistrelle. Change of PRF from High to Moderate
PBR180	N	N/A
PBR181	Y	N/A
PBR182	N	N/A
PBR183	Y	No longer a roost
PBR184	N	N/A
PBR185	N	N/A
PBR186	N	N/A
PBR187	N	N/A
PBR188	N	N/A
PBR189	N	N/A

Label	Change between 2023 and 2018 (Y/N)	Details of Change(s) between 2023 and 2018 - 2014
PBR190	N	N/A
PBR191	N	N/A
PBR192	N	N/A
PBR193	N	N/A
PBR194	N	N/A
PBR195	N	N/A
PBR196	Y	Species Change - now just Leisler's bats, not Brown long-eared and Soprano Pipistrelle
PBR197	Y	Change in PRF from Low to Negligible
PBR198	N	N/A
PBR199	Y	Now a Myotis species roost
PBR200	N	N/A
PBR201	N	N/A
PBR202	N	N/A
PBR203	Y	Change in PRF from High to Medium
PBR204	Y	Species Change - now just Brown long-eared, not Brown Long-eared and Lesser horseshoe bats
PBR205	Y	Change in PRF from Medium to High. Pipistrelle Species recorded in wider stable block area (sub-divided as below - PBR205_ST)
PBR205_ST1	N/A	N/A
PBR205_ST10	N/A	N/A
PBR205_ST11	N/A	N/A
PBR205_ST12	N/A	N/A
PBR205_ST2	N/A	N/A
PBR205_ST3	N/A	N/A
PBR205_ST4	N/A	N/A
PBR205_ST5	N/A	N/A
PBR205_ST6	N/A	N/A
PBR205_ST7	N/A	N/A
PBR205_ST8	N/A	N/A
PBR205_ST9	N/A	N/A
PBR206	Y	Change in PRF from Low to Negligible

Label	Change between 2023 and 2018 (Y/N)	Details of Change(s) between 2023 and 2018 - 2014
PBR207	Y	Change in PRF from Medium to Low
PBR208	N	N/A
PBR209	N	N/A
PBR210	N	N/A
PBR211	N	N/A
PBR212	N	N/A
PBR213	N	N/A
PBR214	N	N/A
PBR215	Y	Now a Brown long-eared bat and Myotis species roost
PBR216	Y	Now a Brown long-eared bat roost
PBR218	N	N/A
PBR219	N	N/A
PBR222	N	N/A
PBR225	Y	Species change - now just Soprano Pipistrelle
PBR226	Y	Now a Leisler's bat roost
PBR228	Y	No longer a roost. PRF change from Medium to High
PBR229	Y	Now a Pipistrelle species roost
PBR230	Y	Change of PRF from High to Low
PBR234	N	N/A
PBR235	N	N/A
PBR236	N	N/A
PBR237	Y	No longer a roost
PBR238	Y	Now a Soprano Pipistrelle bat roost
PBR241	Y	Species change - now Lesser horseshoe bat roost not a Soprano Pipistrelle bat roost
PBR242	Y	No longer a roost
PBR243	N	N/A
PBR244	N/A	N/A
PBR245	N/A	N/A
PBR246	N/A	N/A
PBR247	N/A	N/A

Label	Change between 2023 and 2018 (Y/N)	Details of Change(s) between 2023 and 2018 - 2014
PBR248	Y	Change of PRF from Medium to High
PBR249	Y	Change of PRF from Low to High
PBR250	Y	Change of PRF from Medium to High
PBR251	Y	Change of PRF from Low to Medium
PBR252	Y	Now a Common Pipistrelle bat roost
PBR253	Y	Change of PRF from Low to Negligible
PBR254	N	N/A
PBR255	Y	Species change - now Leisler's bats and Soprano pipistrelle root, not just Soprano pipistrelle
PBR256	Y	Species change - now Soprano pipistrelle root, not Brown long-eared bat
PBR257	N	N/A
PBR259	N	N/A
PBR260	N	N/A
PBR261	Y	Now a Soprano Pipistrelle bat roost
PBR262	N	N/A
PBR263	N	N/A
PBR264	N	N/A
PBR265	N	N/A
PBR266	N	N/A
PBR267	N	N/A
PBR268	N	N/A
PBR269	N	N/A
PBR270	Y	No longer a roost
PBR271	N	N/A
PBR272	N	N/A
PBR273	N	N/A
PBR274	Y	PRF change from Medium to High
PBR275	Y	PRF change from Low to Negligible
PBR276	Y	PRF change from Low to Negligible
PBR277	Y	PRF change from Low to Negligible
PBR278	Y	PRF change from Low to Negligible

Label	Change between 2023 and 2018 (Y/N)	Details of Change(s) between 2023 and 2018 - 2014
PBR279	Y	PRF change from Low to Negligible
PBR280	N	N/A
PBR281	N	N/A
PBR283	N/A	N/A
PBR284	N/A	N/A
PBR285	N/A	N/A
PBR286	N/A	N/A
PBR287	N/A	N/A
PBR288	N/A	N/A
PBR289	N/A	N/A
PBR290	N/A	N/A
PBR291	N/A	N/A
PBR292	N/A	N/A
PBR293	N/A	N/A
PBR294	N/A	N/A
PBR295	N/A	N/A
PBR296	N/A	N/A
PBR298	N/A	N/A
PBR299/PBR116	Y	Building has been demolished between 2018 - 2023
PBR49	Y	No longer a roost
PBR50	Yes	Now a Pipistrelle species roost
PBR53	Y	Now a Soprano Pipistrelle bat roost
PBR54	Y	No longer a roost. PRF change from High to Negligible
PBR62	N	N/A
PBR63	N	N/A
PBR67	N	N/A
PBR73	Y	Species change - now Leisler's bat and Natterer's bat roost not just Natterer's bat
PBR81	Y	PRF change from Medium to Negligible
PBR82	N	N/A
PBR83	Y	Species change - now Common Pipistrelle and Lesser horseshoe bat roost not just Lesser horseshoe bat

Label	Change between 2023 and 2018 (Y/N)	Details of Change(s) between 2023 and 2018 - 2014
PBR84	N	N/A
PBR85	N	N/A

Summary of 2018 Roosts within the Assessment Boundary compared with 2023 Roosts within the Assessment Boundary

As of 2018, 15 buildings supporting 20 bat roosts were within the proposed N6 GCRR (six Soprano pipistrelle roosts (PBR177, 179, 196, 205, 255, 267), one Common pipistrelle roost (PBR205), one unidentified pipistrelle bat roost (PBR182), seven Brown long-eared bats roosts (PBR 183, 178, 179, 196, 204, 256, 267), three Lesser horseshoe bat roosts (PBR178, 204, 210) and two unidentified species bat roosts (253, 270). Six of these are structures were used by more than one bat species. Figures 8.28.1, 8.30.1, 8.32.1 and 8.34.1 show the locations of these roosts.

Following the 2023 surveys, this status has subsequently changed to 19 buildings supporting 23 bat roosts are within the proposed N6 GCRR (eight Soprano pipistrelle roosts (PBR177, 179, 250, 255, 248, 256, 261, 267), one Common pipistrelle roost (PBR252), three unidentified pipistrelle bat roosts (PBR205_ST1, 205_ST9, and 205ST_10), three Brown long-eared bat roosts (PBR204, 215, 267), three Lesser horseshoe bat roosts (PBR178, 210, 241), two Leisler's bat roosts (PBR196, PBR255), and three unidentified Myotis species bat roosts (PBR178, 199, 215). Figures 8.28.1, 8.30.1, 8.32.1 and 8.34.1 show the locations of these roosts.

Survey Limitations

Between 2014 and 2023, a total of 230 structures and 62 trees were assessed as part of the collection of baseline data on the bat populations within the Scheme Study Area. This unprecedented level of surveying allowed a detailed picture of the species assemblage present in the study area and informed the constraints and route selection studies, the design of the proposed N6 GCRR and the preparation of this updated EIAR for the Project.

All structures within the Assessment Boundary which may be affected, either directly or indirectly, were surveyed to record potential usage by bats. In most cases it was possible to carry out internal and external checks for signs of bats in daytime as well as dusk and/or dawn surveys. Inevitably in a few cases, access to inside the structure was not possible. In such cases, surveys at night were undertaken to record any bats emerging from or returning to the structure.

Some surveys (e.g. radio-tracking surveys in 2015) may have been affected by cool night time temperatures and may have forced bats to reduce foraging time. Overall, the repeated surveys carried out since 2014 have allowed bats to be surveyed over multiple seasons which reduces the bias caused by suboptimal weather conditions.

As noted in Bat mitigation guidelines for Ireland v2 (Marnell *et al*., 2022), '*it is extremely difficult to survey trees and be certain that any bat roosts have been detected*'. This has been accounted for in developing the mitigation strategy whereby all trees with potential to support roosting bats will be subject to pre-felling checks, including emergence (Section 8.6.5.2), to ensure the protection of any bats that may be present at that time.

In 2023, 165 buildings were identified within this zone of influence, with building/structure inspections completed on 129 of the 165 buildings. Access was denied for the following building/structure inspection by the occupants of 30 of the 165 buildings:

- PBR129
- PBR175
- PBR185

- PBR195
- PBR213
- PBR244
- PBR257
- PBR266
- PBR296
- PBR63
- PBR166
- PBR176
- PBR191
- PBR200
- PBR234
- PBR245
- PBR259
- PBR273
- PBR298
- PBR84
- PBR174
- PBR184
- PBR193
- PBR208
- PBR243
- PBR247
- PBR263
- PBR280
- PBR299
- PBR85

8.3.8.3 Badger

Badger, and their breeding and resting places, are protected under the Wildlife Acts.

The distribution of badger activity is consistent with that presented in the 2018 EIAR. Seven additional badger setts were recorded in 2023; one of which is located within the Assessment Boundary, noted as a rock mound with anecdotal evidence of badger.

Evidence of Badger *Meles meles* activity was found across the Assessment Boundary from Na Foraí Maola to the N83 Tuam Road. The highest concentrations of badger activity were recorded in the Menlough area and the area between Lackagh Quarry and the N84 Headford Road.

The survey results showed a much greater distribution of Badgers across the Assessment Boundary than suggested by the findings of the desktop review undertaken to inform this updated EIAR. There is a single 2km grid square (M32I) where the National Biodiversity Data Centre (NBDC) database had a record for Badger but the species was not recorded in that overlapping portion of the mammal survey study area and grid square M32I. However, the baseline surveys did record Badger 50m to the north.

Seventeen badger setts were identified both within and in the vicinity of the Assessment Boundary between 2014 and 2018. The majority of setts were recorded as part of the 2015 multidisciplinary survey but some records for setts further from the Assessment Boundary were also recorded in 2014, during the course of other survey work. Sixteen were active at the time of the survey with the remaining sett (S1) showing no signs of recent use, at that time.

The Survey Area for Badger in 2023 was reduced relative to the surveys conducted in 2014-2018; the Survey Area in 2014-2018 extended beyond the potential ZoI of the Project on Badger and so a reduced survey area in 2023 was appropriate. A further seven badger setts were recorded in 2023 (bringing the total number of Badger setts across the Project to 24), although the classification of one (S24) based on anecdotal evidence of badgers using a rock mound as a sett was also recorded in the Coolagh Area. A natural entrance between rocks was recorded but no evidence of digging or fresh bedding was seen.

The status, description and distance from the Assessment Boundary of each of the setts is provided below in Table 8.22. Note that on occasions several setts were inaccessible due to surveyors being refused access by landowners. In these cases, the status of the sett as originally recorded in 2014-2015 has been retained.

Badger foraging signs (snuffle holes) were recorded at areas along the length of the entire Project, including Cappabornia, Castlegar, areas around Lackagh Quarry, Menlough, Dangan, Rahoon/Letteragh, Ballard East, Ballard West, and Forramoyle West. (See Figure. 8.4.1 to 8.4.15 and Figure. 8.5.1 to 8.5.15).

Latrines were observed mainly in the east; with two locations in Castlegar, and two in the Menlough area, respectively, the latter including an active latrine found along the northern bank of the River Corrib in proximity to Menlo Castle.

Badger prints were recorded at Twomileditch (close to the N83 Tuam Road) and in areas around Lackagh quarry, in the east. In the west, badger prints were recorded at Rahoon/Letteragh and in Ballard East. (See Figure 8. 4.1 to 8.4.15 and Figure. 8.5.1 to 8.5.15).

Badgers are a relatively common and widespread mammal species, both locally and nationally. They occur in rural, semi-urban and urban habitats and although they are protected by law, they are listed as ‘Least Concern’ on the Ireland Red List No. 12: Terrestrial Mammals (Marnell *et al*., 2019). For these reasons, Badger are valued as being of Local Importance (Higher Value).

The results of the badger survey are shown in Figures 8.4.1 to 8.4.15.

Table 8.22 Results of the Badger Survey – Badger Setts

Ref. No.	Type of Sett[64]	Status and Description
S1	Disused sett	Inactive sett located beneath blackthorn tree. Single entrance c.160m south-east of the Assessment Boundary at Ch. 3+930 of the proposed N6 GCRR
S2	Inactive main sett	No signs of badger activity and Active sett area overgrown with bracken. This was previously active in 2014-2015. Located in area of scrub along field boundary; numerous tunnels/pathways into the undergrowth c.90 m northwest of the N59 Link Road South of the proposed N6 GCRR at Ch. 1+800

[64] Main sett = breeding sett, focus of most badger activity; Annexe sett = large sett, usually within 50m of the main sett; Subsidiary sett = smaller sett, not peripheral, within territory of badger social group; Outlier sett = small sett, usually on periphery of group territory; Minor sett = incidental sett, not on periphery of group territory.

Ref. No.	Type of Sett[64]	Status and Description
S3	Main sett	Active sett located in woodland near field boundary wall. Single entrance sett with abundant fresh spoil, bedding and latrines Adjacent to (<5m from) the Assessment Boundary at Ch. 9+500 of the proposed N6 GCRR
S4	Annex sett	Active sett located amongst holly bushes under limestone boulder. Single entrance with fresh spoil, bedding and latrine c.85m southeast of the Assessment Boundary at Ch. 9+500 of the proposed N6 GCRR
S5	Subsidiary sett	This active sett is located outside of the 150m buffer of the Assessment Boundary and was not revisited in 2023 at it is outside of the ZoI. The 2014-2015 record of active sett has been retained. Located along field boundary. Single entrance with bedding and latrine c.430m southeast of from the Assessment Boundary at Ch. 9+500 of the proposed N6 GCRR
S6	Main sett/Annex sett	This sett is located outside of the 150m buffer and was not revisited in 2023 as it is outside of the ZoI. The 2014-2015 of active sett has been retained. Located in area of scrub. At least two entrances, fresh spoil, bedding >500m from the Assessment Boundary
S7	Main sett/Annex sett	This sett is located outside of the 150m buffer and was not revisited in 2023 as it is outside of the ZoI. The 2014-2015 record of active sett has been retained. Located under limestone. Two entrances, fresh spoil, bedding. >500m from the Assessment Boundary
S8	Main	In spite of survey efforts, this sett could not be found upon revisit in 2023, however trails and foraging evidence were recorded in the vicinity. The 2014-2015 record of this being an active sett has been retained on a precautionary basis. Located between limestone boulders. This sett has 10 plus entrances, latrines and abundant activity signs c.55m south of the Assessment Boundary (Bóthar Nua tie-in) at Ch. 10+200 of the proposed N6 GCRR
S9	Potential main sett	Active sett located in hazel woodland at base of boulder pile. Single entrance. Large spoil heap, fresh spoil and bedding present. Video evidence of badger entering and exiting sett was recorded using motion-trigger cameras in 2023 Within Assessment Boundary at Ch. 11+810 of the proposed N6 GCRR
S10	Subsidiary sett	Active sett with two entrances, located under scrub along field boundary. Sett partially overgrown, no fresh spoil or bedding – fresh badger foraging signs and trails were recorded between this sett entrance and S9 c.45m northeast of the Assessment Boundary at Ch. 11+810 of the proposed N6 GCRR
S11	Subsidiary sett	Sett is located on land where access was denied by landowner, and therefore this sett could not be revisited for 2023 survey. The 2014-2015 record of active sett has been retained on a precautionary basis. Located in dense scrub at field boundary. Single entrance Within Assessment Boundary at Ch. 12+025 of the proposed N6 GCRR
S12	Main	This sett is located outside of the 150m buffer of the Assessment Boundary and therefore was not revisited in 2023 as it is outside the ZoI of the Project. The 2014-2015 record of active sett has been retained. Located in scrub along field boundary. Six entrances >500m from the Assessment Boundary
S13	Subsidiary sett	Active sett located within improved grassland field. Single entrance. Abundant fresh foraging signs around sett and clear trail recorded alongside hedgerow

Ref. No.	Type of Sett[64]	Status and Description
		c.130m south of Assessment Boundary at Ch. 13+425 of the proposed N6 GCRR
S14	Subsidiary sett	Active sett located along field boundary. Two entrances. Recent digging. Fresh tracks recorded outside sett entrance Within Assessment Boundary at Ch. 13+775 of the proposed N6 GCRR
S15	Subsidiary sett	Inactive in 2023, Active in 2014-2018, single entrance c.100m northwest of AR 13/03 on the proposed N6 GCRR
S16	Subsidiary sett	Inactive, single entrance c.150m to the west of the proposed N59 drainage for the proposed N6 GCRR
S17	Subsidiary sett	Inactive in 2023, Active in 2014-2018, two entrances c.52m north of the proposed N59 drainage for the proposed N6 GCRR
S18	Outlier	Identified in 2023 Inactive – located beneath mound. No fresh signs recorded c.32m north of the Assessment Boundary
S19	Outlier	Identified in 2023 Active – located in woodland with limestone pavement. Badger recorded by camera trap using sett c.150 meters southeast of the Assessment Boundary
S20	Subsidiary sett	Identified in 2023 Inactive - three entrances, no fresh signs c.5 m south of the Assessment Boundary
S21	Outlier	Identified in 2023 Inactive – single entrance. Camera trap set up and no badger activity recorded c.145m north of the Assessment Boundary
S22	Outlier	Identified in 2023 Inactive – single entrance Camera trap set up and no badger activity recorded c.72m northwest of the Assessment Boundary
S23	Subsidiary sett	Identified in 2023 Not recently used, possibly inactive – 2 entrances. Old latrine recorded outside one entrance and worn trail recorded leading from sett into neighbouring field c.70m east of the Assessment Boundary
S24	N/A	Identified in 2023 Anecdotal evidence of badgers using rock mound as sett. Natural entrance between rocks recorded but no digging or fresh evidence

Survey Limitations

Due to the presence of dense vegetation/scrub cover there were some locations within the study area, and within the Assessment Boundary, which could not be fully accessed during the survey. These are shown on Figures 8.4.1 to 8.4.15. No evidence of Badger activity was recorded around the perimeter, or in the vicinity of, any of the inaccessible areas directly affected by the proposed N6 GCRR.

The inaccessible areas have been considered in determining the impact significance and are reflected in the mitigation strategy. Sufficient data was gathered to reliably inform the impact assessment despite not being able to fully access these areas.

8.3.8.4 Other mammal species

The other mammal species baseline presented in this updated EIAR is consistent with that presented in the 2018 EIAR, with additional records noted.

Pine marten *Martes martes* were recorded along the Monument Road in Menlough in 2014/2015 and off Coolough Road in Menlough in 2023. Given its habitat preferences, Pine marten is likely to be present in woodlands across the Assessment Boundary. Pine marten have also been recorded in Bearna Woods and at Mincloon (NBDC on-line database records). Within Appendix 4 of ABP's Inspector's Report dated 22 June 2021, the local Pine marten population is valued as being of County Importance "*due to the scarcity of the species in Ireland*". Pine marten were valued as Local Importance (higher value) in the 2018 EIAR, and it is the professional opinion of the authors that Pine marten should still be valued as such, i.e., as Local Importance (higher value) due to it being a species of Least Concern in Ireland, as it is widely recorded across Ireland, and the abundance of habitat locally and in the surrounding environment for this species.

In 2018, evidence of Wood mouse *Apodemus sylvaticus* and Red squirrel *Sciurus vulgaris* was recorded east of the River Corrib, in woodlands east of Menlough Village, around Lackagh Quarry west of the proposed N84 Headford Road Junction on the proposed N6 GCRR, and south of the Roadstone Quarry at Twomileditch. Red squirrel is known from the Menlough area, Merlin Park Woods, Ballygarraun/Twomileditch, and woodlands in the Ardaun area (NBDC on-line database records). A squirrel drey was observed in a sycamore tree crown in 2023, behind a residential area west of the Ballymoneen Road; however, it was not determined whether this was a Grey Squirrel Sciurus carolinensis or Red Squirrel drey. Red Squirrel is valued as being of Local Importance (higher value), given its patchy distribution across the country.

In 2018, an Irish stoat *Mustela erminea hibernica* was recorded on Bóthar Nua (roadkill). In 2023, Irish hare *Lepus timidus hibernicus* was recorded across the Assessment Boundary, in scrubland south of Lackagh quarry, lands west of Barnacranny and in a dense gorse dominated pavement habitat in Bearna. Both species have been recorded in the Assessment Boundary previously (NBDC on-line database records and McAney, 2010).

Other terrestrial mammal species protected under the Wildlife Acts and likely to be present and widespread given the habitat types and existing land uses, and existing records from the NBDC's online database, include the Hedgehog *Erinaceus europaeus* and the Pygmy shrew *Sorex minutus*. In 2023, signs of Hedgehog were observed predominantly in the west of the Project, in various areas between Cappagh Park and Letteragh, although it can be assumed Hedgehog is likely to be present and widespread throughout lands both within, and in the vicinity of, the Assessment Boundary, given the habitat types and existing land uses, and existing records for hedgehog in the NBDC's online database. The local populations of Irish stoat, Irish hare, hedgehog and pygmy shrew are considered to be of Local Importance (higher value).

Based upon the findings of the desktop reviews undertaken to inform both the 2018 EIAR and this updated EIAR, Galway Bay supports a diverse range of marine mammal species, including Harbour seal *Phoca vitulina*, Grey seal *Halichoerus grypus*, Common dolphin *Delphinus delphis* and Harbour porpoise *Phocoena phocoena*. All cetacean species are also protected under the Habitats Directive (Annex IV). Given their designation as Qualifying Interest species for nearby SACs these marine mammals are considered to be of International Importance. Other cetacean species which may occur in the surrounding marine environment of Galway Bay are of National Importance, given their large foraging ranges and the legal protection afforded to them under the Wildlife Acts.

Evidence in both 2018 and 2023, of Fox *Vulpes vulpes* and Rabbit *Orytolagus cuniculus* were also recorded across the Assessment Boundary. Evidence of Mink *Mustela vison* was recorded along the western bank of the River Corrib (i.e. north and south of the proposed N6 GCRR at Ch. 9+250) and a drainage ditch located near Ballindooly Lough (i.e. between Ch. 12+250 and Ch. 12+300 of the proposed N6 GCRR). Bank vole *Myodes glareolus* and Wood mouse were recorded along a stream within the UoG Sporting Campus. Although these species are not afforded legal protection under the Wildlife Acts, they form part of the local biodiversity resource and are noted here in that context.

Within Appendix 4 of ABP's Inspector's Report dated 22 June 2021, Fox, Wood mouse and Rabbit are assessed as being of Local Importance and states "*The populations* [of wood mouse, fox, and rabbit] *of all but the last two are likely to be of no more than local value."* These species were not valued in the assessment completed in the 2018 EIAR, as they are not protected under the Wildlife Acts, and are common species in Ireland. However, these species have intrinsic value and out of an abundance of caution, each species is further discussed, in more detail about their common and widespread status in Ireland.

Wood mouse is listed as "Least Concern" on the IUCN Red List[65] and "Least Concern" on the Mammal Red List for Ireland, 2019[66]. The species is widespread across Ireland in a variety of habitats and is also found across the European continent. The Irish population is unknown, however populations can reach up to 40 individuals present per hectare[67]. There is some evidence that they may be impacted by the introduction of the bank vole *Clethrionomys glareolus* and the greater white-toothed shrew *Crocidura russula*, however, this may be offset by reduction in predation pressure. Wood mouse are not protected under the Wildlife Acts, due to being common and widespread in Ireland. Local populations are at their lowest in the winter and can expand by 80% in the spring. Evidence of wood mouse was noted during surveys (gnawed hazelnuts) and it is assumed that they are present as the habitats across the Project are suitable with forging resources and the presence of their predators. For these reasons, the local wood mouse populations are assessed as being of Local Importance (lower value).

Fox *Vulpes vulpes* is listed as "Least Concern" on the IUCN Red List and "Least Concern" on the Mammal Red List for Ireland, 2019. The species is widely distributed across rural and urban habitats in Ireland and is widespread across the Northern hemisphere. There is no evidence of a decline in the Irish population. Though fox are not protected under the Wildlife Acts, threats to the species include hunting for livestock protection purposes, but this is not thought to have an effect on the overall population. Evidence of fox was noted in the Assessment Boundary due to the availability of suitable habitat and prey. Based on the information available about the species in Ireland, local fox populations are as being of Local Importance (lower value).

Rabbit *Oryctolagus cuniculus* is listed as "Near Threatened" on the global IUCN Red List and "Least Concern" on the Mammal Red List for Ireland, 2019. Originally found in the Iberian peninsula, however following introductions and natural spread, the species is now widespread throughout Western Europe and the Balkans. Populations in Ireland are thought to be stable, but with natural fluctuations. The species is found mainly where grassland is present, and evidence of grazing can be seen in high-density populations. Threats to the species include disease, hunting by humans and natural predation, though this species is not protected under the Wildlife Acts. Evidence of rabbit was noted in the Assessment Boundary due to suitable habitat available and the presence of their predators. For these reasons, the local rabbit populations are assessed as being of Local Importance (lower value).

8.3.9 Invertebrates

The following section presents the results of the baseline invertebrate surveys carried out to inform the impact assessment. Dedicated surveys were carried out for these species because they are legally protected (i.e. all are listed on Annex II of the Habitats Directive with the White-clawed crayfish and the Freshwater pearl mussel also protected under the Wildlife Acts) and, in the case of the Marsh fritillary butterfly and *Vertigo antivertigo*, that they are rare in Ireland[68] and at particular risk of habitat loss impacts associated with the Project.

No other invertebrate species are considered to be KERs, as an approach has been taken to assess rare and protected invertebrate species, and additional invertebrate species are therefore not specifically discussed in this updated EIAR. Species, habitats and features not qualifying as KERs are not subjected to impact

[65] https://www.iucnredlist.org/en

[66] Marnell, F., Looney, D. & Lawton, C. (2019) Ireland Red List No. 12: Terrestrial Mammals. National Parks and Wildlife Service, Department of the Culture, Heritage and the Gaeltacht, Dublin, Ireland.

[67] Flowerdew, J & Tattersall, F. (2008) Rodents – Order Rodentia – wood mouse *Apodemus sylvatica* Mammals of the British Isles Handbook.

[68] The Marsh fritillary butterfly is listed as Vulnerable in *Ireland Red List No. 4 – Butterflies* (Regan *et al*., 2010) and *Vertigo antivertigo* as Vulnerable, in *Ireland Red List No. 2 – Non-Marine Molluscs* (Byrne *et al*., 2009)

assessment in line with current best practice of assessing the impacts on what are determined to be important ecological or biodiversity features: CIEEM and TII guidelines (CIEEM, 2018 and National Roads Authority, 2009). Surveys were not carried out for these species, however the general value for invertebrate communities can be inferred from the habitats present.

The baseline with respect to white-clawed crayfish and freshwater pearl mussel is consistent with that presented in the 2018 EIAR. There was a reduction in the distribution and extent of suitable marsh fritillary habitat within, and in the vicinity of, the Assessment Boundary in 2023, compared with previous years.

8.3.9.1 White-clawed crayfish

There were no White-clawed crayfish *Austropotamobius pallipes* recorded at any of the survey sites within the Assessment Boundary either in 2014-2018 or in 2023. Furthermore, environmental DNA (eDNA) sampling did not detect the presence of crayfish from the 5 no. survey lakes in 2023 (see section 4.3 in Appendix A.8.17). No other evidence of the presence of this species within the Assessment Boundary was observed (e.g. Otter spraints will commonly contain crayfish remains if they form part of their diet).

Despite some habitat suitability, no White-clawed crayfish eDNA was detected in the water samples from the surveyed lacustrine sites, those being: 'Unnamed Pond', Ballindooley (L1); Ballindooley Lough (L2); Coolagh Lough Upper (L3); Coolagh Lough Lower (L4); and 'Unnamed Pond', Menlo (L5) (See Table 2.1 in Appendix A.8.17). These results were considered as evidence of the species' absence at the sampling locations.

The Terryland River and the River Corrib appeared to be suitable for White-clawed crayfish but none were recorded via sweep netting and hand searching of instream refugia. Ballindooley Lough, Coolagh Lough, and the Unnamed pond in Menlo all had some low suitability for White-clawed crayfish, however, none were recorded via hand searching of refugia or eDNA sampling.

The Merlin Park Stream and Bearna Stream were considered unsuitable for White-clawed crayfish. All watercourses in the western part of the Assessment Boundary (including Oddacres Stream (Cappagh); Lough Inch River (Aille); Cloghscoltia Stream (Trusky East); Trusky Stream (Trusky East and West); Freeport Stream (Trusky West); Sruthán Na Libeirtí Stream, (Forramoyle West) and Newvillage Stream, (Forramoyle West)) were considered unsuitable to support the species, the water chemistry being too acidic and a lack of suitable habitat and/or quality; many of these streams were small or intermittent in nature.

As no populations of White-clawed crayfish have been encountered within the Assessment Boundary and, therefore, within the Zone of Influence of the Project, a value has not been assigned to this species, and it is not a key ecological receptor. For these reasons it is not considered further.

8.3.9.2 Freshwater pearl mussel

There were no populations, or individual records, of the Freshwater pearl mussel recorded within the Assessment Boundary between 2014 and 2018. Freshwater pearl mussel require waters that are consistently high in oxygen, poor in mineral and organics content, and with clean sand and gravel for the establishment of the species and for its ongoing survival within aquatic systems (Moorkens, 1999). It is a long-lived species with a multi-stage life cycle. It is particularly vulnerable to acute and chronic pollution incidents, which prevent establishment of the species in otherwise suitable habitat.

The watercourses present across the Assessment Boundary are poor habitat for the species, and although the Bearna Stream has good potential, no mussels were found in 2014-2018. While the Lough Inch River itself has poor habitat and was affected by various pressures, this watercourse is 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 8.8.1. Surveys were not repeated in 2023 as the 2014-2018 data remains valid as the conditions within the watercourses that could be affected by the Project remain unsuitable for the establishment of Freshwater pearl mussel populations.

The full results of the Freshwater pearl mussel surveys are provided in Appendix A.8.11.

Although no Freshwater pearl mussel were present with the ZoI of the Project, impacts to salmonid fish species could indirectly affect the Freshwater pearl mussel population in Lough Corrib SAC; the QI

population is in the Owenriff River, c.23km to the north. As the population of Freshwater pearl mussel in the Owenriff River is a QI, and as the species is 'Critically Endangered' in Ireland (Byrne *et al*., 2009), the population within the ZoI of the Project is considered to be of International Importance.

During the oral hearing in 2020 a submission was made suggesting that Freshwater pearl mussel were present within the River Corrib. The project ecologists, Scott Cawley Ltd., noted this was most likely Swan mussel as the River Corrib was not suitable for Freshwater pearl mussel. The Inspector appointed by ABP agreed with this conclusion and it is in noted in Appendix 4 of the Inspector's Report that "*I have reviewed the environmental information on the River Corrib supplied by the applicant, the assessment provided by Dr Moorkens and the known ecological requirements of the freshwater pearl mussel and agree with the applicant that the River Corrib is not suitable habitat for freshwater pearl mussel, the most likely species present in the River Corrib is the swan mussel Anodonta cygnea".*

8.3.9.3 Swan Mussel

Although Swan mussel *Anodonta cygnea* was not assessed in the 2018 EIAR, as it was not considered a KER, it was raised at the Oral Hearing in 2020 in a third party submission that mussels had been observed in the River Corrib. During the Oral Hearing in 2020, Scott Cawley Ltd. noted that this was likely Swan mussel, and the Inspector for An Bord Pleanála agreed with this conclusion, as discussed in Appendix 4 of ABP's Inspectors Report dated 22 June 2021:

"Records of mussels in the River Corrib were discussed at the oral hearing. These are most likely to be swan mussel Anodonta cygnea. This species is classified as vulnerable in the Irish Red data Book, it being found in only 29 10km squares, four of which are in County Galway, and declining. If this is a correct identification, then the population is of national importance."

This species is classified as Vulnerable in Irelands Red List No. 2: Non-Marine Molluscs (Byrne *et al.*, 2009), due to populations declining as a result of the spread of invasive species (i.e., the Zebra mussel *Dreissena polymorpha)* (Byrne *et al*., 2009). This species is valued as being of National Importance by the Inspector appointed by ABP and noted in Appendix 4 of ABP's Inspectors Report dated 22 June 2021, as noted above.

8.3.9.4 Other Annex II molluscan species

Molluscan surveys were undertaken in 2014 and 2017. Repeat molluscan surveys in 2023 were not required as the 2014 and 2017 data remains valid, as the baseline conditions of the habitats suitable for these species that could be affected by the Project remain unchanged.

2014 - 2017 Survey Results

A total of 39 molluscan species were recorded during the 2014 and 2017 molluscan surveys, none of which were nationally or internationally rare or protected, 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 the molluscan surveys are presented in Appendix A.8.12. Species are listed according to the nomenclature of Anderson (2005).

There were no legally 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 the Marsh whorl snail *Vertigo antivertigo* is listed as vulnerable in the Irish Red Data List of molluscs (Byrne *et al.*, 2009). This species was recorded in wetland habitat on the east bank of the River Corrib between Menlo Castle and Menlo Graveyard and north of the outflow channel from the Coolagh Lakes, in the fringing wetland habitat along the western side of the Coolagh Lakes, at Ballindooley Lough and at the marsh in Castlegar.

The highest quality molluscan habitat was found towards the southern end of the Coolagh Lakes, concentrated in the high quality fen and transitional habitat areas (see Figure 8.8.1 and the full survey report

in Appendix A.8.12). 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.

Within Appendix 4 of ABPs' Inspector's Report dated 22 June 2021, Marsh whorl snail is valued as being of County Importance as *"This species is classified as vulnerable due to ongoing decline. The population(s) represent one of the 142 10km squares in which this species is known from in Ireland and one of only twelve in County Galway, it is therefore most likely of county importance."*

This species was valued as being of Local Importance (Higher Value) in the 2018 EIAR. It is the professional opinion of the authors, that the Marsh whorl snail should still be valued as such, as it is a species with a widespread distribution in Ireland, and due to the availability of suitable habitat in the immediate surrounding areas and the wider environment.

8.3.9.5 Marsh fritillary

2023 Survey Results (Current Baseline)

For consistency with the previous surveys undertaken to inform the 2018 EIAR, the 2023 surveys focused on suitable habitat patches within, and in the vicinity of, the Assessment Boundary (see Figures 8.9.1 - 8.9.8).

Habitat suitability

There were 180 sites (approximately 190ha) identified during the desk study for assessment for marsh fritillary habitat suitability. The selection of these sites was informed by the previous surveys 2014-2018.

Confirmed/assumed suitable

Of the sites identified in the desk study, 43 survey areas (50.5ha) were surveyed and confirmed to be suitable for marsh fritillary.

58 survey areas (53.77ha) were inaccessible, or access was denied, and it is assumed these areas retain their suitability for marsh fritillary.

In total, the combined amount of suitable habitat available to Marsh Fritillary is estimated to be approximately 104ha in 2023.

Sub-optimal

25 sites (70.62ha) were assessed in Phase 1 of the surveys and were considered sub-optimal for marsh fritillary. They were not calculated as part of the locally available suitable habitat, nor carried forward to Phase 2 of the surveys (larval web).

Not suitable

26 sites (10.72ha) were surveyed and lacked suitability for marsh fritillary. This was primarily due to the various habitat changes within the Assessment boundary and the absence of any consistent land management practices across those sites having occurred between 2016 and 2023. The changes in suitability were associated with land abandonment and encroachment of vegetation.

A further 11 sites (3.83 ha) had been developed or changed prior to 2023 and were deemed not suitable.

Additionally, in June 2023, a significant gorse fire, resulting from the prolonged hot dry weather experienced in the locality that summer, caused extensive fire-damage to areas of scrub and grassland in various areas west of Knocknacarra, including areas of commonage between the townlands of Tonabrocky and Boleybeg, which were previously assessed as suitable for Marsh Fritillary as part of 2014 – 2018 surveys.

Larval Web Surveys (Phase 2)

43 areas (50.5ha) of the suitable habitat were surveyed for larval webs in Phase 2 of the surveys during September 2023, of which c.1.63ha of that area surveyed was within the Assessment Boundary.

A total of 75 larval webs were located from seven specific sites with a combined area of approximately 13.3ha. Larval webs were identified across the Project, with circa 95% of larval webs recorded in the Boleybeg locality.

The closest larval webs identified were in the Forramoyle West locality, approximately 120m from the Project. Other localities of larval webs included one larval web in Roscam (eastern side of the Assessment Boundary) and one larval web in suitable lands to the north of Ballard West.

The Marsh Fritillary butterfly population within the Assessment Boundary is valued as being of County Importance as it is listed on Annex II of the Habitats Directive, with a Conservation Status of 'Inadequate' in Ireland (albeit improving), and is listed as 'Vulnerable' on the Ireland Red List No. 4 Butterflies (Regan *et al*., 2010).

In Appendix 4 of ABP's Inspectors Report dated 22 June 2021, the Marsh fritillary butterfly is valued as being of National Importance:

"This species is estimated to occur in 705 1km squares in Ireland and the applicant recorded marsh fritillary larval food webs in 8 or 9 which is greater than 1% of the total, indicating national importance."

Out of an abundance of caution, for the purpose of the impact assessment, the authors have adopted the approach outlined in Appendix 4 of ABP's Inspector's Report, and the Marsh Fritillary butterfly population within the Assessment Boundary is valued as being of National Importance.

2014-2018 Survey Results

Marsh fritillary surveys were conducted across multiple years to inform the 2018 EIAR, and the results for each year are presented below. Initial surveys were conducted in September 2013, covering 57 survey sites and approximately 491.8ha. Suitable Marsh fritillary habitat was recorded at 29 of those sites, unsuitable habitat at 17 sites, and the remaining 11 were not surveyed due to access restrictions. The area of suitable habitat accounted for 61.2ha, or 12.4% of the sites surveyed.

Two larval webs were recorded at a single site during the 2013 survey. The full results of the 2013 Marsh fritillary survey are provided in Appendix A.8.14.

A total of 196 polygons were surveyed in 2014 for Marsh fritillary, 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.

A total of 111 webs were located within around 40 areas of suitable habitat in 2014. 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 (e.g. in 2013). The rest of the webs were recorded in areas that had not previously been surveyed in 2013. Webs located included both active webs and hibernation webs.

The full results are discussed in the 2014 Marsh fritillary survey report in Appendix A.8.13 and shown on Figures 8.9.3 - 8.9.8.

In 2015, the survey switched from the larger scale of the Assessment Boundary to a more focused survey of suitable habitat patches within, and in the vicinity of, the Assessment Boundary (see Figures 8.9.3 - 8.9.8). A total of 42.7ha was surveyed, comprising around 3ha within the Assessment Boundary.

The majority of areas surveyed in 2015 comprised suitable habitat, although levels of suitability varied (largely related to management issues specific to 2015). The exception to this was one area, comprising 1.15ha of suitable habitat in 2014 and holding Marsh fritillary webs, which was found to be largely lost due to infilling / habitat change in 2015. It was noted that some areas that were of limited suitability in 2014 (largely due to heavy grazing), comprised suitable habitat in 2015. Conversely, some areas that were in good condition in 2014 were found to be overgrazed in 2015. In addition, one area that was considered to be suitable habitat in 2014 (though marginal) was considered to fall outside that classification due to ongoing agricultural improvement in 2015.

A total of 12 webs were located across five polygons within the survey areas in 2015 (see Figures 8.9.3 - 8.9.8). This compares with 39 webs recorded within those same areas in 2014. No webs were recorded within the Assessment Boundary. Webs located included both active webs and hibernation webs.

In 2014, webs were more widely spread throughout suitable habitat, while webs in 2015 were more limited in distribution. This may be attributable, in part at least, to the difference in weather in the two years. A relatively warm and settled summer in 2014 would allow for a good emergence season and distribution of adult females to new areas. Weather in 2015 provided sub-optimal conditions for the species both during the flight period and the early part of the larval stage. This has the potential to both limit distribution of the species at the adult stage and survival of the species at the early larval stage.

A total of 42.4ha were surveyed in September 2016, of which c.6.1ha was within the Assessment Boundary. A total of 56 webs were located within the survey areas in 2016 (see Figures 8.9.3 - 8.9.8), which compares with 12 webs recorded within the area in 2015 and 39 webs in 2014. In 2016, a total of 13 webs were recorded within the Assessment Boundary, with a further 33 webs recorded within 50m of the Assessment Boundary and 6 within 100m.

The section between Ch. 0+700 and Ch. 1+600 of the proposed N6 GCRR comprised a wide-ranging area of good quality habitat in 2016. Many areas in the eastern part were in better condition for the species than in the previous 2 years; possibly due to reduced grazing pressure. Despite this, webs were only recorded in the western part of the survey area.

The habitat area between Ch. 2+200 and Ch. 2+550 of the proposed N6 GCRR held an active and core population with the number of larval webs increasing from two in 2014, to seven in 2015 and to 35 in 2016. Although high quality habitat, the area between Ch. 2+900 to Ch. 3+050 of the proposed N6 GCRR only supported a single web in 2015 and again in 2016. The high-quality habitat area between Ch. 3+550 and Ch. 3+800 of the proposed N6 GCRR held 14 larval webs in 2016; compared with three in 2014 and a single web in 2015.

The quality of the habitat in the area between Ch. 4+700 and Ch. 5+100 of the proposed N6 GCRR has deteriorated year on year over the survey period due to infilling and overgrazing and no larval webs were recorded here in 2016. No larval webs have been recorded in the suitable habitat areas at Ballagh (Ch. 7+700 to Ch. 8+000 of the proposed N6 GCRR).

8.3.10 Birds

All wild birds, and their nests and eggs, are protected under the Wildlife Acts. Some bird species are also listed on Annex I of the EU Birds Directive (see Table 8.23 for those Annex I bird species recorded during the breeding bird surveys).

The results of the various breeding bird surveys carried out to inform this assessment are summarised below.

An additional four breeding bird species of conservation concern and considered to be Key Ecological Receptors (KERs), were recorded within the survey area in 2023: common gull, little egret, snipe and tree sparrow compared to the results presented in the 2018 EIAR.

8.3.10.1 Breeding Birds

Breeding Bird Survey

Current Baseline (2023)

Breeding bird surveys were undertaken within a 50m buffer of the Assessment Boundary, between 25 – 28 April, 25 – 26 May, 30 May – 01 June and 27 – 29 June 2023.

The general breeding bird surveys recorded a total of 64 no. species across the Assessment Boundary, comprising: five SCIs for nearby SPAs, three species listed in Annex I of the Birds Directive, five species on the BoCCI (Gilbert *et al*., 2021) Red List, 18 no. species on the BoCCI Amber List, and 41 no. species on the BoCCI Green List.

Table 8.23 below provides a summary of the findings of the breeding bird surveys with respect to those species which are of conservation concern and are considered Key Ecological Receptors (KERs):

- Special Conservation Interests (SCIs), for a breeding population, of nearby SPAs
- Species listed under Annex I of the Birds Directive (2009/147/EC)

- Red and Amber BoCCI species listed for their breeding populations

Table 8.23 Breeding Birds of Conservation Concern Recorded during the Breeding Bird Surveys in 2023[69]

Common name / Latin name / BTO	Distribution in the Assessment Boundary	Conservation Importance		
		BoCCI (breeding)	Annex I	SCI[1]
Black-headed gull Chroicocephalus ridibundus (BH)	Observed between Lackagh Quarry in the east and the UoG campus in the west	Amber	No	Yes
Common gull Larus canus (CM)	Observed north of Saint James' Church, Bushypark and near the proposed Bearna West Roundabout	Amber	No	Yes
Common tern Sterna hirundo (CN)	Observed at the proposed crossing of the River Corrib	Amber	Yes	Yes
Cormorant Phalacrocorax carbo (CA)	Observed across the study area, largely concentrated around the River Corrib, but with other isolated observations in Menlough, Tonabrocky and Ballard	Amber	No	Yes
Goldcrest Regulus regulus (GC)	Observed across the entire study area with greatest concentrations in Menlough	Amber	No	No
Greenfinch Chloris chloris (GR)	Isolated observations across the entire study area	Amber	No	No
Grey wagtail Motacilla cinerea (GL)	Three observations – along the Ballymoneen Road, in a residential site in Bearna, and along the N59 south of Aughnacurra	Red	No	No
Herring gull Larus argentatus (HG)	Observed across the entire Study Area. Larger concentrations near the coast at Bearna	Amber	No	Yes – but not of any SPAs in the immediate vicinity of the Project
House martin Delichon urbicum (HM)	Observed across the entire study area. Concentrations in Ballybrit, east of Lackagh Quarry and in Bearna	Amber	No	No
House sparrow Passer domesticus (HS)	Observed across the entire study area but with concentrations west of the River Corrib, particularly between Rahoon Road and Gort Na Bró	Amber	No	No
Kestrel Falco tinnunculus (K.)	Observed occasionally with greatest concentrations between Castlegar and the River Corrib	Red	No	No

[69] Note that some of the species listed are also KERs for their wintering populations—see Table 8.25, Table 8.26 and Table 8.27.

Common name / Latin name / BTO	Distribution in the Assessment Boundary	Conservation Importance		
		BoCCI (breeding)	Annex I	SCI[1]
Lesser black-backed gull Larus fuscus (LB)	Occasional observations, with concentrations in Trusky	Amber	No	Yes
Linnet Linnaria cannabina (LI)	Observed across the study area but with concentrations north of Letteragh, and between Trusky and the proposed Bearna West Roundabout	Amber	No	No
Little egret Egretta garzetta (ET)	Single observation of a bird flying over east of Lackagh Quarry	Green	Yes	No
Mallard Anas platyrhynchos (MA)	Occasional observations across the survey area. Several pairs suspected breeding between Letteragh and Ballinfoyle	Amber	No	Yes – but not of any SPAs in the immediate vicinity of the proposed Project
Meadow pipit Anthus pratensis (MP)	Observed across the survey area. Most observations of singing/displaying males indicating breeding	Red	No	No
Peregrine Falco peregrinus (PE)	Two observations of birds at nest site in Lackagh Quarry	Green	Yes	Yes – but not of any SPAs in the immediate vicinity of the proposed Project
Sand martin Riparia riparia (SM)	Two observations of birds flying over the study area – along the River Corrib and at Galway Racecourse	Amber	No	No
Skylark Alauda arvensis (S.)	Two observations from scrub/heath habitats between Ballymoneen Road and Cappagh Road	Amber	No	No
Snipe Gallinago gallinago (SN)	Encountered across the study area, but with most records between the N59 and Loughinch	Red	No	No
Starling Sturnus vulgaris (SG)	Observed across the study area. A common species of urban habitats	Amber	No	No
Swallow Hirundo rustica (SL)	Encountered across the study area.	Amber	No	No
Swift Apus apus (SI)	Concentrated between Ballinfoyle and the River Corrib	Red	No	No

Common name / Latin name / BTO	Distribution in the Assessment Boundary	Conservation Importance		
		BoCCI (breeding)	Annex I	SCI[1]
Tree sparrow Passer montanus (TS)	Single observation in Ballard East, north of Bearna Woods	Amber	No	No
Willow warbler Phylloscopus trochilus (WW)	Encountered frequently across the study area in semi-natural vegetation. Most observations were west of Ballybrit	Amber	No	No

A total of five species listed as SCIs of European sites in the vicinity were recorded across the breeding bird surveys, all of which are listed as SCIs of the Inner Galway Bay SPA, including black-headed gull, cormorant, common gull, common tern and grey heron. Three additional species, Herring gull, Mallard and Peregrine are SCIs of European sites in Ireland but not within the vicinity of the Project.

The majority of records of SCI species consisted of birds flying over the survey area. Peregrine were confirmed to be breeding within Lackagh Quary. Herring gull were recorded across the extent of the Project and are known to breed in urban areas across Ireland. Lesser black-backed gull was recoded across the extent of the Project, with the majority of records located to the north of Bearna in the western extent. Black-headed gull and common tern records were concentrated around the River Corrib, both of these species are known to breed on islands and rock outcroppings in both Galway Bay and Lough Corrib. Cormorant were mainly recorded along the River Corrib with several cormorant also recorded flying over the western extent of the Project and one over the eastern extent in proximity to Ballindooley Lough. Cormorant are known to breed on suitable rock outcroppings and cliffs within Galway Bay. Common Gull were recorded twice, once in proximity to Bearna and once in proximity to St. James' Church in Bushypark, this species is known to breed on islands and rock outcroppings in both Galway Bay and Lough Corrib.

Little grebe and moorhen were recorded within the small pond to the southwest of Ballindooley Lough in the eastern extent of the Project, both of these species are known to breed on waterbodies across Ireland. Mallard were recorded across the Project and are known to breed adjacent to waterbodies across Ireland. Grey heron were recorded at several locations across the Project, twice in the western extent and twice in the eastern extent.

Little egret was also recorded during the survey period and although this species is listed on Annex I of the EU Birds Directive it is a new addition to Ireland and is not yet considered an SCI in Ireland.

A total of three Annex I species were recorded across the Project. Common tern was recorded once flying upstream along the River Corrib. Common tern are SCIs of Inner Galway Bay SPA and Lough Corrib SPA and are known to breed on islands and rock outcroppings within both Galway Bay and Lough Corrib. Peregrine were recorded twice at Lackagh Quarry, a breeding pair are known from this location. Little egret was recorded once within a field to the east of Lackagh Quarry, this species is a recent addition to the Irish fauna and as such is not yet considered as an SCI within Ireland. Little egret breed in colonies, known as 'Heronries' within woodland, generally adjacent to waterbodies.

A total of five red-listed species were recorded across the extent of the Project. Kestrel were recorded in the eastern extent of the Project in proximity to Lackagh Quarry. Snipe and meadow pipit were recorded across the extent of the Project, both of these species are ground nesting species which breed within grassland generally in proximity to wet or boggy habitats, which are prevalent across the Project. Swift were mainly recorded in the eastern extent of the Project, with a single record in the western extent, all of these records consisted of birds flying over the Project corridor while foraging. Grey wagtail was recorded within the western extent of the Project, this species breeds in proximity to suitable waterbodies across Ireland.

A total of 18 Amber-listed species were recorded across the Project, of these species seven are SCI species and are discussed above, the remaining are shown in Figure 8.10.1 - 8.10.15. Tree sparrow was recorded at one location in the west of the Project to the north of Bearna Woods. Tree sparrow are considered to be scarce breeders on the west coast of Ireland with their main breeding population being prevalent in the east

of the country. Goldcrest and willow warbler records were concentrated in areas of deciduous woodland and scrub respectively, with willow warbler being concentrated in the west of the Project and goldcrest in the east in proximity to Menlough woods.

Linnet and swallow were recorded across the entirety of the Project, with concentrations of linnet and swallow in the west, to the north of Bearna, and concentrations of swallow in proximity to the Lackagh Quarry in the east. House sparrow were recorded across the extent of the Project with records concentrated in the Knocknacarra area of Galway City in proximity to dense urban area. Starling were recorded across the Project with concentrations of records in the east and west of the Project. House martin records were concentrated in the east of the Project in proximity to the Racecourse Business Park, with small numbers also recorded in the west of the Project.

Skylark were recorded on two occasions in the eastern extent of the Project to the northwest of Knocknacarra. Skylark breed in grassland, heath and bog habitats, with the western extent of the Project considered the most suitable in terms of habitat types for this species. Sand martin were recorded at two locations, once along the River Corrib and once in proximity to the Racecourse Business Park. Suitable breeding habitat for this species is likely to be found within the quarries in the eastern extent of the Project. Greenfinch were recorded rarely across the Project with the majority of records concentrated on the west of the River Corrib, where semi-natural habitats and scrub dominates the landscape.

The remaining 41 no. species recorded are green-listed species and are common breeding species across Ireland, none of which are of conservation concern. The full suite of Breeding Bird Survey results are illustrated in Figure 8.10.1 - 8.10.15 and the full species list and conservation status for birds observed in 2023 are documented in Appendix A.8.22 Part 2.

2014-2018 Survey Results

The general breeding bird surveys recorded a total of 62 species across the Assessment Boundary, including; three species listed as SCIs for nearby SPAs, two Birds Directive Annex I species, six Red list, 23 Amber list and 33 Green list bird species from Colhoun & Cummins (2013)[70].

Table 8.24 below provides a summary of the findings of the breeding bird surveys[71] with respect to those species which are of conservation concern and are considered to be Key Ecological Receptors (KERs):

- Special Conservation Interests (SCIs), for a breeding population, of nearby SPAs
- Species listed under Annex I of the Birds Directive (2009/147/EC)
- Red and Amber BoCCI (Colhoun& Cummins, 2013) species listed for their breeding populations

The results of the breeding bird surveys are shown on Figures 8.11.1 to 8.11.15 with the full list of bird species recorded provided in Appendix A.8.22. The full results of the desktop review are presented in Appendix A.8.18. Of note in that regard are the results of the bird surveys carried out in 2005/2006 as part of the 2006 N6 Galway City Outer Bypass project (RPS, 2006) which demonstrates the importance of the River Corrib corridor for bird species.

[70] Note that surveys completed between 2014-2018 coincided with the period of assessment within *Birds of Conservation Concern in Ireland 2014-2019* (Colhoun & Cummins, 2013)

[71] Surveys were also carried out to establish the local Barn owl breeding population (a BoCCI Red List species), which confirmed a nest site at Menlo Castle, and this species is also included in Table 8.24

Table 8.24 Breeding Birds of Conservation Concern Recorded during the Breeding Bird Surveys between 2014 and 2018[72]

Common name / Latin name / BTO	Distribution in the Assessment Boundary	Conservation Importance		
		BoCCI (breeding)	Annex I	SCI
Barn owl Tyto alba (BO)	One nest site known at Menlo Castle	Red	No	No
Black-headed gull Larus ridibundus (BH)	Widespread throughout	Red	No	Lough Corrib SPA
Curlew Numenius arquata (CU)	Observed once at Ballindooley Lough	Red	No	No
Grey wagtail Motacilla cinerea (GL)	Observed once west of the Galway Racecourse	Red	No	No
Herring gull Larus argentatus (HG)	Widespread throughout, more frequent west of the River Corrib	Red	No	No
Meadow pipit Anthus pratensis (MP)	Widespread west of the River Corrib, and between Ballybrit and the existing N6	Red	No	No
Whinchat Saxicola rubetra (WC)	Ballagh area (single record)	Red	No	No
Cormorant Phalacrocorax carbo (CA)	Widespread west of the River Corrib	Amber	No	Inner Galway Bay SPA & Connemara Bog SPA
Common tern Sterna hirundo (CN)	Observed once at the proposed River Corrib Bridge	Amber	Yes	Inner Galway Bay SPA & Lough Corrib SPA
Coot Fulica atra (CO)	Observed between the River Corrib and Bóthar Nua, and once near Ballybrit	Amber	No	No
Great black-backed gull Larus marinus (GB)	Observed west of Bearna, at the River Corrib, and once at Ballindooley Lough	Amber	No	No
Goldcrest Regulus regulus (GC)	Widespread west of the River Corrib	Amber	No	No
Greenfinch Carduelis chloris (GR)	Widespread west of the River Corrib and east of the River Corrib, only recorded at Ballybrit	Amber	No	No
House martin Delichon urbicum (HM)	Observed near the Letteragh Road and between Ballindooley Lough and Ballybrit	Amber	No	No
House sparrow Passer domesticus (HS)	Observed near the Letteragh Road and at Ballybrit	Amber	No	No
Kestrel Falco tinnunculus (K.)	Observed near Bearna Woods, Letteragh Road, Lackagh Quarry and the existing N6	Amber	No	No

[72] Note that some of the species listed are also KERs for their wintering populations—see Table 8.25

Common name / Latin name / BTO	Distribution in the Assessment Boundary	Conservation Importance		
		BoCCI (breeding)	Annex I	SCI
Lesser black-backed gull Larus fuscus (LB)	Observed once near Ballymoneen	Amber	No	No
Little grebe Tachybaptus ruficollis (LG)	Observed at the proposed River Corrib Bridge and Ballindooley Lough	Amber	No	No
Linnet Carduelis cannabina (LI)	Widespread throughout	Amber	No	No
Mistle thrush Turdus viscivorus (M.)	Observed at Ballard West, Knocknafroska, Menlough and Lackagh Quarry	Amber	No	No
Peregrine Falco peregrinus (PE)	Observed near Lackagh Quarry and the N83 Tuam Road	Green	Yes	No
Robin Erithacus rubecula (R.)	Widespread throughout	Amber	No	No
Skylark Alauda arvensis (S.)	Observed at Troscaigh Thiar, Cappagh and Ballybrit	Amber	No	No
Stonechat Saxicola torquata (SC)	Observed west of Bearna, near Cappagh, Knocknafroska and between Ballybrit and the existing N6	Amber	No	No
Stock dove Columba oenas (SD)	Observed once near Clybaun Road	Amber	No	No
Starling Sturnus vulgaris (SG)	Widespread throughout	Amber	No	No
Sparrowhawk Accipiter nisus (SH)	Observed once at Galway Racecourse	Amber	No	No
Swift Apus apus (SI)	Observed twice near the UoG Sports Campus	Amber	No	No
Swallow Hirundo rustica (SL)	Widespread west of the River Corrib, and observed near Ballybrit	Amber	No	No
Sand martin Riparia riparia (SM)	Observed around Lackagh Quarry and Ballindooley Lough	Amber	No	No
Wheatear Oenanthe oenanthe (W.)	Rahoon area (single record)	Amber	No	No

[1] Listed as SCIs for their breeding populations

Of note, was that Ringed plover were recorded twice during the breeding bird surveys, once in late May 2015 and once in late June 2015, exhibiting breeding behaviour near the western edge of Galway Racecourse.

Barn Owl Survey

Current Baseline (2023)

A total of 58 sites were initially identified for assessment as potentially suitable for breeding Barn Owl within a 5km radius surrounding the Project.

Field surveys were performed between 07 May and 13 July 2023 to determine the suitability for, and the presence of, Barn Owls at 50 (86%) of the identified sites. Landowner permission was denied to access eight (14%) sites for the assessment. Additional surveys were performed as required outside of the breeding season to assess Barn Owl presence at individual sites during October to December 2023.

A day-time inspection to determine site suitability and to search for signs indicating the presence of Barn Owl was carried out at all 50 accessible sites. Following on this, nocturnal surveys were undertaken at 12 sites where this method was deemed necessary to determine Barn Owl occupancy and breeding status (in addition to day-time inspections).

Field surveys confirmed that 23 (46%) of the 50 sites inspected were not suitable for breeding Barn Owl. The day-time inspection confirmed that 27 (54%) sites were suitable or potentially suitable for breeding Barn Owl, and provided suitable nesting opportunities. These sites consisted of six derelict cottages, six derelict two-storey farmhouses, five castles, five farm buildings, two ruined mansions, two quarries and a single church.

The presence of Barn Owl was confirmed at five sites. Breeding pairs were confirmed at two sites. One of the confirmed breeding sites is located in close proximity to the proposed N6 GCRR (the confirmed nest location is less than 20m from the proposed fenceline for the proposed N6 GCRR and approximately 170m from the proposed road itself). The other confirmed breeding pair is located more than 4km from the proposed N6 GCRR.

Evidence of Barn Owl was recorded at two sites, however there was no evidence of a breeding pair or breeding attempt at either site at the time of the survey. One of these occupied sites is located approximately 425m from the proposed N6 GCRR. Barn Owl activity was not recorded in this site during the 2023 breeding season. Evidence of the presence of Barn Owls in the form of fresh pellets (2) was recorded in December 2023 indicating that this site was used as a roost. This was the first time that evidence of Barn Owl was recorded at this site. The other occupied site is located more than 4km from the proposed N6 GCRR, a bird was observed at this site during the breeding season but there was no evidence of breeding. This site is located close to one of the confirmed breeding sites.

In addition, there is one site (ruined mansion) which is known to have been previously occupied by Barn Owls, however it was not occupied during the survey period, despite the fact that the site remains suitable. This site is located more than 4km from the proposed N6 GCRR.

There were no sites which were deemed to be potentially suitable for Barn Owl and which were not possible to assess for the presence of Barn Owls within 1km of the proposed N6 GCRR, and therefore it is unlikely that there are Barn Owl sites which remain undiscovered and which may be directly affected by the proposed N6 GCRR.

Barn Owl is considered to occur at levels within the defined survey area that are important at the County Level.

2014-2018 Survey Results

A total of 76 sites were surveyed in 2014 for the presence of Barn owl within the Assessment Boundary. A total of 47 (63%) sites were considered to be entirely unsuitable for Barn owl (Category 0). Of the remaining 29 (27%) sites which could potentially be used by Barn owl, 11 (14%) offered potential for roosting but not for nesting (Category 1). Five (6%) were assessed as having likely roosting and/or nesting opportunities (Category 2) and the remaining 13 (15%) offered excellent roosting and nesting opportunities (Category 3). The locations of the surveyed sites, and their suitability for Barn owl, are shown on Figures 3.3 and 3.4 of the Barn Owl Survey Report in Appendix A.8.15.

The presence of Barn owl was confirmed at five of these sites which are within the Assessment Boundary. These included two castles (nest sites at Menlo Castle and Ardfry House), a ruined mansion (roost site at Rinville House), a derelict two-story farmhouse and a quarry (both roost sites). The distribution of these sites is shown on Figure 8.12.1. Two sites, Ardfry Castle and Menlo Castle, were confirmed as nest sites. A ruined mansion (Rinville House) 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 sites which were classed as suitable for Barn owl during the 2014 survey (Category 2 and Category 3; 20 sites in total), were re-visited between June and August in both 2015 and 2016. Two sites (a farmhouse and cottage) which were previously classified as suitable (both Category 3) in 2014 had been demolished and were no longer available to Barn owl. All remaining 18 sites were deemed still suitable for Barn owl. Evidence of Barn owl occupation was recorded at two sites in 2015, namely Menlo Castle and Rinville House, both of which had been active in 2014. There were no signs to indicate recent use of Ardfry Castle, a farmhouse at Carnmore, or at Angliham Quarry where evidence of Barn owl had been recorded in 2014. In addition, a farmhouse with adjacent outbuildings at Ballard, where a Barn owl had been reported by a member of the public in the winter of 2015, showed no evidence of recent use in July 2015. Evidence of Barn Owl occupation was confirmed at a single site in 2016 (Rinville House).

Figure 4.7 and Table 4.2 in Appendix A.8.15, shows the distribution and suitability of all sites surveyed in 2015. As with 2014, no breeding sites were confirmed in either 2015 or 2016.

Observations of Barn Owl evidence at Menlo Castle was collected in 2018. Barn Owl activity was not recorded at Menlo Castle in 2018 and the site was deemed to be unoccupied during that nesting season. There was no evidence of Barn Owl observed during day time inspections in and around the castle and no activity recorded by nocturnal watches.

Other raptors recorded during the Barn owl surveys

Current Baseline (2023)

Raptor species which were encountered during survey work between 2022 and 2023 included Buzzard (six wintering sites in addition to three non-breeding and one courtship and display), Kestrel (26 wintering sites in addition to six non-breeding and four possible/probable breeder pairs); Peregrine (four wintering sites in addition to one confirmed breeding site one possible breeding site), Sparrowhawk (17 wintering sites in addition to two possible breeders), and Long-eared owl (one confirmed breeding site).

2014-2018 Survey Results

Other raptor species which were encountered during survey work in 2014 and 2015 were also recorded. A total of 21 raptor and owl sites (not including Barn owl) were confirmed in 2014 and 2015, which included ten Kestrel sites (four nests and six roosts), six Peregrine sites (three nests and two roosts), three Sparrowhawk sites (two nest sites and one displaying pair) and three Long-eared owl nests, see Figure 4.10 in Appendix A.8.15.

Peregrine falcon Survey

Current Baseline (2023)

Field surveys were carried out between 14 April and 26 June 2023 to determine the suitability for and the presence of Peregrine at all accessible sites identified as potentially suitable. The presence of Peregrine was confirmed at two of the six sites assessed within the defined survey area during the breeding season in 2023. These included two quarries which are both traditional nest sites used by Peregrine. A breeding pair was confirmed at one quarry, a nest attempt was initiated, and the nest location was identified. A breeding pair was confirmed at the second quarry, however this pair did not nest successfully in 2023 and a nest location was not identified. Peregrine were not confirmed at any other site assessed (n = 4) within the defined survey area during the breeding season in 2023. Peregrine breeding pairs were confirmed to be present in both quarries which are located outside the defined survey area, breeding attempts were recorded and nest sites located in both sites during the breeding season in 2023.

The nest site at one quarry is within the proposed fenceline for the proposed N6 GCRR. The breeding pair at the second quarry are located approximately 400m from the proposed fenceline for the proposed N6 GCRR.

Peregrine is considered to occur at levels within the defined survey area that are important at the County Level as informed by the NRA Ecology Guidelines.

2014-2018 Survey Results

Peregrine falcon occupancy was recorded in three quarries in the survey area in May and June 2016, all of which held breeding pairs (see Appendix A.8.16). One breeding pair was successful (Roadstone Quarry at Twomileditch), with pairs in two quarries (Angliham and Lackagh Quarries) failing to raise young. All three

quarry sites which held breeding pairs in 2016 were known sites where Peregrine have previously nested and are regarded as traditional nesting sites. The specific nesting location was recorded for the single successful pair (Roadstone Quarry at Twomileditch) in 2016, for the other two quarries that supported nest sites (Angliham and Lackagh) it was not possible to record a nest location in 2016, however the location of the eyries in previous years is documented. In 2017, Lackagh Quarry was monitored to determine breeding status and the nest site location, which confirmed a breeding pair and which identified the location of the traditional nest ledge. In 2018, a breeding pair of Peregrine falcon was again confirmed in Lackagh Quarry and was successful in fledging young. The nest site was also confirmed in 2018 although it was at a different location to that recorded in previous years.

Red grouse

Current Baseline (2023)

Red grouse surveys were undertaken between the 02 and 03 March, 15 and 16 March, and 28 and 29 March 2023. A slight habitat change since 2014 has rendered some of the habitats unsuitable for Red grouse, i.e. they are either no longer heath habitat due to scrub encroachment or have become enclosed scrub and therefore of lower suitability than the more open habitat with which Red grouse are more strongly associated. No Red grouse were recorded during these dedicated red grouse surveys in 2023. There is limited amount of suitable habitat (bog and heath habitat) within 500m of the proposed N6 GCRR. Although the habitats within the survey area are considered sub-optimal for breeding Red grouse, they have some limited foraging potential for individuals which may temporarily spread out looking for territories outside the larger bog and heath habitats to the north and northwest, and therefore their presence cannot be fully ruled out. Thus, the local Red grouse populations are assessed to be of Local Importance (higher value).

2014-2018 Survey Results

No sightings, or evidence, of Red grouse was recorded during surveys conducted between 2014 and 2015; or during the general breeding bird surveys between 2014 and 2018. During the course of other survey work in September 2014 (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 proposed N6 GCRR at Na Foraí Maola/Lough Inch.

Woodcock

Woodcock surveys were undertaken on 29, 30 and 31 May 2023 and on 01, 06-08, 19-22, and 26 June 2023. A total of 14 survey points were investigated across a total survey area of 106.39ha. No Woodcock were observed at any of the sites during the dedicated 2023 Woodcock surveys. This is consistent with previous Woodcock Surveys conducted in 2014 and 2015, both within and across the entire area of the survey area. Although no Woodcock were recorded, the surveyed areas do have potential habitats for roding males which may temporarily spread out looking for females in territories outside their natural range, and therefore their presence cannot be fully ruled out. Thus, the local woodcock populations are assessed to be of Local Importance (higher value).

No woodcock were observed during surveys completed in 2014 and 2015 by Dr. Chris Peppiatt.

8.3.10.2 Wintering birds

The winter bird surveys recorded a wide range of bird species at sites across the Project.

Table 8.25, Table 8.26 and Table 8.27 below provides a summary of the findings of the winter bird surveys with respect to those species which are of highest conservation concern (e.g. target species), and were recorded within winter bird survey sites:

- Special Conservation Interests (SCIs), for a wintering population, of nearby SPAs
- Species listed under Annex I of the Birds Directive (2008/144/EC)

- Red and Amber BoCCI[73] species listed for their wintering populations

The full results of the winter bird surveys (for all surveyed sites within the wider scheme study area) are provided in Appendix A.8.23. Other record for wintering bird species from Galway City and environs are presented in the full results of the desktop review in Appendix A.8.18. An additional six wintering bird species of highest conservation concern and considered to be Key Ecological Receptors (KERs)[74], were recorded within the wintering bird survey area between 2022 and 2024: gadwall, little egret, red grouse, redwing, ringed plover and whooper swan.

2022-2023 Survey Results (Current baseline)

The 2022-23 wintering bird surveys recorded a total of 26 target species across the study area, comprising: 21 species listed as SCIs; of these 14 are SCIs for nearby SPAs, three species listed in Annex I of the Birds Directive, 10 species on the BoCCI[75] Red List, 13 species on the BoCCI Amber List and three species on the BoCCI Green List.

This included 11 no. species listed as SCIs for the adjacent Inner Galway Bay SPA (Black-headed gull, Cormorant, Common gull, Curlew, Golden plover, Grey heron, Lapwing, Redshank, Ringed Plover, Teal, and Wigeon) and six SCIs of Lough Corrib SPA (Black-headed gull, Common gull, Coot, Golden plover, Shoveler, and Tufted Duck).

The majority of records were concentrated along the River Corrib and the surrounding semi-natural habitats, including Black-headed gull, Common gull, Coot, Little grebe, Mallard, Moorhen and Teal. The majority of Curlew and Grey heron records were from wetland and grassland in the west of the scheme and the majority of herring gull records from urban or semi-urban areas in the east of the Project.

Records of Redshank, Ringed plover and Shag were limited to the coastal extent of the Project, to the west of Bearna. Oystercatcher were recorded both along the coast and in recreational grasslands in the eastern extent of the Project. Golden plover were recorded on a single occasion in large numbers foraging in agricultural grassland in the far eastern extent of the Project, adjacent to the existing N6. Cormorant were recorded along the River Corrib corridor and along the coast in the western extent.

Peregrine were recorded during the winter at their known breeding location in Lackagh Quarry.

The wintering bird survey areas are shown on Figures 8.13.1 with the results and full list of bird species recorded provided in Appendix A.8.23.

[73] Note that the BoCCI categories have changed between 2014-2018 and 2023. Birds observed between 2014-2018 were assessed against the Colhoun & Cummins (2013), which was valid at the time, whilst observations from 2023 have been assessed against the fourth edition of BoCCI (Gilbert *et al*., 2021)

[74] Special Conservation Interests (SCIs), for a wintering population, of nearby SPAs, species listed under Annex I of the Birds Directive (2008/144/EC), and/or Red and Amber species listed for their wintering populations from *Birds of Conservation Concern in Ireland 4: 2020–2026* (Gilbert *et al.* 2020)

[75] Birds of Conservation Concern in Ireland (BoCCI) after Gilbert, G., Stanbury, A. & Lewis, L (2021) Birds of Conservation Concern in Ireland 4: 2020–2026. *Irish Birds 43*: 1–22

Table 8.25 Wintering Birds of Conservation Concern Recorded during the Winter Bird Survey 2022-2023

Common Name / Latin Name	Max. Count	Number of Records	BoCCI	SCI[76]	Annex I
Black-headed Gull Larus ridibundus	65	35	Amber	Inner Galway Bay SPA; Lough Corrib SPA	No
Common Gull Larus canus	5	11	Amber	Inner Galway Bay SPA; Lough Corrib SPA Lough Corrib SPA	No
Coot Fulica atra	2	15	Amber	Lough Corrib SPA	No
Cormorant Phalacrocorax carbo	8	16	Amber	Inner Galway Bay SPA	No
Curlew Numenius arquata	26	27	Red	Inner Galway Bay SPA	No
Golden Plover Pluvialis apricaria	200	1	Red	Inner Galway Bay SPA; Lough Corrib SPA	Yes
Grey Heron Ardea cinerea	3	19	Green	Inner Galway Bay SPA	No
Herring Gull Larus argentatus	35	42	Amber	Yes	No
Kestrel Falco tinnunculus	2	4	Red	No	No
Lapwing Vanellus vanellus	1	2	Red	Inner Galway Bay SPA	No
Little Grebe Tachybaptus ruficollis	4	9	Green	Yes	No
Mallard Anas platyrhynchos	8	52	Amber	Yes	No
Mute Swan Cygnus olor	11	15	Amber	No	No
Oystercatcher Haematopus ostralegus	65	5	Red	Yes	No
Peregrine Falco peregrinus	1	2	Green	Yes	Yes
Red Grouse Lagopus lagopus scotica	1	2	Red	No	No
Redshank Tringa totanus	1	1	Red	Inner Galway Bay SPA	No

[76] Special Conservation Interests (SCI) species are Annex I birds, and migratory birds and their habitats for which sites are selected for SPA designation.

Common Name / Latin Name	Max. Count	Number of Records	BoCCI	SCI[76]	Annex I
Redwing Turdus iliacus	28	24	Red	No	No
Ringed Plover Charadrius hiaticula	2	1	Amber	Inner Galway Bay SPA	No
Shag Phalacrocorax aristotelis	2	2	Amber	Yes	No
Shoveler Anas clypeata	11	6	Red	Lough Corrib SPA	No
Snipe Gallinago gallinago	12	131	Red	No	No
Teal Anas crecca	7	7	Amber	Inner Galway Bay SPA	No
Tufted Duck Aythya fuligula	8	5	Amber	Lough Corrib SPA	No
Whooper Swan Cygnus cygnus	6	1	Amber	Yes	Yes
Wigeon Mareca penelope	8	1	Amber	Inner Galway Bay SPA	No

Hen Harrier

Dedicated Hen Harrier surveys were conducted within the Assessment Boundary during the wintering bird season 2022-23, however no observations of Hen Harrier were recorded.

Historical surveys and desktop data from public records (i.e NPWS and NBDC) indicate that Hen harriers have an established wintering range across lands found within the Assessment Boundary, however, Hen harrier do not commonly frequent urban areas and are more typically found occurring in remote upland habitats during the breeding season and extensive wetland complexes during the wintering period, well removed from the Assessment Boundary and its vicinity.

There is no suitable foraging habitat for Hen harrier within the footprint of the Project. The nearest SPA designated for Hen harrier is the Lough Corrib SPA, located approximately 3.9km north/northwest of the Project.

Species Accounts 2022 - 2023

Brief species accounts from the winter bird surveys are provided below. For the locations of the winter bird survey sites, refer to Figure 8.13.1.

Black-headed gull

Black-headed gull were recorded 35 times across the Assessment Boundary during the 2022-2023 survey season, with numbers ranging in size from single individuals to a maximum flock of 65 birds at the playing fields in Briarhill (WB24). Black-headed gulls were frequently recorded along the River Corrib (WB12) and within habitats such as grasslands, built land (e.g. buildings and stonework), swamps, and Intertidal (mud/sand/shingle shore), across the entire length of the Project.

Common gull

Common gull were recorded infrequently across the Assessment Boundary during the 2022-2023 survey season, from individual up to a maximum count of five. Common gulls were more frequently recorded in

higher numbers along the River Corrib (WB12) and UoG playing fields (WB45), as well as within habitats such as grasslands, built land (e.g. buildings and stonework), swamps, and Intertidal (mud/sand/shingle shore), across the entire length of the Project.

Coot

Coot were recorded 15 times across the Assessment Boundary during the 2022-2023 survey season, typically as lone individuals foraging or rafting in the lakes, swamps, and ponds at both Coolagh (WB04) and Ballindooley (WB02), and in tidal and/or lagoon areas along the River Corrib (WB12). No counts recorded higher numbers than a pair of Coots at any one time (six records of pairs out of 15 total sightings of Coots).

Cormorant

Cormorant were recorded 16 times across the Assessment Boundary during the 2022-2023 survey season, most commonly in tidal/intertidal areas and along the River Corrib (WB12), but also flying over habitats such as fens and flushes and lakes and ponds. Numbers ranged from individuals, with a few instances of pairs, up to a maximum count of eight in intertidal rocky shore areas along the Bearna to Furbo coastline.

Curlew

Curlew were distributed widely across the Assessment Boundary, but the majority of observations across the Assessment Boundary during the 2022-2023 survey season were recorded in the west of the Project in either semi-natural or improved grasslands in the Bushypark (WB10), Letteragh (WB55), Tonabrocky (WB11) townlands. Numbers varied from individuals to medium sized flocks of 16-17, the maximum flock count being 26 Curlew flying over Trusky East/Trusky West areas.

Golden plover

A flock of 200 Golden plover was recorded during the 2022-2023 survey season, in improved grasslands located to the very east of the Assessment Boundary between Ardaun (WB01) and Glenrevagh. No other flocks or sightings of Golden Plover were recorded across the entire length of the Project.

Great Black-backed Gull

An observation of a Great Black-backed Gull was recorded in intertidal areas along the Bearna coastline in December 2022.

Grey heron

Grey heron were recorded regularly across the Assessment Boundary during the 2022-2023 survey season, typically foraging or in flight over areas along the River Corrib, at Coolagh (WB04) and Ballindooley Loughs (WB02), respectively, and in intertidal area along the Bearna coastline. Most records were of single birds, with the maximum count being three Grey Heron at ponds in the Letteragh area (WB55).

Herring Gull

Herring gull were recorded 42 times across the Assessment Boundary during the 2022-2023 survey season, with numbers ranging in size from single individuals to a maximum flock of 35 birds flying over the grasslands in Parkmore East. Herring gulls were frequently recorded along the River Corrib (WB12) and within habitats such as grasslands, built land (e.g. buildings and stonework), swamps, and Intertidal (mud/sand/shingle shore), across the entire length of the Project.

Kestrel

Four sightings of Kestrel were recorded across the Assessment Boundary during the 2022-2023 survey season, from grasslands near the River Corrib (WB12) in the Menlo area, to areas further west of the Assessment Boundary, in Letteragh (WB55) and Trusky West. In all instances bar one, recordings were of singular birds. A pair of Kestrels were recorded perched in a hedgerow in the Menlough area in February 2023.

Lapwing

Two sightings of individual Lapwings were recorded within the Assessment Boundary during the 2022-2023 survey season, at Coolagh lakes (WB04) (March 2023) and Ballindooley Lough (WB02) (December 2022), respectively. No other flocks or sightings of Lapwing were recorded across the entire length of the Project.

Little grebe

Little grebe were recorded at Coolagh Lakes (WB04) and along the River Corrib corridor (WB12), to the north of Meno pier during the 2022-2023 survey season. The numbers were generally low (< five birds) in all nine instances recorded, the maximum count being four in the region of Menlo Pier in January 2023.

Mallard

Mallard were distributed widely across the Assessment Boundary. Of the 52 recorded instances, the majority of observations during the 2022-2023 survey season were recorded along the River Corrib Corridor (WB12), Coolagh lakes (WB04), and Ballindooley Lough (WB02), with reporting of individuals and/or pairs foraging or flying over areas of grassland, marsh, lakes, ponds, watercourses and intertidal zones across the entire route of the Project. The maximum count of Mallard was eight at Menlo pier in December 2022.

Mute swan

Mute swans were recorded at Coolagh Lakes (WB04) and along the River Corrib (WB12) corridor during the 2022-2023 survey season, typically as lone individuals or pairs. The maximum count of Mute Swan at any one time was eleven at Coolagh Lakes in March 2023. A group of four was also recorded in the River Corrib in December 2022.

Oystercatcher

Oystercatcher were distributed widely across the Assessment Boundary, but recorded in two areas predominately during the 2022-2023 survey season; to the west along the intertidal coast areas of Bearna, and to the east of the Project in the Ballybrit area. There were a couple of lone Oystercatcher recorded foraging, but all other records were of larger flocks in the amenity grasslands/playing fields at Ballybrit and Doughiska, respectively. The two largest flocks recorded were at Doughiska (65 in January 2023 and 35 in February 2023) and Ballybrit (35 in January 2023).

Peregrine

Peregrine were recorded twice at one winter bird survey site within the Assessment Boundary during the 2022-2023 survey season. Both records were at Lackagh quarry (WB16), of a single individual, in December 2022.

Red Gouse

There were two instances of Red Grouse being flushed from Heath land within the Assessment Boundary during the 2022-2023 survey season. Once in December 2022 in Trusky West (WB07), the other time in January 2023 in Forramoyle West.

Redshank

An observation of a lone Redshank was recorded in intertidal/coastal areas in Bearna during the 2022-2023 survey season, in January 2023.

Redwing

Redwing flocks were distributed widely across the Assessment Boundary during the 2022-2023 survey season; primarily in grasslands, but also in arable/horticultural/tilled land, scrub/transitional woodland, and hedgerows/treelines. Numbers fluctuated from singular individuals up to a maximum flock count of 28 in flight over Letteragh (WB55).

Ringed Plover

A singular observation of two Ringed Plover was recorded in intertidal/coastal areas in Bearna during the 2022-2023 survey season, in January 2023.

Shag

Two observations of Shag were recorded in intertidal/coastal areas in Bearna during the 2022-2023 survey season. A pair in December 2022 and one individual in January 2023.

Shoveler

Shoveler were recorded on, or flying into, only one of the winter bird survey sites in the Assessment Boundary during the 2022-2023 season, at Ballindooley Lough (WB02). Numbers ranged from either individuals or collective pairs, up to a maximum of 11 birds at any one time.

Snipe

Snipe were distributed widely across the Assessment Boundary and were the most commonly recorded bird during the 2022-2023 wintering bird survey with 131 records in total. Numbers ranged from individuals flushed from grassland and heath habitats to a maximum number of 12 flushed from the semi-natural grasslands along the River Corrib corridor at Menlo.

Teal

Teal were recorded at two winter bird survey sites within the Assessment Boundary during the 2022-2023 wintering bird season, at Ballindooley Lough (WB02) and at Coolagh Lakes. Typically these were recorded in singular or grouped pairs. The maximum count was seven at Ballindooley Lough in February 2023.

Tufted duck

Tufted duck were recorded at two winter bird survey sites within the Assessment Boundary during the 2022-2023 wintering bird season, at Ballindooley Lough and at Coolagh Lakes. From December 2022 to early March 2023, eight tufted duck were recorded at each visit. In late March 2023, this number had reduced to four Tufted Duck.

Whooper Swan

A flock of six Whooper Swan was recorded flying over Coolagh Lakes during the 2022-2023 survey season, in December 2022.

Wigeon

Wigeon were recorded at one winter bird site within the Assessment Boundary during the 2022-2023 wintering bird season, at Ballindooley Lough, on one occasion in December 2022 with eight birds present.

2023-2024 Survey Results

Seven bird species which are listed as SCIs for Lough Corrib SPA were recorded during the 2023-2024 survey season: Black-headed gull, Common gull, Coot, Gadwall, Golden Plover, Shoveler, and Tufted duck.

Thirteen bird species which are listed as SCIs for Inner Galway Bay SPA were recorded during the 2023-2024 winter bird surveys: Black-headed gull, Light-bellied brent goose, Common gull, Cormorant, Curlew, Golden plover, Grey heron, Lapwing, Redshank, Teal, Turnstone, and Wigeon.

Four species listed on Annex I of the Birds Directive (2009/147/EC) were also recorded during these surveys (some of which are also SCIs of the SPAs discussed and valued above): Golden plover, Little egret, Peregrine, and Whooper swan.

Of the bird species recorded during the 2023-2024 winter bird surveys, 10 are on the BoCCI Red List: Curlew, Golden plover, Kestrel, Lapwing, Oystercatcher, Redshank, Redwing, Shoveler, Snipe, and Woodcock.

Of the bird species recorded during the winter bird surveys, 18 are on the BoCCI Amber List: Black-headed gull, Light-bellied brent goose, Common gull, Coot, Cormorant, Gadwall, Gannet, Great crested grebe, Herring gull, Lesser black-backed gull, Mallard, Mute swan, Shag, Teal, Tufted duck, Turnstone, Whooper swan, and Wigeon.

The wintering bird survey areas are shown on Figures 8.13.1 with the results and full list of bird species recorded provided in Appendix A.8.23.

Table 8.26 Wintering Birds of Conservation Concern Recorded during the Winter Bird Survey 2023-2024

Common Name / Latin Name	Max. Count	Number of Records	BoCCI	SCI	Annex I
Black-headed Gull Larus ridibundus	28	61	Amber	Inner Galway Bay SPA; Lough Corrib SPA	No
Brent goose Branta bernicla hrota	1	1	Amber	Inner Galway Bay SPA	No
Common Gull Larus canus	35	32	Amber	Inner Galway Bay SPA; Lough Corrib SPA	No
Coot Fulica atra	6	33	Amber	Lough Corrib SPA	No
Cormorant Phalacrocorax carbo	5	26	Amber	Inner Galway Bay SPA	No
Curlew Numenius arquata	36	59	Red	Inner Galway Bay SPA	No
Gadwall Mareca strepera	5	1	Amber	Lough Corrib SPA	No
Gannet Morus bassana	1	4	Amber	Yes	No
Golden Plover Pluvialis apricaria	74	2	Red	Inner Galway Bay SPA; Lough Corrib SPA	Yes
Great Crested Grebe Podiceps cristatus	2	1	Amber	Yes	No
Greenshank Tringa nebularia	1	2	Green	Yes	No
Grey Heron Ardea cinerea	2	21	Green	Inner Galway Bay SPA	No
Herring Gull Larus argentatus	30	170	Amber	Yes	No
Kestrel Falco tinnunculus	1	21	Red	No	No
Lapwing Vanellus vanellus	1	1	Red	Inner Galway Bay SPA	No
Lesser Black-backed Gull Larus fuscus	1	5	Amber	Yes	No
Little Egret Egretta garzetta	2	3	Green	No	Yes
Little Grebe Tachybaptus ruficollis	3	19	Green	Yes	No
Mallard Anas platyrhynchos	30	101	Amber	Yes	No

Common Name / Latin Name	Max. Count	Number of Records	BoCCI	SCI	Annex I
Mute Swan Cygnus olor	6	46	Amber	No	No
Oystercatcher Haematopus ostralegus	44	13	Red	Yes	No
Peregrine Falco peregrinus	1	2	Green	Yes	Yes
Redshank Tringa totanus	1	7	Red	Inner Galway Bay SPA	No
Redwing Turdus iliacus	30	39	Red	No	No
Shag Phalacrocorax aristotelis	3	9	Amber	Yes	No
Shoveler Anas clypeata	12	9	Red	Lough Corrib SPA	No
Snipe Gallinago gallinago	32	206	Red	No	No
Teal Anas crecca	14	5	Amber	Inner Galway Bay SPA	No
Tufted Duck Aythya fuligula	14	13	Amber	Lough Corrib SPA	No
Turnstone Arenaria interpres	7	1	Amber	Inner Galway Bay SPA	No
Whooper Swan Cygnus cygnus	3	3	Amber	Yes	Yes
Wigeon Mareca penelope	14	12	Amber	Inner Galway Bay SPA	No
Woodcock Scolopax rusticola	1	2	Red	No	No

Hen Harrier

Dedicated Hen Harrier surveys were conducted within the Assessment Boundary during the wintering bird season 2023-24, however, as with the previous year's surveying, no observations of Hen Harrier were recorded.

Species Accounts 2023 – 2024

Brief species accounts from the winter bird surveys are provided below. For the locations of the winter bird survey sites, refer to Figure 8.13.1.

Black-headed gull

Black-headed gull were recorded 62 times within the Assessment Boundary during the 2023-2024 survey season. Records were distributed widely across the Assessment Boundary, with the largest concentration along the River Corrib (WB12), and in numbers ranging from single individuals to a flock of 37 individuals.

Light-bellied brent goose

A flock of five Light-bellied brent goose was recorded on one occasion within the Assessment Boundary during the 2023-2024 survey season, flying offshore at the western extent of the Assessment Boundary near Bearna in March 2024.

Common gull

Common gull were recorded widely across the Assessment Boundary during the 2023-2024 survey season and in numbers ranging from single individuals up to a flock of 35, recorded near Bearna Woods (WB50). Most records of the species were of small numbers of individuals. The only other record of more than 20 individuals was at Briarhill (WB24).

Coot

Coot were recorded 33 times across the Assessment Boundary during the 2023-2024 survey season. Records were focused at two of the survey sites, Coolagh Lakes (WB04) and Ballindooley Lough (WB02), with a small number of records also on the east of the River Corrib (WB12) near Menlough. Although Coot were recorded regularly, the numbers were quite low, with a maximum number of six recorded on the River Corrib in January 2024.

Cormorant

Cormorant records were concentrated along the River Corrib during the 2023-2024 survey season, with most recordings being from Glenlo Abbey (WB12), UoG (WB45), and Coolagh Lakes (WB04). Cormorant were also commonly recorded offshore near Bearna (WB52). In all instances the numbers recorded were low, except for one instance of eight individuals perched on coastal rocks near Bearna and a flock of five flying over the River Corrib.

Curlew

Curlew were distributed widely across the Assessment Boundary during the 2023-2024 survey season, with the records concentrated on the coast at Bearna (WB52), and at Ballard East (WB05), Bushypark (WB10), and Galway Racecourse (WB23). On most occasions on which Curlew were recorded, fewer than 10 birds were present. The largest flocks recorded were of 36 and 25 birds, as recorded near Bearna Woods (WB50).

Gadwall

Gadwall was recorded on one occasion, within the Assessment Boundary during the 2023-2024 survey season, with 5 individuals to the north of Ballindooley Lough (WB02) in March 2024.

Gannet

Three observations of Gannet were recorded during the 2023-2024 survey season. All three were in March 2024, flying over sea inlets and bays along the Bearna coastline. The maximum count was three, with individual birds accounting for the other two records.

Golden plover

Golden plover were recorded three times during the 2023-2024 survey season, on all occasions at the eastern extent of the Assessment Boundary. In January 2023, 200 birds were recorded at Ardaun (WB01), and in January 2024, 74 birds were recorded at Galway Racecourse (WB23).

Great crested grebe

Great crested grebe were recorded once during the 2023-2024 survey season. Two birds were recorded at Ballindooley Lough (WB02) in September 2023.

Greenshank

Greenshank were recorded twice during the 2023-2024 survey season, both records were of individual birds, foraging along the Bearna coastline and intertidal zones in March 2024.

Grey heron

Records of Grey heron were widespread throughout and recorded regularly across the Assessment Boundary, being recorded on 29 occasions at the 2023-2024 survey sites, and were typically flying over the survey

areas. Grey heron was recorded at Ballard East (WB31), Cloghscoltia (WB05 and WB07), Aille (WB06), Cappagh to Ballymoneen Road (WB03), Bushypark (WB10), Glenlo Abbey (WB12), along the River Corrib (WB12), Coolagh and Coolagh Lakes (WB04), Ballindooley Lough (WB02), Castlegar (WB14) and Twomileditch (WB17). Most records were of single birds, with two separate recordings of pairs, in Ballard East (September 2023) and Coolagh lakes (September 2023), respectively.

Herring gull

Herring gull were recorded widely, 170 times across the Assessment Boundary, during the 2023-2024 survey sites, with numbers ranging from single individuals to a maximum flock of 35 birds. Herring gulls were distributed evenly, and frequently recorded along the River Corrib (WB12) and within habitats such as grasslands, built land (e.g. buildings and stonework), swamps, and intertidal (mud/sand/shingle shore), across the entire length of the Project.

Jack Snipe

Five instances of individual Jack Snipe, flushed from habitats ranging from grassland to bog land and marsh, were recorded across the Assessment Boundary, with the highest concentration being at Bearna (WB52). The largest flocks were recorded at Ardaun (WB01) (35 birds), Briarhill (WB24) (30 birds), and Ballindooley Lough (WB02) (30 birds) during the 2023-2024 survey season, between November 2023 and February 2024.

Kestrel

Twenty-two sighting of Kestrel were recorded across the Assessment Boundary during the 2023-2024 survey season, from grasslands near the River Corrib (WB12) in the Menlo area, to areas further west of the Assessment Boundary, in Letteragh (WB55) and Trusky West (WB07).

In all instances bar two, recordings were of individual birds. A pair of Kestrels were recorded in flight over Trusky East in October 2023. Another pair of Kestrels were recorded in flight over Coolagh Lakes in December 2023.

Lapwing

Lapwing were recorded at a single winter bird survey sites within the Assessment Boundary during the 2023-2024 survey season. Three Lapwing were flushed from grassland at Doughishka (WB01) in January 2024. No other flocks or sightings of Lapwing were recorded across the entire length of the Project during the 2023-2024 survey season.

Lesser black-backed gull

Records of Lesser black-backed gull were uncommon but widespread across the Assessment Boundary. They were recorded eight times during the 2023-2024 survey season, primarily in areas to the east of the River Corrib (WB12), at Coolagh Lakes (WB16) and Ballindooley Lough (WB02) which contained four of the eight records of the species. Other records were at Ballybrit (WB14), Glenlo Abbey (WB12), Ballard East (WB05), Coolagh lakes, Bearna (WB52) and along the River Corrib corridor. Typically, sightings were of individual birds. The maximum count was a pair flying over Ballindooley Lough in March 2024.

Little egret

Little egret was recorded at three winter bird survey sites within the Assessment Boundary during the 2023-2024 survey season. One bird was recorded north of Ballindooley Lough (WB02) in March 2024; one bird was recorded at Bearna (WB52), in March 2024; and one bird south of Na Forai Maola Thoir (WB08) in January 2024.

Little grebe

Little grebe were recorded 20 times during the 2023-2024 survey season, at Ballindooley Lough, Coolagh Lakes and along the River Corrib corridor. The numbers were generally low (< four birds) in all instances with the maximum count being three in the region of Menlo Pier in February 2024.

Mallard

Records of Mallard were widespread and distributed widely across the Assessment Boundary. The species was frequently recorded, with 110 occurrences recorded during the 2023-2024 survey season. The majority of observations during the 2023-2024 survey season were recorded along the River Corrib Corridor (WB12),

Ballindooley Lough (WB02), Coolagh Lakes (WB16), and Bushypark (WB10). Other records were at Castlegar (WB14), Doughishka (WB01), Ballard East (WB31), Cloghscoltia (WB05 and WB07) and Aille (WB06). Records were mostly of low numbers of birds (i.e. less than 10), with singular and/or pairs foraging or flying over areas of grassland, marsh, lakes, ponds and watercourses across the entire route of the Project. Larger numbers (i.e. records with 10 or more individuals) were recorded along the River Corrib Corridor (WB12) and at Ballindooley Lough (WB02). The maximum count of Mallard was 30 at Menlo pier in September 2023.

Mute swan

Records of Mute Swan were focused at three winter bird surveys sites, all close to Coolagh Lakes and along the River Corrib channel, Menlough (WB12), Coolagh Lakes (WB16), and Ballindooley Lough (WB02). Most of the recordings of Mute Swan were low in numbers (<4 birds). The maximum count of Mute Swan at any one time was six birds, recorded in the River Corrib (WB12) in November 2023.

Oystercatcher

Oystercatcher were recorded at five of the winter bird survey sites; Bearna (WB52), Ballard East (WB50), Newcastle (WB44), Briarhill (WB24), and Doughiska (WB01). Numbers ranged from single individuals to a flock of 65 recorded at Doughiska in January 2023. The largest flock of Oystercatcher was observed at Briarhill (WB24), where 44 birds were recorded in November 2023.

Oystercatcher were distributed widely across the Assessment Boundary, but recorded in two areas predominately during the 2023-2024 survey season; to the west along the intertidal coast areas of Bearna, and to the east of the Project in the Ballybrit area. There were also recorded sightings of Oystercatcher in grasslands in Greenfields, west of the River Corrib, and in Bog land at Ballard West. There were a couple of lone Oystercatcher recorded foraging in grasslands and intertidal zones, but all other records were of flocks. The maximum counts recorded during the 2023-2024 survey season were in the amenity grasslands/playing fields of Briarhill (WB24) (44 in November 2023).

Peregrine

Peregrine were recorded four times across the Assessment Boundary, two times during the 2022-2023 survey season, and two times during the 2023-2024 survey season. All records were of single individuals. One was recorded at Lackagh Quarry (WB16), on two occasions in December 2022, and one occasion in December 2023; and once at Twomileditch (WB17) in 2023. Another individual was observed at the Roadstone Quarry (near Twomileditch on the N83 Tuam Road) flushed by a Buzzard, in March 2024.

Redshank

Redshank were recorded on seven occasions at An Baile Nua (WB52), during the 2023-2024 survey season, in January 2023, January 2024, and March 2024, with all records being of single individuals in intertidal/coastal areas in Bearna, in January 2023.

Redwing

Records of Redwing flocks were distributed widely across the Assessment Boundary. They were most frequently recorded in the agricultural fields to the north of the Assessment Boundary, near Ballindooley Lough (WB02) during the 2023-2024 survey season; primarily in grasslands, but also in arable/horticultural/tilled land, scrub/transitional woodland, and Twomileditch (WB17). All records were associated with grassland and hedgerow/scrub habitats. Numbers fluctuated from individual birds, up to a maximum flock count of 30 recorded foraging in improved grasslands in Ardaun (WB01) in December 2023. Other sites which supported large numbers of birds were Letteragh (WB55) and Ballindooley Lough (WB02).

Shag

Eleven observations of Shag were made during the 2023-2024 winter bird survey season. The majority were recorded in intertidal/coastal areas in Bearna, with two counts of separate individuals on an intertidal area near Bearna (WB52) at Coolagh Lakes in January 2024.

Shoveler

Nine Shoveler observations were recorded at only one of the winter bird survey sites in the Assessment Boundary during the 2023-2024 season, at Ballindooley Lough (WB02). Numbers typically ranged from six to thirteen, with a maximum number of 40 individuals recorded in December 2023, with all other records being of less than 15 individuals.

Snipe

Snipe were distributed widely across the Assessment Boundary and the most commonly recorded bird during the 2023-2024 wintering bird survey season with 223 records in total. Numbers ranged from individuals flushed from grassland and heath habitats to a maximum number of 60 flushed from improved grasslands in Knocknagreana in October 2023. Records of Snipe were widespread across the Assessment Boundary. The species was most frequently recorded to the west of the River Corrib, at Bushypark (WB10), Ballymoneen (WB03), Ballard East (WB05), and Ballard West (WB07). Most records were of small numbers of birds (<5 individuals), with the maximum number of birds recorded being 60 at Na Forai Maola Thiar (WB08) in October 2023. The other site which supported large flocks of birds was Galway Racecourse, which held a flock of 32 birds in March 2024, and 19 birds in December 2023 and 32 birds in March 2024.

Teal

Teal were recorded at two winter bird survey sites; Coolagh Lakes (WB16) and Ballindooley Lough (WB02). Numbers ranged from 2 birds to a maximum of 15 birds, recorded at Ballindooley Lough (WB02) in March 2024. Teal were present within the Assessment Boundary consistently during the survey 2023-2024 wintering bird season, with records for six of the seven survey months (there were no records from October) at Ballindooley Lough and at Coolagh Lakes. Typically these were recorded in grouped pairs. The maximum count was 15, foraging at Ballindooley Lough in March 2024.

Tufted duck

Thirteen occurrences of Tufted duck were recorded at two winter bird survey sites within the Assessment Boundary during the 2023-2024 wintering bird season; at Ballindooley Lough (WB02) and at Coolagh Lakes (WB16). Numbers ranged from a minimum of 2, to a maximum of 14, which was recorded on 3 occasions in Ballindooley Lough, in December 2023, February 2024, and March 2024.

Turnstone

Turnstone were recorded once during the winter bird surveys. Seven individuals were recorded along the Bearna coastline at An Baile Nua (WB52) in January 2024.

Whooper swan

Four occurrences of Whooper swan were recorded during the 2023-2024 winter bird survey season between October 2023 and January 2024. All occurrences were small in number (<8 birds), and ranged in number from 2 to 7 birds in flight over lands in the Assessment Boundary. Records were made at three sites; Troscaigh Thiar (WB07), Na Forai Maola Thiar (WB08) and Coolagh Lakes (WB16). The largest number of Whooper Swans was recorded in October 2023 flying over heathland just outside of Troscaigh Thiar (WB07).

Wigeon

Wigeon were recorded in two areas within the Assessment Boundary during the 2023-2024 wintering bird season at Ballindooley Lough (WB02) and at Castlegar (WB14). A single observation was made at Castlegar (WB14) of two birds in March 2024. There were thirteen records at Ballindooley Lough (WB02), with numbers ranging from two individuals to a maximum of 14 Wigeons. This maximum was recorded in December 2023.

Woodcock

Woodcock was recorded for the first time within the Assessment Boundary, out of all the wintering bird surveys conducted between 2005 and 2024 (including the dedicated breeding Woodcock surveys conducted during the same period), during the surveys undertaken in November 2023 with two instances of individual Woodcock being flushed from grasslands - one in Menlo and one in Ballard East.

2014-2018 Survey Results

The 2014-2015 wintering bird surveys recorded a total of 26 no. target species across the survey area.

Seven bird species which are listed as SCIs for Lough Corrib SPA were recorded during the survey: Black-headed gull, Common gull, Coot, Golden plover, Hen harrier, Shoveler 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, Golden plover, Grey heron, Lapwing, Great-northern diver, Redshank, Teal, Turnstone and Wigeon.

Seven 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 and valued above): Bar-tailed godwit, Bittern, Golden plover, Great Northern Diver, Hen harrier, Merlin, and Peregrine falcon.

Of the bird species recorded during the winter bird surveys, eight are on the BoCCI Red List for their wintering populations: Bar-tailed Godwit, Curlew, Golden plover, Lapwing, Oystercatcher, Redshank, Shoveler, and Snipe. All are SCI species for the nearby SPAs and are valued accordingly.

Of the bird species recorded during the winter bird surveys, 16 are on the BoCCI (Colhoun & Cummins, 2013) Amber List: Black-headed gull, Bittern, Common gull, Cormorant, Coot, Great crested grebe, Great northern diver, Hen harrier, Light-bellied brent goose, Little Grebe, Merlin, Mute swan, Teal, Tufted Duck, Turnstone, and Wigeon.

The wintering bird survey areas are shown on Figures 8.13.1 with the results and full list of bird species recorded provided in Appendix A.8.23.

Table 8.27 Wintering Birds of Conservation Concern Recorded during the Winter Bird Survey 2014 - 2015

Common name / Latin name	Conservation Importance		
	BoCCI (wintering)	Annex I	SCI
Bar-tailed godwit Limosa lapponica	Red	✓	Inner Galway Bay SPA
Black-headed gull Larus ridibundus	Amber	-	Lough Corrib SPA Inner Galway Bay SPA
Bittern Botaurus stellaris	Amber	✓	-
Common gull Larus canus	Amber	-	Lough Corrib SPA Inner Galway Bay SPA
Cormorant Phalacrocorax carbo	Amber	-	Inner Galway Bay SPA
Coot Fulica atra	Amber	-	Lough Corrib SPA
Curlew Numenius arquata	Red	-	Inner Galway Bay SPA
Golden plover Pluvialis apricaria	Red	✓	Lough Corrib SPA Inner Galway Bay SPA
Great crested Crested Grebe Podiceps cristatus	Amber	-	-
Great northern Northern Diver Gavia immer	Amber	✓	Inner Galway Bay SPA
Grey heron Ardea cinerea	Green	-	Inner Galway Bay SPA
Hen harrier Circus cyaneus	Amber	✓	Lough Corrib SPA
Lapwing Vanellus vanellus	Red	-	Inner Galway Bay SPA
Light-bellied brent goose Branta bernicla hrota	Amber	-	Inner Galway Bay SPA

Common name / Latin name	Conservation Importance		
	BoCCI (wintering)	Annex I	SCI
Little Grebe Tachybaptus ruficollis	Amber	-	-
Merlin Falco columbarius	Amber	✓	-
Mute swan Cygnus olor	Amber	-	-
Oystercatcher Haematopus ostralegus	Red	-	-
Peregrine falcon Falco peregrinus	Green	✓	-
Redshank Tringa totanus	Red	-	Inner Galway Bay SPA
Shoveler Anas clypeata	Red	-	Lough Corrib SPA
Snipe Gallinago gallinago	Red	-	-
Teal Anas crecca	Amber	-	Inner Galway Bay SPA
Tufted duck Aythya fuligula	Amber	-	Lough Corrib SPA
Turnstone Arenaria interpres	Amber	-	Inner Galway Bay SPA
Wigeon Anas penelope	Amber	-	Inner Galway Bay SPA

Species Accounts 2014 - 2015

Brief species accounts from the winter bird surveys are provided for these species below; the winter bird survey site reference numbers are given below in parenthesis. For the locations of the winter bird survey sites, refer to Figure 8.13.1.

Bar-tailed godwit

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

Black-headed gull

Black-headed gull were the most frequently recorded species and were distributed widely across the survey area, but mainly east of the River Corrib (recorded from 10 out of 17 winter bird sites within the ZoI of the Project), and in numbers ranging from single individuals to a flock of 119 birds. Those sites within the ZoI which recorded larger flocks of over 40 individuals were the River Corrib corridor (WB12) and the UoG Sporting Campus (WB45).

Bittern

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

Common gull

Common gull were recorded widely across the Assessment Boundary (recorded from eight out of 17 winter bird sites within the ZoI of the Project) and in numbers ranging in size from single individuals to a flock of 78 birds. The species was most frequently recorded on the River Corrib (WB12) and at the UoG Sporting Campus (WB45) – on six and three occasions respectively. Common gull were recorded more infrequently at the other surveyed sites, and in low numbers; they were only recorded on one of the seven survey visits at five of the eight sites within the ZoI. The largest flocks were recorded 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.

Cormorant

Cormorant were recorded at five winter bird survey sites within the ZoI of the Project: Ballindooley Lough (WB02), Coolagh Lakes (WB04), An Chloch Scoilte (WB07), west of Lough Inch (WB08) and the River Corrib (WB12). However, in all instances the numbers recorded were low; generally, one or two individuals with the exception of a record for four in February 2015 along the River Corrib (WB12).

Coot

Coot were recorded at three of the winter bird survey sites within the ZoI of the Project: Ballindooley 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 relatively low with a maximum of 11 recorded at Ballindooley Lough in February/March 2015.

Curlew

Curlew were distributed widely across the survey area, and were recorded at eight of the 17 winter bird survey sites within the ZoI of the Project. At the majority of survey sites and dates on which they were recorded, fewer than 10 birds were present. The largest flocks were recorded along the River Corrib corridor (WB12) south of Glenlo Abbey Hotel where a flock of 16 was recorded in October 2014 and at the west side of the Galway Racecourse (WB23) (grid reference (ITM) 533091 727407) where a flock of 37 were recorded in January 2015. The species was only regularly recorded at Ballindooley Lough (WB02), where it was present on six of the seven survey visits, with eight or fewer birds present on each occasion.

Golden plover

Golden plover were recorded at one winter bird survey site within the ZoI of the Project, WB08 to the west of Lough Inch, during four out of the seven survey visits. The species were recorded in relatively small numbers (maximum of nine birds) on all but one occasion, when a flock of 73 were recorded in November 2014.

Great crested grebe

Great crested grebe (two birds) were recorded once on the River Corrib corridor (WB12) near Glenlo Abbey Hotel in October 2014.

Great northern diver

A single Great northern diver was recorded in Galway Bay at Ballyloughaun (WB30).

Grey heron

Grey heron were recorded at six of the 17 winter bird survey sites within the ZoI of the Project: Ballindooley Lough (WB02), Cappagh (WB03), Coolagh Lakes (WB04), An Chloch Scoilte (WB07), west of Lough Inch WB08, and the River Corrib corridor WB12. The species was recorded in relatively small numbers, a maximum of three birds were recorded at WB08 in March 2015, with most records being of single birds.

Hen harrier

A single Hen harrier was recorded in the area east of Lough Inch (WB06) in January 2015.

Lapwing

Lapwing were recorded at two winter bird survey sites within the ZoI of the Project: Ballindooley Lough (WB02) where a flock of 16 and a single individual were recorded in January and March 2015 respectively; and, west of Lough Inch (WB08), where 17 were recorded in October 2014.

Light-bellied brent goose

Light bellied brent geese were recorded at Galway Golf Course (WB19), Nimmo's Pier/Claddagh area (WB38) and along the coastline of Galway Bay between Roscam Point and Oranmore (WB71). The largest numbers were recorded at WB38 in January and March 2015 (127 and 83 respectively).

Little grebe

Little grebe were recorded at four winter bird survey sites: Ballindooley Lough (WB02), Coolagh Lakes (WB04), west of Lough Inch (WB08) and the River Corrib corridor (WB12). The numbers recorded were

generally low (< five birds). The species were recorded on all seven survey visits at Coolagh Lakes (WB04) and the River Corrib corridor (WB12). The species was recorded on five out of seven of the survey visits (November 2014 through to March 2015) at Ballindooley Lough (WB02) and only on one occasion in December 2014 at the survey site to the west of Lough Inch (WB08).

Merlin

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

Mute swan

Mute swans were recorded at five winter bird survey sites: Ballindooley Lough (WB02), Coolagh Lakes (WB04), west of Lough Inch (WB08), the River Corrib corridor (WB12) and the Terryland River Valley (WB14). The numbers recorded were generally low (< eight birds). The species were recorded on all seven survey visits on the River Corrib corridor (WB12), with 14 birds recorded near Glenlo Abbey Hotel in February 2015. The species was recorded on six out of seven of the survey visits to the survey site west of Lough Inch (WB08) (September 2014 and November 2014 through to March 2015) and at the Coolagh Lakes (WB04) (October 2014 through to March 2015). The species was recorded on five out of seven survey visits to Ballindooley Lough (WB02) (October 2014 through to January 2015 and March 2015), and on one occasion on the Terryland River (WB14) in February 2015.

Oystercatcher

Oystercatcher were distributed widely across the Assessment Boundary and recorded from five out of 17 winter bird sites within the ZoI of the Project. Numbers ranged from single individuals to a flock of 34 birds. The sites that recorded larger flocks of over 20 individuals were the UoG Sporting Campus (WB45) where 34 birds were recorded in December 2014.

Peregrine

Peregrine were recorded at one winter bird survey site within the ZoI of the Project, at the Roadstone Quarry (WB17). At the Roadstone Quarry a single bird was recorded on three occasions in December 2014, February 2015 and March 2015. Peregrine were also recorded at Angliham Quarry, c.1km north of the Project.

Redshank

Redshank were recorded at two winter bird survey sites within the ZoI of the Project; west of Lough Inch (WB08) and the River Corrib corridor (WB12). Only two birds were recorded at WB08 in March 2015 and only single birds were recorded at WB12, near Waterside, in November and December 2014.

Shoveler

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

Snipe

Snipe were distributed widely across the Assessment Boundary (recorded from eight out of 17 winter bird sites within the ZoI of the Project) and in numbers ranging from single individuals to a flock of 37 birds. The numbers recorded across the sites were generally low (<10). Ballindooley Lough (WB02) had the largest flock of 37 in March 2015, with a flock of 28 in December 2014 and in September and November 2014 one and two birds respectively. A flock of 15 birds was recorded in November 2014 at the Terryland River Valley (WB14), and a flock of 14 recorded at the survey site to the west of Lough Inch (WB08) in January 2015.

Teal

Teal were recorded at five winter bird survey sites within the ZoI of the Project: Ballindooley Lough (WB02), Coolagh Lakes (WB04), west of Lough Inch (WB08), Ballagh (WB10) and the Terryland River Valley (WB14). The numbers recorded at WB04, WB08 and WB10 were generally low (<6 birds) and Teal were not present regularly throughout the winter period (recorded on two, four and one occasion, respectively). Teal were recorded on, or flying into, Ballindooley Lough (WB02) and the Terryland River

(WB14) during all survey visits. At Ballindooley Lough numbers ranged from three in September 2014, to 146 in January 2015, and at the Terryland River numbers ranged from nine in October 2014 to 29 in January 2015.

Tufted duck

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

Turnstone

Five Turnstone were recorded in Galway Bay at Ballyloughaun (WB30) in October 2014.

Wigeon

Wigeon were recorded at one winter bird site Ballindooley Lough (WB02) on one occasion in February 2015, when 28 birds were present.

2005-2006 N6 Galway City Outer Bypass Project Results

Of note are the results of the wintering bird surveys carried out in 2005/2006 as part of the 2006 Galway City Outer Bypass project (RPS, 2006) which demonstrates the importance of the River Corrib corridor for bird species.

In terms of bird species known to use the River Corrib corridor for commuting or foraging, the surveys carried out in 2005/2006 as part of the 2006 Galway City Outer Bypass project recorded the following SCI species flying through the proposed bridge site for that project over the survey period (52 surveys encompassing 104 hours of observations): Black-headed gull, Common gull, Common tern, Cormorant, Coot, Curlew, Grey heron, Hen harrier, Lapwing and Merlin.

The most frequently recorded of these were Black-headed gull, Common gull and Cormorant. Black-headed gull were recorded passing the observation point 409 times (with 810 individuals counted in total); Common gull passed the observation point 93 times (130 individuals in total); and, Cormorant passed the observation point 177 times (248 individuals in total).

Hen harrier and Coot were only recorded once, Curlew twice and Lapwing on four occasions over the survey period. Grey heron were recorded passing the observation point on 20 occasions. Common tern were observed passing the observation point on only 43 occasions and generally low over the water (<5m). Many of these species, Black-headed gull, Common gull, Cormorant, Coot, Curlew, Grey heron along with Redshank, were also recorded along the River Corrib over the course of the surveys carried out in the preparation of the baseline for the 2018 EIAR and this updated EIAR.

Summary

The populations of the species that were recorded within the Assessment Boundary and which are listed as SCIs of nearby European sites, specifically of Lough Corrib SPA and Inner Galway Bay SPA are considered to be of international importance, given the potential link for these birds to the respective SPA populations.

The non-SCI Annex I bird species, which are likely to have a limited population at a county level, are valued as being of County Importance. All other bird species that are red or amber listed are considered to be of Local Importance (Higher Value). Within Appendix 4 of ABP's Inspector's Report dated 22 June 2021, Red grouse is valued as being of National Importance, "*due to population declines of this species*". This species was valued as being of Local Importance (higher value) in the 2018 EIAR. Within Appendix 4 of ABP's Inspector's Report dated 22 June 2021, Snipe and Starling populations are valued as being of County Importance, "*due to large numbers of birds identified within the Assessment Boundary*". These species were valued as being of Local Importance (higher value) within the 2018 EIAR. For this update EIAR

snipe populations have been reassessed and revaluated at County Importance as described below. Starling populations have been reassessed, but the 2018 EIAR evaluation level is retained at Local Importance (Higher Value) as described below. Red grouse was not confirmed in 2023 surveys and, as described below, has retained its 2018 evaluation at Local Importance (Higher Value).

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Starling populations were recorded in large numbers. A large roost of 5,000 birds was recorded at the Coolagh Lakes (WB04) in 2014. This was likely a starling murmuration. No further large wintering populations have been recorded between 2014 and 2023, with a peak count of 27 in 2023. Smaller numbers of breeding starling were recorded, with a peak count of 23 in 2023. Starling is on the Amber list on the Birds of Conservation Concern List for Ireland, version 4, which specifies that no notable breeding or wintering population declines were recorded, and global populations of starling are concentrated outside of Ireland and outside of Europe. The IUCN Red List states that starling are of Least Concern, though numbers globally are decreasing. Breeding starling populations in Ireland have been estimated as approximately 2,000,000[77]. Starling numbers increase in the winter with continental visitors. Though the roost recorded in 2014 had a large number of individuals (5000), this is a relatively small proportion of the estimated Irish population. As such, local starling populations are valued as Local Importance (higher value).

Snipe were recorded both wintering and breeding in the Assessment Boundary. There were 25 records of probable breeding/non-breeding snipe in 2023 and a maximum count of 60 wintering snipe in 2024. Snipe are particularly vulnerable as they are ground nesters in grassland and wetland habitats, with those habitats facing pressure from intensive agricultural practices and development. Wintering populations in Ireland have been estimated as about 800 individuals[78]. Snipe were moved from the Amber list to the Red list in the 2021 publication of Birds of Conservation Concern List for Ireland, version 4. This was due to a sharp decline in breeding populations in a short time period (over 50% decline between 1998 and 2018 and a 78% decline since 1980). For this reason, local snipe populations are valued as being of County Importance.

No Red grouse were recorded during any of the dedicated red grouse surveys. Although the habitats within the survey area are considered sub-optimal for breeding Red grouse, they have some limited foraging potential for individuals which may temporarily spread out looking for territories outside the larger bog and heath habitats to the north and northwest, and therefore their presence cannot be fully ruled out. Given that there were no sightings of Red Grouse during surveys, coupled with the limited availability of sub-optimal breeding habitat, any local Red grouse populations which may exist could not be evaluated at anything higher than of Local Importance (higher value).

With regards to Hen harrier, although there is no suitable foraging habitat and no observations of this species were made between 2014 and 2024, with the exception of one sighting in 2015, it is a SCI of the nearby Lough Corrib SPA, and it cannot be discounted that the species occasionally occur within the footprint of the Project. Due to its inclusion as a SCI for the Lough Corrib SPA, the populations of Hen Harrier within the vicinity are considered to be of International Importance.

8.3.11 Amphibians

Two amphibian species are known to be present within lands contained within the Assessment Boundary; the Common frog Rana temporaria and the Smooth newt Triturus vulgaris[79]. Both are legally protected under the Wildlife Acts (including their breeding and resting places).

Common frog have been recorded throughout the Assessment Boundary, most often in the upland habitats west of the River Corrib and along the River Corrib corridor.

Smooth newt have been recorded in the vicinity of Bearna Woods, Salthill, Terryland Park and at Renmore. Local landowners have also reported the presence of Smooth newt on lands near Coolagh Lakes.

The baseline with respect to amphibians in this updated EIAR is consistent with that presented in the 2018 EIAR.

2023 Survey Results

The 2023 surveys within the Assessment Boundary comprised of suitable habitat (ponds, pools and slow flowing ditches) identified during the 2022-2023 wintering bird and multi-disciplinary surveys.

[77] IWM 115 (2019) Countryside Bird Survey 1998-2016

[78] IWM 106 (2019) Irish Wetland Bird Survey 2009/10 – 2015/16

[79] Records from the National Biodiversity Centre's online database. For full details of the desk review, refer to Appendix A.8.18.

This included a resurvey of all previously surveyed suitable habitat for amphibians (as of 2014), where these were still accessible and where habitat remained suitable.

Common frog (adults, juveniles and tadpoles) were recorded at 30 of the 71 surface water/drainage features surveyed. Smooth newts were recorded at nine of the 52 surface water/drainage features surveyed.

Most of the Smooth newts recorded were located east of the River Corrib, in Lackagh Quarry, although Smooth newts were also recorded within the vicinity of Ballindooley Lough. The majority of records within the quarry were recorded in shallow ponds and tailings ponds. Further sparsely distributed records were observed in a stone cattle trough c. 400m west of the N84 near Ballinfoyle and c. 500m south of Ballindooley Lough.

The distribution of smooth newt records is shown in Figure 8.14.1 to Figure 8.14.8. A summary of the Smooth newt survey results are provided below in Table 8.28.

Table 8.28 Summary of Smooth Newt Records from the 2023 Amphibian Surveys

Location	Feature	Note
Natural pond at Ch. 1+600 of the proposed N6 GCRR	Pond	Larvae present, no adults
Gravel wash-out ponds in Lackagh Quarry, 160m south of Ch. 11+450 of the proposed N6 GCRR	Pond	2 male, 1 female
Gravel wash-out ponds in Lackagh Quarry, 160m south of Ch. 11+450 of the proposed N6 GCRR	Pond	3 Unidentified
Gravel wash-out ponds in Lackagh Quarry, 160m south of Ch. 11+450 of the proposed N6 GCRR	Pond	1 female
Pond at Lackagh Quarry, near Ch. 11+450 of the proposed N6 GCRR	Pond	6 males, 5 females, 2 unidentified
Gravel wash-out ponds in Lackagh Quarry, near Ch. 11+400 of the proposed N6 GCRR	Pond	1 female
Pond at Lackagh Quarry, 330m south of Ch. 11+450 of the proposed N6 GCRR	Pond	1 female
Cattle Trough at Lackagh Quarry, near Ch. 11+700 of the proposed N6 GCRR	Cattle trough	Larvae present, 10+ adults, minimum 3 male, minimum 7 female
Stone cattle Trough at Ch. 13+000 of the proposed N6 GCRR, 543m southeast of Ballindooley Lough	Cattle trough	Larvae present, no adults

Common frogs were predominantly recorded to the west of the River Corrib, to the western most extent of the survey area in Bearna. Records were sparsely distributed to the east of the River Corrib, associated with a drainage ditch connected to Ballindooley Lough and an attenuation pond adjacent to the Bothar na dTreabh Roundabout on the existing N6.

There were a number of habitats identified as suitable for amphibians during previous surveys within the Assessment Boundary in 2014, which were deemed unsuitable during the 2023 surveys (Figures 8.14.1 to 8.14.8). These locations had become dry in some instances or conversely at other locations, the flow of some features was considered too fast for smooth newt to occur. The land use in other survey locations has changed, where construction work was on going or developments were completed since the surveys of 2014.

The results of the amphibian survey are shown on Figure 8.14.1 to Figure 8.14.8.

The Common frog and Smooth newt populations within the survey area are valued as being of Local Importance (Higher Value). They are common and widespread species, both listed as ‘Least Concern’ nationally (King *et al.*, 2011) which are nonetheless protected by law.

2014-2018 Survey Results

During the surveys carried out in 2014, Common frog (adults, juveniles and tadpoles) were recorded at 21 of the 52 surface water/drainage features surveyed across the Assessment Boundary. Smooth newts were recorded at nine of the 52 surface water/drainage features surveyed; most which were located west of the River Corrib. A summary of the 2014 Smooth newt survey results are provided below in Table 8.29.

Two ad-hoc observations of Smooth newt and four ad-hoc observations of Common frog were recorded within the Assessment Boundary during the 2014 multi-disciplinary surveys.

Table 8.29 Summary of Smooth Newt Records from the 2014 Amphibian Surveys

Location	Feature	Note
East of the proposed N6 GCRR within area of scrub and rough grassland, c.35 m east at Ch. 0+500	Well	3 females and 3 males
Southeast of the proposed N6 GCRR within area of scrub, c.10 m southeast at Ch. 5+175	Pond	1 female
West of the proposed N6 GCRR/Ballymoneen Road at Ch. 0+100	Drainage ditch	4 unidentified
North of the proposed N6 GCRR within area of scrub, between Ch. 5+700 to Ch. 5+800	Drainage ditch	1 unidentified and 2 females
South of the proposed N6 GCRR within area of scrub, c.50m south at Ch. 5+800	Drainage ditch	4 gravid females and 1 male
Within the proposed N6 GCRR, southeast of proposed Letteragh Road Junction at Ch. 1+600	Pond	2 gravid females
Area of scrub within the proposed N6 GCRR, east of proposed N59 Letteragh Junction at Ch. 7+850	Pond	1 juvenile male
Gravel wash-out ponds in Lackagh Quarry	Pond	1 unidentified
Cattle trough at Lackagh Quarry c.40m north of the proposed N6 GCRR at Ch. 11+775	Cattle trough	1 female
Within Assessment Boundary in marsh scrub area between Ch. 13+000 and Ch. 13+050	Pond	2 males, 1 female and 1 unidentified gravid female.
Galway Racecourse, within drains northwest of Ballybrit Castle at Ch. 14+350 to Ch. 14+500 >280m from the proposed N6 GCRR	Drainage Ditches	10 males, 5 females, 5 unidentified (>20 newts). Gravid females present.

8.3.12 Reptiles

Common lizard *Zootoca vivipara* is Ireland's only lizard species. They occupy a wide range of habitat types and generally bask on rocks, logs or rank grasses, where they can retreat to refuge or cover. During August, Common lizards give birth to live young. During winter, October onwards, they hibernate until March.

There are records for the Common Lizard from Menlough, Merlin Park Woods, and various locations around Galway City: the River Corrib corridor, Salthill and Cappagh[80]. The Common lizard is legally protected under the Wildlife Acts (including their breeding and resting places).

The baseline with respect to Common lizard in this updated EIAR is consistent with that presented in the 2018 EIAR; noting that more sites were surveyed and a greater number of common lizard were recorded in 2023 compared with 2015, and across a greater number of survey sites, including east of the River Corrib where common lizard were not recorded in 2015.

[80] Records from the National Biodiversity Centre's online database. For full details of the desk review, refer to Appendix A.8.18.

2023 Survey Results

Thirteen survey sites were selected to cover a representative range of suitable habitat types for Common lizard along the entire length of the footprint of the Project, and were located entirely within, partially within, or in close proximity to the Assessment Boundary.

Seven of the survey sites were re-surveys of the 2015 common lizard surveys sites, with an additional six selected in 2023, determined from desk studies conducted prior to fieldwork commencing to identify areas of suitable lizard habitat.

Surveys were augmented by searches of suitable habitat features over the course of other ecological surveys carried out within the Assessment Boundary in 2023-2024.

Lizard were recorded in lands to the west of the River Corrib during the field surveys and in the following habitat types, or mosaics of those habitat types: wet heath, dry heath, exposed siliceous rock, fen, scrub, acid grassland, wet grassland, bare ground, recolonising bare ground and bracken. Aside from the urban environment and large open expanses of bare ground or improved agricultural grassland (due to the lack of refuges), all other areas of semi-natural habitat, or habitat areas that offer a mix of cover and exposed locations for basking, are potentially suitable to support Common lizard.

The Common lizard population within the Assessment Boundary is valued as being of Local Importance (higher value). It is listed as 'Least Concern' on the Ireland Red List No. 5: Amphibians, Reptiles & Freshwater Fish (King *et al.,* 2011) and is widely distributed in Ireland, but is nonetheless protected by law.

The 2023 lizard survey results are summarised below in Table 8.30. The survey area locations are shown on Figures 8.14.1 to 8.14.8.

Table 8.30 Summary of 2023 Common Lizard Survey Results

Site No[81]. and Area Name	Result
Sites 1 - 6 throughout Bearna and Knocknacarra (C, B, D, E, F, G in 2015)	21 August 2023 – None recorded
Sites 1 - 6 throughout Bearna and Knocknacarra (C, B, D, E, F, G in 2015)	22 August 2023 – 1 Adult basking on an Artificial Cover Object (ACO) at Site 5 (Knocknacarra)
Sites 1 - 6 throughout Bearna and Knocknacarra (C, B, D, E, F, G in 2015)	23 August 2023 – 8 Juveniles basking on or retreating under ACOs at Site 1, 2, 3, 5 and 6.
Sites 1 - 6 throughout Bearna and Knocknacarra (C, B, D, E, F, G in 2015)	24 August 2023 – None recorded
Sites 1 - 6 throughout Bearna and Knocknacarra (C, B, D, E, F, G in 2015)	25 August 2023 – 1 Juvenile basking on an ACO at Site 6.
Sites 7 - 13 (inc. J from 2015)	12 September 2023 – None recorded
Sites 7 - 13 (inc. J from 2015)	13 September 2023 – Unsuitable survey conditions
Sites 7 - 13 (inc. J from 2015)	14 September 2023 – None recorded
Sites 7 - 13 (inc. J from 2015)	15 September 2023 – Unsuitable survey conditions
Sites 7 - 13 (inc. J from 2015)	25 September 2023 – 1 Adult underneath ACO at Site 11
Sites 7 - 13 (inc. J from 2015)	26 September 2023 – 1 Adult underneath ACO at Site 8

[81] Sites in 2015: and 2023 A (2015); B (2015), 2 (2023); C (2015), 1 (2023); D (2015), 3 (2023); E (2015) 4 (2023); F (2015), 5 (2023); G (2015), 6 (2023); H (2015); I (2015); J (2015), 9 (2023); K (2015). Additional sites in 2023: 7 - Upper Coolough (nr. Crowe Tours); 8 - east of Lackagh Quarry; 10 – Forramoyle East; 11 Ballyburke Estate; Forramoyle West; 13 - Bothar diarmuida.

Of the 2015 sites that were resurveyed in 2023, only two (2 and 5) had Common lizard present in both surveys, while Common lizard was not observed in sites 6 or 9 in any of the surveys (see Table 8.31).

Table 8.31 Comparison of Common lizard Survey Results between the 2023 and 2015 Surveys

Site Reference 2023	Site Reference 2015	Present in 2015	Present in 2023	Present in both surveys	Absent in both surveys
1	C	Yes	No	No	No
2	B	Yes	Yes	Yes	No
3	D	No	Yes	No	No
4	E	Yes	No	No	No
5	F	Yes	Yes	Yes	No
6	G	No	No	No	Yes
7	N/A	N/A	No	N/A	N/A
8	N/A	N/A	Yes	N/A	N/A
9	J	No	No	No	Yes
10	N/A	N/A	Yes	N/A	N/A
11	N/A	N/A	Yes	N/A	N/A
12	N/A	N/A	Yes	N/A	N/A
13	N/A	N/A	No	N/A	N/A
N/A	A	Yes	N/A	N/A	N/A
N/A	H	No	N/A	N/A	N/A
N/A	I	No	N/A	N/A	N/A
N/A	K	No	N/A	N/A	N/A

2015 Survey Results

Common lizard surveys were conducted in September and October 2015. Common lizard were recorded at five of the 10 survey sites (A, B, C, E, and F); all of which were west of the River Corrib (See Figures 8.15.1 to 8.15.8).

All of these sites were within the footprint of the Project, or adjacent to the Assessment Boundary in habitat mosaics of heath, scrub and wet or acid grassland.

One ad-hoc observation of the species was recorded at Knocknafroska during the multi-disciplinary survey in May 2015, near the N59 Link Road North on the proposed N6 GCRR.

The 2015 lizard survey results are summarised below in Table 8.32.

Table 8.32 Summary of 2015 Common Lizard Survey Results

Survey Site	Result
A	27/28 September 2015 – 1 adult 28/29 September 2015 – 1 adult
B	24/25 September 2015 – 1 juvenile 27/28 September 2015 – 1 juvenile
C	27/28 September 2015 – 1 juvenile
E	25/26 September 2015 – 1 adult 26/27 September 2015 – 1 adult 28/29 September 2015 – 1 adult
F	24/25 September 2015 – 1 juvenile 27/28 September 2015 – 1 juvenile

8.3.13 Fish

The results of the various fisheries surveys carried out, along with the findings of the desktop study, are summarised below. The locations of sampling points/areas are shown on Figure 8.16.1, with the full results (including the macro-invertebrate species lists) provided in Appendix A.8.17 – Part 1 and Part 2.

The baseline with respect to fish for this updated EIAR is consistent with that presented in the 2018 EIAR, with the exception of European eel in Ballindooley Lough identified by employing environmental DNA sampling techniques in 2023.

2023 Survey Results

A catchment-wide electro-fishing (CWEF) survey was undertaken across 26 riverine watercourse sites in August 2023, with a fisheries habitat appraisal completed at 5 lacustrine (lake & pond) sites in September 2023. Sites were electro-fished following notification to Inland Fisheries Ireland and under the conditions of a Department of the Environment, Climate and Communications (DECC) licence.

The watercourses in the vicinity of the Project are typically small upland eroding channels which have been heavily modified (straightened and/or deepened) historically, often resulting in poor quality fisheries habitats. Hydromorphological alterations are widespread in the peri-urban landscape and some watercourses, such as the Knocknacarra Stream, are culverted almost entirely underground with a loss of fisheries potential. Over half of the riverine sites (18) supported three-spined stickleback only or (in most cases) no fish species.

The highest densities of salmonids and the best quality salmonid habitat is present in the Bearna Stream (site D6) and its tributary the Oddacres Stream (site D4). Red-listed European eel ('critically endangered') is widespread in the survey area, being recorded at a total of 6 sites on the Bearna Stream (sites D2, D3 & D6), Oddacres Stream (D4), Trusky Stream (E5) and the Sruthán Na Libeirtí Stream (F3). The species was also detected via eDNA sampling at 3 lake sites (L1, L2 and L5) where high quality eel habitat is present.

No lamprey were recorded during the survey and this is reflected in the poor habitat suitability in the survey area.

The Terryland River was not resurveyed in 2023 as changes had not occurred within the watercourse in the interim years.

The locations of 2023 sampling points/areas are shown on Figure 8.16.1; also see Appendix A.8.17 - Part 2 for the full survey results.

2015 Survey Results

The results of the various fisheries surveys carried out between 22 and 30 September 2015, along with the findings of the desktop study, are summarised below. The locations of sampling points/areas are shown on

Figure 8.16.1, with the full results (including the macro-invertebrate species lists) provided in Appendix A.8.17 – Part 1.

Table 8.33 below provides a summary of the findings of the fish surveys for both the 2015 and 2023 survey periods.

Table 8.33 Results of Fish Surveys for the 2015 and 2023 Survey Periods

Hydrological catchment 2023	Site 2023	Site 2015	Watercourse	Fish species in 2015	Fish species in 2023	Q Value 2015	Q Value 2023
Bearna Stream	D1	N/A	Bearna Stream	N/A	Three-spined stickleback	N/A	Q3
	D2	N/A	Bearna Stream	N/A	Brown trout, European eel	N/A	Q4
	D3	4A	Bearna Stream	Brown trout	Brown trout, European eel	Q4	Q4
	D4	3B	Oddacres Stream	Brown trout, European eel	Brown trout, European eel	Q4	Q3
	D5	3A	Loughinch Stream	None	None	Q3	Q2-3
	D6	N/A	Bearna Stream	N/A	Brown trout, European eel, Sea trout	N/A	Q3-4
Corrib (All species detected via fisheries appraisal only using eDNA in 2023)	B1	N/A	River Corrib	N/A	Too deep for electro-fishing	N/A	Q3
	L1	N/A	Unnamed pond	N/A	Brown trout, European eel	N/A	N/A
	L2	9	Ballindooley Lough	N/A	European eel, Perch, Pike, Rudd, Tench	N/A	N/A
	L3	N/A	Coolagh Lough (upper)	N/A	Bream, Perch, Pike, Roach, Rudd, Ten-spined stickleback, Tench	N/A	N/A
	L4	8	Coolagh Lough (lower)	N/A	Bream, Perch, Pike, Roach, Rudd, Ten-spined stickleback, Tench	N/A	N/A
	L5	6A	Unnamed pond	None	Brown trout, European eel	N/A	N/A
Doughiska	A1	N/A	Merlin Park Stream	N/A	N/A - dry channel	N/A	N/A
Knocknacarra Stream	C1	N/A	Knocknacarra Stream	N/A	None	N/A	N/A
	C2	N/A	Knocknacarra Stream	N/A	N/A - culverted underground	N/A	N/A

Hydrological catchment 2023	Site 2023	Site 2015	Watercourse	Fish species in 2015	Fish species in 2023	Q Value 2015	Q Value 2023
	C3	N/A	Knocknacarra Stream	N/A	N/A - culverted underground	N/A	N/A
	C4	N/A	Knocknacarra Stream	N/A	N/A - culverted underground	N/A	N/A
	C5	N/A	Knocknacarra Stream	N/A	N/A - culverted underground	N/A	N/A
	C6	N/A	Unnamed channel	N/A	None	N/A	Q3
	C7	N/A	Unnamed stream	N/A	N/A - culverted underground	N/A	N/A
	C8	N/A	Knocknacarra Stream	N/A	N/A - culverted underground	N/A	N/A
	C9	N/A	Tonabroky Stream	N/A	N/A - culverted underground	N/A	N/A
	N/A	5B	Knocknacarragh Stream	European eel, Grey mullet, Sand goby, Flounder	Not resurveyed in 2023	N/A	N/A
Sruthán Na Libeirtí	F1	N/A	Sruthán Na Libeirtí Stream	N/A	Three-spined stickleback	N/A	Q3
	F2	N/A	Sruthán Na Libeirtí Stream	N/A	None	Q3	Q3
	F3	1B	Sruthán Na Libeirtí Stream	European eel	European eel	N/A	Q3
	F4	N/A	Newvillage Stream	N/A	None	N/A	Q3
	N/A	1A	Sruthán Na Libeirtí Stream	None	Not resurveyed in 2023	N/A	N/A
	N/A	5A	Unnamed channel	None	Not resurveyed in 2023	N/A	N/A
Terryland River	N/A	7A	Terryland River	None	Not resurveyed in 2023	N/A	N/A
	N/A	7B	Terryland River	European Eel	Not resurveyed in 2023	N/A	N/A
Trusky Stream	E1	2A	Cloghscoltia Stream	None	Brown trout	Q3	Q3
	E2	N/A	Trusky Stream	N/A	N/A - dry channel		N/A
	E3	N/A	Trusky Stream	N/A	N/A - dry channel		N/A
	E4	N/A	Freeport Stream	N/A	None		Q2-3
	E5	2B	Trusky Stream	Flounder, European eel,	Brown trout, European eel,		Q3

Hydrological catchment 2023	Site 2023	Site 2015	Watercourse	Fish species in 2015	Fish species in 2023	Q Value 2015	Q Value 2023
				Three-spined stickleback, Brown trout	Flounder, Three-spined stickleback		

8.3.13.1 Sruthán na Libeirtí Stream hydrological catchment

2023 Survey Results

All streams assessed in this catchment were of poor fisheries value. Similar to the 2015 survey, all streams scored Q3 for water quality in 2023.

Three-spined stickleback were the only fish recorded on the uppermost reaches of the Sruthán Na Libeirtí Stream (F1). It has extensive historical modifications, poor flows, siltation and poor connectivity with downstream habitats. There was, however, some low suitability for European eel (although the species was not specifically recorded).

European eel was the only fish species recorded in the lowermost reaches of the Sruthán Na Libeirtí Stream (F4). Despite this, the site was of poor fisheries value given its shallow, narrow, modified nature and poor connectivity with downstream marine habitats. The site was not accessible for migratory salmonids.

No fish were recorded at the other two sites due to poor hydromorphology, poor flows and tenuous connectivity with downstream habitats.

2015 Survey Results

Sruthán na Líbeirtí was described during the 2015 fisheries habitat survey as a seasonal stream having moderate quality, semi-natural salmonid and European eel Anguilla anguilla habitat in the lower reaches; the electrofishing survey recorded small numbers of European eel in the lower reaches. Water quality in Sruthán na Líbeirtí was assessed as being moderately polluted (Q3[82]).

In terms of its fisheries value, Sruthán na Líbeirtí is valued as being of Local Importance (lower value).

8.3.13.2 Trusky Stream hydrological catchment

2023 Survey Results

Brown trout, European eel, flounder and three-spined stickleback were recorded in the lowermost freshwater reaches of the Trusky Stream (E5) during the 2023 surveys. The site was of moderate value only for salmonids given the shallow nature of the stream. However, there was some limited value as a nursery with localised areas providing good quality spawning substrata. The site was of highest value as a European eel and flounder nursery given abundant cobble and boulder refugia and good connectivity to marine habitats.

Brown trout (a single adult) was the only fish species recorded on the Cloghscoltia Stream (E1). The site was of poor fisheries value. The stream suffered from low flows and had poor spawning and nursery habitat, scoring a water quality value of Q3.

The other 3 sites were not of fisheries value given their evidently ephemeral nature, historical modifications, poor hydromorphology and/or poor connectivity with downstream habitats.

2015 Survey Results

The upper part of the Trusky Stream, where it is crossed by the proposed N6 GCRR, was described during the 2015 fisheries habitat survey as a seasonal stream with some moderate semi-natural salmonid habitat; although the electrofishing survey did not record any fish species present. The lower reaches however, were described as having Brown trout *Salmo trutta* spawning habitat and good quality nursery habitat for European eel elver and juvenile Flounder Platichthys flesus. Fish species recorded during the electrofishing

[82] After Toner *et al.*, 2005: Q5, Q4-5 and Q4 = Unpolluted, Class A; Q3-4 = Slightly polluted, Class B; Q3 or Q2/3 = Moderately polluted Class C; and, Q2, Q1/2 or Q1 = Seriously polluted Class D.

were Brown trout, European eel, Flounder and Three-spined stickleback Gasterosteus aculeatus. Water quality in the Trusky Stream was assessed as being moderately polluted (Q3).

In terms of its fisheries value, the upper reaches of the Trusky Stream is valued as being of Local Importance (lower value); the lower reaches, as Local Importance (higher value).

8.3.13.3 Bearna Stream - hydrological catchment

2023 Survey Results

During 2023 the sites in this catchment had various fisheries values, from poor in the upper reaches (for example site D1 given extensive historical modifications) to high value (site D6). The majority of the streams had water quality values of either Q3 or Q4, which is similar to the previous survey.

The various streams contained three-spined stickleback, brown trout, sea trout, and European eel. Most of these streams were of value as salmonid nurseries supporting good densities of juvenile brown trout. Although European eel were not specifically recorded at some of the sites, they still had low suitability for this species. Most of the streams were unsuitable for lamprey. The Cappagh Road culvert crossing was considered to be a barrier to fish under low flows.

The lower reaches of the Bearna Stream was of very high value for salmonids, supporting a high density healthy mixed cohort brown trout population in addition to a low density of sea trout. The site was of highest value as a salmonid nursery, with abundant in-stream cobble and boulder refugia. Salmonid spawning habitat was good locally but larger substrata predominated. Deep glide upstream of the bridge apron provided valuable holding habitat for adult salmonids (including sea trout). The site was also of high value for European eel given abundant instream refugia and good connectivity to the sea (0.5km downstream).

2015 Survey Results

The Bearna Stream was considered excellent quality salmonid spawning and nursery habitat, and European eel habitat.

Electrofishing surveys recorded both Brown trout and European eel. Water quality in the Bearna Stream was assessed as being unpolluted (Q4).

The tributary of the Bearna Stream was described as a seasonal stream with some moderate semi-natural salmonid and eel habitat; although the electrofishing survey did not record any fish species present. Water quality in the Bearna Stream tributary was assessed as being moderately polluted (Q3).

In terms of its fisheries value, the Bearna Stream was valued as being of Local Importance (higher value). The seasonal unnamed tributary is valued as being of Local Importance (lower value).

8.3.13.4 Knocknacarra Stream hydrological catchment

This was referred to as Knocknacarra Stream during 2015; the Tonabrocky Stream forms part of this catchment but was classified in a separate catchment during 2015.

2023 Survey Results

A total of 5 sites of the Knocknacarragh Stream (C2 to C5, C8), as well as the Tonabroky Stream (C9) and an unnamed stream (C7), were all culverted underground and a fisheries assessment or appraisal was not possible.

No fish were recorded on the uppermost reaches of the Knocknacarragh Stream at Letteragh (C1). It was not of fisheries value given its location in the uppermost reaches of the small, modified, heavily silted stream near a stagnant channel.

Finally, no fish were recorded at the last site (C6), the upper reaches of an unnamed Knocknacarragh Stream tributary in Rahoon. It was not of fisheries value given its shallow (likely ephemeral) nature, historical modifications, poor hydromorphology and poor connectivity with downstream habitats. It was the only stream that received a water quality score, which was Q3.

2015 Survey Results

The upper reaches of the Knocknacarra Stream were largely seasonal ditches with little or no fisheries value; large sections of the lower reaches are culverted. That tidal section of the stream, between the culvert and the estuary, are important as a transitional nursery habitat for estuarine fish and European eel, Grey mullet Chelon labrosus, Sand goby Pomatoschistus minutes and Flounder were recorded there during the electrofishing survey. Water quality in the Knocknacarra Stream was assessed as being moderately polluted (Q3).

In terms of its fisheries value, the upper reaches of the Knocknacarra Stream were valued as being of Local Importance (lower value); the lower reaches, at the estuary, as Local Importance (higher value).

The upper reaches Tonabrocky Stream, in the vicinity of the proposed N6 GCRR, had poor quality fisheries habitat being predominantly a dry drainage channel with localised pockets of water.

The lower reaches of the Tonabrocky Stream are considered excellent quality salmonid and eel habitat, including salmonid spawning habitat. The electrofishing survey recorded Brown trout. Electrofishing surveys carried out by Inland Fisheries Ireland (IFI) in 2008 recorded Atlantic salmon parr (Salmo salar), Brown trout, Sea trout smolts and European eel. IFI have also recorded Sea trout spawning in the lower reaches of the stream. Water quality in the Tonabrocky Stream was assessed as being unpolluted (Q4).

In terms of its fisheries value, the upper reaches of the Tonabrocky Stream is valued as being of Local Importance (lower value); the lower reaches, as Local Importance (higher value).

8.3.13.5 Doughiska hydrological catchment

2023 Survey Results

The Merlin Park Stream in Merlin Park Woods was dry at the time of survey, and the site was not of fisheries value.

2015 Survey Results

This catchment was not surveyed in 2015 as it was not of fisheries value.

8.3.13.6 Terryland River

2023 Survey Results

The Terryland River was not re- surveyed during 2023 as changes had not occurred within the watercourse in the interim years.

2015 Survey Results

The channel of the Terryland River is highly modified in parts, and showing signs of organic pollution, which limits its fisheries value. European eel were the only fish species recorded during the electrofishing surveys. Water quality in the Terryland River was assessed as being moderately polluted (Q2-3).

In terms of its fisheries value, the Terryland River was valued as being of Local Importance (lower value).

8.3.13.7 Corrib hydrological catchment (including Coolagh Lakes, Ballindooley Lough, Corrib Estuary, Galway Bay, and the River Corrib)

2023 Survey Results

All 5 lacustrine sites were of high value for coarse fish species. Pike, perch and roach were observed in the margins for most of these sites. Most of these were considered good quality coarse fish habitat. Perch, rudd, pike, and tench were also detected via eDNA sampling for most of these lakes. This is similar to the previous survey where the Coolagh Lakes were valued as being of Local Importance (lower value).

Brown trout and the Red-listed European eel were detected via eDNA sampling in the two unnamed ponds; European eel was also detected via eDNA sampling in Ballindooley Lough (the species was not detected during the 2015 survey); Ballindooley Lough was of high value for coarse fish species.

The River Corrib (B1) is included in this catchment. However, although the site was included, it was not fished due to prohibitive depths and water volumes. It did not offer good salmonid nursery characteristics with spawning habitat also poor given the very compacted bed. It's holding habitat for adult salmonids was moderate and was more characteristic of a migratory passageway for improved spawning in the tributaries of Lough Corrib rather than an important transitory resting habitat. The European eel and coarse fish value was moderate with improved habitat upstream at Lough Corrib. The river scored a lower water quality value (Q3) as compared to the surveys undertaken to inform the 2018 EIAR (Q4).

2015 Survey Results

Coolagh Lakes

The Coolagh Lakes are of some importance for coarse fish species. Fyke netting recorded Perch Perca fluviatilis, Roach Rutilus rutilus and European eel. The spring fed stream supplying the lakes was electrofished but no fish species were recorded. The Coolagh Lakes do not have a Water Framework Directive water quality status assigned to it.

In terms of their fisheries value, the Coolagh Lakes were valued as being of Local Importance (lower value).

Ballindooley Lough

Ballindooley Lough was considered to be an excellent coarse fishery with the fyke netting survey recording Pike Esox lucius, Perch, Rudd Scardinius erythropthalmus and Tench Tinca tinca. Ballindooley Lough does not have a Water Framework Directive water quality status assigned to it.

In terms of its fisheries value, Ballindooley Lough was valued as being of Local Importance (higher value).

Corrib Estuary and Galway Bay

The Corrib Estuary and Galway Bay are important transitional and marine fisheries habitats, supporting a range of fish species (The Central and Regional Fisheries Boards, 2009). The Corrib Estuary and Galway Bay are also designated under the Habitats Directive as a candidate Special Area of Conservation for Atlantic salmon — Galway Bay Complex SAC. The transitional waters of the Corrib Estuary and the coastal waters of Galway Bay are classified by the EPA as unpolluted (http://gis.epa.ie/Envision).

In terms of its fisheries value, Galway Bay was valued as being of International Importance.

River Corrib

The River Corrib is an important salmonid watercourse, supporting both Atlantic salmon and Brown trout, and is a designated salmonid watercourse under the European Communities (Quality of Salmonid Waters) Regulations, 1988. The River Corrib system is also designated under the Habitats Directive as a Special Area of Conservation for Atlantic salmon, Sea lamprey Petromyzon marinus and Brook lamprey Lampetra planeri; the Lough Corrib SAC. The River Corrib is also an important catchment for the European eel. Water quality in the lower reaches of the River Corrib is classified as unpolluted (Q4) by the EPA (sampled at the Salmon Weir - http://gis.epa.ie/Envision).

In terms of its fisheries value, the River Corrib was valued as being of International Importance.

8.3.14 Local Biodiversity Areas

The local biodiversity areas are included within the Galway City Development Plan 2023–2029 and the most recent draft of the Galway City Biodiversity Action Plan 2014-2024. The results of the biodiversity surveys carried out since 2013, in the preparation of the assessment for both the 2018 EIAR and this updated EIAR, have highlighted many other areas that would be considered to be locally important biodiversity areas. In many cases, these would encompass greater areas than those considered in the draft Galway City Biodiversity Action Plan 2014-2024 given that the current survey areas extend beyond the city boundary. The locations of the biodiversity surveys and receptors across the local area are shown on Figures 8.1 – 8.39 and described under the various sections above.

For the purposes of this assessment, the following biodiversity areas are considered; which include the local biodiversity areas from the draft Galway City Biodiversity Action Plan 2014-2024:

- The Coast Road (R336) to the N59 Moycullen Road (which includes the Cappagh – Ballymoneen and the Ballagh – Barnacranny Hill local biodiversity areas from the draft Galway City Biodiversity Action Plan 2014-2024)

  This local biodiversity area encompasses a mosaic of peatland habitats extending from near the coastline west of Bearna across to the N69 Moycullen Road – the peatland areas form part of a larger expanse of peatland habitat that extend off to the northwest, into the Connemara Bogs SAC. In terms of habitats, it includes the Annex I habitats Wet heath, Dry heath, Molinia meadows and Blanket bog, amongst large areas of scrub, bracken, acid and wet grasslands, along with fens and upland/eroding streams. These habitats in turn support a diverse range of fauna species including: bats, Otter, Badger, the Marsh fritillary butterfly, breeding birds, wintering birds (including species listed as SCIs of the local SPA sites), amphibians, reptiles and fish species. Parts of this site lie within Moycullen Bogs NHA

- Rusheen Bay – Bearna Woods – Illaunafamona

  This local biodiversity area is described in the draft Galway City Biodiversity Action Plan 2014-2024 as follows "*It incorporates several types of shoreline including glacial cliffs, gravel banks, rocky shore, sandy shore, muddy sand and saltmarsh. It also has several types of woodland in Barna Woods together with various semi-natural grassland types between Silver Strand and Gentian Hill. The coast is very indented with a number of sheltered feeding and roosting areas for significant numbers of wintering birds. The dynamic complex of shingle bars and saltmarsh at Illaunafamona is included in this area*." This area lies within Galway Bay Complex SAC and Inner Galway Bay SPA

- The River Corrib and the Coolagh Lakes (which includes the River Corrib and adjoining wetlands local biodiversity areas from the draft Galway City Biodiversity Action Plan 2014-2024)

  This local biodiversity area supports a range of aquatic and wetland habitats ranging from rivers and lakes to reed swamp, wet woodland, marsh, wet grassland, fens and heath. These include a diverse range of Annex I habitats including Hard water lakes, Wet heath, Molinia meadow, Cladium fen, Hydrophilous tall herb habitat, Alkaline fen, Transition mire and Residual alluvial forests. Drier areas within this habitat complex support the Limestone pavement and Calcareous grassland Annex I habitat types. These habitats in turn support a diverse range of fauna species including bats, Otter, Badger, breeding birds, wintering birds (including species listed as SCIs of the local SPA sites), molluscs, amphibians and fish species. This area includes part of Lough Corrib SAC and part of Lough Corrib pNHA

- Menlough to Coolough Hill (including Lackagh Quarry)

  This local biodiversity area comprises a mosaic of semi-natural woodland, broadleaved woodland, exposed limestone rock, scrub and semi-natural grasslands, and a quarry site. This includes a range of Annex I habitat types, including: Limestone pavement, Calcareous grassland, Turloughs and Petrifying springs. These habitats in turn support a diverse range of fauna species including: bats (including a Lesser horseshoe bat maternity and hibernation roost), Otter, Badger and breeding birds (including a Barn owl nest site). This area includes part of Lough Corrib SAC and part of Lough Corrib pNHA

- Ballindooley – Castlegar (which is linked to the River Corrib by the Terryland River valley)

  This local biodiversity area comprises a mosaic of wetland habitats associated with Ballindooley Lough (including reed swamp, wet grassland, fen and wet woodland) and areas of semi-natural woodland and exposed limestone rock. This includes a diverse range of Annex I habitat types including Hard water lakes, Alkaline fen, Cladium fen, Residual alluvial forests and Limestone pavement. These habitats in turn support a diverse range of fauna species including: bats, Badger, breeding birds, wintering birds (including species listed as SCIs of the local SPA sites), amphibians and fish species

- Galway Racecourse, Ballybrit

  Although primarily consisting of amenity grassland around the margins, the centre of the racecourse supports semi-natural grasslands, and the Marsh fritillary butterfly was recorded here in 2014.

- Doughiska

  This biodiversity area comprises a mosaic of semi-natural grassland and exposed limestone rock, with some semi-natural woodland cover and scrub patches, amongst improved agricultural fields. In places the grassland habitats correspond with the Annex I Calcareous grassland habitat type, and the exposed or wooded limestone rock with Annex I Limestone pavement

- Galway Bay (which includes the Mutton Island and Nearby Shoreline local biodiversity areas from the draft Galway City Biodiversity Action Plan 2014-2024)

Galway Bay Complex SAC and Inner Galway Bay SPA lie within this biodiversity area. This biodiversity area includes a diverse range of shoreline, transitional, estuarine and marine habitats which in turn support a rich species assemblage. The Annex I habitats present include Large shallow inlets and bays, associated with which are Reefs, Tidal mudflats, Lagoons, Salicornia mud, Perennial vegetation of stony banks and Atlantic salt meadows. These habitats support the SCI bird species of Inner Galway Bay SPA, providing nesting, foraging and roosting sites which include open water, intertidal and terrestrial habitats. The habitats within Galway Bay also support a diverse range of invertebrate and plant communities (marine and intertidal) and fish species, along with Otter, Harbour seal and cetaceans.

The Galway City Development Plan 2023-2029 also identifies the following additional local biodiversity areas and other areas/features of local importance in the city including Lough Atalia and Renmore Lagoon, Merlin Park Woods, Roscam, Terryland Forest Park, City Canal System, Waterbody, Merlin Park Cave, Terryland Glenanail, and Cooper's Cave Terryland. Of these nine aforementioned local biodiversity areas, four (City Canal System, Waterbody, Terryland Glenanail, and Cooper's Cave Terryland) were deemed relevant for this assessment. Lough Atalia and Renmore Lagoon, Merlin Park Woods, Roscam, Terryland Forest Park and Merlin Park Cave are deemed a significant distance from the Project and will not be impacted so are not further discussed.

- City Canal System

  This biodiversity area comprises the canal system located in the western part of the city and one artery to the east of the River Corrib at Newtownsmyth

- Waterbody

  This biodiversity areas consists of a small lake adjoining a residential development on the Headford Road near Ballindooley Lough

- Terryland Glenanail

  This biodiversity areas is composed of a small river flowing from the south-eastern corner of Lough Corrib

- Cooper's Cave Terryland

  This comprises a square bedding cave chamber which is located to the northeast of the Terryland River sink. Cooper's Cave is regarded to be of National Importance as it is a key hibernation and mating site for lesser horseshoe bats

8.3.15 Summary Ecological Valuation and Identification of Key Ecological Receptors

Table 8.34 below summarises the ecological evaluation of all receptors taking into consideration legal protection, conservation status and local abundance. Key Ecological Receptors (KERs) are identified in blue in the table. Species, habitats and features not qualifying as KERs are not subjected to impact assessment in line with current best practice of assessing the impacts on what are determined to be important ecological or biodiversity features: CIEEM and TII guidelines (CIEEM, 2018 and National Roads Authority, 2009).

All designated areas for nature conservation that lie within the ZoI of the Project are considered to be KERs given that they are sites selected specifically for biodiversity conservation. Those designated areas for nature conservation that lie beyond the ZoI of the Project are not considered to be at risk of impact and are therefore, not considered to be KERs.

In almost all cases, habitat and species valued as being of local importance (higher value), or higher, are considered to be KERs as they are important contributors to the local biodiversity resource and are of conservation concern, at least locally. However, some of the higher biodiversity value habitats and species included in Table 8.34 below are not considered as KERs because, although they are present within the wider Scheme Study Area, they lie beyond the ZoI of the Project (as noted in the table below) and are therefore not at risk of being affected during construction or operational phases of the Project.

Habitats valued as being of a local importance (lower value) are not considered to be KERs in this assessment. This is not to say that they are of no biodiversity value, but that impacts on these habitat types in their local context are not likely to result in a significant effect on biodiversity. It should be noted that this relates to the impact on the habitat itself as distinct from considering the role these habitat types play in supporting KER species – impacts of the Project in that sense are captured and assessed under the relevant species' headings in Section 8.5.

These lower biodiversity value habitats include built or artificially created habitats, transient habitats as a result of disturbance, or those that have been highly anthropogenically modified (e.g. BC3, BL3, ED2, ED3, ED4, FL8, GA1, GA2, WS3, WS5). These habitat types tend to be associated with residential, commercial or industrial development, roads and highly managed amenity areas. It also includes grassland habitats that are relatively species poor and bracken, which is considered to be a problem species in terms of biodiversity for many habitat types.

In some cases, local importance (lower value) habitat can be associated with, or develop into, higher value habitats and where this is the case it is captured in valuing and considering whether a particular habitat type is a KER for this assessment. One example of this is the habitat Exposed calcareous rock (ER2). As a quarry wall feature it is considered a local importance (lower value) habitat type. In many cases it can be associated with the Annex I habitat Limestone pavement and is valued accordingly. Limestone quarry walls can also support calcareous springs (or the priority Annex I habitat Petrifying springs) and where this is the case the spring features are considered and valued separately in Table 8.34 below.

Non-native invasive species are not considered as KERs, as they can result in negative effects on biodiversity and it is in that context they are included within the impact assessment.

The habitat clusters presented in Section 8.3.5.49 above, support a range of species and habitats that are valued individually below. These valuations range from local importance (e.g. GA1 improved agricultural grassland) to international importance (e.g. Limestone pavement [*8240]). These habitat clusters are considered to be KERs, however they are not given a separate ecological valuation from the biodiversity receptors presented below and assessed in this updated EIAR.

The local biodiversity areas are, by definition, important locally. However, they support a range of habitats and species that are valued individually below; with the valuations ranging from local importance (e.g. spoil and bare ground) through to internationally important (e.g. priority Annex I habitats). Therefore, they are considered to be KERs but are not given an ecological valuation separate from the biodiversity receptors presented below and assessed in this updated EIAR.

Table 8.34 Ecological Evaluation and Identification of KERs[83]

Ecological Receptor	Ecological Valuation	KER
Designated Areas for Nature Conservation		
Lough Corrib SAC	International	Yes
Galway Bay Complex SAC	International	Yes
Ardrahan Grassland SAC	International	Yes
Ballyvaughan Turlough SAC	International	No

[83] KERs are highlighted blue

Ecological Receptor	Ecological Valuation	KER
Castletaylor Complex SAC	International	Yes
Kiltiernan Turlough SAC	International	Yes
Lough Fingall Complex SAC	International	Yes
Rahasane Turlough SAC	International	Yes
Maumturk Mountains SAC	International	Yes
The Twelve Bens/Garraun Complex SAC	International	Yes
Connemara Bog Complex SAC	International	Yes
Ross Lake and Woods SAC	International	Yes
East Burren Complex SAC	International	Yes
Moneen Mountains SAC	International	Yes
Black Head-Poulsallagh Complex SAC	International	Yes
Gortnandarragh Limestone Pavement SAC	International	Yes
Inishmore Island SAC	International	Yes
Kilkiernan Bay and Island SAC	International	Yes
Lough Corrib SPA	International	Yes
Inner Galway Bay SPA	International	Yes
Rahasane Turlough SPA	International	Yes
Cregganna Marsh SPA	International	Yes
Connemara Bog Complex SPA	International	Yes
Moycullen Bogs NHA	National	Yes
Cregganna Marsh NHA	International	Yes
Oughterard District Bog NHA	National	No
Lough Corrib pNHA	International[#]	Yes
Galway Bay Complex pNHA	International[†]	Yes
Furbogh Wood pNHA	National	Yes
Kiltullagh Turlough pNHA	National	Yes
Ballycuirke Lough pNHA	International	Yes
Connemara Bog Complex pNHA	International	Yes
Killarainy Lodge, Moycullen pNHA	National	No
Drimcong Wood pNHA	National	Yes
Ross Lake and Woods pNHA	International	Yes

Ecological Receptor	Ecological Valuation	KER
Black Head-Poulsallagh Complex pNHA	International	Yes
Lough Fingall Complex pNHA	International	Yes
Rahasane Turlough pNHA	International	Yes
Gortnandarragh Limestone Pavement pNHA	International	Yes
Moneen Mountain pNHA	International	Yes
East Burren Complex pNHA	International	Yes
Kiltiernan Turlough pNHA	International	Yes
Castletaylor Complex pNHA	International	Yes
Turloughcor pNHA	National	Yes
Ballyvaughan Turlough pNHA	International	No
Inishmore Island pNHA	International	Yes
Maumturk Mountains pNHA	International	Yes
The Twelve Bens/ Garraun Complex pNHA	International	Yes
Mason Island Machair pNHA	International	Yes
Mweenish Island Machair pNHA [001306]	International	Yes
Finish Island Machair pNHA	International	Yes
Duck Island pNHA	International	Yes
Inishmuskerry pNHA	International	Yes
Ardmore Point pNHA	International	Yes
Eagle Rock pHNA	International	Yes
Geabhrog island pNHA	International	Yes
Oilean Na Ngeabhrog (Glencoh Rock) pNHA	International	Yes
Kinvarra Saltmarsh pNHA	International	Yes
Oilean Na Ngeabhrog (Illaungurraig) pNHA	International	Yes
Other designated areas for nature conservation	International - National	No, as beyond the ZoI of the Project (see the updated NIS for more detailed discussion in relation to European sites – SACs and SPAs)
Habitats (outside of designated areas for nature conservation)		
Flower beds and borders (BC4)	Local Importance (Lower Value)	No
Stone walls and other Stonework (BL1)	Local Importance (Lower Value)	No
Buildings and artificial surfaces (BL3)	Local Importance (Lower Value)	No
Exposed sand, gravel or till (ED1)	Local Importance (Lower Value)	No

Ecological Receptor	Ecological Valuation	KER
Spoil and bare ground (ED2)	Local Importance (Lower Value)	No
Recolonising bare ground (ED3)	Local Importance (Lower Value)	No
Active quarries and mines (ED4)	Local Importance (Lower Value)	No
Exposed siliceous rock (ER1)	Local Importance (Lower Value)	No
Exposed calcareous rock (ER2) Limestone pavement [*8240]	International Importance	Yes
Quarry walls	Local Importance (Lower Value)	No
Limestone/marl lakes (FL3) Hard water lakes [3140]	National Importance	Yes
Mesotrophic lakes (FL4) Part of Ballindooley complex	County Importance[84]	Yes
Eutrophic lakes (FL5) Part of Ballindooley complex	County Importance[85]	Yes
Turloughs (FL6) Turloughs [*3180]	International Importance	Yes
Other artificial lakes and ponds (FL8)	Local Importance (Lower Value)	No
Calcareous springs (FP1) Priority Petrifying springs [*7220] Non-Annex I habitat type	International Importance Local Importance (Higher Value)	Yes Yes
Reed and large sedge swamps (FS1) Cladium fen [*7210]	International Importance	Yes
Hydrophilous tall herb [6430] Non-Annex I habitat type	National Importance Local Importance (Higher Value)	Yes Yes
Tall-herb swamps (FS2) Cladium fen [*7210]/Hydrophilous tall herb [6430] Non-Annex I habitat type	International/National Importance Local Importance (Higher Value)	Yes Yes
Eroding/upland rivers (FW1)	Local Importance (Higher Value)	Yes
Depositing/lowland rivers (FW2) River Corrib, including Vegetation of flowing waters [3260]	International Importance	Yes
Terryland River	Local Importance (Higher Value)	Yes
Drainage ditches (FW4)	Local Importance (Higher Value)	Yes

[84] On the basis that it forms part of the wetland complex at Ballindooley Lough

[85] On the basis that it forms part of the wetland complex at Ballindooley Lough

Ecological Receptor	Ecological Valuation	KER
Improved agricultural grassland (GA1)	Local Importance (Lower Value)	No
Amenity grassland (improved) (GA2)	Local Importance (Lower Value)	No
Marsh (GM1)	Local Importance (Higher Value)	Yes
Dry calcareous and neutral grassland (GS1) Calcareous grassland [*6210/6210]	International/National Importance	Yes
Non-Annex I habitat type	Local Importance (Higher Value)	Yes
Non-Annex I habitat type	Local Importance (Lower Value)	No
Dry meadows and grassy verges (GS2) Lowland hay meadows [6510]	National Importance	No, as not within ZoI of the Project
Non-Annex I habitat type	Local Importance (Higher Value)	Yes
Non-Annex I habitat type	Local Importance (Lower Value)	No
Dry-humid acid grassland (GS3) Species rich Nardus upland grassland [*6230]	National Importance	No, as not within ZoI of the Project
Non-Annex I habitat type	Local Importance (Higher Value)	Yes
Non-Annex I habitat type	Local Importance (Lower Value)	No
Wet grassland (GS4) Molinia meadow [6410]	National Importance	Yes
Non-Annex I habitat type	Local Importance (Higher Value)	Yes
Non-Annex I habitat type	Local Importance (Lower Value)	No
Dense bracken (HD1)	Local Importance (Lower Value)	No
Dry siliceous heath (HH1) Dry heath [4030]	National Importance	Yes
Dry calcareous heath (HH2) Dry heath [4030]	National Importance	No, as not within ZoI of the Project
Wet heath (HH3) Wet heath [4010]	National Importance	Yes
Lowland blanket bog (PB3) Active blanket bog [*7310]	International Importance	Yes
Rich fen and flush (PF1) Alkaline fens [7230]/Cladium fen [*7210]	International Importance	Yes
Non-Annex I habitat type	County Importance	Yes
Non-Annex I habitat type	Local Importance (Higher Value)	Yes
Poor fen and flush (PF2) Non-Annex I habitat type	County Importance	No, as not within ZoI of the Project

Ecological Receptor	Ecological Valuation	KER
Non-Annex I habitat type	Local Importance (Higher Value)	Yes
Transition mire and quaking bog (PF3) Transition mires [7140]	National Importance	No, as not within ZoI of the Project
Non-Annex I habitat type	County Importance	No, as not within ZoI of the Project
Non-Annex I habitat type	Local Importance (Higher Value)	No, as not within ZoI of the Project
Residential	Local Importance (Lower Value)	No
(Mixed) broadleaved woodland (WD1)	Local Importance (Higher Value)	Yes
Mixed broadleaved/conifer woodland (WD2)	Local Importance (Higher Value)	Yes
(Mixed) conifer woodland (WD3)	Local Importance (Higher Value)	Yes
Conifer plantation (WD4)	Local Importance (Lower Value)	No
Scattered trees and parkland (WD5)	Local Importance (Lower Value)	No
Hedgerows (WL1)	Local Importance (Higher Value)	Yes
Treelines (WL2)	Local Importance (Higher Value)	Yes
Oak-ash-hazel woodland (WN2) Limestone pavement [*8240]	International Importance	Yes
Non-Annex I habitat type	Local Importance (Higher Value)	Yes
Wet willow-alder-ash woodland (WN6) Residual alluvial forest [*91E0]	International Importance	Yes
Non-Annex I habitat type	Local Importance (Higher Value)	No, as not within ZoI of the Project
Scrub (WS1) Limestone pavement [*8240]	International Importance	Yes
Non-Annex I habitat type	Local Importance (Higher Value)	Yes
Immature woodland (WS2)	Local Importance (Higher Value)	No, as not within ZoI of the Project
Ornamental/non-native shrub (WS3)	Local Importance (Lower Value)	No
Recently-felled woodland (WS5)	Local Importance (Lower Value)	No
Cluster 1 Forramoyle (Ch. 0+000 to Ch. 1+6001 of the proposed N6 GCRR)	The value of the biodiversity receptors recorded within the habitat cluster, within the Assessment Boundary, range from Local Importance (Lower Value) to Internationally Important.	Yes
Cluster 2 Troscaigh (Ch. 1+600 to Ch. 2+800 of the proposed N6 GCRR)	The value of the biodiversity receptors recorded within the habitat cluster, within the Assessment Boundary, range from Local Importance (Lower Value) to Nationally Important.	Yes

Ecological Receptor	Ecological Valuation	KER
Cluster 3 Cloughscoltia (Ch. 2+800 to Ch. 4+400 of the proposed N6 GCRR)	The value of the biodiversity receptors recorded within the habitat cluster, within the Assessment Boundary, range from Local Importance (Lower Value) to Nationally Important.	Yes
Cluster 4 Cappagh Road to Ballymoneen Road (Ch. 4+400 to Ch. 5+600 of the proposed N6 GCRR)	The value of the biodiversity receptors recorded within the habitat cluster, within the Assessment Boundary, range from Local Importance (Lower Value) to Nationally Important.	Yes
Cluster 5 East of Ballymoneen Road (Ch. 5+750 to Ch. 5+950 of the proposed N6 GCRR)	The value of the biodiversity receptors recorded within the habitat cluster, within the Assessment Boundary, range from Local Importance (Lower Value) to Local Importance (Higher Value).	Yes
Cluster 6 Knocknabrona/Knocknafrosca (Ch. 7+700 to Ch. 8+300 of the proposed N6 GCRR)	The value of the biodiversity receptors recorded within the habitat cluster, within the Assessment Boundary, range from Local Importance (Lower Value) to Nationally Important.	Yes
Cluster 7 Menlough (Ch. 9+600 to Ch. 10+450 of the proposed N6 GCRR)	The value of the biodiversity receptors recorded within the habitat cluster, within the Assessment Boundary, range from Local Importance (Lower Value) to Internationally Important.	Yes
Cluster 8 Lackagh (Ch. 11+800 to Ch. 12+100)	The value of the biodiversity receptors recorded within the habitat cluster, within the Assessment Boundary, range from Local Importance (Lower Value) to Nationally Important.	Yes
Cluster 9 Ballindooley Lough and surrounding land (Ch. 12+300 to Ch. 12+500 of the proposed N6 GCRR)	The value of the biodiversity receptors recorded within the habitat cluster, within the Assessment Boundary, range from Local Importance (Lower Value) to Nationally Important.	Yes
Cluster 10 Castlegar (Ch. 13+500 of the proposed N6 GCRR)	The value of the biodiversity receptors recorded within the habitat cluster, within the Assessment Boundary, range from Local Importance (Lower Value) to Local Importance (Higher Value).	Yes
Cluster 11 Briarhill (Ch. 15+900 to Ch. 16+300 of the proposed N6 GCRR)	The value of the biodiversity receptors recorded within the habitat cluster, within the Assessment Boundary, range from Local Importance (Lower Value) to Internationally Important.	Yes
Cluster 12 Ardaun (Ch. 16+950 to Ch. 17+150 of the proposed N6 GCRR)	The value of the biodiversity receptors recorded within the habitat cluster, within the Assessment Boundary, range from Local Importance (Lower Value) to Local Importance (Higher Value).	Yes
Flora Species		

Ecological Receptor	Ecological Valuation	KER
Red list bryophytes and vascular plants; Woodsy thyme moss *Plagiomnium cuspidatum*, Lesser striated feathermoss *Plasteurhynchium striatulum*, Imbricate bog moss *Sphagnum affine*, Red bog-moss *Sphagnum capillifolium*, Spring gentian *Gentiana verna*, Brown beak-sedge *Rhynchospora fusca*	National Importance	Yes
Other red list vascular plants (Fern grass *Catapodium rigidum*, Eyebright *Euphrasia artica*, Downy oat-grass *Avenula pubescens*)	Local Importance (Higher Value)	Yes
FPO listed species; Slender green feather moss *Hamatocaulis vernicosus*, Small white orchid *Pseudorchis albida*, Slender cottongrass *Eriophorum gracile*.	N/A	No, as not within ZoI of the Project
Non-native invasive plant species	N/A	No
Fauna Species		
Otter	International Importance	Yes
Lesser horseshoe bat	National Importance	Yes
All other bat species	Local Importance (Higher Value)	Yes
Badger	Local Importance (Higher Value)	Yes
Pine marten	Local Importance (Higher Value)	Yes
Other mammal species protected under the Wildlife Acts	Local Importance (Higher Value)	Yes
Harbour seal, Grey seal, Common dolphin and Harbour porpoise	International Importance	Yes
Other cetacean species occurring in the marine environment of Galway Bay	National Importance	Yes
Other mammal species not protected under the Wildlife Acts (wood mouse, fox and rabbit)	Local Importance (Lower Value)	No
White-clawed crayfish	N/A	No, as not within ZoI of the Project
Freshwater pearl mussel	International Importance[86]	Yes
Vertigo antivertigo	Local Importance (Higher Value)	Yes
Swan mussel	National Importance	Yes
Marsh fritillary butterfly	National Importance	Yes
SCI bird species	International	Yes
Barn owl	County Importance	Yes
Peregrine falcon	County Importance	Yes

[86] Assessed in the updated NIS in the context of the qualifying interest population of Lough Corrib SAC in the Owenriff River

Ecological Receptor	Ecological Valuation	KER
All other Red listed bird species (non-SCI breeding populations)	Local Importance (Higher Value)	Yes
All other Amber listed bird species (non-SCI breeding populations)	Local Importance (Higher Value)	Yes
Any other Green listed bird species (non-SCI breeding populations)	Local Importance (Higher Value)	Yes
All other wintering bird species (non-SCI)	Local Importance (Higher Value)	Yes
Smooth newt	Local Importance (Higher Value)	Yes
Common frog	Local Importance (Higher Value)	Yes
Common lizard	Local Importance (Higher Value)	Yes
Atlantic salmon	International Importance	Yes
European eel	International	Yes
All other fish species recorded	Local Importance (Higher Value)	Yes
Non-native invasive fauna species	N/A	No
Local Biodiversity Areas		
Local biodiversity areas	The value of the biodiversity receptors recorded across the local biodiversity areas, in the vicinity of the Project, range from Local Importance (Lower Value) to Internationally Important	Yes
The Coast Road (R336) to the N59 Moycullen Road	Local Importance (Lower Value) to Internationally Important includes Moycullen Bogs NHA	Yes
Rusheen Bay – Barna Woods – Illaunafamona	Local Importance (Lower Value) to Internationally Important includes Galway Bay Complex SAC and Inner Galway Bay SPA	Yes
The River Corrib and the Coolagh Lakes	Local Importance (Lower Value) to Internationally Important includes Lough Corrib SAC/SPA/pNHA	Yes
Menlough to Coolough Hill (including Lackagh Quarry)	Local Importance (Lower Value) to Internationally Important includes Lough Corrib SAC	Yes
Ballindooley – Castlegar	Local Importance (Lower Value) to Internationally Important	Yes
Galway Racecourse, Ballybrit	Local Importance (Lower Value) to Internationally Important	Yes
Doughiska	Local Importance (Lower Value) to Internationally Important	Yes
Galway Bay	Local Importance (Lower Value) to Internationally Important	Yes

Ecological Receptor	Ecological Valuation	KER
	includes Galway Bay Complex SAC and Inner Galway Bay SPA	
City Canal System	County Importance	Yes
Waterbody	County Importance (See above under FL5)	Yes
Terryland Glenanail	Local Importance (Higher Value) See above under Terryland River	Yes
Cooper's Cave Terryland	National Importance (See Lesser Horseshoe bat above)	Yes

[#] Generally encompassed within Lough Corrib SAC

[†] Generally encompassed within Galway Bay Complex SAC

8.4 Characteristics of the Project

A detailed description of the Project and construction activities are provided in Chapter 5, Description of the Project and Chapter 7, Construction Activities.

The main characteristics of the Project of relevance to the ecological assessment are outlined below.

The Project comprises of 5 phases as detailed in Chapter 5 and 7.

8.4.1 Construction

8.4.1.1 Phase 1

Phase 1 of the Project will take 12 months to complete.

The main characteristics of the construction of Phase 1 of the Project that have potential for biodiversity impact are:

- Site preparation and clearance, including ground investigations, archaeological test trenching and fencing
- Removal of properties, boundaries, and amenities
- Earthwork activity, including removal of topsoil, general earthworks and operation of construction traffic
- Laying of base material and flooring
- Construction of new structures, including of pre-cast concrete stable and washroom units, loading bays, retaining walls, pavilion, machinery shed, maintenance shed, pre-parade ring and ESB sub-station
- Additional access roads

(Approval for these works was granted by Galway City Council in December 2024 Planning Ref. No.:24/60279).

8.4.1.2 Phase 2

Works undertaken as part of Phase 2, the proposed N6 GCRR (which will take 36 months to complete) will include the following:

- The provision of the proposed N6 GCRR in two stages which will take place concurrently:
  - Stage A - N6 Coolagh Junction to N59 Letteragh Junction
  - Stage B - N59 Letteragh Junction to R336 west of Bearna

- Existing stableyard to be demolished, including existing machinery shed
- Existing commercial building on the third-party lands to the north of the Galway Racecourse to be demolished and the site cleared
- Existing horse box parking off Racecourse Avenue to be demolished, including removal of existing access arrangement to the Ballybrit graveyard, to accommodate the Galway Racecourse Tunnel as part of the proposed N6 GCRR

The main characteristics of the construction of Phase 2 of the Project that have potential for biodiversity impact are:

- Demolition of existing dwellings, stable blocks and the commercial buildings
- Earthworks - the excavation and placement of material for the construction of cuttings and embankments as well as the hauling of materials and importation/exportation of materials to complete the road formation
- Road works – sub-base and base construction, bituminous pavement, surfacing
- Drainage – the installation of pipe culverts, filter drains, linear grassed channels and wetlands
- Construction of retaining walls, piling works, construction of bridges including their foundations, piers, abutments and the installation of large beams and other reinforced concrete works
- Blasting – excavation of rock for cuttings and tunnels (See also Chapter 9, Soils and Geology)
- Construction of a cut and cover tunnel
- Diversion and construction of utilities and services
- Accommodation works for landowners - such as access roads, entrances, fences, gates, walls, ducting and reconnection of severed services
- Temporary traffic management

8.4.1.3 Phase 3

During this phase, which will take 9 months, the new stables will be constructed.

The main characteristics of the construction of Phase 3 of the Project that have potential for biodiversity impact are:

- Site preparation and clearance, and fencing
- Earthworks activity, general earthworks and operation of construction traffic
- Construction of new structures, including new permanent stable yard, water supply wells, vet, security, storage facilities and Groom's Pavilion, horsebox parking

(Approval for these works was granted by Galway City Council in December 2024 Planning Ref. No.:24/60279).

8.4.1.4 Phase 4

The proposed temporary stables will be demolished during a 3-month period once Phase 3 is complete. All demolition activities will be carried out within the Assessment Boundary.

The main characteristics of the deconstruction that have potential for biodiversity impact are:

- Demolition of concrete structures and other buildings
- Clearing demolished materials from site
- Providing suitable surface for car parking

(Approval for these works was granted by Galway City Council in December 2024 Planning Ref. No.:24/60279).

8.4.2 Operational Phase

On completion of Phase 1, both the existing stable yard and the temporary stable yard will be in operation for a short period. During Phase 2 the temporary stables will be in operation.

From the end of Phase 2 through to Phase 5, the proposed N6 GCRR will be operational. At the end of Phase 3, and during phase 4, the Permanent stables will be in operation.

8.4.2.1 Phase 5

The Project is fully operational at Phase 5.

The main characteristics of the operation that have potential for biodiversity impact are:

- Potential traffic impacts associated with proposed N6 GCRR
- The presence of additional roadside lighting associated with the proposed N6 GCRR
- The presence and operation of additional buildings and lighting

8.5 Evaluation of Impacts

8.5.1 Introduction

The following section presents the assessment of potential impacts on biodiversity within the Zone of Influence (ZoI) of the Project. As outlined in Section 8.2.6, this is focussed on the Key Ecological Receptors (KERs) identified in Section 8.3.15. This includes consideration of the Do-Nothing Scenario, i.e. the existing trends with the potential to affect biodiversity in the absence of the Project.

8.5.2 Changes to the Impact Assessment since 2018 EIAR

The impact assessment has been updated to incorporate all relevant clarifications, amendments and updates made since the 2018 EIAR in response to queries raised by An Bord Pleanála, statutory consultees, and other participating third parties, and the assessment undertaken by the Inspector appointed by An Bord Pleanála (ABP) presented in their report dated 22 June 2021.

Although the baseline changes have required some level of minor updates to the impact assessment to capture the biodiversity baseline variances recorded between the 2018 EIAR and this updated EIAR, the updates are largely not material and do not affect the conclusions of the impact assessment. This is with the exception of Barn owl as the conclusion of the impact assessment and subsequent residual impacts has changed since 2018.

Minor amendments include:

- Additional designated areas for nature conservation (as discussed in the NIS) due to additional impact pathways considered
- Changes in habitat loss impact calculations due to changes in the design
- Addition of rare and protected plant species
- Addition of Swan mussel as a KER
- Changes in suitable Marsh fritillary butterfly habitat due to changes in land use

As detailed in Chapter 16, Air Quality of this updated EIAR, the air quality assessment of the Project has been updated to take account of the new TII *Air Quality Assessment of Specified Infrastructure Projects* guidelines (TII, 2022). The potential ecological impacts due to air quality impacts has been reassessed for this updated EIAR to take account of the updated air quality assessment and the updated information since the 2018 EIAR on habitat and vegetation tolerances to nitrogen-based emissions (Aherne *et al*., 2020;

Aherne *et al*., 2021). The updated assessment is provided below but has not resulted in material changes to the overall findings as presented in the 2018 EIAR.

In this section, unless indicated otherwise, the air quality parameter values discussed are the modelled contributions and the estimated background levels based on measured values from roads in proximity to the proposed N6 GCRR. The assessment also considered the worst-case scenario for the Design Year (2046).

Emissions from car exhausts, and the deposition of particulate matter produced by engine, brake and tyre wear, can contribute to increased deposition of pollutants, such as oxides of nitrogen (NO_x, NO_s), ammonia (NH_3) and acid deposition (TII, 2022), which can impact receiving habitats in the vicinity of a road carriageway, and the associated nitrogen deposition (N_{dep}) into the neighbouring landscape. This can affect the ecosystems and vegetation present, influencing plant growth rates and species composition, diversity, and abundance.

The current understanding of air quality impacts from roads and their interaction/effects on ecology are set out in the TII's *Air Quality Assessment of Specified Infrastructure Projects* (TII, 2022)) and two UK reports: *The Ecological Effects of Diffuse Air Pollution from Road Transport* (Bignal *et al.*, 2004) and *The Ecological Effects of Air Pollution from Road Transport: An Updated Review* (Natural England, 2016).

National assessments indicate that there is no risk of carbon monoxide, 1-3 butadiene, benzene, lead and sulphur dioxide concentrations exceeding relevant air quality standard limits due to emissions from traffic anywhere in Ireland (Bignal *et al*., 2004; Natural England, 2016; EPA, 2021). Nitrogen dioxide (NO_2) and particulate matter (PM10 and PM2.5) are considered important in terms of human receptors (TII, 2022) and are not specifically addressed in recent reports on air quality impacts on designated nature conservation (IAQM, 2020; Aherne *et al*., 2020; Aherne *et al.*, 2020), other than the inclusion of NO_2 into the overall N_{dep} contributions modelled for the proposed N6 GCRR.

Air quality modelling for the nitrogen-based parameters were calculated for Lough Corrib SAC at distances up to, at least, 200m from the proposed edge of the of the proposed N6 GCRR, in 10m intervals (refer to Chapter 16, Air Quality, of this updated EIAR), with more detailed measurements for specific receptor sites.

The air quality modelling was completed for the Year of Opening (2031) and the Design Year (2046) for the proposed N6 GCRR. The latter represents the worst-case scenario and was used for this assessment. The air quality ZoI for the relevant nitrogen-based parameters associated with traffic emissions were considered for each modelled 'Link' (section of the proposed N6 GCRR between major junctions (Link 50, Link 51, Link 52, Link 53, Link 54, Link 57, Link 58, Link 59, Link 60 and Link 61)) and the road edge (the outer most traffic lane) was considered as 0m for the ZoI. These link locations are shown on Figures 16.1.01 to 16.1.15. The ZoI at each Link considers impacts to Annex I habitats outside the Assessment Boundary or areas of Annex I habitat being retained within the Assessment Boundary. Remaining habitats within the Assessment Boundary are considered to be lost during construction and therefore will not be affected by operational air quality impacts.

8.5.3 Do Nothing Scenario

Existing trends

As detailed in the 2018 EIAR, across the study area, as evidenced from a review of historical orthophotos and the Galway City Habitats Inventory dataset (Natura, 2005), there have been changes to the biodiversity baseline in recent decades: the most significant change likely to have been habitat loss due to development and habitat degradation impacts, primarily as a result of either agricultural intensification/reclamation or scrub encroachment through agricultural abandonment. The existing road network has limited drainage control or pollution control measures and, with increasing traffic numbers, may have had some effects on biodiversity in the receiving environment.

There have been habitat losses due to development in the area between the Cappagh and Ballymoneen Roads, and along the network of local roads which extend north from the R336 coast road, e.g. Na Foraí Maola Road, Troscaigh Road, Bearna to Moycullen Road L1321 and the Aille Road L5384. In some cases areas of peatland habitats have likely been affected. Where agricultural management has been reduced, or has been abandoned altogether, fields are becoming overgrown by gorse, bramble scrub and/or dense bracken cover. In places this is encroaching upon peatland habitat. This is most evident in the western part of the study area in those isolated peatland habitat blocks set between the network of local roads and the

associated ribbon-type residential development. Sections of watercourses have been culverted as a consequence of development; the most extensive of which are associated with the Knocknacarra Stream. Coolough, Ardaun and Doughiska have seen losses of Limestone pavement [*8240] and most likely also areas of semi-natural grassland habitat [e.g. 6210] since 1994 as a result of road development, residential and industrial development, and agricultural land use change/improvement. Quarrying activities in the local area have resulted in the loss of limestone pavement and potentially also areas of calcareous grassland habitats since the year 2000. Scrub encroachment has also reduced the extent of exposed limestone pavement habitat area at Menlough, in the area between Bóthar Nua and Seanbóthar.

Since the 2018 EIAR, the changes in habitat baseline comprise relatively minor and expected changes in habitat classifications and extents. These are largely due to land use changes associated with development (creating buildings/artificial surfaces and areas of bare ground), land abandonment/reduced land management (grassland fields developing into rank dry meadows and grassy verges and/or becoming encroached by bracken or scrub), new or intensified agricultural activities, vegetation clearance (new areas of spoil and bare ground and associated losses of habitat areas/features such as hedgerows and treelines) or natural succession of vegetation (recolonisation of bare ground by grassland or scrub habitats) given the four year period between the habitat survey undertaken in 2019 and the most recent survey in 2023. Site clearance and construction activities associated with development projects continues to result in semi-natural habitat loss around the margins of Galway City. Some key changes include small losses of Annex I habitat areas – dry heaths [4030], wet heaths [4010], calcareous grassland [6210], limestone pavement [*8240] and alkaline fens [7230] and the reclassification of River Corrib as corresponding Annex I Vegetation of flowing waters [3260] habitat. The largest single area of habitat change (c.11.9ha) relates to the reclassification of Lackagh Quarry from an active quarry (ED4) to spoil and bare ground (ED2) given the timeframe that has elapsed since the quarry site was last actively worked.

Three additional non-native invasive flora species were recorded in 2023, within the survey area but outside of the Assessment boundary, the first two of which are listed on the Third Schedule of the European Communities (Birds and Natural Habitats) Regulations, 2011: Three cornered garlic Allium triquetrum, Giant rhubarb *Gunnera tinctoria* and Old man's beard *Clematis vitalba*.

There is little historical baseline data to establish trends for fauna species locally although the habitat changes that have occurred has had some effects, both positive and negative, on fauna biodiversity and distributions locally. It can be stated from the ecological surveys conducted to date that fauna species and signs of fauna activity was consistent with that presented in the 2018 EIAR for most species. There were minor changes to the location of, and bat composition and numbers occupying, bat roosts and some reduction in the distribution and extent of suitable Marsh fritillary habitat within, and in the vicinity of, the Assessment boundary identified from the surveys undertaken in 2023, compared with previous years. Six additional six wintering bird species (Gadwall, Little egret, Red grouse, Redwing, Ringed plover and Whooper swan) and four additional breeding bird (Common gull, Little egret, Snipe and Tree sparrow) species of conservation concern and considered to be Key Ecological Receptors (KERs)[87],were recorded within the survey area in 2023.

Likely Future Trends

As the full extent of the Project passes through lands zoned under either the Galway City Council Development Plan 2023-2029, the Galway County Council Development Plan 2022-2028, or the Ardaun Local Area Plan 2018-2024, the current land use zonings provide the best indication of what the future short to medium-term biodiversity trends might be, as they will influence and direct development in the surrounding area. These are unchanged from that presented in the 2018 EIAR. It is also likely that traffic numbers will continue to increase on a road network with limited drainage control or pollution control measures, which may have effects on biodiversity receptors in the receiving environment.

The area around Sruthán na Líbeirtí is zoned for environmental management, as is the Trusky Stream corridor and the coastline – this zoning aims to protect areas of high biodiversity and promote sustainable development. An area east of Sruthán na Líbeirtí, and to the west of Bearna Woods, is zoned green wedge

[87] Special Conservation Interests (SCIs), for a breeding population, of nearby SPAs, species listed under Annex I of the Birds Directive (2009/147/EC), and/or Red and Amber species listed for their breeding populations from *Birds of Conservation Concern in Ireland 4: 2020–2026* (Gilbert *et al.* 2020)

with the area in between zoned as rural fringe, these zonings limit the types of future development on those lands.

The area between Bearna Woods and the River Corrib is a mix of residential, amenity, agri-amenity and agriculture zonings. The lands between the Project and the Cappagh Road are predominantly zoned residential, with some amenity and industrially zoned areas. Similarly, lands around UoG and the N59 Moycullen Road are a mix of residential and amenity zonings. Sitting between both these areas is a large expanse of lands zoned for agriculture which includes part of the Moycullen Bogs NHA at Tonabrocky. A second area at na hAille comprises both agricultural and agri-amenity land use zoning.

Between Menlough and the N83 Tuam Road, lands to the north of the Project are largely zoned agricultural (in line with their current use) with a band of agri-amenity zoned lands extending from Menlough Village to Galway City along the east bank of the River Corrib. There is a small pocket of light-industrial and residential zoned lands along the N84 Headford Road, residential along the N83 Tuam Road and areas of light residential zoning at Menlough and adjacent to the southern end of Lackagh Quarry.

Aside from Galway Racecourse (which is zoned as an amenity area), lands between the N83 Tuam Road and the R339 are zoned for industrial, residential or commercial uses.

The majority of lands adjoining the Project at Doughiska (east of the existing N6 and between the R446 and the R449) fall within what is the Ardaun Local Area Plan boundary. The Ardaun Local Area Plan 2018-2026 includes large areas zoned for development. West of the existing N6 in this area is largely zoned for residential development.

Current biodiversity trends are likely to continue in areas zoned for environmental management, green wedge, rural fringe or agriculture with some limited development and land use change likely. Amenity or agri-amenity zoned areas are likely to come under some level of increased pressure from developing and constructing additional recreational infrastructure and through increased human presence and disturbance. Areas zoned for residential, commercial or industrial purposes are likely to have the greatest effects on local biodiversity through habitat loss and/or modifications (potentially affecting Annex I and other semi-natural habitats) and any associated effects on fauna species.

However, any effects on biodiversity are likely to be moderated by the environmental protective policies in both the Galway City Council Development Plan 2023-2029, Galway County Development Plan 2022-2028, and the Ardaun Local Area Plan 2018-2024.

The interaction between the existing trends, future trends, and other plans or projects with the Project are considered and assessed further in the cumulative impacts section (Section 8.8).

8.5.4 Designated Areas for Nature Conservation

This section describes and assesses the potential for the Project to result in likely significant effects on designated areas for nature conservation at SACs, SPAs, NHAs or pNHAs and has been reviewed and updated since the 2018 EIAR to take account from the assessment undertaken by the Inspector appointed by An Bord Pleanála. In the context of European sites this is focussed on the habitats and species for which the sites are selected (QIs for SACs and SCIs for SPAs) and the conservation objectives supporting their conservation status in each site. This assessment is directly related to the assessment methodology for European sites required under the Habitats Directive, which is presented in the updated Natura Impact Statement (NIS) for the Project.

In the case of NHAs and pNHAs the assessment considers whether the integrity[88] of any such site would be affected by the Project with reference to the ecological features for which the site is designated, or is proposed.

The list of European sites considered as KERs in the biodiversity assessment has been expanded since the 2018 EIAR from Lough Corrib SAC, Lough Corrib SPA, Galway Bay Complex SAC and Inner Galway Bay SPA to align with the assessment presented in the updated NIS. The following additional European sites are included in the assessment (see Section 8.5.4.1 of this updated EIAR for more details): Ardrahan Grassland

[88] Refer to Section 8.2.5 for definition and impact assessment methodology

SAC, Castletaylor Complex SAC, Kiltiernan Turlough SAC, Lough Fingall Complex SAC, Rahasane Turlough SPA, Rahasane Turlough SAC, Cregganna Marsh SPA, Maumturk Mountains SAC, The Twelve Bens/Garraun Complex SAC, Connemara Bog Complex SAC, Connemara Bog Complex SPA, Ross Lake and Woods SAC, East Burren Complex SAC, Moneen Mountain SAC, Black Head-Poulsallagh Complex SAC, Gortnandarragh Limestone Pavement SAC, Inishmore Island SAC and Kilkieran Bay and Island SAC.

In including additional European sites into the assessment, and with the additional impact pathways considered in the updated NIS, the following pNHA sites are also now incorporated into the biodiversity assessment as KERs: Furbogh Wood pNHA, Kiltullagh Turlough pNHA, Killarainy Lodge, Moycullen pNHA, Drimcong Wood pNHA, Turloughcor pNHA, Ballycuirke Lough pNHA, Connemara Bog Complex pNHA, Ross Lake and Woods pNHA, Black Head-Poulsallagh Complex pNHA, Lough Fingall Complex pNHA, Rahasane Turlough pNHA, Gortnandarragh Limestone Pavement pNHA, Moneen Mountain pNHA, East Burren Complex pNHA, Kiltiernan Turlough pNHA, Castletaylor Complex pNHA, Inishmore Island pNHA, Maumturk Mountains pNHA, The Twelve Bens/Garraun Complex pNHA, Mason Island Machair pNHA, Mweenish Island Machair pNHA, Finnish Island Machair pNHA, Duck Island pNHA, Inishmuskerry pNHA, Ardmore Point pNHA, Eagle Rock pNHA, Geabhrog Island pNHA, Oilen Na Ngeabhrog (Glencoh Rock) pNHA, Kinvarra Saltmarsh pNHA and Oilean Na Ngeabhrog (Illaungurraig) pNHA.

8.5.4.1 European Sites

In the context of assessing whether the Project is likely to result in an impact on the integrity of any European sites, the tests and assessment presented in the updated NIS fulfil this role. The updated NIS considers whether the Project will affect the conservation objectives supporting the favourable conservation condition of the European site's QIs/SCIs and as a result presents an assessment of whether the integrity of any European sites would be affected i.e. if the Project would adversely affect on the integrity of a European site, this would constitute a likely significant effect in the context of the EIA Directive.

The nature and scale of the Project, the identified potential impacts and their relationship to European sites were considered in order to determine which European sites were within the ZoI of the Project, in view of best scientific knowledge and in view of conservation objectives, and therefore potentially at risk of the Project affecting their conservation objectives. The potential impacts associated with the Project are discussed below in relation to those European sites within its ZoI (see also Section 7 of the updated NIS).

As explained in Section 8.3.2, (and in further detail in Section 7 of the updated NIS) the Zone of Influence (ZoI) is a distance within which the proposed works could potentially affect the conservation condition of QI habitats or QI/SCI species of a European site.

The mechanism to define the ZoI is summarised as follows:

- Consider the nature, size and location of the Project
- Consider the sensitivities of the ecological receptors
- Identify impact sources and pathways
- Determine the ZoI based on the extent of the impact

Considering the ZoI, in the absence of mitigation measures, the Project was assessed as having the potential to adversely affect the integrity of the following European sites (refer to Section 9 of the updated NIS):

- Lough Corrib SAC
- Lough Corrib SPA
- Galway Bay Complex SAC
- Inner Galway Bay SPA
- Ardrahan Grassland SAC
- Castletaylor Complex SAC
- Kiltiernan Turlough SAC

- Lough Fingall Complex SAC
- Rahasane Turlough SAC
- Rahasane Turlough SPA
- Cregganna Marsh SPA
- Maumturk Mountains SAC
- The Twelve Bens/Garraun Complex SAC
- Connemara Bog Complex SAC
- Connemara Bog Complex SPA
- Ross Lake and Woods SAC
- East Burren Complex SAC
- Moneen Mountain SAC
- Black Head-Poulsallagh Complex SAC
- Gortnandarragh Limestone Pavement SAC
- Inishmore Island SAC
- Kilkieran Bay and Island SAC

The locations of these European sites relative to the Project, and the predicted ZoI, are shown on Figure 8.18.1.

Lough Corrib SAC

The Project and its boundary overlaps with, i.e. traverses through or adjacent to one European site, namely Lough Corrib SAC at four locations: at the termination of the proposed drainage outfall from the N59 Link Road North at Kentfield; at the site of the proposed River Corrib Bridge between Dangan and Menlough; to the west of the Coolagh Lakes (Ch. 9+850 to Ch. 10+100 of the proposed N6 GCRR); and, to the west and north of Lackagh Quarry where the Project will consist of a tunnel (Lackagh Tunnel) and approach road infrastructure (Ch. 10+620 to Ch. 11+800 of the proposed N6 GCRR). Refer to Plate 8.1 below. The Project also traverses a number of groundwater bodies that support groundwater dependant wetland habitats within this European site and traverses a number of watercourses that lie within or drain to this European site.

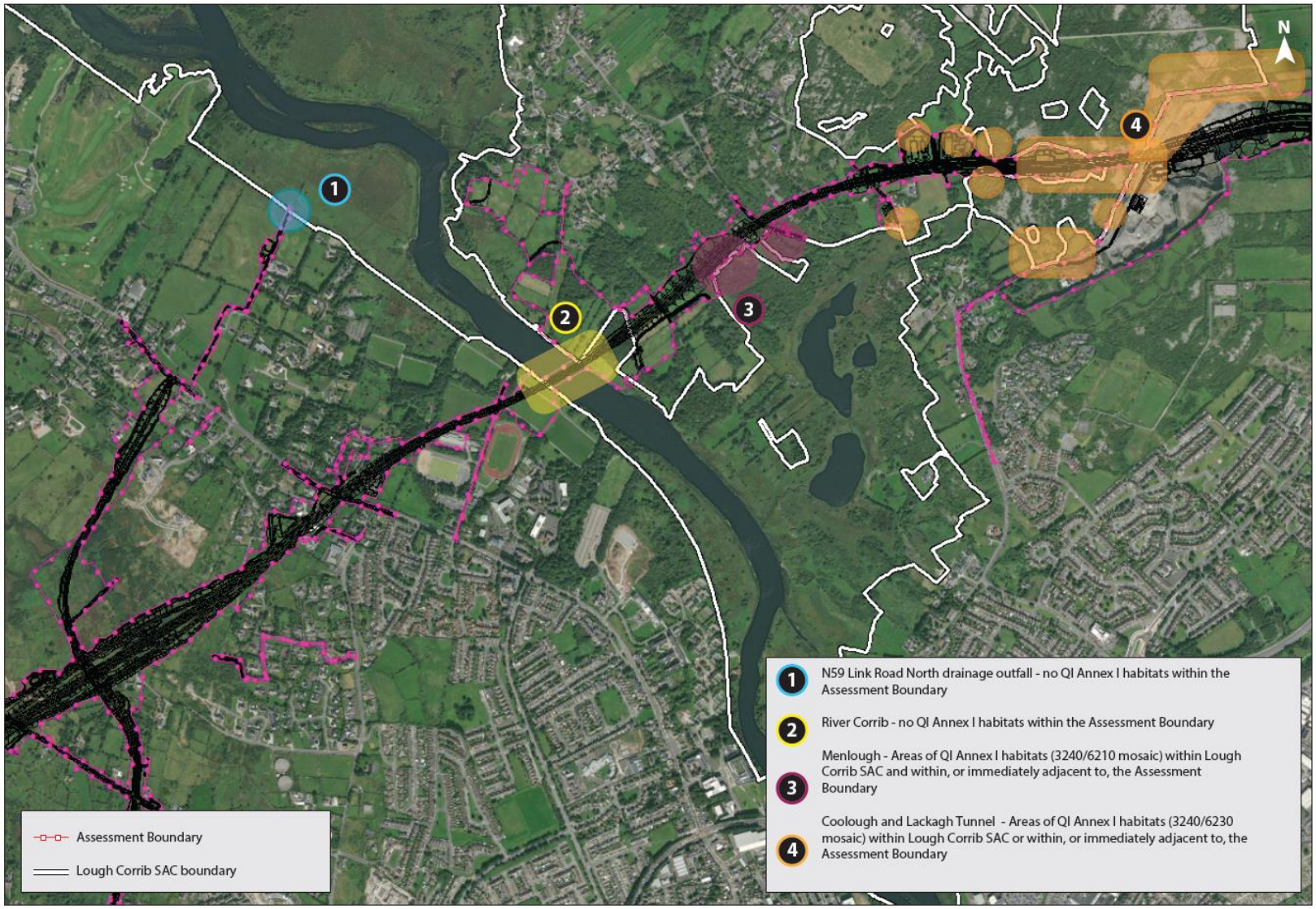

Plate 8.1 Project Overlap with European Sites

The following are the potential impacts by which the Project could (in the absence of mitigation measures) potentially affect the QIs of Lough Corrib SAC:

- Habitat loss and habitat fragmentation
- Habitat degradation through structural effects to the overlying/adjacent limestone bedrock associated with the proposed Lackagh Tunnel and approaches
- Habitat degradation as a result of the Project affecting the functioning and quality of the existing hydrogeological regime
- Habitat degradation as a result of the Project affecting water quality in receiving watercourses during construction
- Habitat degradation as a result of air quality impacts
- Habitat degradation as a result of introducing/spreading non-native invasive plant species to habitat areas within Lough Corrib SAC
- Mortality risk to aquatic species in the River Corrib during construction of the proposed River Corrib Bridge
- Mortality risk to Otter during operation through collisions with road traffic

Habitat loss

There are no areas of QI Annex I habitats within Lough Corrib SAC that lie beneath the footprint of the Project or will be directly impacted. Neither will the Project result in the direct loss of any habitats that support the QI habitats that are present in Lough Corrib SAC. However, within Lough Corrib SAC there are areas of the QI habitats Limestone pavement [*8240] and Calcareous grassland [6210] that lie within the Assessment Boundary yet outside of the footprint of the Project which could be directly impacted, if not protected from construction works. With respect to these QI habitats and their conservation objectives, habitat loss could affect the habitat area of Calcareous grassland and Limestone pavement within Lough Corrib SAC, and could also affect the distribution of these habitat types within the European site. The Project will not result in the fragmentation of any QI habitats, nor will it fragment the River Corrib corridor. With respect to the QI species associated with this SAC (e.g. otter, sea lamprey, brook lamprey and Atlantic salmon), habitat loss within, or along the banks of, the River Corrib is minimal and will not affect any breeding or resting sites or the species' ability to maintain their populations.

Habitat degradation as a result of tunnelling/excavations associated with construction of the Lackagh Tunnel

Construction of the Lackagh Tunnel as part of the proposed N6 GCRR could affect the structural integrity of the rock mass above, and result in damage to, or loss of, the QI Annex I habitats Limestone pavement and Calcareous grassland within Lough Corrib SAC at the surface. With respect to these QI habitats and their conservation objectives, habitat loss could affect the habitat area of Calcareous grassland and Limestone pavement within Lough Corrib SAC, and could also affect the distribution of these habitat types within the European site.

Habitat degradation as a result of hydrogeological impacts

The construction of the Lackagh Tunnel and the supporting piers for Menlough Viaduct have the potential to interact with groundwater conduits and potentially affect groundwater flow locally with the Lough Corrib Fen 1 (Menlough) GWB. This in turn could affect the groundwater supply to the Western and Eastern Coolagh Springs that contributes to the Coolagh Lakes, supporting QI wetland habitats in the SAC. With respect to the QI habitats and species and their conservation objectives, this impact could affect:

- The natural hydrological regime (e.g. water levels and flooding) and water chemistry
- The area, local distribution and condition of groundwater dependant wetland habitat
- The vegetation composition, diversity, structure and distribution, the abundance and distribution of typical and locally distinctive species associated with QI habitats

The drainage design of the Project avoids any long-term impacts to the existing groundwater regime that could affect any of the groundwater dependant habitats in Lough Corrib SAC. However, mitigation measures are required in the event that any groundwater conduits are encountered during construction and to ensure that karst features do not affect the functioning of the infiltration basins during operation.

Habitat degradation as a result of hydrological impacts

The Project could affect surface water quality in the receiving environment which supports aquatic/wetland habitats within Lough Corrib SAC. These habitats in turn support the QI aquatic species present: Otter, Atlantic salmon, Sea lamprey and Brook lamprey. With respect to the QI habitats and species and their conservation objectives, this impact could affect:

- Habitat area, distribution and condition/quality, along with vegetation composition, diversity, structure and distribution, and the abundance and distribution of typical and locally distinctive species
- Fish populations (including Atlantic salmon) through affecting fish numbers, population structure and habitat quality, which can also affect recruitment in the Freshwater pearl mussel populations upstream
- Otter abundance and distribution, prey abundance and the availability of holt and couch sites

Habitat degradation as a result of air quality impacts

Dust deposition arising from construction activities could locally affect the extent, diversity, and vegetation composition or structure of habitats within Lough Corrib SAC that are present in the vicinity of the Project.

A detailed assessment of the modelled operational phase nitrogen-based air quality parameters and their ZoI was undertaken for the proposed N6 GCRR where it traverses through and near to the Lough Corrib SAC (Link 53 of the proposed N6 GCRR (ref Figures 16.1.01 to 16.1.15)) has been undertaken and is summarised as follows):

- The critical level for NO_x is 30µg/m^3 for the protection of vegetation, which is not exceeded along the length of the proposed N6 GCRR where it passes through/close to the Lough Corrib SAC. NO_x concentrations associated with the operation of the Project pose no risk to the conservation objectives of any QI habitats in Lough Corrib SAC.
- Alkaline habitats, such as Limestone pavements [*8240] and Calcareous grassland [6210] have substrates that inherently neutralise potential acidification and will not be affected by any increases in acid deposition associated with the operation of the proposed N6 GCRR. Bog habitats are affected by Acid Deposition specifically Raised bogs and Blanket bogs, none of which were recorded within the ZoI in Lough Corrib SAC. Acid deposition associated with the operation of the Project poses no risk to the conservation objectives of any QI habitats in Lough Corrib SAC.
- The critical level for NH_3 is >3µg/m^3 for vascular plants (IAQM, 2020), which is not exceeded along the length of the proposed N6 GCRR where it passes through/close to the Lough Corrib SAC. Therefore, NH_3 contributions associated with the operation of the Project pose no risk to the conservation objectives associated with vascular plants of any QI habitats in Lough Corrib SAC.
- The critical level for NH_3 is >1µg/m^3 for bryophytes and lichens (IAQM, 2020). NH_3 concentrations above the critical level has a ZoI (30m from the edge of the footprint of the N6 GCRR) that intersects Limestone pavement [8240] of c.181m^2 (or 0.025% of Limestone pavement habitat within Lough Corrib SAC) at one location near Coolagh Lakes south of the proposed N6 GCRR. The potential impact to bryophytes species within the Limestone pavement intersecting this 30m ZoI will not compromise habitat quality through species composition, bryophyte cover or distinctiveness within the Limestone pavement of the Lough Corrib SAC. Therefore, NH_3 contributions associated with the operation of the Project pose no risk to the conservation objectives associated with bryophytes of any QI habitats in Lough Corrib SAC.
- The critical loads for N_{dep} vary for different Annex I habitats and were obtained from the EPA Research Report (Aherne *et al.*, 2021) and supported by the habitat-specific critical loads on the APIS website[89].

[89] https://www.apis.ac.uk/search-pollutant-impacts

The assessment investigated the various N_{dep} categories (2kg N/ha/yr, 5kg N/ha/yr, 7.5kg N/ha/yr, 10kg N/ha/yr and 15kg N/ha/yr) and N_{dep} concentrations greater than or equal to 7.5kg N/ha/yr is the only N_{dep} critical load that has a ZoI (30m from the edge of the footprint of the proposed N6 GCRR) that intersects a corresponding habitat for that critical load, namely Limestone pavement [8240] of c.181m^2 (or 0.025% of Limestone pavement habitat within Lough Corrib SAC)] at one location near Coolagh Lakes south of the proposed N6 GCRR. Any nitrogen enrichment within this 181m^2 Limestone pavement within the ZoI affected will not compromise the limestone habitat or habitat quality in terms species composition within the Lough Corrib SAC. N_{dep} contributions associated with the operation of the Project pose no risk to the conservation objectives of any QI habitats in Lough Corrib SAC.

Habitat degradation as a result of introducing/spreading non-native invasive plant species

Introducing/spreading non-native invasive plant species could locally affect the extent, diversity, and area of QI habitats or habitat areas supporting QI species within Lough Corrib SAC.

Habitat degradation as Mortality risk from construction works and road traffic

Constructing a bridge over the River Corrib poses a mortality risk to aquatic species beneath in the river; albeit a low level risk of having any long-term population level effects, given the temporary nature of the proposed works.

Operation of the Project presents a permanent risk of Otter mortality due to road traffic collisions and could have long-term effects on the Otter population of Lough Corrib SAC.

Lough Corrib SPA

As the Project does not traverse the SPA, none of the SCI species, or their supporting habitats within the SPA, are directly impacted by the Project.

However, there are the following impacts by which the Project could (in the absence of mitigation measures) affect the SCI bird species of Lough Corrib SPA and their supporting wetland habitats:

- Habitat degradation as a result of hydrogeological impacts
- Habitat degradation as a result of hydrological impacts
- Disturbance/displacement

Habitat degradation as a result of hydrogeological impacts

The Project could affect the groundwater quality at potential ex-situ sites used by wintering bird species listed as SCIs for Lough Corrib SPA. This impact could affect the type, quality and extent of suitable habitat available to SCI bird species at ex-situ sites which lie within the hydrogeological ZoI. This impact could affect the type, quality and extent of suitable habitat available to SCI bird species locally and therefore, the number and range of areas available to the SPAs SCI bird populations and could have effects on their long-term population trends.

The design of the Project avoids any long-term impacts to the existing groundwater regime that would affect any of the potential ex-situ sites used by SCI listed wintering birds. However, mitigation measures are required in the event that any groundwater conduits are encountered during construction and to ensure that karst features do not affect the functioning of the infiltration basins during operation.

Habitat degradation as a result of hydrological impacts

The Project could affect the quality of surface water in the receiving environment which supports aquatic/ wetland / marine habitats and species, which could affect the type, quality and extent of suitable habitat available to SCI bird species locally and therefore, the number and range of areas available to the SPAs SCI bird populations and could have effects on their long-term population trends.

Disturbance/displacement

Long-term blasting in the vicinity of Ballindooley Lough could displace SCI listed bird species from this site for one or more winter seasons. Displacing SCI bird species from Ballindooley Lough, an important local

site for some of the wintering bird species listed as SCIs for Lough Corrib SPA, could potentially negatively affect the long-term population trends of the wintering SPA population.

The following are the bird species listed as SCIs for Lough Corrib SPA which were recorded within the ZoI of the Project and are therefore, at risk of significant effects: Shoveler, Tufted duck, Hen harrier, Coot, Golden plover, Black-headed gull, Common gull and Common tern. Wetlands are also listed as an SCI and could also be affected by the Project. None of the other SCIs are at risk of impacts from the Project as they are not present within the ZoI of the Project.

Galway Bay Complex SAC

As the Project does not traverse Galway Bay Complex SAC, none of the QI habitats or species will be directly impacted by the Project and there is no risk of direct habitat loss or habitat fragmentation or direct mortality risk to QI species within the European site. Galway Bay Complex SAC is also beyond the ZoI of any air quality or hydrogeological effects from the Project. There is also no risk of disturbance associated with either construction or operation of the Project affecting Otter or Harbour seal populations within Galway Bay Complex SAC.

However, there are the following impacts by which the Project could (in the absence of mitigation measures) affect the QI habitats and species of Galway Bay Complex SAC:

- Habitat degradation as a result of hydrogeological impacts
- Habitat degradation as a result of hydrological impacts
- Habitat degradation as a result of introducing/spreading non-native invasive plant species
- Barrier effect
- Mortality risk

Habitat degradation as a result of hydrogeological impacts

A direct pathway is present between the swallow hole at Galway Racecourse and Galway Bay through the shared Clarinbridge groundwater body. A pollution event, of a sufficient magnitude, has the potential to affect the receiving groundwater environment to an extent that it undermines the conservation objectives supporting groundwater dependent habitats in the Inner Galway Bay SPA and Galway Bay Complex SAC. An accidental pollution event during construction/operation could affect the groundwater inputting to Galway Bay and could affect the quality of the habitats and the fauna communities.

Habitat degradation as a result of hydrological impacts

The Project could affect surface water quality in the receiving environment which supports freshwater, wetland and marine habitats, within Galway Bay Complex SAC. These habitats in turn support Otter and the Harbour seal. With respect to the QI habitats and species and their conservation objectives, this impact could affect:

- The structure, extent and distribution of intertidal and marine communities associated with QI habitats
- The number and extent of typical plant and animal species associated with QI habitats
- Habitat area and distribution along with the vegetation structure and composition
- Otter prey abundance and the availability of holt and couch sites
- The condition of Harbour seal breeding and haul out sites

Habitat degradation as a result of introducing/spreading non-native invasive plant species

Introducing/spreading non-native invasive plant species could affect the extent, distribution, area and diversity of QI habitats or habitat areas supporting QI species.

Barrier effect

Introducing new culverts on watercourses within the Bearna Stream catchment may present a barrier to Otter movement throughout that catchment, potentially affecting the Otter population of Galway Bay Complex SAC.

Mortality risk

Introducing new road crossings on watercourses within the Bearna Stream catchment increases the risk of road traffic collisions with Otter, potentially affecting long-term population trends of the Otter population of Galway Bay Complex SAC.

Inner Galway Bay SPA

As the Project does not cross the SPA, none of the SCI species, or their supporting habitats within the SPA, are directly impacted by the Project. At its nearest point, the Project is more than 1km from the SPA boundary and therefore, there is no risk of disturbance/displacement of SCI birds from habitats within the SPA.

However, there are the following impacts by which the Project could (in the absence of mitigation measures) potentially affect the SCI bird species of Inner Galway Bay SPA and their supporting wetland habitats:

- Habitat degradation as a result of hydrogeological impacts
- Habitat degradation as a result of hydrological impacts
- Disturbance/displacement

Habitat degradation as a result of hydrogeological impacts

The Project could affect the groundwater quality at potential ex-situ sites used by wintering bird species listed as SCIs for Inner Galway Bay SPA. This impact could affect the type, quality and extent of suitable habitat available to SCI bird species at ex-situ sites which lie within the hydrogeological ZoI. This impact could affect the type, quality and extent of suitable habitat available to SCI bird species locally and therefore, the number and range of areas available to the SPAs SCI bird populations and could have effects on their long-term population trends.

The design of the Project avoids any long-term impacts to the existing groundwater regime that would affect any of the potential ex-situ sites used by SCI listed wintering birds. However, mitigation measures are required in the event that any groundwater conduits are encountered during construction and to ensure that karst features do not affect the functioning of the infiltration basins during operation.

Habitat degradation as a result of hydrological impacts

The Project could affect the quality of surface water in the receiving environment which supports freshwater, wetland and marine habitats, within Inner Galway Bay SPA and at potential ex-situ sites used by SCI birds species (Ballindooley Lough in particular). This impact could affect the type, quality and extent of suitable habitat available to SCI bird species locally and therefore, the number and range of areas available to the SPAs SCI bird populations and could have effects on their long-term population trends.

Disturbance/displacement

Long-term blasting in the vicinity of Ballindooley Lough could displace SCI listed bird species from this site for one or more winter seasons. Displacing SCI bird species from Ballindooley Lough, an important local site for some of the wintering bird species listed as SCIs for Inner Galway Bay SPA, could potentially negatively affect the long-term population trends of wintering SPA population.

As Galway Bay lies downstream of the Project, and lies within its ZoI, all bird species listed as SCIs for Inner Galway Bay SPA are at risk from impacts associated with the Project: Great northern diver, Cormorant, Grey heron, Light-bellied brent goose, Wigeon, Teal, Red-breasted merganser, Ringed plover, Golden plover, Lapwing, Dunlin, Bar-tailed godwit, Curlew, Redshank, Turnstone, Black-headed gull, Common gull and Common tern. Wetlands are also listed as an SCI and could also be affected by the Project.

Inishmore Island SAC/Kilkieran Bay and Island SAC

In March 2024, since the 2018 NIS, the oral hearing in 2020 and the assessment undertaken by the Inspector appointed by An Bord Pleanála (ABP) documented in ABP's Inspector's report dated 22 June 2021, two cetacean species (Bottlenose dolphin Tursiops truncatus and Harbour porpoise Phocoena phocoena) were added as QIs at 16 existing marine and coastal SAC sites around the Irish marine waters. Due to foraging ranges, cetacean species from nearby European sites could use habitat within Galway Bay and possibly be affected by impacts to water quality within the receiving environment. Inishmore Island SAC and Kilkieran Bay and Island SAC are both designated for Harbour porpoise, and lie c.53.2km southwest and c.41.7km west of the Assessment Boundary, respectively.

Although these SACs lie remote from the Project, there is one indirect impact by which the Project could (in the absence of mitigation) potentially affect the cetacean QI species using Galway Bay:

- Habitat degradation as a result of hydrological impacts

Habitat degradation as a result of hydrological impacts

As noted previously, in the absence of mitigation measures, the Project could affect water quality in Galway Bay (and, therefore, there is a risk that any harbour porpoise from the QI populations of Inishmore Island SAC or Kilkieran Bay and Islands SAC that might use habitat in Galway Bay could be negatively affected). Mitigation measures have been designed to ensure that the water quality in the receiving environment is not affected during construction.

European Sites and Construction-related Traffic

Upon review of the assessment undertaken by the Inspector appointed by An Bord Pleanála (ABP) documented in ABP's Inspector's report dated 22 June 2021, the potential for construction-related traffic to affect European sites associated with the wider existing road network, which, on a precautionary basis, extend south of Galway along the M18, R458 and N67, has been included in this assessment for the following European sites: Lough Corrib SAC, Galway Bay Complex SAC, Lough Corrib SPA, Inner Galway Bay SPA, Ardrahan Grassland SAC, Castletaylor Complex SAC, Cregganna Marsh SPA, Kiltiernan Turlough SAC, Lough Fingall Complex SAC, Rahasane Turlough SPA and Rahasane Turlough SAC.

Potentially significant risks associated with construction related traffic include the following:

- Increased spills and leaks which could contaminate groundwater and/or surface water (i.e. habitat degradation as a result of hydrogeological and/or hydrological impacts)
- Increased generation and deposition of dust and emissions (i.e. habitat degradation as a result of air quality impacts
- The introduction and spread of non-native invasive species (i.e. habitat degradation as a result of introducing/spreading non-native invasive plant species to the surrounding area)

Habitat degradation as a result of hydrological impacts

An increase in construction related traffic on the wider, existing road network could indirectly impact nearby European sites through water-quality related impacts by way of surface runoff.

Habitat degradation as a result of hydrogeological impacts

An increase in construction related traffic on the wider, existing road network could indirectly impact nearby European sites through water-quality related impacts by way of surface run-off to non-tarred areas.

Habitat degradation as a result of air quality impacts

An increase in construction related traffic on the wider, existing road network could indirectly impact nearby European sites through additional emissions.

Habitat degradation as a result of introducing/spreading of non-native plant species

An increase in construction related traffic on the wider, existing road network could result in the introduction and spread of non-native invasive species to nearby European sites.

European Sites and Recreational Pressure

Upon review of the appointed ecologist Dr Arnold's Appropriate Assessment Report [appended (as Appendix 6) to the ABP's Inspector's Report dated 22 June 2021], the potential impact pathway related to increased recreational pressure and the additional European sites in its zone of influence, has been included in the assessment for this updated EIAR. Dr Arnold refers to the impact pathway arising as a result of "*increasing recreational pressure on certain … [European] sites due to increased mobility of an expanding human population*" if "*improvements to the road network bring in additional tourists or indirectly increase the resident population*."

The following European sites are assessed on a precautionary basis for recreational pressure: Lough Corrib SAC, Galway Bay Complex SAC, Lough Corrib SPA, Inner Galway Bay SPA, Ardrahan Grassland SAC, Castletaylor Complex SAC, Maumturk Mountains SAC, The Twelve Bens/Garraun Complex SAC, Connemara Bog Complex SAC, Connemara Bog Complex SPA and Ross Lake and Woods SAC.

The transport modelling for the proposed N6 GCRR was used to assess the potential increase in recreational traffic and its associated potential to give rise to recreational pressures on European sites. This model highlighted a number of roads which will experience a 10% or greater increase in potential recreational trips as a result of the proposed N6 GCRR, including:

- An unnamed local road which forms the boundaries of the townlands of Shantallow, Furzypark, Ballyglass, Fiddaun, Monksfield and Lismoylan, in southern Co. Galway, which lies in proximity to Ardrahan Grassland SAC and Castletaylor Complex SAC
- An unnamed local road in the townlands of Liss, Ballycolgan, Skeaghbeg, Ballybaun, Ballycasey, Kilcoona and Mausrevagh, in northern Co. Galway, which lies in proximity to Lough Corrib SAC and SPA
- An unnamed local road on the eastern edge of Galway City and the townlands of Ardaun, Garraun North and Garraun South which lies in proximity to Inner Galway Bay SPA and Galway Bay Complex SAC
- An unnamed local road in the townlands of Forramoyle West and Forramoyle East which is in proximity to Galway Bay Complex SAC and Inner Galway Bay SPA
- Multiple local roads in and around Galway City, its suburbs and the River Corrib, with Lough Corrib SAC and SPA, Galway Bay Complex SAC and Inner Galway Bay SPA being in close proximity to most of these

No other roads in proximity to European sites within the area of influence of the proposed N6 GCRR were shown to have an increase of 10% or above in recreational traffic. These include Maumturk Mountains SAC, The Twelve Bens/Garraun Complex SAC, Connemara Bog Complex SAC, Connemara Bog Complex SPA and Ross Lake and Woods SAC, which are outside the zone of influence.

The increase in recreational traffic will not pose any risk to the conservation objectives and, therefore, result in any likely significant effects on any European sites in the wider vicinity of Galway City, including those listed in the first three points above, due to the following:

- The unnamed local road which forms the boundaries of the townlands of Shantallow, Furzypark, Ballyglass, Fiddaun, Monksfield and Lismoylan, in southern Co. Galway is greater than 2.8km from the closest European site (Ardrahan Grassland SAC)
- All of the sites in proximity to the above mentioned local road in southern County Galway are privately owned lands and as such open access to the public is not available, thereby, there will be no increase in foot traffic on these sites associated with the Project
- All of these European sites, barring the Galway Bay Complex SAC, Inner Galway Bay SPA and Lough Corrib SAC, are more than 300m from the roads where increased recreational pressure has been modelled, and as such are not at risk of air quality impacts from the increased traffic

Although the Project will contribute to increase recreational pressure in the surrounding supporting road network, the increase will not be significant enough <10%, or where >10% the roads do not provide or facilitate direct access to European sites. The resultant potential for increase in recreational pressure will not

pose any risk to the conservation objectives and will not, therefore, result in any likely significant effects on any European sites in the wider vicinity of Galway. In those circumstances no mitigation measures are required in respect of potential impacts from increased recreational pressure.

European Sites and Potential Deterioration due to Loss of Supporting Habitats/Populations

The additional potential impact pathway related to possible deterioration or decline in European site QIs/SCIs due to loss of supporting habitats/populations as identified by the appropriate assessment undertaken by the Inspector appointed by ABP and appended to ABP's Inspector's Report dated 22 June 2021 is considered in this section of the updated EIAR.

The European sites which are considered in the zone of influence as identified by the Inspector appointed by ABP include: Lough Corrib SAC, Galway Bay Complex SAC, Lough Corrib SPA, Inner Galway Bay SPA, Ardrahan Grassland SAC, Castletaylor Complex SAC, Kiltiernan Turlough SAC, Lough Fingall Complex SAC, Connemara Bog Complex SAC, Connemara Bog Complex SPA, Rahasane Turlough SAC, East Burren Complex SAC, Moneen Mountain SAC, Black Head-Poulsallagh Complex SAC, Gortnandarragh Limestone Pavement SAC and Ross Lake and Woods SAC.

The analysis of this potential impact pathway is fully detailed in Section 9.8 of the updated NIS.

The Project will cause a direct loss or fragmentation of habitat areas within the receiving ecological environment by traversing or cutting through habitat areas. Across the Assessment Boundary this includes a variety of habitat types from natural, semi-natural to improved/managed habitats and developed landscapes, including habitats that correspond with Annex I habitat types. The Project only overlaps with Lough Corrib SAC, at four locations and is therefore the only European site at risk of direct habitat loss or fragmentation effects. The only potential impact identified is the impact related to the loss of habitat with the Lough Corrib SAC. It is however a very discrete area and a limited area within the SAC which will be potentially affected, and none of this limited area is composed of QI Annex I habitat. Design measures, such as the Lackagh Tunnel and the River Corrib Bridge, ensure QI Annex I habitats are retained within the SAC. Therefore as much as there may be some loss of individual plants of typical and positive indicator species, these are outside the SAC and none are critically rare to result in significant effects on the QI habitats and population within the immediate Lough Corrib SAC or similar habitats/populations in the region.

As is described in further detail in Section 9.8 of the NIS, as a result of the incorporation of design measures and with the successful mitigation of potential impacts, there will be no deterioration as a result of loss in supporting habitats / populations that will effect the conservation objectives of European sites within the immediate and local European sites, and as such no mitigation measures are required in respect of potential impacts from loss of supporting habitats or species.

8.5.4.2 Natural Heritage Areas and proposed Natural Heritage Areas

Considering the ZoI of the Project, in the absence of mitigation measures the Project has the potential to have a likely significant effect upon the following NHAs/pNHAs:

- Lough Corrib pNHA
- Moycullen Bogs NHA
- Galway Bay Complex pNHA
- Furbogh Wood pNHA
- Kiltullagh Turlough pNHA
- Ballycuirke Lough pNHA
- Connemara Bog Complex pNHA
- Drimcong Wood pNHA
- Ross Lake and Woods pNHA
- Black Head-Poulsallagh Complex pNHA

- Lough Fingall Complex pNHA
- Rahasane Turlough pNHA
- Gortnandarragh Limestone Pavement pNHA
- Moneen Mountain pNHA
- East Burren Complex pNHA
- Kiltiernan Turlough pNHA
- Castletaylor Complex pNHA
- Turloughcor pNHA
- Inishmore Island pNHA
- Maumturk Mountains pNHA
- The Twelve Bens/Garraun Complex pNHA
- Mason Island Machair pNHA
- Mweenish Island Machair pNHA
- Finish Island Machair pNHA
- Duck Island pNHA
- Inishmuskerry pNHA
- Ardmore Point pNHA
- Eagle Rock pHNA
- Geabhrog island pNHA
- Oilean Na Ngeabhrog (Glencoh Rock) pNHA
- Kinvarra Saltmarsh pNHA
- Oilean Na Ngeabhrog (Illaungurraig) pNHA

The locations of these designated areas for nature conservation relative to the Project, and the predicted ZoI, are shown on Figure 8.17.1.

Moycullen Bogs NHA

Areas of the Moycullen Bogs NHA at Na Foraí Maola Thiar and Lough Inch are either in a separate catchment or down gradient of the Project. Furthermore, the area of the Moycullen Bogs NHA at Tonabrocky lies in a distinct sub catchment to that of the Project. None of these areas will therefore be affected by groundwater drawdown induced from cuttings due to the Project (see Appendix A.8.24). In contrast, the Project lies immediately adjacent to Moycullen Bogs NHA at Tonabrocky. This portion of the NHA consists of a mosaic of Lowland blanket bog (PB3) which included the Annex I habitats Blanket bog [*7130] and *Rhynchosporion* depressions [7150], Wet heath (HH3) which corresponded with the Annex I habitat Wet heath [4010], Transition mire (PF3) which corresponded with the Annex I habitat Transition mires [7140], Dry heath (HH1) which corresponded with the Annex I habitat Dry heath [4030] and Scrub (WS1).

Habitat Degradation – Air Quality

Construction Impacts

Dust emissions associated with construction works could, in extreme circumstances, affect adjoining habitats, potentially burying sensitive habitats or plant species. Best practice construction methodologies (e.g. watering of the construction site/access roads and road cleaning) and mitigation measures (dust screens during construction, see Section 8.6.3) have been designed to minimise construction generated dust and to contain it within the Assessment Boundary.

Operational Impacts

A detailed assessment of the modelled operation nitrogen-based air quality parameters and their ZoI was undertaken for the Project where it passes near to the Moycullen Bogs NHA.

Link 54, Link 57, Link 58, Link 59, Link 60 and Link 61 are in the vicinity of Moycullen Bogs NHA. At Link 57, Link 58, Link 59, Link 60 and Link 61 the ZoI of NO_x, NH_3 and N_{dep} (category 5kg N/ha/yr for relevant Annex I habitats) does not extend to 200m from the proposed edge, nor do these extend to the Moycullen Bogs NHA boundary along these Links of the proposed N6 GCRR (refer Figures 16.1.01 to 16.1.15).

At Link 54, however, Moycullen Bogs NHA lies within 200m of the road edge:

- The critical level for NO_x is 30µg/m^3 for the protection of vegetation, which is not exceeded along the length of Link 54 (not the entire length of the proposed N6 GCRR). NO_x concentrations associated with the operation of the Project pose no risk to vegetation or the conservation of habitats associated with the Moycullen Bogs NHA
- The Air Pollution Information System (APIS) has published critical load range (0.1keq/ha/yr to 1.0keq/ha/yr) for bog habitats. The ZoI for modelled traffic contribution to acid deposition is 40m, and all Blanket bog habitat in Moycullen Bogs NHA at Link 54 is outside the 40m ZoI. Acid deposition associated with the operation of the Project poses no risk to the conservation of bog habitats and their vegetation communities associated with the Moycullen Bogs NHA
- The critical level for NH_3 is >3µg/m^3 for vascular plants and >1µg/m^3 for bryophytes and lichens (IAQM, 2020); neither is exceeded along the length of Link 54. NH_3 concentrations associated with the operation of the Project pose no risk to the conservation on plants associated with the Moycullen Bogs NHA
- The critical loads for N_{dep} vary for different Annex I habitats and were obtained from the EPA Research Report (Aherne *et al.*, 2021) and supported by the habitat-specific critical loads on the APIS website[90]. The N_{dep} critical load for Transition mires [7140], Wet heaths [4010] and Blanket bogs (including active*) [7130], is 5kg N/ha/yr and the ZoI is 10m for Link 54. None of these peatland habitat types occur within Moycullen Bogs NHA and within the N_{dep} ZoI. N_{dep} contributions associated with the operation of the Project pose no risk to the conservation of habitats and vegetation communities associated with the Moycullen Bogs NHA

Conclusion

During operation, air quality impacts from the Project on vegetation within Moycullen Bogs NHA are not likely to occur and will not result in a likely significant negative effect, at any geographic scale.

Habitat Degradation – Non-native Invasive Plant Species

Planting, dispersing, or allowing/causing the dispersal, spread or growth of certain non-native plant species is controlled under Article 49 of the European Communities (Birds and Natural Habitats) Regulations, 2011; and refers to plant or animal species listed on the Third Schedule of those regulations (see also Section 8.3.6.6).

[90] https://www.apis.ac.uk/search-pollutant-impacts

As the Project lies immediately adjacent to the boundary of Moycullen Bogs NHA, the accidental spread of such non-native invasive plant species as a result of construction works has the potential to have long-term impacts upon habitat areas within the NHA; potentially affecting plant species composition, diversity and abundance.

Introducing any of these non-native invasive plant species to Moycullen Bogs NHA has the potential to result in a likely significant negative effect, at a national geographic through affecting habitat area and quality within the NHA. Mitigation measures have been designed to avoid this impact (see Section 8.6.3.6).

Habitat Degradation – Hydrogeology

Areas of Moycullen Bogs NHA at Na Foraí Maola Thiar, Lough Inch, and Tonabrocky are beyond the hydrogeological ZoI of the Project (Figures 10.7.101 to 10.7.115, 10.8.101 to 10.8.115) both in terms of the potential for impacts on groundwater quantity and/or groundwater quality that support the habitats therein.

The only area of Moycullen Bogs NHA that lie in the immediate vicinity of the Project occurs at Letteragh. A detailed hydrogeological/hydrological assessment, see the Eco-hydrogeology Summary Report for Moycullen Bogs NHA (Letteragh) (Appendix A.8.24) concluded that the Project poses no risk of affecting the hydrogeological/hydrological regimes at Moycullen Bogs NHA (Letteragh), and will have no residual direct or indirect groundwater related impacts that could have any likely significant residual effects. A brief summary of this now follows.

The permanent ponds at Moycullen Bogs NHA (Letteragh) result from surface water that collects in low points where granite, the underlying geology of the area, has weathered. Given that granite is of low permeability, connectivity between groundwater and the ponded surface water is slight. Water ponding on the surface at the Moycullen Bogs therefore does not result from groundwater from the bedrock, but instead from water ponded on the top of the bedrock that has saturated the subsoil and which has no natural discharge point, thus breaching the ground surface ("pluvial ponding").

An empirical calculation (Sichardt calculation) based on the vertical extent to which the groundwater table is lowered at the point of groundwater dewatering and permeability, was used to assess the potential for groundwater impacts at the Moycullen Bogs NHA (Letteragh). Even with conservative estimates for vertical lowering and permeability, the assessment showed that groundwater levels will not be lowered beyond the maximum conservative drawdown. Moreover, a geophysical survey, as well as drilled boreholes, were both undertaken to prove the depth to bedrock, which confirmed that the bedrock at the Letteragh cutting is either at or consistently close to the surface, and that groundwater levels will not be lowered beyond the maximum conservative drawdown.

Therefore, the Project cannot impact on any habitats or species within Moycullen Bogs NHA as a consequence of any impacts on the existing hydrogeological regime and is not likely to have a significant effect on the NHA in that regard.

Habitat Degradation – Surface Water Quality

During construction, contaminated surface water runoff and/or an accidental spillage or pollution event has the potential to have a significant negative effect on habitats and species in the adjoining Moycullen Bogs NHA. The effects of frequent and/or prolonged pollution events in a peatland complex have the potential to be extensive and far-reaching and could potentially have significant long-term effects.

However, it is considered unlikely that a pollution event of such a magnitude would occur during construction, or be any more than temporary in nature. Nevertheless, a precautionary approach is being taken in assuming a level of risk of water quality impacts. Consequently, detailed mitigation measures have been designed to further minimise the risk of the Project having any perceptible effect on habitat quality in Moycullen Bogs NHA during construction (see Section 8.6.2).

Habitat degradation as a consequence of construction effects on surface water quality has the potential to affect the peatland habitat complex, and the species it supports in Moycullen Bogs NHA and therefore, has the potential to result in a significant negative effect.

Overall, in the absence of mitigation the Project has the potential to affect the integrity of, and therefore have a significant negative effect on, Moycullen Bogs NHA as a result of air quality, non-native invasive plant

species and surface water quality impacts during construction, potentially at the national geographic scale at which this receptor is valued.

Lough Corrib pNHA

In relation to Lough Corrib pNHA, the potential impact pathways connecting the Project to the pNHA site are also as per those presented above in Section 8.5.4.1 and in the updated NIS for Lough Corrib SAC and Lough Corrib SPA. However, the zone within which the Project directly interacts with Lough Corrib pNHA is much smaller than that associated with Lough Corrib SAC, and only includes the main river channel and banks. As the Project has the potential, in the absence of mitigation measures, to adversely affect the integrity of Lough Corrib SAC and Lough Corrib SPA, it also has the potential to affect the integrity of, and therefore have a significant negative effect on, Lough Corrib pNHA.

Galway Bay Complex pNHA

In the case of Galway Bay Complex pNHA, which is remote from the Project, the potential impact pathways connecting the Project to Galway Bay are as presented and assessed in the updated NIS for Galway Bay Complex SAC and Inner Galway Bay SPA (and summarised in Section 8.5.4.1 above). As the Project has the potential to adversely affect the integrity of Galway Bay Complex SAC and Inner Galway Bay SPA, and hence the receiving marine environment in Galway Bay, it also has the potential to have a significant negative effect on Galway Bay Complex pNHA.

Cregganna Marsh pNHA

Potential impacts of the Project on Cregganna Marsh pNHA have been assessed in Section 8.5.4.1 and the updated NIS as this pNHA is contained within the boundary of Cregganna Marsh SPA. Potential impacts include effects from construction-related traffic in proximity to the wider road network (e.g. N67). Potentially significant risks associated with construction related traffic include the risk of habitat degradation as a result of hydrological/hydrogeological impacts (as a result of contamination of surface and groundwaters), habitat degradation as a result of air quality impacts (e.g. deposition of dust and emissions) and habitat degradation as a result of the introduction and/or spread of non-native invasive species to the surrounding environment.

Connemara Bog Complex pNHA, Ross Lake and Woods pNHA, Lough Fingall Complex pNHA, Rahasane Turlough pNHA and Kiltiernan Turlough pNHA

Potential impacts on Connemara Bog Complex pNHA, Ross Lake and Woods pNHA, Lough Fingall Complex pNHA, Rahasane Turlough pNHA and Kiltiernan Turlough pNHA have been assessed in Section 8.5.4.1 and the updated NIS owing to the fact that these pNHA sites are contained within the boundaries of associated SACs/SPAs. Potential impacts include potential increase in recreational pressure associated with the operation of the Project and potential loss of supporting habitats/populations of typical species and positive indicator species.

Castletaylor Complex pNHA

Potential impacts of the Project on Castletaylor Complex pNHA have been assessed in Section 8.5.4.1 and the updated NIS as this pNHA is contained within the boundary of Castletaylor Complex SAC. Impacts include effects from construction-related traffic in proximity to the wider road network (M18), potential increase in recreational pressure associated with the operation of the Project and potential loss of supporting habitats/populations of typical species and positive indicator species. Potentially significant risks associated with construction related traffic include the risk of habitat degradation as a result of hydrological/hydrogeological impacts (as a result of contamination of surface and groundwaters), habitat degradation as a result of air quality impacts (e.g. deposition of dust and emissions) and habitat degradation as a result of the introduction and/or spread of non-native invasive species to the surrounding environment.

Black Head- Poulsallagh Complex pNHA, Gortnandarragh Limestone Pavement pNHA, Moneen Mountain pNHA and East Burren Complex pNHA

Potential impacts on Black Head- Poulsallagh Complex pNHA, Gortnandarragh Limestone Pavement pNHA, Moneen Mountain pNHA and East Burren Complex pNHA have been assessed in Section 8.5.4.1 and the updated NIS owing to the fact that these pNHA sites are contained within the boundaries of

associated SACs/SPAs. Impacts include the potential loss of supporting habitats/populations of typical species and positive indicator species.

Furbogh Wood pNHA, Kiltullagh Turlough pNHA, Ballycuirke Lough pNHA, Drimcong Wood pNHA and Turloughcor pNHA

In relation to Furbogh Wood pNHA, Kiltullagh Turlough pNHA, Ballycuirke Lough pNHA, Drimcong Wood pNHA and Turloughcor pNHA, there is the potential for the Project to affect these pNHA sites as a result of construction-related traffic due to their proximity to the wider road network (i.e. N84, N59, R339 and R336). Potentially significant risks associated with construction related traffic include the risk of habitat degradation as a result of hydrological/hydrogeological impacts (as a result of contamination of surface and groundwaters), habitat degradation as a result of air quality impacts (e.g. deposition of dust and emissions) and habitat degradation as a result of the introduction and/or spread of non-native invasive species to the surrounding environment.

Inishmore Island pNHA

Potential impacts of the Project on Inishmore Island pNHA have been assessed in Section 8.5.4.1 and the updated NIS as this pNHA is contained within the boundary of Inishmore Island SAC. Impacts include the potential for habitat degradation as a result of hydrological impacts and the Projects' potential to affect water quality in Galway Bay (within which QI populations of harbour porpoise associated with this site may occur).

Maamturk Mountains pNHA and The Twelve Bens/ Garraun Complex pNHA

Potential impacts on Maamturk Mountains pNHA and The Twelve Bens/Garraun Complex pNHA have been assessed in Section 8.5.4.1 and the updated NIS owing to the fact that these pNHA sites are contained within the boundaries of associated SACs. Potential impacts include potential increase in recreational pressure associated with the operation of the Project.

Mason Island Machair pNHA, Mweenish Isladn Machair pNHA, Finish Island Machair pNHA, Duck Island pNHA, Inishmuskerry pNHA, Ardmore Point pNHA, Geabhrog Island pNHA, Oilean Na Ngeabhrog (Glencoh Rock) pNHA, Kinvarra Saltmarsh pNHA, Oilean Na Ngeabhrog (Illaungurraig) pNHA and Eagle Rock pNHA

Mason Island Machair pNHA, Mweenish Isladn Machair pNHA, Finish Island Machair pNHA, Duck Island pNHA, Inishmuskerry pNHA, Ardmore Point pNHA, Geabhrog Island pNHA, Oilean Na Ngeabhrog (Glencoh Rock) pNHA, Kinvarra Saltmarsh pNHA, Oilean Na Ngeabhrog (Illaungurraig) pNHA and Eagle Rock pNHA all overlap with the boundary of Kilkieran Bay and Islands SAC. Habitat degradation effects as a result of hydrological impacts (i.e. the potential for the Project to affect water quality in Galway Bay (within which QI populations of harbour porpoise associated with this site may occur) has been assessed in Section 8.5.4.1 and the updated NIS. Given the absence of potential impact pathways there is no risk to island, machair, terrestrial or coastal habitats, or supported bird species in the overlapping SPA, for which these pNHAs may be designated for and impacts in that regard can therefore be excluded at this stage.

The Project also has the potential to affect biodiversity in a broader sense than just the QIs/SCIs of designated sites. Where biodiversity receptors in such sites do not form part of the QIs/SCIs in the updated NIS assessment, they are considered under the other individual impact assessment headings for each KER below.

8.5.5 Habitats

This section assesses the potential impact of the Project on habitats. Its focus is on habitat impacts outside designated areas for nature conservation which are discussed separately in Section 8.5.4, and detailed in the updated NIS.

In terms of quantifying the magnitude of effects for both Annex I and non-Annex I habitats, the estimated percentage of the local habitat resource being affected is based upon the total area of a given habitat type that was recorded within the Scheme Study Area, regardless of whether it was within a designated area for nature conservation or not. This provides some local context as to the magnitude of the habitat loss and whether the impact is significant or not, and at what geographic scale.

8.5.5.1 Construction Phase Impacts

Habitat Loss & Fragmentation

Since the 2018 EIAR, there have been minor changes in the extents of habitat loss, due to modifications to the Project detailed in Chapter 5 of this updated EIAR, changes in land usage, and natural changes in the landscape (e.g., scrub encroachment).

The construction of the Project will result in habitat loss across its length, totalling c. 287ha. Some of the habitat types directly affected are considered to be of International/National importance, given their priority Annex I/Annex I status under the Habitats Directive. In the western part of the study area the Annex I habitats affected are Dry heaths [4030], Wet heath [4010], *Molinia* meadows [6410] and Blanket bog (active) [*7130]. The section of the River Corrib crossed by the Project is classified as the Annex I Vegetation of flowing waters [3260] habitat. East of the River Corrib the Annex I habitat types affected are Limestone pavement [*8240], Calcareous grassland [6210], Residual alluvial forests [*91E0], Turloughs [*3180], Petrifying springs [*7220] and *Molinia* meadows [6410]. These cover an area of c.10.9ha.

Other habitat types considered to be of a Local Importance (higher value) will also be lost as a result of the Project. These include hedgerows (WL1), treelines (WL2), sections of stream/river channel (FW1), eutrophic lakes (FL5), calcareous springs (FP1), grasslands (GS1, GS2, GS3, GS4 and GM1), fen and flush (PF2), woodlands (WD1, WD2, WD3, and WN2) and scrub (WS1). These cover an area of c. 87.7ha[91].

The remaining areas of habitat within the Assessment Boundary (c.188ha) are made up of habitats of a Local Importance (lower value). This is primarily made up c.70ha of Improved agricultural grassland (GA1), c.34ha of Buildings and artificial surfaces (BL3), c.15ha of Spoil and bare ground (ED2), c.19ha of Dry calcareous and neutral grassland (GS1), c.14ha of Dense bracken (HD1), c.11ha of residential properties, c.6ha of Wet grassland (GS4), c.5ha of Dry meadows and grassy verges (GS2) and c.8ha of Amenity grassland (improved) (GA2). There is also c. 21km of Stone walls and other stonework (BL1). Flower beds and borders (BC4), Recolonising bare ground (ED3), Exposed siliceous rock (ER1), Exposed calcareous rock (ER2), Other artificial lakes and ponds (FL8), Dry-humid acid grassland (GS3), Scattered trees and parkland (WD5), and Ornamental/non-native shrub (WS3) make up the remainder.

In all cases where landholdings have been severed by the Project, access is being provided to the severed lands or in some instances the severed lands are required to facilitate the construction and operation of the Project. Therefore, it is assumed that land use practices, for example abandonment of grazing and/or mowing, will continue as they are at present as there is no reason to suggest otherwise over the short to long term, and can be seen in some areas since the 2018 EIAR.

The various KER habitat types affected, and the areas involved, are summarised below in Table 8.35. These calculations include all KER habitat areas within the Assessment Boundary, as the possibility of areas within the Assessment Boundary but outside of the footprint of the Project itself being affected by construction activities cannot be ruled out.

Habitat loss may also lead to habitat fragmentation in many instances; creating new divisions of existing habitat blocks or contributing to an existing trend of fragmenting semi-natural habitat blocks, as has been happening to some areas of upland habitat in the western part of the study area, as a result of other development.

Habitat fragmentation can lead to isolation of habitat units and affect how ecosystems function, their resilience to change and, with regard to species, affect interactions within or between populations, population density or species richness. The project has been designed (through use of bridges, culverts, mammal passageways and tunnels) to maintain the significant ecological corridors such as the River Corrib and local streams and the natural and semi-natural habitats associated with designated sites, reducing fragmentation of the more significant local ecological areas.

[91] Although some of the local importance habitat types (both higher and lower value) will be directly affected within Lough Corrib SAC (e.g. WD1, WN2 and BL3) none of these habitat types are QIs, or support QI habitats or species, and losses of these habitat types within Lough Corrib SAC will not affect the site's conservation objectives

In the assessment below, where reference areas are used to calculate the percentage habitat loss of areas of Local Importance (higher value) these include areas that correspond with Annex I habitat types (where applicable).

The mitigation measures that have been designed to avoid or reduce the effects of direct impacts to habitats are in Section 8.6.3.

Table 8.35 KER Habitat Types within the Assessment Boundary

Habitat Type	Extent[92]
International Importance	
Active Blanket Bog [*7130]	c.0.01ha
Wet heath/Dry heath/Active Blanket Bog [4010/4030/*7130]	c.0.01ha
Turlough [*3180]	One (c.0.04 ha of c.0.11ha is within Assessment Boundary)
Petrifying springs [*7220]	Six features
Limestone pavement [*8240]	c.2.73ha[93]
Limestone pavement/Calcareous grassland mosaic [*8240/6210]	c.0.03ha
Residual alluvial forests [*91E0]	c.0.14ha
National Importance	
Vegetation of flowing waters [3260]	c.0.52ha
Wet heath [4010]	c.2.72ha
Wet heath/Dry heaths mosaic [4010/4030]	c.0.96ha
Dry heaths [4030]	c.1.76ha
Wet heath/Dry heath/Molinia meadow[4010/4030/6410]	c.0.45ha
Calcareous grassland [6210]	c.0.25ha
Molinia meadow [6410]	c.1.03ha
Local Importance (higher value)	
Calcareous springs (FP1)	29 features
Reed and large sedge swamps (FS1)	c.0.12ha
Eroding/upland rivers (FW1)	c.120m of Sruthán na Líbeirtí c.220m of the Trusky Stream c.140m of the Bearna Stream (and tributary) c.475m of the Tonabrocky Stream see Section 8.5.5.3 for more details on FW1

[92] This includes either a measure of habitat area (ha), linear length of habitat lost (m/km), or a total number of point features affected (e.g. spring/seepage sites), as appropriate

[93] Some of the Limestone pavement habitat within the Assessment Boundary lies within Lough Corrib SAC – some of which also included areas of Calcareous grassland [6210] in a mosaic

Habitat Type	Extent[92]
Drainage ditches (FW4)	c.0.08ha
Marsh (GM1)	c.0.42ha
Dry calcareous and neutral grassland (GS1)	c.16.51ha
Dry calcareous and neutral grassland/Scrub mosaic (GS1/WS1)	c.4.89ha
Dry meadows and grassy verges (GS2)	c.9.68ha
Dry-humid acid grassland (GS3)	c.5.24ha
Wet grassland (GS4)	c.9.47ha
Rich fen and flush (PF1)	c. 0.2ha
Poor fen and flush (PF2)	c.1.3ha
(Mixed) broadleaved woodland (WD1)	c.4.6ha
Mixed broadleaved/conifer woodland (WD2)	c.0.04ha
(Mixed) conifer woodland (WD3)	c.0.01ha
Oak-ash-hazel woodland (WN2)	c.3.37ha
Scrub (WS1)	c.27.73ha
Scrub/Dry meadows and grassy verges (WS1/GS2)	c.2.92ha
Scrub/Oak-ash-hazel woodland/ Exposed calcareous rock (WS1/WN2/ER2)	c.0.74ha
Hedgerows (WL1)	c.10.64km
Treelines (WL2)	c.5.58km

Habitat Degradation – Surface Water Quality

During construction, contaminated surface water runoff and/or an accidental spillage or pollution event into any surface water feature has the potential to have a significant negative impact on water quality and consequently affect aquatic and wetland habitats in the receiving environment. The effects of frequent and/or prolonged pollution events in a river system have the potential to be extensive and far-reaching and could potentially have significant long-term effects. In a worst-case scenario, estuarine and coastal habitats downstream could also be affected.

However, it is considered unlikely that a pollution event of such a magnitude would occur during construction, or be any more than temporary in nature. Nevertheless, a precautionary approach is being taken in assuming a level of risk of water quality impacts. Consequently, detailed mitigation measures are required to further minimise the risk of the Project having any perceptible effect on water quality during construction.

Habitat degradation as a consequence of construction effects on surface water quality has the potential to affect the conservation status of aquatic, wetland or estuarine/marine habitats and therefore, has the potential to result in a significant negative impact.

The mitigation measures that have been designed to avoid or reduce the potential impacts of the Project on surface water quality are presented in Section 8.6.3.4.

Habitat Degradation – Hydrological Regime

Construction works at the watercourse crossings along the Project can have a temporary impact on the flow and flooding regime locally. None of these are predicted to have any long-term effects that would give rise to a likely significant negative effect on any aquatic habitats or species through effects on the hydrological regime (for more detail refer to Section 11.5 of Chapter 11, Hydrology).

Habitat Degradation – Groundwater

Any effects on the existing hydrogeological baseline supporting lakes, turloughs, and wetland or peatland habitats has the potential to negatively impact upon habitat extent and distribution, and vegetation structure and composition. The potential effects of impacting upon the existing hydrogeological regime are not necessarily limited to habitats within the Assessment Boundary but can be far-reaching, with significant negative long-term effects[94].

There will be no impacts to groundwater recharge rates during construction that will have any effect on biodiversity receptors. All groundwater intercepted by construction works will be managed and discharged within the same GWB and will remain within the surface water catchment that they would naturally have been received by. The groundwater recharge rate will not change in the Galway Granite Batholith aquifer (the area west of the N59 Moycullen Road) with only a temporary minor increase in the recharge rate (between 0.1m and 0.4m) in the Visean Undifferentiated Limestone aquifer (the area east of the N59 Moycullen Road). Although there will be some loss of aquifer volume in the Galway Granite Batholith aquifer and the Visean Undifferentiated Limestone aquifer, it will have an imperceptible impact on the groundwater resource (for more detail refer to Section 10.5 of Chapter 10, Hydrogeology).

During construction, deep excavations or tunnelling are likely to interact with groundwater. As a consequence, construction works have the potential to affect groundwater levels from construction dewatering or drawdown associated with excavations. There is also the potential that construction works could impact on groundwater flow paths or conduits, potentially affecting groundwater dependant or supported habitats and/or species. There is also a higher risk of impacts to groundwater quality through contaminated surface water runoff and/or an accidental spillage or pollution. As above in relation to surface water features, impacts on the groundwater could potentially have a significant negative effect on biodiversity.

Based on the findings of the hydrogeological impact assessment in Chapter 10, Hydrogeology, the Project does not pose a risk to the groundwater supply to Ballindooley Lough. Nor does it pose a risk of affecting the turlough features at Menlough (c.320m northwest of Ch. 10+100 of the proposed N6 GCRR), at Ballinfoyle c.190m south of Ch. 12+100, and at Ballindooley c.400m north of the N84 Headford Road Junction.

The Project does however, have the potential to affect the groundwater supply to the Coolagh Lakes (which form part of the Lough Corrib SAC) and the turlough located between Bóthar Nua and Seanbóthar (Ch. 10+320 of the proposed N6 GCRR). Although the magnitude of the impact cannot be fully quantified, on a precautionary basis it is assessed as having the potential to affect water levels at these features and thereby, affect the supported aquatic and wetland habitats. The assessment of impacts relating to European sites are discussed separately in Section 8.5.3.1 and detailed in the updated NIS.

The proposed Menlough Viaduct will be constructed over the Turlough located between Bóthar Nua and Seanbóthar (Ch. 10+320 of the proposed N6 GCRR). Although none of the supporting piers will be located within the Turlough, there is the potential for construction works to affect the supporting hydrogeological regime.

Habitat degradation as a consequence of construction effects on the existing groundwater resource and regime has the potential to affect the conservation status of groundwater dependant aquatic or wetland habitats and species and therefore, has the potential to result in a significant negative impact.

A more detailed description of how the Project could affect the existing hydrogeological regime during construction is presented in Chapter 10, Hydrogeology.

[94] The potential hydrogeological ZoI of the Project is shown on Figures 10.7.101 to 10.7.115, 10.8.101 to 10.8.115

The mitigation measures that have been designed to avoid or reduce the potential impacts of the Project on groundwater are presented in Section 8.6.5.

Habitat Degradation – Air Quality

As discussed above in Section 8.5.5.3, the Project has the potential to generate dust during construction works which could affect vegetation in habitat areas adjacent to the Assessment Boundary. Mitigation measures have been designed to contain dust emissions during construction (see Section 8.6.3.3).

Habitat Degradation – Non-native Invasive Plant Species

Planting, dispersing, or allowing/causing the dispersal, spread or growth of certain non-native plant species is controlled under Article 49 of the European Communities (Birds and Natural Habitats) Regulations, 2011; and refers to plant or animal species listed on the Third Schedule of those regulations (see also Section 8.6.3.6).

The accidental spread of such non-native invasive plant species as a result of construction works has the potential to impact upon terrestrial habitats[95]; potentially affecting plant species composition, diversity and abundance over the long-term. This is not only confined to habitats within and immediately adjacent to the Assessment Boundary but includes habitat areas along the network of proposed haul routes associated with the Project (Figure 7.101 to 7.124).

The effects of introducing such non-native invasive plant species to highly sensitive and ecologically important habitat areas (e.g. designated area for nature conservation or areas of Annex I habitat) have the potential to result in a likely significant negative effect, at geographic scales ranging from local to international. Mitigation measures have been designed to avoid this potential impact (see Section 8.6.3.6).

Habitat Degradation – Tunnelling/Excavation

Tunnelling works or deep excavations have the potential to affect the structural integrity of the ground above a tunnel excavation, or that of the ground immediately adjacent to a deep cutting/excavation. This in turn can affect the habitats present.

This potential impact is only likely to arise in the habitats present within Lough Corrib SAC and either above the proposed Lackagh Tunnel or immediately adjacent to the cutting associated with the western approach to same. At this location, the overlying/adjoining habitats within Lough Corrib SAC comprise a mosaic of wooded Limestone pavement [*8240], scrub covered Limestone pavement [*8240], exposed Limestone pavement [*8240], and Calcareous grassland [6210]. All of these habitat types are QI habitats of Lough Corrib SAC. This assessment is discussed separately in Section 8.5.4.1 and detailed also in the updated NIS.

8.5.5.2 Operational Phase Impacts

Habitat Degradation – Surface Water Quality

During operation, there will be drainage outfalls to all river/stream catchments crossed by the Project. Therefore, there is a risk that discharges from the road drainage network could affect water quality, potentially over the long-term, and consequently impact upon aquatic/wetland habitats. In a worst-case-scenario, this could result in long-term effects upon habitat extent and distribution, vegetation structure and composition.

The proposed drainage design consists of a petrol interceptor followed by attenuation and constructed wetland (where drainage will be discharged to the existing surface water/drainage network) as described in detail in Chapter 5, Project Description of this updated EIAR. The drainage design, along with the design of any culverts associated with the Project and any stream/river realignments, also ensures that during operation there will not be any perceptible impacts on the functioning of the existing hydrological regime (e.g. flood risk, flow rates or river morphology).

[95] Non-native invasive aquatic plant species (or fauna species) were not recorded in the aquatic habitats which will be impacted by construction works

Habitat degradation as a consequence of operational effects on surface water is not predicted to affect the conservation status of any aquatic, wetland or estuarine/marine habitats and will therefore, not result in a likely significant effect, at any geographic scale.

Habitat Degradation – Groundwater

There will be no impacts to groundwater recharge rates during construction that will have any effect on biodiversity receptors as all groundwater intercepted by the road drainage will be discharged to the same GWB. The infiltration basins will lead to local increases in the groundwater levels but overall there will be no net change to the groundwater resource.

There will be no active dewatering, of the bedrock aquifer, required during the operation phase but passive dewatering, of the bedrock aquifer, will occur at a number of cutting locations and the drainage associated with the Project will cause the groundwater levels to adjust locally. This impact on the hydrogeological regime has the potential to affect the conservation status of groundwater dependant aquatic or wetland habitats and species and therefore, has the potential to result in a significant negative impact.

Impacts to groundwater quality could be caused by discharging contaminated road runoff to ground or where leachate/runoff from limestone fill could affect the pH of acidic groundwater along the western section of the Project.

The proposed drainage design for the proposed N6 GCRR consists of a petrol interceptor followed by attenuation and infiltration ponds (where discharging to ground) - as described in detail in Chapter 5, Project Description. The functioning and effectiveness of the proposed road drainage network are discussed in more detail in Chapter 11, Hydrology. The drainage design, including the design of the infiltration basins, minimises the risk of a pollution event during operation affecting groundwater quality. Risk of spillage is low (<0.5%) and any impacts that do accidentally occur will be temporary. However, it is important that they are inspected to ensure that karst features do not affect the functioning of the infiltration basins during operation. If this is identified during routine inspections of the infiltration basins then mitigation is required to ensure any issues are addressed so that they continue to function as designed over the design life of the Project

Decommissioning of the existing wells within Galway Racecourse will change the groundwater flow regime on a local scale. The project hydrogeologist considered that as these wells are proposed to be replaced by new wells in different locations to the existing wells the impact of moving the zone of contribution will be Negligible in relation to the overall integrity of the aquifer.

Local impacts to the local water chemistry, in terms of pH change, may apply where limestone derived alkaline material is placed over granite bedrock. Surface water run-off, interflow or groundwater movements through such material has the potential to impact local areas of peatland habitats by changing the pH of the recharge water particularly where this alkaline material is saturated (below the groundwater table). This potential impact will only apply to adjacent peatland habitats within hydrogeological Zone of influence of the Project. The use of limestone based road material for the pavement and capping layers does not pose such a risk as these layers will be protected from direct surface water and groundwater infiltration and are located in the unsaturated zone above the groundwater table. This protection is provided by the road bitumen surface and the use of native topsoil capping along the grass verge and embankment sections of the Project. Restriction on the use of limestone derived formation material will apply locally to road sections in the vicinity of peatland habitats within the granite bedrock area (west of the existing N59 Moycullen Road).

A more detailed description of how the Project could affect the existing hydrogeological regime during construction is presented in Chapter 10, Hydrogeology.

The mitigation measures that have been designed to avoid or reduce the potential impacts of the Project on groundwater are presented in Section 8.6.3.5.

Habitat Degradation – Shading

There are two elevated structures associated with the Project which will have some level of shading effect on the habitats beneath during operation: the proposed River Corrib Bridge (Ch. 8+850 to Ch. 9+500 of the proposed N6 GCRR) and the proposed Menlough Viaduct (Ch. 10+100 to Ch. 10+420 of the proposed N6 GCRR). The retaining wall along the southern edge of the proposed road carriageway between Ch. 9+840

and Ch. 10+025 of the proposed N6 GCRR also has the potential to cause a shading effect on adjacent habitats. Shading effects include both a reduction in sunlight and a reduction in direct precipitation reaching plants beneath the bridge structure, affecting species communities, diversity and distribution. This potential impact will only arise in situations where habitats are being retained beneath the structure, as opposed to where habitats will be permanently lost as a result of construction works.

Habitat Degradation – Non-native Invasive Plant Species

Given the presence of non-native invasive plant species listed on the Third Schedule of the European Communities (Birds and Natural Habitats) Regulations, 2011 in the immediate vicinity of the Project, there is the potential that these species will recolonise vegetated areas within the Assessment Boundary post-construction. As such, there is a risk that routine maintenance works may inadvertently spread contaminated vegetation cuttings.

The effects of introducing such non-native invasive plant species to highly sensitive and ecologically important habitat areas (e.g. designated areas for nature conservation or areas of Annex I habitat) have the potential to result in a significant negative effect, at geographic scales ranging from local to international. Mitigation measures have been designed to avoid this potential impact (see Section 8.6.3.6).

Habitat Degradation – Air Quality

At no point along the proposed N6 GCRR and the surrounding habitats is the NO_x critical level of 30µg/m^3 exceeded during the Design Year (2046: ranges from 8.9µg/m^3 to 23.5µg/m^3). Therefore, NO_x contributions associated with the operation of the Project will not result in any likely significant effects, at any geographic scale, on vegetation or associated habitats along the entirety of the proposed N6 GCRR.

At no point within Link 50, Link 53, Link 54, Link 57, Link 58, Link 59, Link 60 and Link 61 of the proposed N6 GCRR and the surrounding habitats is the NH_3 critical level of 3µg/m^3 exceeded during the Design Year (2046: ranges from 0.8µg/m3 to 2.72µg/m^3). NH_3 contributions from the Project will not result in any likely significant effects, at any geographic scale, on conservation of vascular species composition or associated habitats surrounding the proposed N6 GCRR at these Links (ref Figures 16.1.01 to 16.1.15).

The NH_3 critical level of 3µg/m^3 is exceeded the in Link 51 and Link 52; however, the NH_3 levels drop below the critical level of 3µg/m^3 at 10m from the road. The 10m buffer at these two Links does not extend beyond the Assessment Boundary. All the retained Annex I habitats within the Assessment Boundary of these two Links are outside the 10m ZoI and their vascular plant communities will not be affected by the NH_3 emissions. NH_3 contributions from the Project will not result in any likely significant effects, at any geographic scale, on vascular species composition or associated habitats surrounding the proposed N6 GCRR at these two Links.

In the absence of any likely significant effects on plant species or habitats, NO_x and the NH_3 critical levels for vascular plants are not further assessed in the habitat-based impact assessments that follow. The habitat-based assessment that follows considers potential impacts to habitats from:

- NH_3>1µg/m^3 (Bryophyte and lichen critical levels) contributions
- N_{dep} contributions where the habitat has a relevant critical load assigned
- Acid deposition contribution for bog habitats only, for which APIS has published critical load (ranges from 0.1keq/ha/yr to 1.0keq/ha/yr depending on the plant species composition and acidification of drainage water)[96]

[96] [96] https://www.apis.ac.uk/search-pollutant-impacts

8.5.5.3 Impact Assessment on Habitats

Turloughs [*3180]

Turloughs (FL6) which corresponds with this Annex I habitat type

The structure proposed for the Menlough Viaduct passes over the Turlough at Ch. 10+320 of the proposed N6 GCRR and avoids any direct impacts. This retention of the Turlough habitat in this area is captured in the mitigation strategy (Section 8.6) and shown on Figure 8.22.7. Construction and the long-term presence of the piers, whilst not located within the Turlough, they are situated immediately adjacent to it, pose a risk to the supporting hydrogeological regime and may affect both the functioning of the Turlough and the vegetation community present. Construction works also pose a pollution risk to groundwater and surface water quality.

The presence of groundwater conduits connecting the infiltration ponds at Ch. 10+650 to Ch. 10+800 of the proposed N6 GCRR to the Turlough, and also in relation to the infiltration ponds at Ballindooley Lough (Ch. 12+200 of the proposed N6 GCRR) is unknown. If groundwater conduits do connect road drainage to the turlough there is the potential for impacts which could affect the vegetation composition and diversity.

Accidentally introducing non-native invasive plant species into turlough habitat could also increase the extent and magnitude of road effects, degrading the habitat quality; as could dust deposition during construction.

One Turlough habitat occurs within 200m of, and adjacent to, the road edge within Link 53 (Ch. 10+300 of the proposed N6 GCRR (refer Figures 16.1.01 to 16.1.15)).

The critical level for NH_3 is >1µg/m^3 for bryophytes and lichens (IAQM, 2020), which has a 40m ZoI in Link 53. The Turlough will likely be affected by loss of bryophyte and lichen species within the ZoI through operational air quality impacts by way of elevated NH_3 concentration.

Turlough habitat critical load for N_{dep} is greater than/equal to 10kg N/ha/yr (Aherne *et al*., 2021; APIS website), which has a 30m ZoI in Link 53. The Turlough habitat (extent and distribution) will not be lost as the habitat is delineated by its hydrogeological characteristics, but the vegetation composition of the Turlough and its supporting fringing habitats will likely be affected within this ZoI and the quality of the Turlough habitat (vegetation composition, structure and zonation) will likely be impacted by nitrogen enrichment from N_{dep} contributions associated with the operation of the Project.

There is therefore a risk that the Project could result in the loss of turlough habitat, or have long-term effects on plant species composition. Such an impact would constitute a negative effect on conservation status[97] and result in a likely significant negative effect, at the international geographic scale.

Blanket bog (active) [*7130]

Lowland blanket bog (PB3) which corresponds with this Annex I habitat type

Blanket bog corresponding to the Annex I habitat active blanket bog was recorded at two locations within the Assessment Boundary. This habitat forms mosaics with dry heath (HH1) and wet heath (HH3).

An area of blanket bog of c. 93m^2 corresponding with the Annex I habitat at the Foraí Maola Thiar area, at Ch. 1+400 of the proposed N6 GCRR will be permanently lost as a direct result of construction works or through indirect hydrogeological effects. This area occurs in a mosaic with dry heath (HH1) habitat, which accounts for 35% of the area covered by the mosaic (i.e. 50m^2 of a total area of 143m^2). A further 94m^2 of

[97] The methodology for determining effects on the conservation status on Annex I habitats at a national level is assessed under the headings of range, area, structure & function, and future prospects (NPWS 2013c, 2013d, 2013e). Under the area criterion, any loss of habitat area with respect to the Favourable Reference Range (FRA) results in the habitat moving from Favourable conservation status (if that is the baseline condition) to either Inadequate or Bad. If the baseline condition is either Inadequate or Bad, then additional habitat loss is adding to an existing decline and potentially inhibiting efforts to maintain or restore Annex I habitats at favourable conservation status at a national level. The FRA for any of the Annex I habitat types affected by the proposed N6 GCRR are either estimates based on partial data, or values much greater than the current area based upon a statistically robust estimate—generally to account for historic losses or impacts Since the Habitats Directive came into force in 1994. The FRA are also not spatially defined. In applying the precautionary principle, due to the absence of a clearly defined FRA, the loss of any area of Annex I habitat is considered to be affecting conservation status at the geographic scale at which the particular Annex I habitat has been valued.

The same assessment methodology also applies when assessing conservation condition at a site level.

blanket bog habitat will be lost from the Foraí Maola Thiar area, at Ch. 0+900 of the proposed N6 GCRR. This habitat occurs in a mosaic with dry heath (HH1) and wet heath (HH3) habitat. However, as this area of habitat extends beyond the Assessment Boundary, for the purposes of the impact assessment, it is assumed that in the mosaic of blanket bog, Dry heath and Wet heath, all habitats affected in are blanket bog, and the area lost is also accounted for in the wet heath/dry heath summary below.

In the context of the total area of these Annex I habitat types recorded within the Scheme Study Area, the areas lost represent approximately 0.0002%. However even the areas of lowland blanket bog habitat recorded within the Scheme Study Area are only likely to represent a proportion of the actual local lowland blanket bog habitat resource[98]. Therefore, the actual percentage of habitat loss is likely to be much smaller.

The two areas of lowland blanket bog occur at the edges of two separate areas of peatland habitat mosaics. Therefore, habitat fragmentation is not likely to effect the habitat or the peatland habitat complex overall.

Accidentally introducing non-native invasive plant species could also increase the extent and magnitude of road effects on lowland blanket bog, degrading the habitat quality; as could an accidental pollution event or dust deposition during construction.

Blanket bog occurs within 200m of the road edge along Link 54, Link 60 and Link 61, northern side of the proposed N6 GCRR (ref Figures 16.1.01 to 16.1.15).

The critical level for NH_3 is >1µg/m^3 for bryophytes and lichens (IAQM, 2020). At no point along these Links of the proposed N6 GCRR do Blanket Bogs fall within the ZoI (no ZoI for Link 54 and Link 60 and a 10m ZoI for Link 61) for NH_3. NH_3 contributions associated with the operation of the Project will not result in any likely significant effects, at any geographic scale, on bryophytes and lichens associated with the Blanket bog habitats across the Project.

The N_{dep} critical load for Blanket bog is greater than/equal to 5kg N/ha/yr (Aherne *et al.*, 2021; APIS website). At no point along these Links of the proposed N6 GCRR do Blanket Bogs fall within the ZoI (10m ZoI for Link 54 and Link 60 and a 20m ZoI for Link 61) for N_{dep}. N_{dep} contributions associated with the operation of the Project will not result in any likely significant effects, at any geographic scale, on Blanket bog habitats across the Project.

The Air Pollution Information System (APIS) has published critical loads[99] (0.1keq/ha/yr to 1.0keq/ha/yr) for bog habitats, including Blanket bogs[100]. The calculated background level for acid deposition is 0.09keq/ha/yr, very near the lower limit of the critical load range for bogs. When added to the modelled traffic contribution, this exceeds the lower critical load level beyond 200m from the road edge. The contribution from the Project drops below the Critical load at 40m for Link 54 and Link 60, and 30m for Link 61 and at no point along these Links of the proposed N6 GCRR do Blanket bogs fall within these ZoI for acid deposition. Acid deposition contributions from the operation of the Project will not result in any likely significant effects, at any geographic scale, on Blanket bogs.

Despite the relatively small area of habitat loss, considering the likely effects and ongoing pressures on these habitat types locally, the loss of any area of this Annex I habitats constitutes a negative effect on conservation status. Therefore, the loss of Lowland blanket bog habitat associated with the Project will result in a likely significant negative effect, at the national geographic scale.

[98] Based upon a review of available orthophotography for the km grid square M22 (which covers the western part of the Scheme Study Area), approximately 40km^2 of upland habitats are likely to be present but are not described or mapped. These are likely to be a mosaic of heath and bog habitats.

[99] Deposition flux of an air pollutant below which significant harmful effects on sensitive ecosystems do not occur, according to present knowledge (IAQM, 2020).

[100] https://www.apis.ac.uk/search-pollutant-impacts

Petrifying springs [*7220]

Calcareous springs (FP1) which corresponds with this Annex I habitat type

Six Calcareous springs corresponding with the Annex I habitat Petrifying springs [*7220] were recorded in Lackagh Quarry (see Figure 8.22.8).

Five of these six Petrifying spring features have been recorded to the north of the Assessment Boundary, two along the north face of Lackagh Quarry and three along the west face. One Petrifying spring was recorded south of the Assessment Boundary along the east face of Lackagh Quarry.

The most southerly of the Petrifying springs along the western face of Lackagh Quarry lies c.25m north of the proposed N6 GCRR at Ch. 11+400 of the proposed N6 GCRR, and lies within the area where rock stabilisation measures are required as part of the construction of the eastern entrance to the Lackagh Tunnel (see Chapter 9, Soils and Geology). Although no impacts are predicted as a result of any effects on the existing hydrogeological regime during construction or operation (refer to Chapter 10, Hydrogeology), the installation of rock stabilisation measures here could potentially directly impact on this Petrifying spring and result in the permanent loss of this feature. There are three other Petrifying spring features which lie within areas where material deposition areas will have direct impacts and result in the permanent loss of these features (LQ113a, LQ113b, LQ123).

Loss of Petrifying spring features, as priority Annex I habitats, has the potential to result in a significant negative effect at the national or international geographic scales but only where habitat impacts would affect the habitat's conservation status at those levels. In order for habitat area loss to affect a habitat's favourable conservation status at a national level, it must affect the national favourable reference area (FRA), as this is the reference value against which the area parameter is measured in the context of assessing conservation status.

The national FRA for this habitat type is defined as a minimum of 0.1379km^2 and a maximum of 0.1549 km^2 in NPWS (2019b) and it notes therein that "*Although some small losses of habitat area may have occurred since the Directive came into force, and during the current reporting period, the magnitude of the decline is thought to be small. It is unlikely that >10% of the resource has been lost since 1994. Most changes are likely to be relating to condition, rather than area. Thus the Favourable Reference Area is set as ≈ the current area.*".

The current FRA is based upon the data presented in NPWS (2019b) and the 10km grid square within which the Petrifying springs affected by the Project are located (M32) is within the current Favourable Reference Range (FRR) of this habitat type. Although the FRR and distribution of this habitat type in 2018 did not include the 10km grid square M32, it is assumed that the inclusion of M32 in the 2019 FRR and distribution for Petrifying springs habitat is due to the Petrifying spring habitat recorded in Lackagh Quarry as part of the 2015 survey undertaken for the proposed N6 GCRR, presented in the 2018 EIAR.

Despite the fact that the Project will result in the loss of four Petrifying spring features in Lackagh Quarry, it will not affect the national FRA or FRR (as reported in NPWS, 2019b) for Petrifying spring habitat as the spring features affected were only recorded in 2023 and, therefore, could not form part of the national FRA reported by the NPWS in 2019. As two petrifying spring features are being retained in Lackagh Quarry, the loss of four Petrifying spring features will not affect the FRR, or the national distribution, of the habitat as the 10km grid square M32 will retain Petrifying spring habitat. Furthermore, and as evidenced by the increase in Petrifying spring habitat features in Lackagh Quarry between 2015 and 2023, it's likely that Petrifying spring features will continue to develop on retained cliff faces in the quarry over time. Therefore, their loss cannot affect the conservation status of this habitat type at either the national or international geographic scales.

There is little data available as to the current number of Petrifying spring sites at the county level. However, considering the restricted range of this habitat type in County Galway (based upon the data presented in NPWS, 2019b) it is likely that the number of sites is restricted and the loss of even four Petrifying springs is likely to be a significant negative effect, at the county geographic scale.

Residual alluvial forests [*91E0]

Wet willow-alder-ash woodland (WN6) which corresponds with this Annex I habitat type

The Project will result in the permanent loss of c.0.14ha of Residual alluvial forest habitat. This equates to c.0.73% of this Annex I habitat type mapped within the Scheme Study Area. Although, given the expanse of unsurveyed wet woodland habitat present along the River Corrib and on the shores of Lough Corrib to the north of the Scheme Study Area, this percentage figure is likely to be an overestimate of the loss of Residual alluvial forest habitat locally.

Habitat degradation as a result of effects on the existing hydrogeological regime during construction and operation have the potential to affect areas of Residual alluvial forest that form an element of the wetland habitats supported by the Coolagh Lakes.

Accidentally introducing non-native invasive plant species could also increase the extent and magnitude of potential impacts due to the Project; as could an accidental pollution event affecting the River Corrib, the Coolagh Lakes or Ballindooley Lough.

Alluvial woodland occurs within 200m of the road edge within Link 53 of the proposed N6 GCRR (ref Figures 16.1.01 to 16.1.15).

The critical level for NH_3 is >1µg/m^3 for bryophytes and lichens (IAQM, 2020). The ZoI for Link 53 is 40m and at no point does Alluvial woodland fall within the ZoI for NH_3. NH_3 contributions associated with the operation of the Project will not result in any likely significant effects, at any geographic scale, on bryophytes and lichens associated with the Alluvial woodland across the Project.

The N_{dep} critical load for Alluvial woodland is greater than/equal to 10kg N/ha/yr (Aherne *et al.*, 2021; APIS website). At no point along Link 53 does Alluvial woodland fall within the 30m ZoI for N_{dep}. N_{dep} contributions associated with the operation of the Project will not result in any likely significant effects, at any geographic scale, on Alluvial woodland across the Project.

Despite the relatively small area of habitat loss, the loss of any area of this priority Annex I habitat constitutes a negative effect on conservation status. Therefore, the loss of Residual alluvial forest habitat associated with the Project will result in a likely significant negative effect, at the international geographic scale.

Wet heath [4010] & Dry heaths [4030]

Dry siliceous heath (HH1) and Wet heath (HH3) which corresponds with this Annex I habitat type

Wet heath and Dry heaths are assessed together, as both habitat types generally form intricate mosaics with one another in areas affected by the Project. From Bearna to Ballagh (Ch. 0+000 to Ch. 8+300 of the proposed N6 GCRR) a total of c.4.94ha of heathland habitats will be permanently lost as a direct result of construction works or through indirect hydrogeological or air quality effects: c.1.76ha of Dry heaths, c.2.72ha of Wet heath[101], c.0.96ha of Dry heaths/Wet heaths mosaic, c.0.45ha of Wet heath/*Molinia* meadow/Dry heath mosaic[102] between Ch. 2+920 and Ch. 3+040 (in the ratio of 82/15/3%, respectively).

In the context of the total area of these Annex I habitat types recorded within the Scheme Study Area, the areas lost represent c.3.0%. However even the areas of heath habitat recorded within the Scheme Study Area are only likely to represent a proportion of the actual local heathland habitat resource[103]. Therefore, the actual percentage of habitat loss is likely to be much smaller.

[101] This c.2.72ha of Wet heath habitat includes an area of *c*.1.78ha that lies within the proposed development boundary and will be directly impacted, and an *additional* c.0.94ha that lies outside of the Assessment Boundary but within the hydrogeological and air quality ZoI.

[102] This c.0.45ha of Wet heath/*Molinia* meadow/Dry heath mosaic habitat includes an area of c.0.43ha that lies within the Assessment Boundary and will be directly impacted, and an *additional* c.0.02ha that lies outside of the Assessment Boundary but within the hydrogeological ZoI

[103] Based upon a review of available orthophotography for the km grid square M22 (which covers the western part of the Scheme Study Area), c.40km^2 of upland habitats are likely to be present but are not described or mapped. These are likely to be a mosaic of heath and bog habitats.

The Project will also increase the fragmentation of heathland habitats; although the affected habitat blocks are already isolated from the larger more cohesive areas to the north at Na Foraí Maola, Lough Inch, Cappagh, Tonabrocky and Ballagh which will be unaffected.

Habitat degradation as a result of effects on the existing hydrogeological regime during construction and operation is also likely to affect the areas of Wet heath along the Project. The construction hydrogeological ZoI will be temporary and is not predicted to have long-term effects on its own. However, the operational hydrogeological ZoI (in the context of groundwater drawdown effects) extends beyond the Assessment Boundary to include additional areas of heathland habitat. This is not likely to have any long-term effects on areas of Dry heath, but Wet heath habitats is likely to dry out to some degree, with decreasing effect from the road edge. As it is not possible to quantify the effects of the predicted groundwater drawdown of Wet heath habitat condition, a precautionary approach is being taken in assuming any Wet heath habitat within the operational hydrogeological ZoI will be permanently lost. For the purposes of the impact assessment, it is also assumed that in a mosaic of Dry heath and Wet heath that all habitat affected in this way is Wet heath (a worst-case approach as Dry heath is not likely to be affected by the effects of operational groundwater drawdown). The area of potential Wet heath habitat within this zone is c.0.94ha. The likelihood is that the species composition will change to resemble more of a Dry heath habitat type. Peatland habitats within the hydrogeological ZoI could be affected by groundwater pH change and mitigation measures will be implemented to avoid this impact.

Accidentally introducing non-native invasive plant species into heath areas could also increase the extent and magnitude of road effects on these habitat types, degrading the habitat quality; as could an accidental pollution event or dust deposition during construction.

Dry heath

Dry heath occurs within 200m of the road edge within Link 53, Link 54, Link 58, Link 59, Link 60 and Link 61 of the Proposed N6 GCRR (refer Figures 16.1.01 to 16.1.15).

The critical level for NH_3 is >1µg/m^3 for bryophytes and lichens (IAQM, 2020). Dry heath habitat areas within the ZoI includes:

- Three habitats in the 20m ZoI at Link 58 between ~Ch. 4+750 and 5+100

The presence of bryophytes and non-crustose lichens is a criteria listed for the vegetation composition of Dry heaths (Perrin *et al*., 2014). The vegetation composition of the western-most of the three habitat areas (Ch. 4+750 of the proposed N6 GCRR to the north) (9.14m^2) will likely be affected by the proposed N6 GCRR due to operational air quality impacts by way of elevated NH_3 concentration affecting the presence of bryophyte and lichen species.

The remaining two habitats lie north (between Ch. 4+900 and 4+950 of the proposed N6 GCRR) and south (between Ch. 5+000 and 5+050) of the proposed N6 GCRR. As per the TII (2022) guidelines these two receptors were investigated by way of more detailed modelled air quality data along transects extending away from the road edge and taking into consideration the road elevations at these transect locations. Considering the elevation of the proposed road, and the results of the air quality modelling, there is no ZoI for NH_3 >1µg/m^3 to the north of the proposed N6 GCRR. To the south, the ZoI reduces from 20m to 10m, reducing the ZoI to the Assessment Boundary.

Other than the loss of the western-most fragment of Dry heath, there is no Dry heath habitat that intersects the ZoI for NH_3 along the length of the proposed N6 GCRR. NH_3 contributions associated with the operation of the Project will not result in any likely significant effects, at any geographic scale, on bryophytes and lichens associated with the remaining Dry heath habitats across the Project.

The N_{dep} critical load for Dry heath is greater than/equal to 7.5kg N/ha/yr (Aherne *et al.*, 2021; APIS website). Dry heath habitat areas within the ZoI includes:

- Three habitats in the 20m ZoI at Link 58 between Ch. 4+750 and 5+100 of the proposed N6 GCRR

The western-most of the three habitat areas (Ch. 4+750 of the proposed N6 GCRR to the north) (9.14m^2) will likely be altered by the nitrogen enrichment from the elevated N_{dep} contributions to an extent that may cause the habitat to lose its Annex I habitat characteristic.

The remaining two habitats lie north (between Ch. 4+900 and 4+950) and south (between Ch. 5+000 and 5+050) of the proposed N6 GCRR. As per the TII (2022) guidelines these two receptors were investigated by way of more detailed air quality modelling data along transects extending away from the proposed road edge and taking into consideration the proposed road elevations at these transect locations. Considering the elevation of the proposed N6 GCRR, and the results of the air quality modelling at these transects, there is no ZoI for N_{dep}>=7.5 north or south of the proposed N6 GCRR.

Other than the loss of the western-most fragment of Dry heath, no Dry heath outside the Assessment Boundary will be impacted by nitrogen enrichment through N_{dep} contributions associated with the operation of the Project.

Wet heath

Wet heath occurs within 200m of the road edge within Link 53, Link 54, Link 58, Link 59, Link 60 and Link 61 (ref Figures 16.1.01 to 16.1.15).

The critical level for NH_3 is >1μg/m^3 for bryophytes and lichens (IAQM, 2020). Wet heath habitat within the ZoI includes:

- One habitat in the 20m ZoI at Link 58 between Ch. 5+050 and 5+100, south of the proposed N6 GCRR
- One habitat in the 20m ZoI at Link 59 between Ch. 2+950 and 3+050, extending south of the proposed N6 GCRR and outside the Assessment Boundary and northwards within the Assessment Boundary, encompassing a part of a retained Wet heath habitat

Bryophytes contribute to vegetation composition of Wet heaths in terms of moss cover and, along with non-crustose lichens, as positive indicator species (Perrin *et al*., 2014). Mosses also inform vegetation structure of Wet heaths in terms of cover and signs of burning (Perrin *et al*., 2014). The vegetation composition and structure of the Wet heath habitat at Link 58 (315.87m^2) will have its vegetation composition and structure potentially affected by the proposed N6 GCRR air quality impacts by way of elevated NH_3 concentration affecting bryophyte and lichen communities.

As per the TII (2022) guidelines the Wet heath habitat straddling Link 59 was investigated by way of more detailed air quality modelling data along transects extending north and south from the road edge and taking into consideration the proposed road elevations at these transect locations. Considering the elevation of the proposed road, and the results of the air quality modelling, the ZoI in the north and south reduces from 20m to 10m, reducing the ZoI to the Assessment Boundary in the south and avoiding the retained Wet heath habitat in the north.

Other than the loss of the Wet heath at Link 58, there is no Wet heath habitat that intersects the ZoI for NH_3 along the length of the proposed N6 GCRR. NH_3 contributions associated with the operation of the Project will not result in any likely significant effects, at any geographic scale, on bryophytes and lichens associated with the remaining Wet heath habitats across the Project.

The N_{dep} critical load for Wet heath is greater than/equal to 5kg N/ha/yr (Aherne *et al.*, 2021; APIS website). Wet heath habitat areas within the ZoI includes:

- One habitat in the 40m ZoI at Link 58 between Ch. 5+050 and 5+100, south of the proposed N6 GCRR
- Three habitats in the 50m ZoI at Link 59 between Ch. 2+950 and 3+800

The Wet heath habitat (315.87m^2) in Link 58 and the Wet heath habitat (218.49m^2) in Link 59, at Ch. 3+500 of the proposed N6 GCRR to the south, will have their vegetation composition and structure altered by the proposed N6 GCRR, and air quality impacts by way of nitrogen enrichment through N_{dep} contributions.

As per the TII (2022) guidelines the remaining two habitat receptors in Link 59 were investigated by way of detailed air quality modelling data along transects extending away from the proposed road edge and taking into consideration the proposed road elevations at these transect locations. Considering the elevation of the proposed road for the habitat straddling Link 59 between Ch. 2+950 and 3+050:

- The ZoI to the south changes from 50m to 20m reducing the extent of the Wet heath within the ZoI (150.74m^2). This area of Wet heath will have its vegetation composition and structure altered through

groundwater impacts and air quality impacts by way of nitrogen enrichment through N_{dep} contributions affecting the habitat.

- To the north the ZoI will be reduced to 40m and will remain within the Assessment Boundary but will contribute to the nitrogen enrichment of a part of the retained Wet heath habitat.

Three areas of Wet heath habitats outside the Assessment Boundary, all within the hydrogeology ZoI, and a part of a retained Wet heath habitat within the Assessment Boundary will be impacted by N_{dep} contributions from traffic emissions. The composition and structure of the vegetation at these Wet heath habitats is likely to be affected by nitrogen enrichment.

The remaining Wet heath habitats outside the Assessment Boundary will not be impacted by air quality related impacts.

Despite the relatively small area of habitat loss, and that the areas that will be lost are a multitude of small, isolated habitat patches, considering the likely effects and ongoing pressures on these habitat types locally, the loss of any area of these Annex I habitats constitutes a negative effect on conservation status. Therefore, the loss of Wet heath and Dry heath habitat associated with the Project will result in a likely significant negative effect, at the national geographic scale.

Calcareous grassland [6210]

Dry calcareous and neutral grassland (GS1) which corresponds with this Annex I habitat type

The Project will result in the permanent loss of c.0.25ha of Calcareous grassland habitat: c.0.09ha at Lackagh Quarry (Ch. 11+750 of the proposed N6 GCRR), four small patches between Ch. 12+000 and Ch. 12+220 of the proposed N6 GCRR (totalling c.0.16ha. In the context of the total area of Calcareous grassland habitat recorded within the Scheme Study Area, the areas lost represent c.0.6%. The Calcareous grassland habitat affected is the non-priority variant [6210] and as such, is valued as being of national importance.

There is also some Calcareous grassland habitat present in a mosaic with Limestone pavement within the boundary of Lough Corrib SAC and, as assessed in the updated NIS, it is not directly impacted by the Project (this is captured in the mitigation strategy and shown on Figure 8.22.7 as habitat areas to be retained).

All of the affected areas are small, isolated grassland patches and therefore, the Project will not have any significant fragmentation impacts on Calcareous grassland habitat locally.

Accidentally introducing non-native invasive plant species into Calcareous grassland habitat could also increase the extent and magnitude of road effects, degrading the habitat quality; as could an accidental pollution event or dust deposition during construction.

Calcareous grassland occurs within 200m of the proposed road edge around Coolagh Junction, and within Link 50, Link 51, Link 52 and Link 53 (refer Figures 16.1.01 to 16.1.15).

The critical level for NH_3 is >1µg/m^3 for bryophytes and lichens (IAQM, 2020). At no point along Link 51, Link 52 and Link 53 do Calcareous grasslands fall within the ZoI (110m ZoI for Link 51, 70m ZoI for Link 52 and 40m ZoI for Link 53) for NH_3. NH_3 contributions associated with the operation of the Project will not result in any likely significant effects, at any geographic scale, on bryophytes associated with the Calcareous grassland habitats along these links.

At Link 50, south of the interchange in the eastern extent of the Project:

- Three Calcareous grassland habitats occur within the 100m ZoI, two west of the junction and one south of the junction.

These three Calcareous grassland habitats at Link 58 will have their vegetation characteristics altered through the potential air quality impacts by way of elevated NH_3 concentration affecting bryophyte and lichen communities. Bryophytes are listed as positive indicator species (not high-quality positive indicator species), along with herbs and grasses for Calcareous grasslands. Therefore, loss of bryophytes will only affect the vegetation quality but will not affect the habitat significantly enough to change the status of the Calcareous grassland habitat.

The N_{dep} critical load for Calcareous grassland is greater than/equal to 10kg N/ha/yr (Aherne *et al.*, 2021; APIS website). At no point along Link 51, Link 52 and Link 53 do Calcareous grassland fall within the ZoI (30m ZoI for Link 50 and Link 53, 40m ZoI for Link 51 and Link 52) for N_{dep}. Nd_{ep} contributions associated with the operation of the Project will not result in any likely significant effects, at any geographic scale, on Calcareous grasslands along these Links.

Despite the relatively small area of habitat loss, and that the areas that will be lost are a multitude of small, isolated habitat patches, considering the likely effects and ongoing pressures on Calcareous grassland habitat locally, the loss of any area of this Annex I habitat constitutes a negative effect on conservation status. Therefore, the loss of the non-priority Calcareous grassland habitat associated with the Project will result in a likely significant negative effect, at the national geographic scale.

Molinia meadow [6410]

Wet grassland (GS4) which corresponds with this Annex I habitat type

The Project will result in the permanent loss of c.1.03ha of Molinia meadow habitat: an area of c.0.09ha at Na Foraí Maola (Ch. 0+900 of the proposed N6 GCRR) and c.0.93ha at the southern end on the Ballindooley Lough wetland complex (Ch. 12+250 to Ch. 12+400 of the proposed N6 GCRR). An additional area of c.0.43ha of Molinia meadow habitat will be lost which occurs in a mosaic with wet heath and dry heath habitats at Ballard West (Ch. 2+900 to Ch. 3+050 of the proposed N6 GCRR).

In the context of the total area of *Molinia* meadow habitat recorded within the Scheme Study Area, the areas lost represent c.6%. Although as noted above for the heath habitats, given the local expanse of unsurveyed upland habitat present to the north of the Scheme Study Area this percentage figure is likely to be an overestimate of the loss of *Molinia* meadow habitat locally.

The *Molinia* meadow at Na Foraí Maola is an isolated patch with no existing connectivity to other semi-natural habitat sites across the Project, largely due to the existing local road network and residential development. Therefore, habitat fragmentation effects are not likely to arise. The *Molinia* meadow affected at Ballindooley is at the very southern end of the wetland complex which itself is an isolated wetland ecosystem. Therefore, habitat fragmentation is not likely to affect the habitat or the wetland complex overall.

Habitat degradation as a result of effects on the existing hydrogeological regime during operation is also likely to affect the areas of *Molinia* meadow along the Project. The operational hydrogeological ZoI (in the context of groundwater drawdown effects) extends beyond the Assessment Boundary to include two small additional areas of *Molinia* meadow habitat to be lost. This habitat is likely to dry out to some degree, with decreasing effect from the proposed road edge. As it is not possible to quantify the effects of the predicted groundwater drawdown of *Molinia* meadow habitat condition, a precautionary approach is being taken in assuming any *Molinia* meadow habitat within the operational hydrogeological ZoI will be permanently lost. As with heath habitat mosaics described above, for the purposes of the impact assessment, it is also assumed that in a mosaic of *Molinia* meadow, Dry heath and Wet heath, all habitat affected in this way is *Molinia* meadow and Wet heath (a worst-case approach as Dry heath is not likely to be affected by the effects of operational groundwater drawdown). The area of potential *Molinia* meadow habitat within this zone is c.0.03ha.

Accidentally introducing non-native invasive plant species into *Molinia* meadow habitat could also increase the extent and magnitude of road effects, degrading the habitat quality; as could an accidental pollution event or dust deposition during construction.

One Molinia meadow occurs within 200m of the proposed road edge along Link 52, northern side of the proposed N6 GCRR (refer Figures 16.1.01 to 16.1.15).

The critical level for NH_3 is >1µg/m^3 for bryophytes and lichens (IAQM, 2020). Molinia meadow within the ZoI includes:

- One habitat in the 70m ZoI at Link 52 between Ch. 12+150 and 12+400

The ZoI is within the Assessment Boundary and intersects part of a retained Molinia meadow habitat.

As per the TII (2022) guidelines this habitat receptor was investigated by way of detailed air quality modelling data along a transect extending away from the proposed road edge and taking into consideration

the proposed road elevation at this location. Considering the elevation of the road, and the results of the air quality modelling, the ZoI for NH_3 >1µg/m^3 reduces from 70m to 20m which excludes the retained Molinia meadow habitat within the Assessment Boundary. NH_3 contributions associated with the operation of the Project will not result in any likely significant effects, at any geographic scale, on bryophytes and lichens associated with the Molinia meadow across the Project.

The N_{dep} critical load for Molinia meadow is greater than/equal to 10kg N/ha/yr (Aherne *et al*., 2021; APIS website). At no point along Link 52 of the proposed N6 GCRR does Molinia meadow fall within the 40m ZoI for N_{dep}. N_{dep} contributions associated with the operation of the Project will not result in any likely significant effects, at any geographic scale, on Molinia meadow across the Project.

Despite the relatively small areas of habitat loss, considering the likely effects and ongoing pressures on *Molinia* meadow habitat locally the loss of any area of this Annex I habitat constitutes a negative effect on conservation status. Therefore, the loss of Molinia meadow habitat associated with the Project will result in a likely significant negative effect at the national geographic scale.

Limestone pavement [*8240]

Exposed calcareous rock (ER2), Oak-ash-hazel woodland (WN2) and Scrub (WS1) which corresponds with this Annex I habitat type

There is c.2.76ha of Limestone pavement habitat present within the Assessment Boundary. This figure includes c.0.03ha of Limestone pavement/Calcareous grassland mosaic above the Lackagh Tunnel. Of this c.2.76ha, c.2.31ha lies outside of the boundary of Lough Corrib SAC. The remainder lies within the boundary of Lough Corrib SAC and, as assessed in the updated NIS, is not directly or indirectly impacted by the Project (this is captured in the mitigation strategy and shown on Figures 8.38.7 to 8.38.8 as habitat areas to be retained).

Therefore, the Project has the potential to affect c.2.31ha of Limestone pavement habitat which lies within the Assessment Boundary, and outside of Lough Corrib SAC. In the context of the total area of Limestone pavement habitat recorded within the Scheme Study Area (c.187.90ha), the areas lost represent c.1.5%. Other areas of Limestone pavement habitat, outside of the area covered by the habitat surveys, have been mapped locally to the north of Menlough Village near Coolanillaun and Angliham Quarry (Natura, 2005) which cover an area of c.22ha. Adding this marginally reduces the percentage loss to c.1.3%.

The design of the Project includes for a culvert structure to span over c.0.04ha of exposed Limestone pavement (LPE) at Ch. 10+030. This will ensure that this area of Limestone pavement is not permanently removed, the natural clint and grike structure of the pavement area is retained, and does not affect its area, or range at any geographic scale. However, some level of vegetation removal is likely to be required to facilitate construction of the culvert, and the resulting shading effects of the structure (c.4.5m high and c.30m wide, over c.68% of this habitat patch) will likely affect the extent and species composition of the vegetation cover beneath the structure, reducing the quality of the Limestone pavement habitat remaining. However, in the context of the overall area of Limestone pavement habitat present locally (c.209.9ha, of which the area partially beneath the culvert represents <0.02%), affecting the quality of such a small area is preferable than loss of the area entirely and reduces the magnitude of the impact the Project will have on this habitat type.

The Menlough Viaduct passes over c.0.97ha of Limestone pavement habitat between Ch. 10+100 and Ch. 10+475 of the proposed N6 GCRR; the construction of which is likely to affect the habitats beneath through vegetation removal during site clearance, habitat loss, and shading from the viaduct structure during operation. The affected habitat areas include c.0.22ha of wooded Limestone pavement (LPW) west of Bóthar Nua (Ch. 10+100 of the proposed N6 GCRR) and, between Bóthar Nua and Seanbóthar (Ch. 10+130 to Ch. 10+475 of the proposed N6 GCRR), c.0.07ha of LPE and c.0.67ha of LPW. The construction methodology described in the constructability report in Appendix A.7.2, will ensure that construction impacts will only be temporary for the majority of this area due to the limestone pavement protection system that will be used. Use of this protection system will result in any vegetation beneath it being supressed for the duration of construction. Although some level of vegetation is likely to recolonise when the temporary protection system is removed, this will be inhibited by the shading effects of the viaduct structure and the existing species composition is not likely to fully re-establish itself. The area of Limestone pavement that will be permanently lost to the supporting piers is c.0.05ha. Although the viaduct will reduce the quality of Limestone pavement habitat remaining, as above, the area affected is relatively small in the context of the

local habitat resource (c.0.5%) and retaining, rather than the permanent loss of, Limestone pavement habitat reduces the magnitude of the impact the Project will have on this habitat type.

The other Limestone pavement areas within the Assessment Boundary, but outside of Lough Corrib SAC, is a total area of c. 1.3ha. 0.67ha of this habitat was recorded on either side of the Menlough Viaduct (Ch. 9+825 to Ch. 10+150, and Ch. 10+500 to Ch. 10+600 of the proposed N6 GCRR). A further 0.62ha of this habitat was recorded at Doughiska between Ch. 15+900 and Ch. 16+250 of the proposed N6 GCRR, with the remaining area recorded around Lackagh Quarry (at Ch. 11+100 and Ch. 11+500 of the proposed N6 GCRR). Construction works are likely to result in either the loss of, or significant damage to, these Limestone pavement habitat areas.

There is also c.0.44ha of Limestone pavement and Calcareous grassland within Lough Corrib SAC which lie above the proposed Lackagh Tunnel. Although this habitat area will not be directly affected by the Project, tunnelling beneath it poses a risk to the structural integrity of the rock mass that supports surface above and therefore, could affect these Annex I habitats. This is assessed further in the updated NIS.

An additional small area (c.0.01ha) of Wooded Limestone pavement and Limestone pavement/Calcareous grassland habitat mosaic occurs within Lough Corrib SAC between Ch. 9+950 and Ch. 10+025 of the proposed N6 GCRR.

In terms of habitat fragmentation, the only area of Limestone pavement outside of Lough Corrib SAC that will be bisected by the Project is that beneath the Menlough Viaduct. As this structure will be elevated on piers across its length (between Ch. 10+100 to Ch. 10+425 of the proposed N6 GCRR), and substantial areas of this habitat type remain on either side, the Project will not have any significant fragmentation impacts on Limestone pavement habitat locally.

Accidentally introducing non-native invasive plant species into Limestone pavement habitat areas could also increase the extent and magnitude of road effects on these habitat types, degrading the habitat quality; as could an accidental pollution event or dust deposition during construction. Limestone pavement occurs within 200m of the proposed road edge around proposed Coolagh Junction, and within Link 50, Link 51, Link 52 and Link 53 (ref Figures 16.1.01 to 16.1.15). The assessment of Limestone pavements within the Lough Corrib SAC is detailed in the updated NIS and the summary findings are included in Section 8.5.4.1 of this updated EIAR. Only Limestone pavement habitats outside the Lough Corrib SAC are evaluated below.

The critical level for NH_3 is >1μg/m^3 for bryophytes and lichens (IAQM, 2020). Limestone pavement habitats within the ZoI includes:

- One Limestone pavement area in the 100m ZoI at Link 50 east of Ch. 17+500 of the proposed N6 GCRR
- Three Limestone pavement areas in the 100m ZoI at the junction south of Link 50
- One Limestone pavement area in the 110m ZoI at Link 51 between Ch. 16+150 and 16+200 of the proposed N6 GCRR to the east
- Three retained Limestone pavement areas within the Assessment Boundary, within the 110m ZoI at Link 51 between Ch. 16+100 and 16+250 of the proposed N6 GCRR to the west
- Four areas of Limestone pavement within the 70m ZoI at Link 52 between Ch. 13+200 and 13+550:
  - As per the TII (2022) air quality guidelines the three areas of Limestone pavement in Link 52 were investigated by way of a detailed modelled air quality data along transects extending away from the proposed road edge and taking into consideration the proposed road elevations at these transect locations. Considering the depth of the road, and the results of the modelled air quality transects, the ZoI disappears at Ch. 13+550 (one Limestone pavement area is removed from the ZoI), and the ZoI at approx. Ch. 13 +300 is reduced to 60m (two Limestone pavement areas are removed from the ZoI), leaving only one Limestone pavement area within the ZoI at Link 52 (between Ch. 13+250 and 13+300 of the proposed N6 GCRR).
- Eleven areas of Limestone pavement intersect the 40m ZoI in Link 53 between Ch. 9+850 and 10+550 of the proposed N6 GCRR

- Two areas of Limestone pavement intersect the 40m ZoI in Link 53 near the western portal of the Lackagh tunnel (near Ch. 11+050 and between Ch. 11+100 and 11+200 of the proposed N6 GCRR to the south):
  - As per the TII (2022) air quality guidelines the latter two areas of Limestone pavement in Link 53 were investigated by way of detailed air quality modelling data along transects extending away from the proposed road edge and taking into consideration the proposed road elevations at these transect locations. Considering the depth of the proposed road, and the results of the air quality modelling, there is no ZoI for NH_3 >1µg/m^3 and these two habitat units will not be impacted by NH_3 contributions from the Project.

NH_3 concentrations will not affect the habitat extent or distribution which is based on the limestone substrate. The quality of the habitat by way of species richness (bryophytes and lichens, but more specifically bryophytes listed as indicators of local distinctiveness) may be affected within the Limestone pavement areas within the ZoI, but the species composition within the overall Limestone pavement habitats will not be compromised in terms of bryophyte and lichen species which will persist outside of the ZoI. NH_3 contributions associated with the operation of the Project may cause very localised changes to habitat quality by way of bryophyte and lichen species richness, only in the Limestone areas within the ZoI and poses no risk to the conservation of bryophytes associated with the remaining Limestone pavement habitats across the Project.

The N_{dep} critical load for Limestone pavement is greater than/equal to 7.5kg N/ha/yr (Aherne *et al.*, 2021; APIS website). Limestone pavement habitats within the ZoI includes:

- Two Limestone pavement areas in the 70m ZoI at the junction south of Link 50
- One Limestone pavement area in the 80m ZoI at Link 51 between Ch. 16+150 and 16+200 of the proposed N6 GCRR to the east
- Three retained Limestone pavement areas within the Assessment Boundary, within the 80m ZoI at Link 51 between Ch. 16+100 and 16+250 of the proposed N6 GCRR to the west
- Two areas of Limestone pavement within the 60m ZoI at Link 52 between Ch. 13+250 and 13+550 of the proposed N6 GCRR:
  - As per the TII (2022) air quality guidelines the three areas of Limestone pavement in Link 52 were investigated by way of detailed air quality monitoring along transects extending away from the proposed road edge and taking into consideration the proposed road elevations at these transect locations. Considering the depth of the proposed road, and the results of the air quality modelling, the ZoI disappears at Ch. 13+550 (one Limestone pavement area is removed from the ZoI), and the ZoI at Ch. 13 +300 is reduced to 50m (reducing the extent of the remaining Limestone pavement within the ZoI at Link 52 (between Ch. 13+250 and 13+300 of the proposed N6 GCRR).
- Eleven areas of Limestone pavement intersect the 40m ZoI in Link 53 between at Ch. 9+850 and 10+550
- Two areas of Limestone pavement intersect the 40m ZoI in Link 53 near the western portal of the Lackagh tunnel (near Ch. 11+050 and between Ch. 11+100 and 11+200 of the proposed N6 GCRR to the south).
  - As per the TII (2022) air quality guidelines the latter two areas of Limestone pavement in Link 53 were investigated by way of detailed air quality modelling along transects extending away from the road edge and taking into consideration the road elevations at these transect locations. Considering the depth of the proposed road, and the results of the air quality modelling, the ZoI for N_{dep} reduces to 20m or less and both Limestone pavement areas are removed from the ZoI.

N_{dep} contributions will not affect the habitat extent or distribution which is based on the limestone substrate. The quality of the habitat by way of species richness and composition may be affected by nitrogen enrichment within the Limestone pavement areas within the ZoI, but the species composition with the overall Limestone pavement habitats will not be compromised outside of the ZoI. N_{dep} contributions associated with the operation of the Project may cause very localised changes to habitat quality by way of species

composition, only in the Limestone areas within the ZoI and poses no risk to the conservation of the remaining Limestone pavement habitats across the Project.

Despite the relatively small area of habitat affected by the Project in the context of the local resource, considering the likely effects and ongoing pressures on Limestone pavement habitat, the loss of any area of this Annex I habitat constitutes a negative effect on conservation status. Therefore, the loss of Limestone pavement habitat associated with the Project will result in a likely significant negative effect at the international geographic scale.

Hard water lakes [3140]

Limestone/marl lakes (FL3) which corresponds with this Annex I habitat type

The complex of Hard water lakes at the Coolagh Lakes are within Lough Corrib SAC and are assessed in the updated NIS. There are no direct impacts on this habitat type in Lough Corrib SAC. The Project has the potential to affect both the groundwater and surface water regimes supporting the Hard water lake habitat in Lough Corrib SAC.

Although there are no direct impacts on Ballindooley Lough, run-off from the Project during construction has the potential to affect surface water quality. Ballindooley Lough is upgradient from the Project, in terms of groundwater flow, and there is therefore no potential for groundwater impacts to the lake itself.

As an Annex I habitat type, negatively affecting the water quality status of Ballindooley Lough has the potential to degrade the Hard water lake habitat and result in a likely significant residual effect, at the national geographic scale.

Alkaline fen [7230]

Rich fen and flush (PF1) which corresponds with this Annex I habitat type

The Alkaline fen along the River Corrib and associated with the Coolagh Lakes are within Lough Corrib SAC and, as assessed in the updated NIS, there are no direct impacts on this habitat type in Lough Corrib SAC. The Project has the potential to affect both the existing groundwater regime and surface water quality (during construction in the absence of mitigation measures) supporting wetland habitats in Lough Corrib SAC.

Although there are no direct impacts on Ballindooley Lough, run-off from the Project during construction has the potential to affect surface water quality and the Alkaline fen habitat associated with the wetland complex there. Ballindooley Lough is upgradient from the Project, in terms of groundwater flow, and there is therefore no potential for groundwater impacts to those areas of the wetland complex that support Alkaline fen habitat.

As an Annex I habitat type, negatively affecting surface water quality at the Ballindooley Lough wetland complex has the potential to degrade the Alkaline fen habitat and potentially result in a likely significant residual effect at the national geographic scale.

Hydrophilous tall herb [6430]

Reed and large sedge swamps (FS1), Tall-herb swamps (FS2) and Marsh (GM1) which corresponds with this Annex I habitat type

The Hydrophilous tall herb habitat along the River Corrib and associated with the Coolagh Lakes are within Lough Corrib SAC and are assessed in the updated NIS. There are no direct impacts on this habitat type in Lough Corrib SAC. The Project has the potential to affect both groundwater and surface water quality supporting wetland habitats, including Hydrophilous tall herb habitat, in Lough Corrib SAC.

Hydrophilous tall herb occurs within 200m of the proposed road edge within Link 53 of the proposed N6 GCRR to the south.

The two habitat areas are more than 110m from the road edge at Link 53 and outside the NH_3>1µg/m^3 40m ZoI for Link 53 and the 30m ZoI critical load for N_{dep} greater than/equal to 10kg N/ha/yr and will not be impacted by emissions from the operation of the Project.

Cladium fen [*7210]

Reed and large sedge swamps (FS1), Tall-herb swamps (FS2) and Rich fen and flush (PF1) which corresponds with this Annex I habitat type

The *Cladium* fen along the River Corrib and associated with the Coolagh Lakes are within Lough Corrib SAC and are assessed in the updated NIS. There are no direct impacts on this habitat type in Lough Corrib SAC. The Project has the potential to affect both groundwater and surface water quality supporting wetland habitats in Lough Corrib SAC.

Although there are no direct impacts on this habitat type at Ballindooley Lough, run-off from the Project during construction has the potential to affect surface water quality and the *Cladium* fen habitat associated with the wetland complex there. Ballindooley Lough is upgradient from the Project, in terms of groundwater flow, and there is therefore no potential for groundwater impacts to those areas of the wetland complex that support Alkaline fen habitat.

As a priority Annex I habitat type, negatively affecting surface water quality at the Ballindooley Lough wetland complex has the potential to degrade the *Cladium* fen habitat and potentially result in a likely significant residual effect, at the international geographic scale.

Cladium fen occurs within 200m of the proposed road edge along Link 52 and Link 53 of the proposed N6 GCRR northern and southern sides, respectively (refer Figures 16.1.01 to 16.1.15).

At more than 100m from the proposed road edge at Link 52 it is well outside the NH_3>1µg/m^3 70m ZoI for Link 52 and the 20m ZoI critical load for N_{dep} greater than/equal to 15kg N/ha/yr and will not be impacted by emissions from the operation of the Project.

At more than 140m from the road edge at Link 53 it is well outside the NH_3>1µg/m^3 40m ZoI for Link 53 and the 10m ZoI critical load for N_{dep} greater than/equal to 15kg N/ha/yr and will not be impacted by emissions from the operation of the Project.

Hay meadows[6510]

An isolated Hay meadow habitat occurs within 200m of the proposed road edge within Link 52 of the proposed N6 GCRR to the north. At more than 190m from the road edge it is outside the NH_3>1µg/m^3 70m ZoI for Link 52 and the 40m ZoI critical load for N_{dep} greater than/equal to 10kg N/ha/yr and will not be impacted by emissions from the operation of the Project.

Mesotrophic lakes (FL4) and Eutrophic lakes (FL5)

These lakes form part of the larger wetland complex associated with Ballindooley Lough. Although direct impacts on the eutrophic lake that lies within the Project are not likely to occur, run-off from the Project during construction has the potential to affect the quality of these lake habitats at Ballindooley. Similarly, the existing groundwater regime could be affected by works within that portion of the eutrophic lake that lies within the Project and the hydrogeological ZoI.

Negatively affecting the habitat quality of these lakes has the potential to result in a significant residual effect at the county geographic scale.

Calcareous springs (FP1)

There were 29 Calcareous springs, not corresponding to the priority Annex I habitat Petrifying springs, recorded in Lackagh Quarry. Of these, 18 will be lost as a result of construction works, in the vicinity of the eastern entrance to the Lackagh Tunnel and south of the proposed N6 GCRR between Ch. 11+700 and Ch. 11+750. All other spring features associated with the Lackagh Quarry faces will be retained as part of the works, including two Annex quality petrifying springs and 11 calcareous springs. The majority of the springs within Lackagh Quarry will be retained as part of the Project, with the loss of 18 non-annex calcareous spring features resulting in a likely significant negative effect at the local geographic scale.

Reed and large sedge swamps (FS1)

The loss of a relatively small area (c.0.12ha) of what is a locally common habitat, supporting typical species of that habitat type (*Phragmites australis* reed swamp), is not likely to affect the long-term presence or

viability of this habitat type locally. However, the Project does have the potential to affect water quality at Ballindooley Lough which could affect a much larger area of this habitat type (c.3.6ha or 10.5% of the local habitat resource).

Therefore, the Project has the potential to affect this habitat's conservation status and result in a likely significant negative effect at the local geographic scale.

Eroding/upland rivers (FW1)

A full description of the hydrological baseline of each of the watercourses discussed below is provided in Chapter 11, Hydrology.

Sruthán na Líbeirtí

There is c.530m of Sruthán na Líbeirtí within, or along, the Assessment Boundary. Of this, c.120m will be permanently lost to construction works, with the remaining length of stream channel located along the Assessment Boundary and therefore, may be affected to some degree by construction works. The impact associated with the loss of instream habitat will be offset slightly by the creation of two new sections of stream channel, c.45m and c.40m in length. The impact associated with the loss of instream habitat will be further reduced by the creation of a new section of stream channel within the culvert structure, c.125m in length. As a seasonal stream in the upper reaches (where it is directly impacted by the Project), with no fish species recorded during the fisheries surveys, the loss of natural stream channel habitat is not considered to be a likely significant negative effect at any geographic scale.

Impacts to water quality in Sruthán na Líbeirtí during construction however, have the potential to have a significant negative effect, at the local geographic scale.

Trusky Stream

The Project will result in the loss of c.220m of the Trusky Stream channel during construction. The impact associated with the loss of instream habitat will be offset slightly by the creation of a new section of stream channel, c.65m in length. The impact associated with the loss of instream habitat will be further reduced by the creation of a new section of stream channel within the culvert structure, c.50m in length.

As a seasonal stream in the upper reaches (where it is directly impacted by the Project), with no fish species recorded during the fisheries surveys, the loss of natural stream channel habitat is not considered to be a likely significant negative effect at any geographic scale.

Impacts to water quality in the Trusky Stream during construction however, have the potential to have a significant negative effect, at the local geographic scale.

Bearna Stream

There is c.345m of the Bearna Stream (and c.240m of its unnamed tributary) within, or along, the Assessment Boundary. Of this, c.140m of the natural river channel will be permanently lost to construction works, with the remaining length of river channel located along the Assessment Boundary and therefore, may be affected to some degree by construction works. The impact associated with the loss of instream habitat will be reduced by the creation of new sections of stream channel within the culvert structures, c.140m in length. As a seasonal stream in the upper reaches (where it is directly impacted by the Project), with no fish species recorded during the fisheries surveys, the loss of natural stream channel habitat is not considered to be a likely significant negative effect at any geographic scale.

Impacts to water quality in the Bearna Stream during construction however, have the potential to have a significant negative effect, at the local geographic scale.

Tonabrocky Stream

Approximately 475m of the Tonabrocky Stream channel will be permanently lost to construction works. The impact associated with the loss of instream habitat will be offset slightly by the creation of a new section of stream channel, c.250m in length. The impact associated with the loss of instream habitat will be further reduced by the creation of a new section of stream channel within the culvert structure, c.80m in length.

As a seasonal stream in the upper reaches (where it is directly impacted by the Project), with a low fisheries value, the loss of natural stream channel habitat is not considered to be a likely significant negative effect at any geographic scale.

Impacts to water quality in the Tonabrocky Stream during construction however, have the potential to have a significant negative effect, at the local geographic scale.

Knocknacarra Stream

The Knocknacarra Stream is of a low ecological value in its upper reaches, where it is closest to the Assessment boundary (the stream lies c.120m outside of the Assessment Boundary at Ch. 5+250 of the proposed N6 GCRR). It is seasonal with little water present in the upper reaches, heavily culverted along a significant proportion of its length (almost 50% - see Section 11.3.6 of Chapter 11, Hydrology), and no fish were recorded here during the fisheries survey. Its fisheries value is limited to the tidal section at the estuary, after it emerges from an extensive culverted section.

Therefore, the loss of natural river channel habitat is not considered to be a likely significant negative effect, at any geographic scale.

Impacts to water quality in the Knocknacarra Stream during construction however, have the potential to have a significant negative effect, at the local geographic scale.

Depositing/lowland rivers (FW2)

A full description of the hydrological baseline of each of the watercourses discussed below is provided in Section 11.3.6 of Chapter 11, Hydrology.

River Corrib

The potential for the Project to impact upon the River Corrib is assessed in Section 8.5.5.1 and Section 8.5.5.2 above and in the updated NIS.

Terryland River

The Project will not have any direct impact on the Terryland River. As described in Section 11.3.6 of Chapter 11, Hydrology, the Project will not affect the flow regime of the Terryland River nor will it have any perceptible impact on water quality. The proposed N83 Flood Relief Measures will result in a slight increase in flood levels within the Terryland River channel, due to the discharge of flood waters into that catchment. However, the flood impact on the Terryland basin will only be slight given the extensive flood storage and flood area within this basin.

Considering the above, and that the Terryland River is heavily modified, with poor water quality and of a low fisheries value, the Project will not result in a likely significant negative effect, at any geographic scale.

Drainage ditches (FW4)

The only notable network of drainage ditches in the eastern part of the study area are those associated with the wetland habitat complex at Ballindooley Lough. None of these features will be lost as a result of construction works although construction works in the vicinity pose a risk of affecting water quality and consequently the supported aquatic vegetation. In the western part of the study area, drainage ditches are a more common habitat; associated with the boundaries of wet grassland fields and the margins of the numerous heath and peatland habitat blocks. The design of the Project includes for drainage pipes and structures that will maintain the functioning of drainage and surface water networks, where these are crossed by the Project. Although the actual losses of drainage ditches cannot be fully quantified (for the most part due to their seasonal nature), given the likelihood of there being extensive drainage networks associated with the locally extensive heath, peatland and wetland habitat complexes, any losses associated with the Project are not likely to affect the long-term presence or viability of this habitat type locally.

Therefore, the Project is not likely to affect this habitat's conservation status locally or result in a significant negative effect at the local geographic scale.

Marsh (GM1)

The Project will result in the loss of a small number of marsh areas at Na Foraí Maola Thiar, An Chloch Scoilte and Ballard East: totalling c.0.13ha. There will also be an additional indirect hydrogeology impact on the marsh habitat at Ballard East (Ch. 3+600 to Ch. 3+650 of the proposed N6 GCRR), Ballard West (Ch. 2+800 and Ch. 3+100 of the proposed N6 GCRR) and na Forai Maola Thiar (Ch. 1+400 of the proposed N6 GCRR) as a result of groundwater drawdown will result in an additional area of c.0.29ha being permanently affected. This equates to c.10.3% of this habitat type mapped within the Scheme Study Area, a percentage which is likely to be an overestimate of the actual magnitude of habitat loss given the extensive wetland complex present beyond, and upstream of, the Scheme Study Area at Coolanillaun and Tonacurragh.

The affected habitat patches are small, isolated and do not form an integral part of any larger semi-natural mosaics. They also did not support any atypical or notable plant communities or species. The larger marsh areas recorded during the habitat surveys are associated with the wetland complex at Coolanillaun and these are beyond the ZoI of the Project. Therefore, impacts on those areas that will be lost is not likely to affect the long-term presence or viability of this habitat type locally.

Therefore, the Project is not likely to affect this habitat's conservation status locally or result in a significant negative effect at any geographic scale.

Dry calcareous and neutral grassland (GS1)

The Project will result in the permanent loss of c.16.51ha of Dry calcareous/neutral grassland, and c.4.89ha of a mosaic of Dry calcareous/neutral grassland and Scrub, valued as being of Local Importance (higher value). This equates to, at most, c.24.53% of the total area of Dry calcareous/neutral grassland habitat recorded within the Scheme Study Area. However, based on a review or orthophotography of the surrounding local area (not covered within the extents of the habitat map) there is likely to be a much greater area of this habitat type present locally and the quoted 24.53% is likely to be an overestimate of the percentage habitat loss.

Therefore, the Project is not likely to affect this habitat's conservation status locally or result in a significant negative effect at any geographic scale.

Dry meadows and grassy verges (GS2)

The Project will result in the permanent loss of c.9.68ha of dry meadows and grassy verges habitat valued as being of Local Importance (higher value). This equates to c.13.5% of the total area of acid grassland habitat recorded within the Scheme Study Area. However, based on a review or orthophotography of the surrounding local area (not covered within the extents of the habitat map) there is likely to be a much greater area of this habitat type present locally and the quoted 13.18% is likely to be an overestimate of the percentage habitat loss.

Therefore, the Project is not likely to affect this habitat's conservation status locally or result in a significant negative effect at any geographic scale.

Dry-humid acid grassland (GS3)

The Project will result in the permanent loss of c.5.24ha of Dry-humid acid grassland habitat valued as being of Local Importance (higher value).

The area of Dry-humid acid grassland habitat permanently affected is c.47.72% of the area of this habitat recorded locally. Additional areas of habitat would be expected to be present locally, associated with the margins of peatland habitat and low-intensity managed agricultural fields present to the north and west of the Project in the western part of the study area. However, these areas are likely to be relatively small based upon its extent and distribution across the habitat mapped area and are not likely to significantly affect the relative percentage loss of this habitat type locally.

Accidentally introducing non-native invasive plant species into Dry-humid acid grassland habitat could also increase the extent and magnitude of road effects, degrading the habitat quality; as could an accidental pollution event or dust deposition during construction. During operation, air quality effects on Dry-humid acid grassland habitat in the vicinity of the Project are not likely to affect plant species composition, diversity or abundance.

Therefore, the Project is likely to affect this habitat's conservation status locally and result in a significant negative effect at the local geographic scale.

Wet grassland (GS4)

The Project will result in the permanent loss of c.9.47ha of wet grassland habitat valued as being of Local Importance (higher value). There will also be an additional indirect hydrogeology impact on wet grassland habitat as a result of groundwater drawdown will result in an additional area of c.0.73ha being permanently affected. This equates to c.6.55% of the total area of wet grassland habitat recorded within the Scheme Study Area. However, based on a review or orthophotography of the surrounding local area (not covered within the extents of the habitat map) there is likely to be a much greater area of this habitat type present locally and the quoted 6.55% is likely to be an overestimate of the percentage habitat loss.

Therefore, the Project is not likely to affect this habitat's conservation status locally or result in a significant negative effect at the local geographic scale.

Rich fen and flush (PF1)

The Rich fen and flush habitat along the River Corrib and associated with the Coolagh Lakes are within Lough Corrib SAC and are assessed in the updated NIS, where relevant in relation to the QIs of the SAC. There are no direct impacts on this habitat type in Lough Corrib SAC. The Project has the potential to affect both groundwater and surface water quality supporting wetland habitats in Lough Corrib SAC. There will also be an additional indirect hydrogeology impact on rich fen and flush habitat at Ballard East (Ch. 3+700 to Ch. 3+850 of the proposed N6 GCRR) as a result of groundwater drawdown which will result in an area of c.0.2ha being permanently affected.

Although there are no direct impacts on this habitat type at Ballindooley Lough, run-off from the Project during construction has the potential to affect surface water quality and the rich fen and flush habitat associated with the wetland complex there. Ballindooley Lough is upgradient from the Project, in terms of groundwater flow, and there is therefore no potential for groundwater impacts to those areas of the wetland complex that support rich fen and flush habitat.

As a priority Annex I habitat type, negatively affecting surface water quality at the Ballindooley Lough wetland complex has the potential to degrade the Cladium fen habitat and potentially result in a significant residual effect, at the international geographic scale.

Poor fen and flush (PF2)

The Project will result in the direct, permanent loss of c.0.11ha of Poor fen and flush habitat. There will also be an additional indirect hydrogeology impact on the fen habitat at na Foraí Maola Thiar (Ch. 1+250 and Ch. 1+450 of the proposed N6 GCRR), Ballard East (Ch. 3+700 to Ch. 3+850 of the proposed N6 GCRR) and Knocknafroska (Ch. 7+800 to Ch. 7+975 of the proposed N6 GCRR) as a result of groundwater drawdown will result in an additional area of c. 1.19 ha being permanently affected.

The area of Poor fen and flush habitat permanently affected is c.53.43% of the area of this habitat recorded locally and has all been valued as being of a local importance (higher value). Additional areas of habitat would be expected to be present locally, associated with the expanses of peatland habitat present to the north and west of the Project in the western part of the study area. However, these areas are likely to be small based upon its extent and distribution across the habitat mapped area and are not likely to significantly affect the relative percentage loss of this habitat type locally.

Dust deposition during construction could also increase the extent and magnitude of road effects, degrading the habitat quality. During operation, air quality effects on Poor fen and flush habitat in the vicinity of the Project are not likely to affect plant species composition, diversity or abundance.

Therefore, the Project is likely to affect this habitat's conservation status locally and result in a significant negative effect, at the local geographic scale.

(Mixed) broadleaved woodland (WD1)

The Project will result in the permanent loss of c.4.6ha of (Mixed) broadleaved woodland; equating to c.19.0% of the local resource of this habitat type. The most significant blocks of woodland affected are near the west bank of the River Corrib (Ch. 9+460 to Ch. 9+625 of the proposed N6 GCRR) where one block of c.0.8ha and a second block of c.1.55ha of woodland will be lost (this second woodland block also lies within Lough Corrib SAC). In terms of the potential Lough Corrib SAC impact, this is discussed separately in Section 8.5.4.1, under the heading of Designated Areas for Nature Conservation, and in the updated NIS.

Accidentally introducing non-native invasive plant species into woodland habitat could also increase the extent and magnitude of road effects, degrading the habitat quality; as could an accidental pollution event or dust deposition during construction. During operation, air quality effects on woodland habitat in the vicinity of the Project are not likely to affect plant species composition, diversity or abundance.

Even considering that much of the affected woodland blocks have been planted, many for amenity purposes, the loss (and fragmentation) of such a relatively large proportion of broadleaved woodland is likely to affect this habitat's conservation status locally and result in a significant negative effect at the local geographic scale.

Mixed broadleaved/conifer woodland (WD2)

The Project will result in the permanent loss of c.0.04ha of Mixed broadleaved/conifer woodland: c.0.03ha at Ch. 1+580 of the proposed N6 GCRR, next to the Troscaigh Road (L5387) and 0.01ha was recorded close to Ballymoneen road at Ch. 5+550 of the proposed N6 GCRR. The area at the Troscaigh Road is part of a small woodland block (c.0.18ha) associated with the adjoining residential property, and the area near the Ballymoneen road is part of a small woodland block (c.0.64 ha) associated with the adjacent farmland. The habitat loss will not fragment the woodland nor is it likely to affect the long-term presence or viability of this habitat type locally, there are five other mixed broadleaved/conifer woodland blocks mapped within the Scheme Study Area, totalling an area of c.3.12ha.

Therefore, the Project is not likely to affect this habitat's conservation status locally or result in a significant negative effect at the local geographic scale.

(Mixed) conifer woodland (WD3)

The Project will result in the permanent loss of c.0.01ha of Mixed conifer woodland at Ch. 1+580 of the proposed N6 GCRR, next to the Troscaigh Road (L5387). This is part of a small woodland block (c.0.05ha) associated with the adjoining residential property. The habitat loss will not fragment the woodland nor is it likely to affect the long-term presence or viability of this habitat type locally.

Therefore, the Project is not likely to affect this habitat's conservation status locally or result in a significant negative effect at the local geographic scale.

Oak-ash-hazel woodland (WN2)

The Project will result in the permanent loss of c.3.37ha of Oak-ash-hazel woodland; the majority of which is located near Menlough Village. This equates to c.1.5% of the total area of Oak-ash-hazel woodland mapped within the Scheme Study Area.

Accidentally introducing non-native invasive plant species into woodland habitat could increase the extent and magnitude of road effects, degrading the habitat quality; as could an accidental pollution event or dust deposition during construction. During operation, air quality effects on woodland habitat in the vicinity of the Project are not likely to affect plant species composition, diversity or abundance.

Although the area directly impacted is relatively small, the potential for indirect impacts could result in long-term impacts occurring and affecting a much greater area. Therefore, the Project has the potential to affect this habitat's conservation status locally and result in a likely significant negative effect at the local geographic scale.

Scrub (WS1)

The Project will result in the permanent loss of c.27.73 ha of Scrub across the study area; the majority of which will occur between Bearna and Ballagh. This equates to c.7.4% of the total area of scrub habitat mapped within the Scheme Study Area.

However, based on a review or orthophotography of the surrounding local area (not covered within the extents of the habitat map) there is likely to be a much greater area of this habitat type present locally and the quoted 5.3% is likely to be an overestimate of the percentage habitat loss. Dust deposition during construction could also increase the extent and magnitude of road effects, degrading the habitat quality. However, given the extent of this habitat type locally, this will not pose a risk to this habitat's conservation status at a local level. During operation, air quality effects on scrub habitat in the vicinity of the Project is not likely to affect plant species composition, diversity or abundance.

Therefore, the Project is not likely to affect this habitat's conservation status or result in a significant negative effect at the local geographic scale.

Hedgerows (WL1)

The Project will result in the permanent loss of c.10.64km of Hedgerow; the majority of which will occur in the eastern part of the study area.

Although there is not sufficient data to quantify the magnitude of hedgerow loss in a local context, it is likely that the extent and distribution of the habitat locally will be affected over the long-term. Particularly considering that Hedgerows are scarce or absent from much of the study area owing to the prevalence of stone walls as field boundaries and, in the western part of the Scheme Study Area, extensive scrub encroachment.

Accidentally introducing non-native invasive plant species could increase the extent and magnitude of road effects, degrading the habitat quality; as could an accidental pollution event or dust deposition during construction. During operation, air quality effects on hedgerow habitat in the vicinity of the Project are not likely to affect plant species composition, diversity or abundance.

Therefore, the Project is likely to affect this habitat's conservation status locally and result in a significant negative effect, at the local geographic scale.

Treelines (WL2)

The Project will result in the permanent loss of c.5.58km of Treelines.

Although there is not sufficient data to quantify the magnitude of Treeline loss in a local context, it is likely that the extent and distribution of the habitat locally will be affected over the long-term; particularly considering the scarcity or absence of mature treelines within the study area.

Accidentally introducing non-native invasive plant species could increase the extent and magnitude of road effects, degrading the habitat quality; as could an accidental pollution event or dust deposition during construction. During operation, air quality effects on treeline habitat in the vicinity of the Project are not likely to affect plant species composition, diversity or abundance.

Therefore, the Project is likely to affect this habitat's conservation status locally and result in a significant negative effect, at the local geographic scale.

Clusters of important habitats

Cluster 1 Forramoyle (Ch. 0+000 to Ch. 1+6001 of the Proposed N6 GCRR)

In terms of biodiversity effects, the Project will result in habitat loss across this area, including the loss of areas of the Annex I habitats Active blanket bog, Wet heath, Dry heath and Molinia meadow, as well as habitat of local importance (higher value); eroding/upland rivers, semi-natural grasslands, poor fen and flush, and woodland and scrub habitats (see Section 8.5.5 above for habitat impacts). The Project may also result in the loss of Imbricate bog-moss *Sphagnum affine* and Red bog-moss *Sphagnum capillifolium* within this cluster (see Section 8.5.6 below for rare and protected plant impacts).

Cluster 2 Troscaigh (Ch. 1+600 to Ch. 2+800 of the Proposed N6 GCRR)

The Project will result in habitat loss within this cluster, including the Annex I habitats Wet heath and Dry heath as well as habitat of local importance (higher value); semi-natural grasslands and woodland and scrub habitats (see Section 8.5.5 above for habitat impacts).

Cluster 3 Cloughscoltia (Ch. 2+800 to Ch. 4+400 of the Proposed N6 GCRR)

Cluster 3 is a continuation of Clusters 1 and 2, and as such the Project will result in similar habitat loss. Areas of the Annex I habitats Wet heath, Dry heath and Molinia meadow will be lost, as well as habitats of local importance (higher value); eroding/upland rivers, semi-natural grasslands, poor fen and flush, rich fen and flush, and woodland and scrub habitats (see Section 8.5.5 above for habitat impacts). The Project may also result in the loss of Woodsy thyme moss *Plagiomnium cuspidatum* within this cluster (see Section 8.5.6 below for rare and protected plant impacts).

Cluster 4 Cappagh Road to Ballymoneen Road (Ch. 4+400 to Ch. 5+600 of the Proposed N6 GCRR)

Similarly to habitat Clusters 1-3, the Project will result in the loss of the Annex I habitats Wet heath and Dry heath in Cluster 4. Habitats of local importance (higher value) will also be lost within this cluster; eroding/upland rivers, semi-natural grasslands, and woodland and scrub habitats (see Section 8.5.5 above for habitat impacts). The Project may also result in the loss of Downy oat-grass *Avenula pubescens* within this cluster (see Section 8.5.6 below for rare and protected plant impacts). The Project may also result in the loss of Downy oat-grass *Helictotrichon pubescens* within this cluster (see Section 8.5.6 below for rare and protected plant impacts).

Cluster 5 East of Ballymoneen Road (Ch. 5+750 to Ch. 5+950 of the Proposed N6 GCRR)

The Project will result in the loss habitats of local importance (higher value) within Cluster 5. These habitats include semi-natural grasslands, drainage ditches and woodland and scrub habitats. There are no Annex I habitats or rare and protected plant species within this cluster. See Section 8.5.5 above for habitat impacts.

Cluster 6 Knocknabrona/Knocknafrosca (Ch. 7+700 to Ch. 8+300 of the Proposed N6 GCRR)

Cluster 6 is the eastern-most habitat cluster of acid-type habitats. The Project will result in the loss of the Annex I habitat Wet heath, as well as habitats of local importance (higher value): semi-natural grasslands, poor fen and flush, drainage ditches, woodland and scrub habitats. Section 8.5.5 above describes the habitat impacts in detail. The Project may also result in the loss of Downy oat-grass *Avenula pubescens* within this cluster (see Section 8.5.6 below for rare and protected plant impacts).

Cluster 7 Menlough (Ch. 9+600 to Ch. 10+450 of the Proposed N6 GCRR)

The Project will result in habitat loss of several Annex I habitats within this cluster: Limestone pavement (both the exposed and wooded variants), a small Turlough, Alluvial woodland and Calcareous grassland (within a limestone pavement mosaic). Habitats of local importance (higher value) will also be lost within this cluster: semi-natural grasslands, drainage ditches, woodland and scrub habitats. See Section 8.5.5 above for a description of the habitat impacts in detail. The Project may also result in the loss of Lesser striated feathermoss *Plasteurhynchium striatulum* within this cluster (see Section 8.5.6 below for rare and protected plant impacts).

Cluster 8 Lackagh (Ch. 11+800 to Ch. 12+100 of the Proposed N6 GCRR)

Cluster 8 lies to the east of Lackagh Quarry. In terms of biodiversity impacts, the Project will result in the loss of the Annex I habitat Calcareous grassland, as well as non-annex semi-natural grassland, woodland and scrub habitats of local importance (higher value) (see Section 8.5.5 above for habitat impacts).

Cluster 9 Ballindooley Lough and surrounding land (Ch. 12+300 to Ch. 12+500 of the Proposed N6 GCRR)

The Project will result in the loss of the Annex I habitat Molinia meadows within this habitat cluster, as well as a eutrophic lake of County Importance. Habitats of local importance (higher value) that will be lost within this habitat cluster include reed and large sedge swamps, rich fen and flush, and scrub and woodland habitats (see Section 8.5.5 above for habitat impacts).

Cluster 10 Castlegar (Ch.13+500 of the Proposed N6 GCRR)

Cluster 10 is comprised of improved agricultural grassland habitat and hedgerows within the Assessment Boundary. The Project will result in the loss of these habitats within the habitat cluster (see Section 8.5.5 above for habitat impacts).

Cluster 11 Briarhill (Ch. 15+900 to Ch. 16+300 of the Proposed N6 GCRR)

The Project will result in the loss of the Annex I habitat Limestone pavement (wooded variant) within this habitat cluster. Habitats of local importance (higher value) that will be lost within this cluster include semi-natural grasslands, woodland and scrub habitats. See Section 8.5.5 above for a description of the habitat impacts in detail.

Cluster 12 Ardaun (Ch. 16+950 to Ch. 17+150 of the Proposed N6 GCRR)

The Project will result in the loss habitats of local importance (higher value) within Cluster 12. These habitats include semi-natural grasslands and scrub habitats. There are no Annex I habitats or rare and protected plant species within this cluster. See Section 8.5.5 above for habitat impacts.

8.5.6 Rare and protected plant species

As discussed in Appendix 4 of ABP's Inspector's Report dated 22 June 2021, six red list plant species are within the Assessment Boundary and therefore at risk of being directly impacted by the Project, including; Four bryophyte species listed on *Ireland Red List No. 8: Bryophytes* (Lockhart *et al.,* 2012), i.e., Woodsy thyme moss, Lesser striated feathermoss, Imbricate bog-moss, and Red bog-moss, and two vascular plant species listed on *Ireland Red List No. 10: Vascular Plants* (Wyse Jackson *et al.,* 2016) i.e., Spring gentian and brown beak-sedge.

In the case of Woodsy thyme moss *Plagiomnium cuspidatum* (at Ch. 3+350 of the proposed N6 GCRR), lesser striated feather-moss *Plasteurhynchium striatulum* (at Ch. 9+800 of the proposed N6 GCRR, Imbricate bog-moss *Sphagnum affine* (at Ch. 1+250 of the proposed N6 GCRR), Red bog-moss *Sphagnum capillifolium* (at Ch. 1+250 of the proposed N6 GCRR) and Spring gentian *Gentiana verna* (at Ch. 11+300 of the proposed N6 GCRR) one population of each of these would likely be directly impacted by the Project, as described in Appendix 4 of ABP's Inspector's Report dated 22 June 2021.

Other locations where populations of these species, and other red list species (i.e. Brown beak sedge *Rhynchospora fusca*) were found outside of the footprint of Project, that will not be directly impacted, could be indirectly impacted, through impacts on the receiving hydrogeological or hydrological environments, dust deposition or through introducing/spreading non-native invasive plant species. The view of Inspector appointed by ABP, as stated in Appendix 4 of ABP's Inspector's Report dated 22 June 2021, in regards to the valuations of these species, is as follows:

"The population[s] [are] likely to be of national importance."

Imbricate bog-moss *Sphagnum affine* is classified as Vulnerable on the Irish Red List, due to its occurrence in less than 5 locations in Ireland.[104] This species is associated with poor fen, marshes, base-rich seepages, ditches, flushed bogs and wet sites[105] and was recorded within a wet heath habitat [4010] within the Assessment Boundary. Within Ireland, this species has a restricted distribution[106]. There have been four

[104] Lockhart, N., Hodgetts, N. & Holyoak, D. (2012) Ireland Red List No.8: Bryophytes. National Parks and Wildlife Service, Department of Arts, Heritage and the Gaeltacht, Dublin, Ireland.

[105] Mosses and Liverworts of Britain and Ireland – a field guide (2010) Atherton, I., Bosquant, S., Lawley, M. (eds.), British Bryological Society.

[106] Mosses and Liverworts of Britain and Ireland – a field guide (2010) Atherton, I., Bosquant, S., Lawley, M. (eds.), British Bryological Society.

Hill, M.O. (1988) *Sphagnum imbricatum* ssp. *austinii* (Sull.) Flatberg and ssp. *affine* (Ren. & Card.) Flatberg in Britain and Ireland, *Journal of Bryology*, 15:1, 109-115.

Lockhart, N., Hodgetts, N. & Holyoak, D. (2012) Ireland Red List No.8: Bryophytes. National Parks and Wildlife Service, Department of Arts, Heritage and the Gaeltacht, Dublin, Ireland.

National Biodiversity Data Centre, Species Detail – Imbricate Bog-moss (*Sphagnum affine*) - https://maps.biodiversityireland.ie/Species/126775

records of the species reported since 2000 on the NBDC database (at Derryclare Lough, Co. Galway, and Cromaglan Mountain, Co. Kerry). *Sphagnum affine* is similar in appearance to some forms of *Sphagnum palustre* and *Sphagnum papillosum*, and is not reliably separable from these species in the field and is easily overlooked.[105] Therefore it is likely to be under recorded within Ireland.

The Project will result in the loss of the single record of *Sphagnum affine* recorded within the Assessment Boundary directly by removal, and may indirectly affect other unknown populations of this species locally through impacts on the receiving hydrogeological or hydrological environments, or through introducing/spreading non-native invasive plant species. Due to the restricted nature and uncertainty of the species distribution in Ireland, and using a conservative and precautionary approach, the Project has the potential to negatively affect the species conservation status and result in a significant negative effect at a national geographic scale.

Red bog-moss *Sphagnum capillifolium* is assessed as Data Deficient on the Irish Red List.[104] This assessment is made for species where it is thought likely that future research will show that a threatened classification is appropriate and that it will be included in the Red List in the future, following further research. This species is thought to be less common than *Sphagnum rubellum*, a species which used to be referred to as a subspecies, rather than a separate species, under the broader *Sphagnum capillifolium* species concept. However, the distribution of *Sphagnum capillifolium* within Ireland is poorly known, and it is likely under recorded, with many records occurring for the broader aggregate species concept.[106] Since 2003, there have been 60 records of the species submitted to the NBDC database across 44 hectads, with eight occurrences of the species recorded within Co. Galway.[107]

The Project will result in the loss of the single record of *Sphagnum capillifolium* recorded within the Assessment Boundary directly by removal, and may indirectly affect other unknown populations of this species locally through impacts on the receiving hydrogeological or hydrological environments, or through introducing/spreading non-native invasive plant species. While this species is likely under recorded within Ireland, on the basis of existing information on the species abundance and distribution, and using a conservative and precautionary approach, the Project has the potential to affect this species' conservation status and result in a significant negative effect at the county geographic scale, as the loss of the local population within the Assessment Boundary is unlikely to affect the species' national range or distribution.

Woodsy thyme moss *Plagiomnium cuspidatum* is assessed as Near Threatened on the Irish Red List.[104] This category is assigned to species that are assessed as close to qualifying for a threatened category (i.e. occurs in 6–12 hectads (1970–2010) but has not declined; or < 20 hectads (1970–2010) and has declined). This species was recorded in three relevés within the Assessment Boundary, 2680_R1 (Ch. 3+350 of the proposed N6 GCRR), 2527_R1 (Ch. 4+450 of the proposed N6 GCRR) and 2354_R1 (Ch. 12+950 of the proposed N6 GCRR). There are 73 records of the species within Ireland recorded on the NBDC database since 1872 across 43 hectads, with 40 records occurring since 2000[108]. The most recent record of this species within county Galway is from Omey Island and was recorded in 2006. The closest desktop record to the Assessment Boundary dates from 1957 at Ballindooley Castle. There are a total of ten records of the species within County Galway. Like the other bryophyte species recorded within the Assessment Boundary, it is likely that it is nationally under recorded due to low recording effort associated with species groups requiring specialist knowledge for identification.

The Project will result in the loss of the three records of *Plagiomnium cuspidatum* recorded within the Assessment Boundary directly by removal, and may indirectly affect other unknown populations of this species locally through air quality effects, or through introducing/spreading non-native invasive plant species. While this species is likely under recorded within Ireland, on the basis of existing information on the species abundance and distribution, and using a conservative and precautionary approach, the Project has the potential to affect this species' conservation status and result in a significant negative effect at the county

[107]National Biodiversity Data Centre, Species Detail – Acute-leaved Bog-moss (*Sphagnum capillifolium* subsp. *capillifolium*) - https://maps.biodiversityireland.ie/Species/126779

[108] National Biodiversity Data Centre, Species Detail – Woodsy thyme moss (*Plagiomnium cuspidatum*) - https://maps.biodiversityireland.ie/Species/126610

geographic scale, as the loss of the local population within the Assessment Boundary is unlikely to affect the species' national range or distribution.

Lesser striated feather-moss *Plasteurhynchium striatulum*, like Woodsy thyme moss *Plagiomnium cuspidatum*, is assessed as Near Threatened on the Irish Red List.[104] This species grows on calcareous rocks (e.g. stone walls, Limestone pavement and exposed calcareous rock habitats), and was recorded in six relevés within the Assessment Boundary: 3857_R1 (Ch. 9+550 of the proposed N6 GCRR), 4422_R1 (Ch. 9+800 of the proposed N6 GCRR), 3941_R1 (Ch. 9+950 of the proposed N6 GCRR), 5507_R1 (Ch. 10+000 of the proposed N6 GCRR), 3790b_R1 (Ch. 10+100 of the proposed N6 GCRR) and 4033_R1 (Ch. 11+300 of the proposed N6 GCRR). There are 39 records of the species within Ireland recorded on the NBDC database since 1872 across 39 hectads, with 21 records occurring since 2000[109]. There are eight desktop records from within County Galway, the most recent of which was recorded in 2014. Like Woodsy thyme moss *Plagiomnium cuspidatum*, the closest desktop record to the Assessment Boundary dates from 1957 at Ballindooley Castle. Due to the species' specific habitat requirements, its distribution is restricted to areas of exposed calcareous rock, and overlaps the distribution of mapped *8240 Limestone pavement habitat in Ireland[110]. The future prospects for this habitat is assessed as unfavourable-inadequate in Ireland, due to losses to land use change but has a stable trend due to the effects of conservation efforts within the Burren and Aran Islands (NPWS 2019)[111]. This species is not particularly distinctive and is considered likely to be under recorded[105].

The Project may result in the loss of the six records of *Plasteurhynchium striatulum* recorded within the Assessment Boundary directly by removal, and may indirectly affect other unknown populations of this species locally through air quality effects or through introducing/spreading non-native invasive plant species. While this species is likely under recorded within Ireland, on the basis of existing information on the species abundance and distribution, as well as it specific habitat requirement, using a conservative and precautionary approach, the Project has the potential to affect this species' conservation status and result in a significant negative effect at the county geographic scale, as the loss of the local population within the Assessment Boundary is unlikely to affect the species' national range or distribution.

Spring gentian *Gentiana verna* is assessed as Near Threatened on the Irish Red List.[112] In the case of vascular plants, this threat category is defined as:

"*Taxa are assessed as Near Threatened on the basis of an observed past or suspected future population reduction of 20–29% based on decline in Area of Occupancy or habitat quality*."

This species was recorded within five relevés across the Scheme Study Area, one of which occurs within the Assessment Boundary. Within Ireland, this species is restricted to lowland calcareous grasslands (including the Annex habitat 6210 Calcareous grasslands), calcareous dunes and limestone pavement-associated heath and calcareous grassland habitats around Galway Bay, and is relatively abundant in the Burren, Co. Clare.[113] There are 382 records of the species within Ireland across 28 hectads on the NBDC database since 1981.[114] While the future prospects for Limestone pavement and associated habitat is assessed as unfavourable in Ireland, the trend for Limestone pavement is assessed as stable due to conservation measures in the Burren and Aran Islands (NPWS 2019).[111]

The Project may result in the loss of the single record of *Gentiana verna* recorded within the Assessment Boundary directly by removal, and may indirectly affect other unknown populations of this species locally through air quality effects (i.e. dust deposition), or through introducing/spreading non-native invasive plant

[109] National Biodiversity Data Centre, Species Detail – Lesser striated feather-moss (*Eurhynchium striatulum*) - https://maps.biodiversityireland.ie/Species/126440

[110] Wilson, S. & Fernández, F. (2013) *National survey of limestone pavement and associated habitats in Ireland. Irish Wildlife Manuals, No. 73.* National Parks and Wildlife Service, Department of Arts, Heritage and the Gaeltacht, Ireland.

[111] NPWS (2019). *The Status of EU Protected Habitats and Species in Ireland. Volume 1: Summary Overview*. Unpublished NPWS report

[112] Wyse Jackson, M., FitzPatrick, Ú., Cole, E., Jebb, M., McFerran, D., Sheehy Skeffington, M. & Wright, M. (2016) *Ireland Red List No. 10: Vascular Plants.* National Parks and Wildlife Service, Department of Arts, Heritage, Regional, Rural and Gaeltacht Affairs, Dublin, Ireland.

[113] Hedley, S. (2015) *Gentiana verna* L.. Spring Gentian. Species Account. Botanical Society of Britain and Ireland.

[114] National Biodiversity Data Centre, Species Detail – Spring Gentian (*Gentiana verna*) - https://maps.biodiversityireland.ie/Species/29304

species. However, four of the five locally recorded populations of the species are not likely to be lost due to direct or indirect effects of the Project. On the basis of existing information on the species abundance and distribution within the local and wider geographic region, the Project has the potential to affect this species' conservation status and result in a significant negative effect at the local geographic scale, as the loss of the species occurrence within the Assessment Boundary will reduce the local population, but will not affect the species' range or distribution within County Galway, as a further four occurrences of the species within the Scheme Study Area will not be lost. Three other plant species of Least Concern (Wyse Jackson *et al.,* 2016), i.e. Fern grass, Eyebright, and Downy oat-grass identified within the Assessment Boundary were discussed in Appendix 4 of An Bord Pleanála's Inspector's Report dated 22 June 2021:

"The locally uncommon species are fern grass Catapodium rigidum, which is more frequent further south and east, an eyebright Euphrasia arctica , which is more frequent north and east, and downy oat-grass Helictotrichon pubescens, which more frequent to the east, there were also two species[115] apparently not, or very rarely, recorded in Ireland and assumed to be non-native or errors; meadow oat-grass Helictotrichion pratense and marsh valerian Valeriana dioica. The populations of the first three are likely to be of at least local importance, while native populations of the last two would be of national importance."

Fern grass *Catapodium rigidum,* eyebright *Euphrasia arctica* and downy oat-grass *Avenula pubescens* are all assessed as Least concern on the Irish Red List.[112] This is defined as a taxon that "…*does not qualify for Critically Endangered, Endangered, Vulnerable or Near Threatened. Widespread and abundant taxa are included in the category*."

Eyebright *Euphrasia arctica,* is slightly less common than the two grasses, but has a widespread distribution, with 2091 records occurring over 676 hectads[116]. There are 899 records of the species from Ireland recorded since 2000. However, there are no recent desktop records from Galway City, with records within County Galway centred in the south and northwest of the county. This species was recorded in nine relevés within the Assessment Boundary. *Euphrasia* is a difficult genus to identify to species level[117], and as such is likely to be under recorded. This species is relatively widespread on grassland habitats.

The Project may result in the loss of the occurrences of this species within the Assessment Boundary species directly by removal and may indirectly affect other unknown populations of this species locally due to dust deposition, or through introducing/spreading non-native invasive plant species. On the basis of existing information on the species abundance and distribution within the local and wider geographic region, the Project has the potential to affect this species' conservation status and result in a significant negative effect at the local geographic scale, as the loss of the species occurrence within the Assessment Boundary will reduce the local population, but will not affect the species' range or distribution within County Galway.

Within Ireland, Fern grass *Catapodium rigidum* is relatively common and has a widespread distribution, with 3464 records occurring over 659 hectads, with five records occurring within Galway City. There are 1787 records of the species from Ireland recorded since 2000. The species has an increasing population trend, occurring on a range of different semi-natural and artificial habitats, with a preference for calcareous substrates.[118] This species was recorded in 2 relevés within the Assessment Boundary.

Downy oat-grass *Avenula pubescens* is similarly relatively common and has a widespread distribution, with 3207 records occurring over 552 hectads, with 14 records occurring within or close to Galway City. There are 1851 records of the species from Ireland recorded since 2000. This species grows on a range of semi-natural grassland habitats. While relatively widespread, the species has a decreasing population trend due to

[115] These species are considered to be non-native recordings

[116] *Euphrasia arctica* (Lange ex Rostrup) - BSBI distribution map: https://bsbi.org/maps?taxonid=2cd4p9h.h4y

[117] Parnell, J., Curtis, T. (2012) *Webb's an Irish flora*, 8th edn. Cork University Press, Cork.

Stace, C.A. (2019) *New flora of the British Isles.* 4th ed. Middlewood Green, C&M Floristics.

[118] *Catapodium rigidum* (L.) C.E.Hubb. in *BSBI Online Plant Atlas 2020*, eds P.A. Stroh, T. A. Humphrey, R.J. Burkmar, O.L. Pescott, D.B. Roy, & K.J. Walker.

Catapodium rigidum (L.) - BSBI distribution map: https://bsbi.org/maps?taxonid=2cd4p9h.xfy

habitat modification through agricultural improvements.[119] This species was recorded in 25 relevés within the Assessment Boundary, and in two relevés outside of the Assessment Boundary.

The Project may result in the loss of the occurrences of these species within the Assessment Boundary directly by removal, and may indirectly result in the loss of this species locally due to dust deposition, shading effects or through introducing/spreading non-native invasive plant species. However, due to the likely local relative abundance of these species and the likely relatively high suitable local habitat resource where these species are likely to occur, the Project is not likely to affect the species conservation status of Fern grass *Catapodium rigidum* or Downy oat-grass *Avenula pubescens* and result in a significant negative effect, at any geographic scale.

As discussed in Section 8.3.6, records of meadow oat-grass *Helictochloa pratensis* and marsh valerian *Valeriana dioica* are considered likely recording errors or non-native populations, and as such have not been assigned a valuation.

8.5.7 Mammals

8.5.7.1 Otter

Construction Phase Impacts

Although it cannot be predicted if Otter will establish new holt or couch sites within the ZoI of the Project before construction works commence, it is a possibility and this scenario has been taken into account in the mitigation strategy (refer to Section 8.6.5.1).

Loss of breeding/resting sites

Based on the findings of the field surveys carried out, as there were no Otter breeding or resting places, holt or couch sites, present within the Assessment Boundary, there will not be any loss of holt or couch sites as a result of construction works.

Habitat Loss

In the context of rivers directly impacted by the Project, Otter were recorded along the River Corrib and within the catchment of the Tonabrocky Stream.

In the context of river systems, the Threat Response Plan Otter *Lutra lutra* 2009-2011 document (Department of the Environment, Heritage and the Gaeltacht, 2011) defines terrestrial Otter habitat as a 10m zone of riparian habitat along the riverbanks. On all watercourses crossed by the Project, bar the River Corrib, construction works will result in the permanent loss of some level of riparian vegetation; primarily within the construction footprint of the crossing structure (or temporary crossing structures) but also, in many cases, to construct the drainage outfalls to the surface water network. Instream habitat will also be lost, or be highly modified, as a result of construction works to install culverts. The level of permanent habitat loss will be greatest on watercourses where stream realignments are proposed as part of the design: Sruthán na Líbeirtí, the Trusky Stream and the Tonabrocky Stream.

On the River Corrib, the construction of the proposed bridge structure will not result in the loss of any instream habitat nor will it result in the permanent loss of Otter habitat on the west or east bank of the river within 5m of the river bank. Nevertheless, some vegetation cutting/removal would likely be required to facilitate the construction works and on an ongoing basis as part of the maintenance works associated with the Project during operation. Some effects to any remaining vegetation underneath the bridge structure would also be expected as a result of shading effects. The construction of the drainage outfalls to the River Corrib will, however, result in the loss of c.3m of riparian habitat on each bank.

Habitat losses of such a comparatively small scale, in the context of the instream and riparian habitat resource in all surface water catchments crossed by the Project which support Otter, would not constitute a

[119] *Avenula pubescens* (Huds.) Dumort. in BSBI Online Plant Atlas 2020, eds P.A. Stroh, T. A. Humphrey, R.J. Burkmar, O.L. Pescott, D.B. Roy, & K.J. Walker.

Avenula pubescens (Huds.) Dumort - BSBI distribution map: https://bsbi.org/maps?taxonid=2cd4p9h.6y3sv8

significant decline in the extent of available Otter habitat and will not affect the local Otter population's ability to maintain itself, even in the short-term. Even in a case where it would be partially converted to hard surfaces, such as where a precast concrete culvert is installed, Otter routinely use highly modified habitat within culverts and beneath bridges.

Habitat loss associated with the construction of the Project will not have a likely significant effect on the conservation status of Otter and will not have a likely significant negative effect, at any geographic scale.

Habitat degradation - water quality

During construction, contaminated surface water runoff and/or an accidental spillage or pollution event into any surface water feature has the potential to have a significant negative impact on water quality and consequently an impact on Otter; either directly (e.g. acute or sub-lethal toxicity from pollutants) or indirectly (e.g. affecting their food supply or supporting habitats). The effects of frequent and/or prolonged pollution events in a river system have the potential to be extensive and far-reaching and could potentially have significant long-term effects.

However, it is considered unlikely that a pollution event of such a magnitude would occur during construction, or be any more than temporary in nature. Nevertheless, a precautionary approach is being taken in assuming a level of risk of water quality impacts and detailed mitigation measures are required to further minimise the risk of the Project having any perceptible effect on water quality during construction.

Habitat degradation as a result of effects on surface water quality during construction has the potential to affect the species' conservation status and result in a likely significant negative effect, at a local geographic scale. Mitigation measures have been designed to protect water quality during construction (see Section 8.6.3.4).

Habitat Severance/Barrier Effect

The physical disturbance to the stream/river channels and the associated riparian margins will result in the severance of river habitat, at least temporarily, during construction. This may also result in some level barrier effect during construction works on all watercourses.

However, given that Otter are generally nocturnal in habitat and works will typically be carried out during normal daylight working hours, affected Otters would be expected to habituate to the altered landscape and any resulting barrier effect would be temporary in nature (see below on disturbance/displacement and the habituation of Otters to disturbance).

The severance/barrier effect of construction works on Otter is not likely to affect the local population, over even the short-term, and is not likely to affect the species conservation status and result in a significant negative effect, at any geographic scale.

Disturbance/displacement

There were no Otter breeding or resting places present within the ZoI of the Project. Therefore, there will not be any disturbance or displacement effect on such sites associated with construction works.

Otter were recorded widely along the River Corrib corridor, and in the Tonabrocky Stream catchment, and therefore increased human presence and/or noise and vibration associated with construction works, has the potential to (at least temporarily) displace commuting or foraging Otter.

Otter are known to tolerate human disturbance, including road traffic, under certain circumstances (Bailey & Rochford, 2006, The Environment Agency, 2010, Irish Wildlife Trust, 2012). This is also evidenced by the presence of Otter signs along the River Corrib through the UoG Campus and in the Menlo area (see Figures

8.4.1 to 8.4.15[120]), the presence of an active Otter couch site within 50m of the Quincentenary Bridge, and the presence of Otter (including holt sites) in the urban centre of Galway City.

As construction works will typically be undertaken during normal daylight working hours and Otter are generally nocturnal in habit, and that Otter can (in many circumstances) tolerate high levels of human presence and disturbance, displacement of Otter from their habitat is extremely unlikely to affect the local Otter population. Therefore, disturbance during construction is not likely to have a significant effect on the species' conservation status and will not result in a likely significant negative effect, at any geographic scale.

Operational Phase Impacts

Habitat Severance/Barrier Effect

The installation of new culverts or bridge structures has the potential to result in a permanent barrier to Otter movement along watercourses crossed by the Project. Particularly during periods of spate flow or flooding, where increased water volumes and flow rates may render the structure impassable by Otter.

In the case of the proposed River Corrib Bridge, this impact will not arise as it is a clear span structure and will not affect the existing hydrological regime or functioning of the floodplain (see Chapter 11, Hydrology). Therefore, the Otter population associated with the River Corrib (and thus Lough Corrib SAC) will not be affected in this regard. However, on all other watercourses (whether used by Otter at present, such as the Tonabrocky Stream, or not) the risk of the crossing structure resulting in a barrier effect is possible.

The habitat severance/barrier effect to Otter associated with the Project has the potential to affect local Otter populations over the long-term, potentially affecting the species' conservation status, and result in a likely significant negative effect, at a local geographic scale. Mitigation measures to maintain mammal passage along watercourses used by Otter have been designed (see Section 8.6.5.1).

Disturbance/displacement

As discussed above in relation to construction impacts, Otter can be relatively tolerant of human and traffic disturbance. Any increased level of disturbance associated with the operation of the Project is therefore, extremely unlikely to result in any perceptible disturbance/displacement of Otter from their habitat.

Nocturnal mammals, such as the Otter, would be likely to be disturbed by the introduction of artificial light into established breeding and foraging areas (Rich & Longcore, 2005).

Lighting will be provided for the proposed UoG Sports Pitches. Whist there is planning permission to floodlight the existing pitches adjacent to the river, they are currently unlit. There is no holt located within or near the area of light spill from the proposed lighting for the proposed UoG Pitches. The light spill will not impede Otter from using the River Corrib for feeding or commuting.

There will be no light spill to any other watercourses where Otter were recorded and there will not be any impacts in that regard.

Disturbance or displacement associated with the operation of the Project is not likely to affect the conservation status of Otter and therefore, will not result in a likely significant negative effect, at any geographic scale.

Habitat degradation - water quality

There will be outfall points to surface water features from the road drainage network during operation. The proposed drainage design for the proposed N6 GCRR incorporates pollution control measures (this includes petrol interceptors, wetland and other measures, such as SuDS) followed by either infiltration ponds (where discharging to ground) or attenuation ponds (where drainage will be discharged to the existing surface water/storm sewer), as described in detail in Chapter 5, Project Description.

[120] There is a distinct difference in recorded levels of Otter signs/activity between the west and east banks of the River Corrib in the vicinity of the proposed River Corrib Bridge; with Otter clearly favouring the east bank of the River Corrib than that on the side of UoG Sporting Campus. Although whether this is as a result of the west bank being more accessible to the public (and hence subject to higher levels of disturbance, particularly due to the presence of dogs), as a result of the open, and sparsely vegetated, nature of the riparian margin on the west bank, or some combination of the two, is unknown

Those sections of the road drainage that are to be discharged to ground, pose no risk to surface water quality. It is extremely unlikely that the normal operating water quality of the drainage outfalls discharging to the existing surface water/drainage network, even in the unlikely event of a pollution incident, would have any perceptible impact on water quality in receiving watercourses. The functioning and effectiveness of both elements of the road drainage network are discussed in more detail in Chapter 11, Hydrology.

Habitat degradation as a result of effects on surface water quality during operation is not likely to have any effect on the Otter population or its conservation status, and therefore will not result in a likely significant negative effect, at a local geographic scale.

Mortality Risk

The introduction of the Project into a rural landscape, which includes new watercourse crossings, will permanently increase the risk of road traffic collisions with Otter; particularly where Otter have been recorded (see Figures 8.4.1 to 8.4.15). The exceptions to this are along the River Corrib, where the Project is elevated above the river and floodplain such that it would not be accessible by Otter, and the Menlough Viaduct which is elevated above the turlough at Ch. 10+320 of the proposed N6 GCRR.

Although it is not possible to quantify the magnitude of the effect, the increased collision risk has the potential to result in long-term effects on Otter populations locally, potentially affecting their local conservation status.

Collision risk to Otter associated with the Project has the potential to result in a likely significant negative effect, at the local geographic scale. Mitigation measures have been designed to avoid this potential impact (see Section 8.6.5.1).

8.5.7.2 Bats

This section of the impact assessment deals with impacts on bats species. Firstly, it describes the different types of impacts that could potentially affect all bat species and then secondly deals with the potential impacts on each species individually.

Construction Phase Impacts

Roost Loss

Nineteen buildings supporting 23 bat roosts are within the Assessment Boundary (8 Soprano pipistrelle roosts (PBR177, 179, 250, 255, 248, 256, 261, 267), 1 Common pipistrelle roost (PBR252), 3 unidentified pipistrelle bat roosts (PBR205_ST1, 205_ST9, and 205ST_10), 3 Brown long-eared bat roosts (PBR204, 215, 267), 3 Lesser horseshoe bat roosts (PBR178, 210, 241), 2 Leisler's bat roosts (PBR196, PBR255), and three unidentified Myotis species bat roosts (PBR178, 199, 215).

Four of these are structures used by more than one bat species. Figures 8.28.1 to 8.35.1 to 5.20.1 show the locations of these respective roosts.

Eighteen of these structures are proposed for demolition, with one of the structures (PBR241) to be retained. The main residential building at PBR241 complex is to be retained for Lesser horseshoe bats and protected from adverse impacts. A rocket box will also be installed near the roost at PBR241, rather than a bat box fixed to the building itself, so as not to detract from its cultural heritage value, this is discussed further in this derogation licence application as a compensation measure[121].

PBR183 was confirmed as no longer being a roost in the 2023 surveys, However, while the main structure will be demolished, an outbuilding on the property will be retained for the purposes of compensation for loss of other roosts.

Three trees will be felled (PTR48, PTR45, PTR43) that have been confirmed as supporting bats (Leisler's bat (PTR48) and Pipistrelle bats, respectively (PTR45 and PTR43) and an additional eight trees have high (or

[121] Note that the term "compensation" is used in this application refers to addressing impacts which cannot be mitigated. These impacts will have no impact on any European Site and the term "compensation" as used in this application does not in any way infer the same meaning as used in Article 6(4) of the E.U. Habitats Directive.

category 1 as per 2014 – 2018 classification) potential to support bats and will also be felled. Figures 8.25.1 to 8.26.1 show the locations of these trees.

Appendix 4 of ABP's Inspector's Report dated 22 June 2021, the ecologist appointed by ABP, Dr. Arnold considered the loss of roosts for both Whiskered bat and Natterer's bat, to be significant at a National level, and at a County level for Nathusius' pipistrelle and Brown long-eared bat. However, it is the author's view that the potential impacts of the permanent loss of these 19 roost structures, apart from the Lesser horseshoe, bat roosts, and the three trees are deemed to be significant at a local level as they are valued as important at the local geographic level, almost all had a low number of bats using them and were recorded using other roost sites across the study area which will not be impacted by the Project. The NPWS, in their grant of the Bat Derogation Licence which reflected the author's professional opinion of impact significance, accepted the conclusion of the assessment that the loss of roost structures is of local significance.

The impacts of the loss of the Lesser horseshoe bat roosts are potentially significant at a national level in the absence of mitigation measures. The surveys undertaken to inform the 2018 EIAR confirmed that the roost at Aughnacurra (PBR178) was a satellite roost linked to Menlo Castle.

Given that prior to 2020, the physical structure of the Menlo Castle roost was subject to deterioration, the Aughnacurra roost could be a relatively new addition to their network of roosts. As of 2020, a series of restoration works have commenced at Menlo Castle. These works were ongoing in 2023.

The Aughnacurra satellite roost (PBR178) is within a sub-optimal building (garage) in terms of the preferred building type for this species, and its occupation by bats may be a reflection of the lack of availability of better roost opportunities in the area.

While there is historic evidence that PBR178 was a Lesser horseshoe maternity roost, the low to negligible levels of Lesser horseshoe activity at the property recorded in 2023 surveys indicates that this has since changed and is perhaps intermittently used by Lesser horseshoe bats as a day roost. Records show Myotis species are also present at the property.

It cannot be wholly-discounted that Lesser horseshoes will return to this roost in larger numbers over subsequent years, therefore, taken a conservative and precautionary approach, it should be considered that the loss of the satellite Lesser horseshoe bat roost at Aughnacurra (PBR178) and the loss of another Lesser horseshoe bat night roosts (PBR210) within their foraging area could result in an impact on the Lesser horseshoe bat at a national geographic scale, in the absence of any measures to address this impact.

In the context of the potential impact on the Lough Corrib SAC, of which Lesser horseshoe bats are a QI, although this species is present within the study area, the roost that forms the QI population for this European site (Eborhall House) is more than 30km away from the Project, on the northern shore of Lough Corrib. This distance would be regarded to be beyond the normal core foraging range of the Eborhall House population and beyond the normal commuting range of this species except on exceptional occasions or over long periods of time, for example, bats dispersing and moving between areas in the wider landscape over a period of many years/generations.

Furthermore, radio-tracking surveys of the Menlough population of bats (which were identified within the study area) undertaken for this project in 2014 and for the route selection studies for the proposed N6 GCRR did not suggest any evidence of movement between that population and the Eborhall House roost. Given the lack of any linkage between the study area and the roosts that are the reason for designation of this European site, likely significant effects on the Lough Corrib SAC's Lesser horseshoe bat population have been ruled out.

Twelve other bat roosts were deemed to be in proximity to the Project (within 100m of the Assessment Boundary). Potential direct impacts are predicted on these roosts as a result of disturbance during the construction phase, although it is acknowledged that in some areas this impact may be of a lower magnitude than others as the boundary is set back from the actual construction footprint of the Project.

These roosts include night roosts for Lesser horseshoe bats, day roosts for Soprano and Common pipistrelle bats, Leisler's bats and a possible maternity roost for Brown long-eared bats. This is predicted to result in impacts regarded to be significant at a local level in the absence of mitigation for all of these species.

Only PBR173 is suspected to be vulnerable to a significant level of construction impacts. PBR173 is a suspected maternity roost for Brown long-eared bats. All other roosts are set back from the Assessment Boundary or are in locations where the construction works for the Project are less likely to be as intrusive.

The species that is potentially incurring the greatest potential loss of roosting is the Soprano pipistrelle bat population, which also happens to be the most commonly occurring bat in the country and recorded at almost all recording locations in the study area.

The impact on population of Lesser horseshoe bats lost as a result of demolition comes from the loss of one property at Aughnacurra (PBR178), a satellite roost to Menlo Castle (PBR06) (which itself will not be affected by the demolition works).

Habitat Loss

Bats rely on suitable semi-natural habitats which support the insect prey upon which they feed. The Project will result in loss of foraging habitat for all bat species recorded. There are few areas that are deemed unsuitable for bats or where the baseline data collection has not recorded bat activity.

For Lesser horseshoe bats, the radio-tracking studies have revealed areas proved to be used for feeding but for other bat species, their foraging areas have been inferred from predicted theoretical "core sustenance zones" (CSZ) taken from best practice guidance (UK Bat Conservation Trust, 2020). A CSZ refers to the area surrounding a communal bat roost within which habitat availability and quality will have a significant influence on the "resilience and conservation status" of the colony using the roost.

Due to the large number of bat roosts recorded in the Survey Areas, all parts of the Project overlap with at least one CSZ for a bat roost.

The level of significance of the loss of these foraging habitats can be described in terms of impacts on individual roosts in terms of the proportion of loss of the CSZ as a result of the Project. It is important to note that the percentage loss of area within the CSZ does not account for any additional barrier effects provided by the Project which could prevent bats reaching foraging areas on the other side of the proposed N6 GCRR.

There is also evidence (Berthinussen and Altringham, 2012[122]) that there is displacement of bats from the margins of the road corridor which extends the impact zone well outside of the construction area.

However, it should be noted that these displacement effects have only been investigated and detected in relatively open landscapes away from woodland and large water bodies. Certain sections of the Project where woodland is being retained close to the edge of the footprint of the proposed N6 GCRR, may exhibit less of an adverse effect.

Theoretical core sustenance zones (CSZs) for the Irish bat species are listed below with an indication of the level of confidence attached to the CSZ size. Unidentified bats have been given a CSZ radius of 3km which represents the average of the above CSZ radii. Where bats were identified only to genus level, calculations are included for CSZ radii of the largest and smallest radius of any Irish bat species in that genus.

The core sustenance zone for the Irish bat species are listed below in Table 8.36 with an indication of the level of confidence attached to the zone size.

Table 8.36 Bat Roosts Adjacent to the Project and CSZ

Species	CSZ Radius (km)	Confidence in CSZ Size (text taken from Bat Conservation Trust, 2016)
Lesser horseshoe bat	2	Good. The CSZ in the context of the roost at Menlo Castle and at Cooper's Cave is regarded to be 2km, based on the results of radio tracking surveys as documented in Section 8.3.8.25 of this report. This has been calculated using the same approaches as outlined in the BCT guidance (2020).
Brown long-eared bat	3	Poor. No data on mean-maximum distance between roost and foraging areas available from the literature. In addition, the calculated weighted

[122] Berthinussen A. and Altringham J. (2012) *The effect of a major road on bat activity and diversity*. Journal of Applied Ecology 2012, 49, 82–89

Species	CSZ Radius (km)	Confidence in CSZ Size (text taken from Bat Conservation Trust, 2016)
		(based on the number of bats used to calculate the CSZ) average (3.45km) lies just below the threshold where it was rounded down to give a CSZ size of 3km. The CSZ of the Brown Long-eared bat that was studied during radio-tracking in 2014 is regarded to be approximately less than 4km radius (maximum foraging distance was 4.07km but data collection only took place over 2 days). Since only one bat was tracked, the BCT recommended CSZ distance of 3km has been used.
Daubenton's bat	2	Poor. No data on mean-maximum distance between roost and foraging areas available from the literature. The maximum foraging distances of the Daubenton's bats that were studied has shown a limited feeding area within the River Corrib corridor up to 2.5km from the roost. Due to the low numbers of bats that were analysed the BCT recommended CSZ distance of 2km has been used.
Natterer's bat	4	Good. Calculation based on a reasonable sample size from multiple colonies and studies. The BCT recommended CSZ distance of 4km has been used.
Whiskered bat	1	Poor. Data available from multiple colonies but only for a single study for this species. The BCT recommended CSZ distance of 1km has been used.
Common pipistrelle bat	2	Moderate. Data available from multiple colonies but only from a single study. The BCT recommended CSZ distance of 2km has been used.
Soprano pipistrelle bat	3	Good. Calculation based on a reasonable sample size from multiple colonies and studies. The BCT recommended CSZ distance of 3km has been used.
Nathusius' Pipistrelle bat	3	Poor. Calculation based on small sample size. The BCT recommended CSZ distance of 3km has been used.
Leisler's bat	3	Poor. Calculation based on small sample size. The BCT recommended CSZ distance of 3km has been used.

For all confirmed roosts that were identified during the field surveys, the proportion of the CSZ that will be lost as a result of the Project was calculated (refer to Appendix A.8.25 for details). Whilst the CSZ is a generic radial distance from the roost, in some cases not all of this habitat would be regarded to be suitable foraging habitat for bats as it included built land with little suitable habitat to provide foraging resources. Bats will therefore not use all of the CSZ; they will selectively feed in the most resource rich areas. However, such potentially unsuitable areas within the footprint of the proposed N6 GCRR were not deducted from the CSZs for each roost, thereby giving a worst-case scenario for the assessment of impacts. CSZs around night roosts have not been included in this analysis as theoretically these roosts occur within the CSZ of the associated day roost.

The percentage loss of area within the CSZ does not account for any additional barrier effects provided by the road which could prevent bats reaching foraging areas on the other side of the proposed N6 GCRR. Research by Berthinussen and Altringham (2012a, 2012b, 2015) has identified landscape-scale reduction in bat activity and diversity as a result of the construction of road developments in the UK. Whilst barrier effects and severance of flight paths has been clearly demonstrated, the causes of displacement of bats from the margins of the corridor of the proposed N6 GCRR are less clear. (Also see Bontadina *et al.* (2002), Reiter *et al.* (2013), CALTRANS (July 2016): Technical Guidance for the Assessment and Mitigation of the Effects of Traffic Noise and Road Construction Noise on Bats, Luo *et al.*, (2015)).

The scale and significance of habitat loss during construction was therefore influenced by:

- The nature of the roost (transition/occasional roost occasionally used by small numbers of bats compared to maternity roosts for larger numbers of bats)

- Records of bats within the CSZ indicating concentrations of feeding within the CSZ which could suggest some areas being more important than others
- Proportion of suitable habitat within the CSZ
- Potential for the proposed N6 GCRR to form a barrier to reaching the remaining portions of the CSZ (i.e. whilst the loss of CSZ may be very small, bats may not be able to reach it and consequently a larger proportion of the CSZ may actually be unavailable)

Table 8.37 describes the total area of high-suitability habitat present within each CSZ, the area of high-suitability bat habitat that will be lost within each CSZ during construction, and the total area of high-suitability bat habitat remaining within each CSZ post-construction. These calculations take into account all areas of high-suitability habitat which are being retained within the Assessment Boundary.

High suitability commuting and foraging habitat for bats (i.e. high-quality bat habitat) is defined in Bat Surveys for Professional Ecologists: Good Practice Guidelines (Collins, 2023) as follows:

- 'Commuting habitat – Continuous, high-quality habitat that is well connected to the wider landscape that is likely to be used regularly by bats for flight-paths such as river valleys, streams, hedgerows, lines of trees and woodland edge
- Foraging habitat – high-quality habitat that is well connected to the wider landscape that is likely to be used regularly by foraging bats such as broadleaved woodland, tree-lined watercourses and grazed parkland
- Site is close to known roosts'

Based on the survey results, bats utilise a wide range of habitats, with the urban area of Galway City generally being the only foraging or commuting habitat not likely to be regularly used by bats. The high-density urban habitats and marine habitats have been removed from the CSZ high quality habitat calculations as they do not correspond to with high-suitability bat habitat in consideration of the habitat preferences of these bat species, the habitat types present within the CSZ and connectivity between them at a landscape scale, and the results of the bat surveys.

Table 8.38 describes the scale of habitat loss associated with bat roosts which will not be removed as a consequence of the Project.

Table 8.37 Extent of Direct High-Suitability Bat Habitat Loss within the Theoretical Core Sustenance Zone relating to the Roosts within the Assessment Boundary (*the calculated areas of high-suitability bat habitat loss take into account area of habitat*)

Roost Reference	Species	CSZ Radius	Area of Habitat Loss within the CSZ	% of Total CSZ being lost	Total Area of High-Suitability Bat Habitat within the CSZ	Area of High-Suitability Bat Habitat Loss within the CSZ	% of High-Suitability Bat Habitat Loss within the CSZ	Area of High-Suitability Bat Habitat remaining within the CSZ	Likely Significance of Impact of Habitat Loss
		km	ha	%	ha	ha	%	ha	
PBR50	*Pipistrellus species*	3	118.22	4.18	1879.23	95.30	5.07	1783.93	Significant negative effect at a local geographic scale only
		2	96.76	7.70	756.65	73.96	9.78	682.68	
PBR177	*Pipistrellus pygmaeus*	3	99.33	3.51	2012.00	95.99	4.77	1916.01	Significant negative effect at a local geographic scale only
PBR178	*Myotis species*	4	122.84	2.44	3363.79	119.50	3.55	3244.29	Significant negative effect at a local geographic scale only
		1	30.39	9.67	267.00	30.25	11.33	236.75	
	Rhinolophus hipposideros	2	63.21	5.03	1001.64	62.06	6.20	939.58	Significant negative effect at a local geographic scale only
PBR179	*Pipistrellus pygmaeus*	3	101.98	3.61	2163.37	101.67	4.70	2061.70	Significant negative effect at a local geographic scale only
PBR196	*Nyctalus leisleri*	3	114.67	4.06	2068.27	105.74	5.11	1962.53	Significant negative effect at a local geographic scale only
PBR199	*Myotis species*	4	148.08	2.95	3569.02	130.98	3.67	3438.05	Significant negative effect at a local geographic scale only
		1	36.49	11.61	290.26	36.49	12.57	253.78	
PBR204	*Plecotus auritus*	3	114.34	4.04	2055.14	105.80	5.15	1949.34	Significant negative effect at a local geographic scale only

Roost Reference	Species	CSZ Radius	Area of Habitat Loss within the CSZ	% of Total CSZ being lost	Total Area of High-Suitability Bat Habitat within the CSZ	Area of High-Suitability Bat Habitat Loss within the CSZ	% of High-Suitability Bat Habitat Loss within the CSZ	Area of High-Suitability Bat Habitat remaining within the CSZ	Likely Significance of Impact of Habitat Loss
		km	ha	%	ha	ha	%	ha	
PBR205_ST1 PBR205_ST9 PBR205_ST10	*Pipistrellus Species*	3	112.37	3.97	2108.17	89.45	4.24	2018.72	Significant negative effect at a local geographic scale only
		2	97.05	7.72	899.05	74.48	8.28	824.58	
PBR210	*Rhinolophus hipposideros*	2	63.01	5.01	1018.20	62.52	6.14	955.68	Significant negative effect at a local geographic scale only
PBR215	*Myotis species*	4	52.22	1.04	3254.61	52.22	1.60	3202.39	Significant negative effect at a local geographic scale only
		1	19.34	6.16	311.58	19.34	6.21	292.24	
PBR215	*Plecotus auritus*	3	43.89	1.55	2121.26	43.89	2.07	2077.37	Significant negative effect at a local geographic scale only
PBR241	*Rhinolophus hipposideros*	2	36.49	2.90	1034.25	36.49	3.53	997.75	Significant negative effect at a local geographic scale only
PBR248	*Pipistrellus pygmaeus*	3	117.68	4.16	1958.13	103.89	5.31	1854.24	Significant negative effect at a local geographic scale only
PBR250	*Pipistrellus pygmaeus*	3	114.52	4.05	2019.95	106.04	5.25	1913.92	Significant negative effect at a local geographic scale only
PBR252	*Pipistrellus pipistrellus*	2	61.86	4.92	968.84	61.85	6.38	906.98	Significant negative effect at a local geographic scale only
PBR255	*Pipistrellus pygmaeus*	3	98.62	3.49	1988.57	95.29	4.79	1893.28	Significant negative effect at a local geographic scale only
	Nyctalus leisleri	3	98.62	3.49	1988.57	95.29	4.79	1893.28	Significant negative effect at a local geographic scale only

Roost Reference	Species	CSZ Radius	Area of Habitat Loss within the CSZ	% of Total CSZ being lost	Total Area of High-Suitability Bat Habitat within the CSZ	Area of High-Suitability Bat Habitat Loss within the CSZ	% of High-Suitability Bat Habitat Loss within the CSZ	Area of High-Suitability Bat Habitat remaining within the CSZ	Likely Significance of Impact of Habitat Loss
		km	ha	%	ha	ha	%	ha	
PBR256	*Pipistrellus pygmaeus*	3	97.82	3.46	2006.82	94.48	4.71	1912.34	Significant negative effect at a local geographic scale only
PBR261	*Pipistrellus pygmaeus*	3	37.77	1.34	1906.73	37.77	1.98	1868.96	Significant negative effect at a local geographic scale only
PBR267	*Pipistrellus pygmaeus*	3	79.69	2.82	2019.54	76.50	3.79	1943.04	Significant negative effect at a local geographic scale only
	Plecotus auritus	3	79.69	2.82	2019.54	76.50	3.79	1943.04	Significant negative effect at a local geographic scale only

Table 8.38 Extent of Direct Habitat Loss around Confirmed Bat Roosts (*day roosts close to the Assessment Boundary, but not to be removed) (* takes into account that c. 10ha of foraging habitat is being retained intact within the Assessment Boundary at Menlough)*

PBR Ref	Species[123]	CSZ (km)[124]	CSZ (ha)	Area of CSZ within Assessment Boundary (ha)	Deductions for Habitat Retention within CSZ at Menlough (ha)	% loss
Roost Adjacent to Assessment Boundary (<100m)						
PBR73	MyNa	4	5027	133.25	10	2.45
PBR73	NyLe	3	2827	99.64	10	3.17
PBR139	NyLe	3	2827	64.13	N/A	2.27
PBR145	PiPy	3	2827	120.77	N/A	4.27
PBR173	PlAu	3	2827	103.07	10	3.29
PBR192	PlAu	3	2827	133.64	N/A	4.73
PBR219	RhHi	2	Night roost	N/A (76.84)	N/A	N/A
PBR216	PlAu	3	2827	44.52	N/A	1.57
PBR225	PiPy	3	2827	44.52	N/A	1.57
PBR225	PlAu	3	2827	44.52	N/A	1.57
PBR226	NyLe	3	2827	114.01	10	3.68
PBR229	PiSp	3	2827	136.52	N/A	4.83
PBR238	PiPy	3	2827	81.36	N/A	2.88
PBR250	PiPy	3	2827	126.66	10	4.13
PBR252	PiPi	2	1257	77.40	10	5.36
PBR288	PiPy	3	2827	50.03	N/A	1.77
Roosts away from Project (>100m)						
PBR6	MyDa	2	1257	78.18	10	5.42
PBR6	RhHi	footnote 2	2625[125]	98	10	3.35
PBR7	PiPi	2	1257	60.87	N/A	4.84
PBR15	PlAu	3	2827	0	N/A	N/A
PBR112	RhHi	2	1257	84.90	N/A	6.75
PBR17	PlAu	3	2827	102.85	N/A	3.64

[123] Species abbreviations are as follows; MyNat: *Myotis nattereri*, NyLe: *Nyctalus leisleri*, PiPy*: Pipistrellus pygmaeus*, PlAu*: Plecotus auratus*, RhHi: *Rhinolophus hipposideros*, PiSp*: Pipistrellus* species, PiPi: *Pipistrellus pipistrellus*, MyDa*: Myotis daubentoniid*, *Unid:* Unidentified, *MyMy: Myotis* species

[124] BCT (2020) *Core Sustenance Zones and habitats of importance for designing Biodiversity Net Gain for bats*. Bat Conservation Trust, London

[125] Based on the MCP for the 2015 radio-tracking surveys

PBR Ref	Species[123]	CSZ (km)[124]	CSZ (ha)	Area of CSZ within Assessment Boundary (ha)	Deductions for Habitat Retention within CSZ at Menlough (ha)	% loss
PBR17	MyNa	4	5027	141.83	10	2.62
PBR18	RhHi	2	1257	17.18	10	0.57
PBR20	MyNa	4	5027	130.86	10	2.40
PBR21	PlAu	3	2827	49.90	N/A	1.77
PBR21	RhHi	2	1257	0.03	N/A	0.00
PBR25	PlAu	3	2827	106.67	10	3.42
PBR25	RhHi	2	1257	71.44	10	4.89
PBR42	PiPy	3	2827	45.40	N/A	1.61
PBR44	RhHi	2	1257	0	N/A	N/A
PBR44	PiPy	3	2827	0	N/A	N/A
PBR47	Unid.	4	5027	115.40	10	2.10
PBR51	PlAu	3	2827	100.23	N/A	3.55
PBR54	RhHi	2	1257	90.32	N/A	7.19
PBR64	MyNa	4	5027	41.76	N/A	0.83
PBR82	PlAu	3	2827	110.20	10	3.54
PBR82	RhHi	2	Night roost	N/A	N/A	N/A
PBR82	MyNa	4	5027	136.77	10	2.52
PBR83	RhHi	2	Night roost	N/A	N/A	N/A
PBR85	RhHi	2	Night roost	N/A	N/A	N/A
PBR89	PlAu	3	2827	41.93	N/A	1.48
PBR92	PlAu	3	2827	29.44	N/A	1.04
PBR94	PlAu	3	2827	48.11	N/A	1.70
PBR100	PlAu	3	2827	90.97	N/A	3.22
PBR105	PlAu	3	2827	91.82	N/A	3.25
PBR111	PlAu	3	2827	106.79	N/A	3.78
PBR124	RhHi	2	1257	27.46	N/A	2.18
PBR125	RhHi	2	Night roost	N/A	N/A	N/A
PBR126	RhHi	2	Night roost	N/A	N/A	N/A
PBR127	RhHi	2	Night roost	N/A	N/A	N/A
PBR128	RhHi	2	Night roost	N/A	N/A	N/A

PBR Ref	Species[123]	CSZ (km)[124]	CSZ (ha)	Area of CSZ within Assessment Boundary (ha)	Deductions for Habitat Retention within CSZ at Menlough (ha)	% loss
PBR129	RhHi	2	Night roost	N/A	N/A	N/A
PBR130	RhHi	2	Night roost	N/A	N/A	N/A
PBR133	MyDa	2	1257	68.13	10	4.62
PBR134	NyLe	3	2827	125.69	N/A	4.45
PBR136	Unid.	4	5027	97.65	N/A	1.94
PBR138	PlAu	3	2827	84.28	10	2.63
PBR140	MyMy	1	314	12.38	N/A	3.94
PBR141	PiPi	2	1257	51.19	N/A	4.07
PBR142	MyDa	2	1257	24.70	10	1.17
PBR143	MyDa	2	1257	44.51	10	2.75
PBR144	MyDa	2	1257	26.67	10	1.33
PBR147	PiPi	2	1257	51.00	N/A	4.06
PBR148	PiPi	2	1257	23.15	N/A	1.84
PBR149	PiPi	2	1257	24.09	N/A	1.92
PBR150	MyDa	2	1257	0.05	N/A	0.00
PBR151	MyMy	1	314	12.55	N/A	4.00
PBR152	MyDa	2	1257	0.03	10	N/A
PBR153	RhHi	2	1257	90.28	N/A	7.18
PBR156	RhHi	2	Night roost	N/A	N/A	N/A
PBR156	PlAu	3	Night roost	N/A	N/A	N/A
PBR157	RhHi	2	Night roost	N/A	N/A	N/A
PBR158	RhHi	2	1257	70.96	10	4.85
PBR159	RhHi	2	1257	0	N/A	N/A
PBR160	RhHi	2	1257	0	N/A	N/A
PBR165	PiPi	2	1257	50.74	N/A	4.04
PBR217	RhHi	2	1257	26.49	N/A	2.11
PBR217	PlAu	3	2827	49.93	N/A	1.77
PBR218	RhHi	2	Night roost	N/A	N/A	N/A
PBR220	PiPi	2	1257	34.13	N/A	2.72
PBR222	PiPy	3	2827	53.80	N/A	1.90

PBR Ref	Species[123]	CSZ (km)[124]	CSZ (ha)	Area of CSZ within Assessment Boundary (ha)	Deductions for Habitat Retention within CSZ at Menlough (ha)	% loss
PBR224	PiSp	3	2827	53.23	N/A	1.88
PBR242	PiSp	3	2827	128.36	N/A	4.54

The proportion of habitat loss relating to each roost being lost is less than 7% of the CSZ in all but four cases. These 4 cases are all bats which had been identified only to species level, and more than 7% of the CSZ is lost only in the scenario where the smallest CSZ radius for a species in that genus has been used. The proportion of the CSZ being lost is less than 5% of the CSZ in the majority of other cases.

For Pipistrelle bat species which are adapted to feeding in a wide variety of landscape types, the impact of habitat loss during construction is not predicted to be significant since these bats will be able to utilise the majority of suitable habitat in their CSZ that is currently available to them and are not reliant on having to cross the construction area to reach foraging areas. This applies particularly to roosts to the north of the Assessment Boundary as the majority of optimal feeding areas are outside of the urban city core which lies to the south.

For Lesser horseshoe bats which show a greater preference for following linear landscape features between roosts and foraging areas[126], the potential impact of habitat loss is compounded by the barrier effect which may prevent bats using suitable habitats on the other side of the Assessment Boundary or moving between day and night roosts or between different roosts used at other times of year. Impacts are regarded to be potentially significant at a county level if the foraging range is affected (e.g. by not being able to reach night roosts) or national-scale where the fecundity or mortality rates are affected due to lack of feeding resources as a result of loss of feeding habitat and barrier effects. Significant efforts have been made to provide effective methods to getting bats across the construction areas and underneath or over the proposed N6 GCRR so that they can avail of habitats on both sides of the proposed N6 GCRR.

The magnitude of habitat loss for Lesser horseshoe bats has been measured in terms of the physical loss of the most important habitat as a result of the Project. The area deemed to be of highest importance for Lesser horseshoe bats is regarded to be the core foraging area used by Menlo Castle (PBR06) radio-tracked bats in summer 2015 and still present in 2023.

Prior to the birthing period in mid-June, female bats will utilise the best foraging habitats closest to the roost and research in at least one study (Bontadina *et al*, 2002[127]) has highlighted the importance of habitat within 600m of the roost.

Approximately 7ha of woodland, scrub, hedgerows and grassland will be lost in the area from the River Corrib to the Bothár Nua which spans the core foraging area for the Menlo Castle roost (PBR06).

The loss of this 7ha equates to 5.6% of the core foraging area (125ha) recorded in 2015 which is regarded to be the area of highest importance for the roost[128], although not all of the core foraging area is used equally by bats.

The loss of habitat within the core foraging area for the Menlo Castle Lesser horseshoe roost (PBR06) is deemed to be a potentially significant factor threatening the viability of the roost there. If bats cannot feed close to the roost, especially close to the birthing period, then fecundity may be reduced. When compounded

[126] In the CEDR guidelines they are in Group A: Extremely manoeuvrable bats, which often fly within foliage, or close to vegetation, surfaces and structures at variable flight heights. When commuting, they often follow linear and longitudinal landscape elements. Low-flying (typically < 2 m) when commuting over open gaps.

[127] Bontadina, F., Schofield H. and Naef-Daenzer B. (2002) *Radio-tracking reveals that Lesser horseshoe bats (Rhinolophus hipposideros) forage in woodland*. J. Zool., Lond. 258, 281-290.

[128] This differs from the 98ha of land within the Assessment Boundary which is within the 2925ha of CSZ for the roost at Menlo Castle as per the table in Appendix K.

by other potential effects of the Project (collision, barrier effects) this relatively small loss of habitat might have a significant impact on the population.

Other bat roosts in proximity along the Project are unlikely to be associated with such optimum bat habitats. The loss of woodland in the Menlough area is unavoidable as the belt of woody vegetation on the northeast bank of the river stretches from the Quincentenary Bridge in the city all the way to Menlough Village and therefore the proposed N6 GCRR and as such the Project will inevitably cross it at some location.

In order to prevent the loss of foraging habitats resulting in an adverse impact on bat species at either a local, county or national geographic scale, design measures have been incorporated into the design of the Project. This updated EIAR therefore only addresses those impacts which cannot be fully mitigated by design.

Fragmentation of foraging habitat and commuting routes and areas used by bats for other non-roosting activities[129]

Given that there is evidence of bats crossing the Assessment Boundary in multiple locations, and that all parts of the Project are within the theoretical or proven CSZ of at least one bat roost, there is the potential for the Project to act as a barrier to flight paths for all species (except Leisler's bats which have been shown to fly at greater altitudes so as not to be affected by ground level features) and in all locations.

The barrier effect can manifest itself as soon as the site clearance phase commences and the barrier itself is in the form of the cleared lands. Removal of hedgerows, treelines, woodland and scrub will take place across the length of the Project. Whilst it is not proposed to remove all the vegetation within the Assessment Boundary, it has been assumed that intervention of some kind in the landscape may occur within the boundary to the extent that it could affect bat behaviour, thereby assessing the worst-case scenario.

Interpretation of the patterns of bat activity records has indicated that potential barrier effects would be most significant at the following locations:

1. Bats flying to/from Bearna Woods – The woods were one of the few sites where Natterer's bats were recorded and also support a small/dispersed population of Lesser horseshoe bats. The relatively open, heathy landscape to the north of the woods would be regarded to offer less suitable opportunities for bat foraging so the woods are likely to be important for local populations of several bat species.

2. Aughnacurra (including Chestnut Lane and Upper Dangan) – the potential barrier effect posed by the Project here is somewhat reduced by the proximity of the River Corrib which bats use as a flight corridor. The barrier effect would be likely to supress movements at a very localised scale.

3. Barrier effects in the area spanned by Menlough Castle-Coolagh-Castlegar are potentially the most significant as it is the known core foraging area/CSZ for the nationally-important Menlo Castle population of Lesser horseshoe bats as well as for roosts of other bat species close to the Assessment Boundary. Severance of Lesser horseshoe flight paths between Menlo Castle and Cooper's Cave in particular could have significant effects on the ability of the breeding population to mate and hibernate in suitable roosts. Severance of flight paths between day and night roosts also could affect the ability of bats to reach suitable foraging areas further away by using the night roosts as stepping-stones.

4. The location of the Menlo Castle roost is regarded to be at a key location in the national distribution of Lesser horseshoe bats. The main strongholds for this species are in south Mayo, mid-Clare/south Galway, Kerry and West Cork but the species is present all along the west coast counties from Cork to Leitrim. Analysis of the genetic and echolocation differences has revealed that the Irish population is made up of differentiated north and south populations (Dool *et al*, 2016[130]). Factors such as habitat connectivity were identified as being one of the reasons why this species is subject to population fragmentation at a national scale. Dool *et al* (2016) describe the "Limerick gap" as an area where there has been a separation of lesser horseshoe bat populations, leading to genetic isolation in these areas. As

[129] As fragmentation of feeding habitat has the potential to disturb normal bat behavioural patterns, and thus adversely affect the ability of local bat populations to persist and reproduce, impacting on their local distribution and/or abundance and thereby conflicting with Regulation 51(b) of S.I. 477.

[130] Dool S.E., Puechmaille S.J., Kelleher C., McAney K., and Teeling E. (2016) *The effects of human-mediated habitat fragmentation on a sedentary woodland-associated species (Rhinolophus hipposideros) at its range margin.* Acta Chiropterologica, 18(2): 377–393, 2016.

can be seen in Plate 8.2, the Menlo Castle roost is in an area of similarly low densities of roost records and the loss of the population could create a new gap in in the natural range of the species in Ireland.

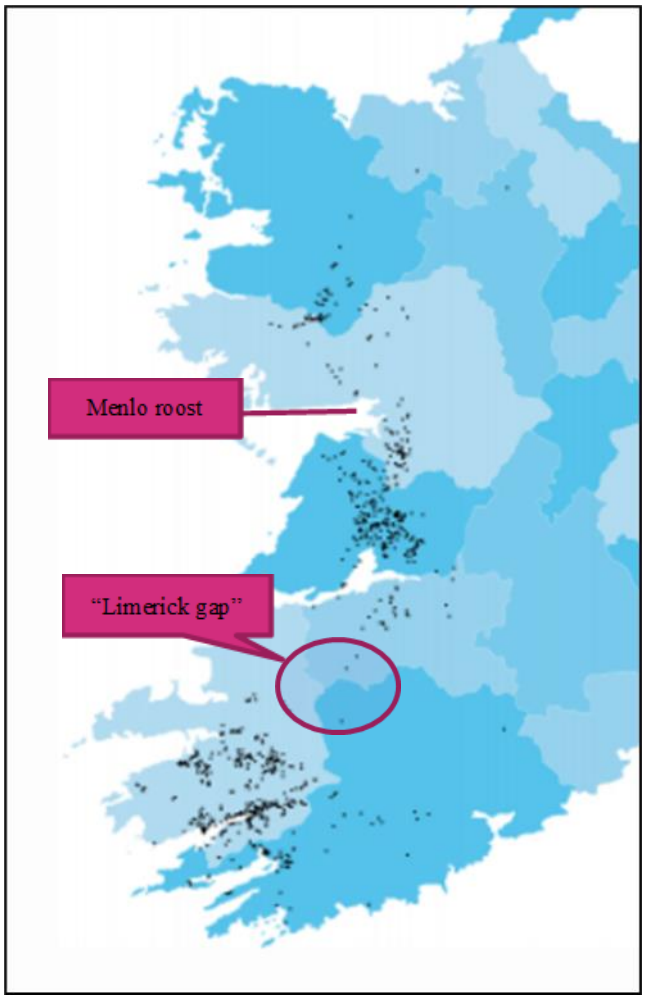

Plate 8.2 Lesser horseshoe Bat Population Distribution (*taken from Bat Conservation Ireland distribution maps*)

5. Based on the distribution of maternity roosts in the range of this species in Ireland, the Menlo Castle maternity roost and the local population it supports are of national importance, as defined in NRA (2009) "a smaller population may qualify as nationally-important where the population forms a critical part of a wider population or the species is at a critical phase of its life cycle". However, the roost size falls well below the threshold for designation as a Special Area of Conservation (100 bats in maternity roost) and it has been confirmed by the NPWS as not being part of the Lough Corrib SAC's qualifying interest population.

6. There are only six known maternity roosts in and around Lough Corrib, with the majority of roosts concentrated on the northern shores near Cong. Only two roosts are located on the southern end: Ross Lake Gatehouse and Menlo Castle. These southern roosts may be stepping-stones for long-term movements and gene flow between bats at the northern shore of Lough Corrib, Lough Mask and Lough Carra and populations in South Galway and Clare. Recent counts from Ross Lake Gatehouse have shown that this roost has undergone significant deterioration resulting in decline in numbers from 150 bats in 1994 to five bats in 2011 (Rebecca Teesdale pers. Comm., 2014 and p44 in Roche *et al*, (2015)). A decline in the Ross Lake roost could potentially increase the relative importance of the roost at Menlo Castle as a stepping stone roost, as it would be the only significant maternity colony at the southern end of Lough Corrib.

7. Prior to 2020, Menlo Castle itself was in a structurally-unstable condition and the bat roost was vulnerable to rock fall, vandalism and blockage within the chimney flue. Since 2020, a series of restorative works has been conducted at Menlo Castle. These were still ongoing in 2023. If bats were not able to reach the foraging areas and Cooper's Cave due to a barrier effect, then it would add another

impact which might put the viability of this population at risk. There is no evidence to suggest that Menlo Castle Lesser horseshoe bat population is connected to the Eborhall Lesser horseshoe bat population, which is the qualifying interest (QI) population for Lough Corrib SAC. Any predicted impacts on Lesser horseshoe bats associated with the Project will not affect the conservation objectives of the Lough Corrib SACs QI Lesser horseshoe bat population, nor the QI Lesser horseshoe bat populations of any other European sites.

The numbers of Lesser horseshoe bats recorded using Cooper's Cave for hibernation has been relatively small (around 10% of the estimated roost size at Menlo Castle) but much of the cave is not accessible and there may be higher numbers present. The only other hibernation site known for this population is Menlo Castle and the roost site is not accessible for counting. A wildlife overpass has been included as part of the design of the Project to allow bats to reach the cave for hibernation and to avoid them being forced to use less suitable locations. While Cooper's Cave is under on-going pressures from fly tipping and disturbance, it is likely that bats will continue to use it unless the entrance is blocked altogether.

The western portion of the proposed N6 GCRR (from Bearna to Upper Dangan) has a lower distribution density of bats and has less-suitable habitats for foraging but a barrier effect is still predicted in the absence of any effective mitigation. Such potential impacts are likely to result in a significant negative effect at a local geographic scale as the bat populations have been valued as being important at a local geographic scale, there are few roosts known in this area, and no important landscape features (such as major watercourses, areas of woodland or hedgerow networks) are predicted to be severed.

Mitigation to preserve flight paths across construction areas are detailed in Section 8.6.5.2.

Installation of temporary working and site compound lighting which may cause indirect disturbance of flight patterns

As construction works will typically be undertaken during normal daylight working hours, the requirement for lighting for construction works during night time will be limited.

Over the expected 36-month construction phase there will be up to a total of 10 weeks of night time working. Temporary night-time closure of existing local roads may be required where overbridges are to be constructed at locations such as the Rahoon Road, Letteragh Road, N59 Moycullen Road, Menlo Castle Bóithrín, Bóthar Nua, Seanbóthar, N84 Headford Road, N83 Tuam Road, Briarhill Business Park Road and R339 Monivea Road.

Night-time working requiring the use of floodlighting to permit safe working have the potential to displace bats from the illuminated area. This will be particularly sensitive at the following locations:

- N59 Moycullen Road near the Aughnacurra satellite roost (PBR178) and a proposed replacement roost structure
- Menlo Castle Bóithrín which is an important flight path for Lesser horseshoe bats and other bat species
- Bóthar Nua which is an important flight path for Lesser horseshoe bats and other bat species
- Sean Bóthar which is an important flight path for Lesser horseshoe bats and other bat species
- N84 Headford Road which is an important crossing point for Lesser horseshoe bats and close to known night/occasional day roosts for this species and is also close to a proposed replacement roost structure

In all cases where lighting may cause disturbance, it will be temporary in nature but may last over several consecutive nights and this could result in temporarily lower bat diversity in these areas. Such displacement (which would be a matter of metres) could prevent bats from accessing foraging areas or roosts, or result in bats taking more circuitous routes to get to foraging areas and hence potentially depleting energy reserves.

It cannot be predicted precisely when these works will take place during the year but it could be a significant disturbance if affecting bats pre-parturition (birth) or pre-hibernation when energy reserves are essential for survival. However, the potential impact only arises during months when bats are most active (April to September) and during these months the need for night lighting is likely to be limited as daylight hours are longer.

Such potential impacts have the potential to result in a significant negative effect at a local geographic scale.

Operational Phase Impacts

Direct mortality through collisions

Research (Butchkowski and Hassinger, 2002; Dodd *et al*., 2004; Capo *et al*., 2006; Choquene, 2006; Glista and DeVault, 2008; Hein *et al*.,2009; Russell *et al*., 2009; Sparks and Choate, 2000; Whitaker and Mumford, 2009) has provided evidence that mortality of bats due to road collisions can reach an annual mortality of 5% of the bats in local roosts. Altringham (2008) arrived at a similar estimate, based on conservative calculations for a road in the UK crossed by lesser horseshoe bats from a large roost (data from Billington, 2001-2006).

Theoretical studies (e.g. Lande 1987, With and King 1999, Carr and Fahrig 2001) "show that populations of animal species with low reproductive rates and high intrinsic mobility, such as bats, are more susceptible to decline and ultimately extinction by the additional mortality caused by roads" (taken from Appendix A, WC1060 main report).

Lesiński (2007) recorded mortality highest where roads approached tree stands (up to 6.8 per km/year) or crossed a forest (2.7 per km/year) and lowest within densely built-up areas (0.3 ind./km/year). If the highest rates were applied to the Lesser horseshoe bat roost at Menlo Castle (PBR06) then this could equate to 34 deaths per year based on the maximum roost foraging area being bisected by c. 5km of the proposed N6 GCRR (based on radio-tracking in 2014). The lower rate for mortality near forests would result in 13 deaths per year. Whilst the long-term population fluctuations are not known for this population, in a worst-case scenario such mortality rates could cause the entire roost to become extinct in less than two years assuming that all of the bats in the roost are exposed to the same level of mortality risk and that all of the bats killed per km were of this species. The loss of this roost would be regarded to be a significant potential effect at a national geographic scale, assuming a worst-case scenario and in the absence of any mitigation.

Similar mortality rates could be applied to similar low-flying gleaning species of bats such as Brown long-eared bats and some Myotis species such as Daubenton's bats. Since this would have significant negative effect on these species, a complex mitigation strategy has been developed and is presented in Section 8.6.5.2.

Measures that have been incorporated into the design of the Project including underpasses, culverts and a wildlife overpass at Castlegar, will reduce the percentage of the local bat population flying over the proposed N6 GCRR (and) being at risk of collision. The risk cannot be removed entirely as not all measures are 100% effective at a population level, so a derogation licence has been sought (see Appendix A.8.25 – Part 2) to permit any residual mortality incidents which may occur. It noted in this context that a bat derogation licence application for the Project was submitted to the NPWS in March 2024, and granted in April 2024 (see Appendix A.8.25 Part 1 of this updated EIAR for the 2024 bat derogation licence). As the 2024 bat derogation licence expired on 31 December 2024, a new derogation licence application was submitted to the NPWS on 1 April 2025.

Barrier/Severance effects

The effects of the Project on the movements of bats across the landscape after completion have been studied more frequently than the effects during the construction phase. Monitoring of bat activity around road schemes have shown the effects of traffic disturbance, lighting, loss of connecting landscape features and foraging habitats can result in depreciation in bat activity up to 1.6km from the road itself in certain landscapes (Berthinussen and Altringham (2012b, 2015), Elmeros *et al* (2016). The research is still in progress and the effects of different habitat types at the edge of the road carriageway is yet to be fully understood. In the absence of fully applicable research, it is predicted that potential significant impacts caused by the Project acting as a barrier to landscape-scale movements may occur in the following location and on the following species:

- Movements of bats to Bearna Woods: As described in the context of impacts on PBR241, the Project may impact on the movements of bats using north-south trajectory. Bearna Woods was noted as an area of relatively high bat diversity and abundance and is one of the few areas of continuous woodland in this part of the study area. A barrier effect may limit populations mixing outside of the Bearna Woods area and potentially lead to decline in reproductive rates. There are seven confirmed roosts south of the Project near Bearna which could persist in the presence of the Project but will have more limited access to foraging areas north of the Project. The survey results have suggested widespread bat activity along

the roads aligned north-south. Some of these may continue to be used by bats and cross the narrower parts of the proposed N6 GCRR but there are no culverts or underpasses in this location that allow bats to pass under the Project

- Movements of bats along banks of the River Corrib: Currently, bats move up and down the River Corrib corridor unhindered by lighting or physical obstacles. It is possible that existing lighting within the UoG campus and at Quincentenary Bridge may be a deterrent to light-sensitive bats such as Lesser horseshoe bats. The Project will introduce embankments for the bridge on both banks which could present a physical barrier to such movements. While bats will be able to fly around the toe of the abutments on each bank and under the elevated deck of the proposed River Corrib Bridge and have free movement over the river itself, such re-routing of flight paths could add to the energy requirements for individual bats. On the west bank, assuming that bats are commuting north-south in the area from the N59 Moycullen Road to the river (750m wide corridor), the proposed abutments would reduce the flight corridor to 420m and lead to an additional c. 500m of flight to get around the abutment in the Aughnacurra area. Assuming a flight speed of 3.5m/s (Lesser horseshoe bat) this would mean that a flight of 60m across the Project that would normally take 17s will take 142s when the proposed River Corrib Bridge is in place. On the eastern bank, bats will be able to fly either around the western toe of the bridge abutment or under the road at the Menlo Castle Bóithrín with the barrier stretching between the two points for a distance of 210m

- Movement of bats in the area around Menlough-Coolough Road-Ballindooley-Castlegar area: this area is regarded to be important for Lesser Horseshoe bats, Brown long-eared and Pipistrelle bats. The movement of Lesser horseshoe bats has been confirmed by radio-tracking individuals in 2014 and 2015. This data suggests that the majority of flights across the Project are in the section Ch. 9+500 – Ch. 10+150 of the proposed N6 GCRR between the River Corrib and the Coolough Road. The embankment section will either provide a barrier to bats or force them up and over the proposed N6 GCRR bringing them across the flow of traffic and risking collision with vehicles. Similar potential barrier effects are predicted at the N84 Headford Road and further east at Ch. 12+200 – Ch. 12+450 of the proposed N6 GCRR and at locations north of Castlegar Village. Static detectors placed at Ch. 12+600 and Ch. 12+750 proposed N6 GCRR in 2015 recorded relatively high levels of activity for Lesser horseshoe bats, Common and Soprano pipistrelle bats and Leisler's bats suggesting that they would be affected by a barrier to movement in this location (Leisler's bats less so due to their tendency to fly at height).

Barrier effects in the absence of mitigation are likely to result in a significant negative effect at a local geographic scale for all chainages along the route of the proposed N6 GCRR and at a national geographic scale for effects in the section Ch. 8+500 (N59 Moycullen Road) to Ch. 13+150 (School Road, Castlegar) proposed N6 GCRR.

Mitigation to reduce barrier effects within the design and operation of the Project are detailed in Section 8.6.7.2.

Indirect disturbance of flight patterns due to operational lighting

The barrier effect can be compounded by light spill associated with the illumination of the corridor of the proposed N6 GCRR. Examination of light spill modelling has identified potential light spill impacts on bats (where light levels exceed 1 lux) at the following locations:

- Ch. 2+850 of the proposed N6 GCRR: Lighting at the Bearna East Roundabout may impact on the movement of bats in the locality and prevent them using the proposed culvert CO2/01b. However, proposed landscape planting near the mouth of the culvert entrances will help in shading the flight paths approaching the culvert at this location to allow bats to fly through.

- Ch. 4+300 – Ch. 4+550 of the proposed N6 GCRR: Lighting at the Cappagh Road junction is close to PBR139 and PBR146 (both Leisler's bat roosts) and Soprano pipistrelle activity has been recorded nearby. Localised displacement may occur in this area although the presence of roadside scrub and garden shrubs and trees will provide shaded area which may be used by bats to avoid lit areas.

- N59 Link Road North and South on the proposed N6 GCRR: This will be illuminated over a length of 2.4km across open agricultural and heath landscape. Light spill may cause a localised barrier to

movements in an east-west direction although there are only two roosts (PBR49 and PBR237) which are parallel to this link road and neither are in the light spill of the proposed lighting design.

- Ch. 11+050 – Ch. 11+150 of the proposed N6 GCRR: Lighting at western entrance to Lackagh Tunnel. This will be localised and will not affect roosts but is likely to have a displacement effect on bats over an area of circa 150m x 50m where light levels exceed 1 lux. Whilst there is little bat activity data collected for this location, it is likely to be used by several species of bats for feeding and commuting.

- Ch. 11+380 – Ch. 11+500 of the proposed N6 GCRR: Lighting at eastern entrance to Lackagh Tunnel. This will be localised and will not affect roosts but is likely to have a displacement effect on bats over an area of circa 150m x 50m where light levels exceed 1 lux. There is bat activity data collected for this location including feeding and resting Lesser horseshoe bats and it is likely to be used by several other species of bats for feeding and commuting.

- Ch. 11+975 – Ch. 14+500 of the proposed N6 GCRR: The N84 Headford Road at this location is currently unlit and the proposed new lighting will introduce c.8ha of illuminated area. This area is used by several species including Lesser horseshoe bats and will result in a displacement from this area. PBR154 (a Lesser horseshoe bat night roost and occasional day roost) will be impacted upon by light spill to the roost. However, the entry to the roost will still remain unlit and well shielded from the lighting as it faces to the east and is at a lower elevation than the N84 Headford Road and the Project. Light spill from lighting columns in the area of Ballindooley-Castlegar (Ch. 12+600 to Ch. 13+600 of the proposed N6 GCRR) will generally be contained within the immediate vicinity of the Project which, at this location, is sunken below the level of the surrounding landscape. Light spill here will help to deter bats from crossing the road and reduce the risk of vehicle collision, whilst the Castlegar Wildlife Overpass will be in darkness and provide a safe crossing point.

- Lighting in the area around the N83 Tuam Road Junction, the City North Business Park Link and the Parkmore Link Road will alter and may have localised impacts on the flight paths of Pipistrelle species recorded nearby.

- Ch. 14+850 – Ch. 15+000 of the proposed N6 GCRR: Eastern end of Galway Racecourse Tunnel entrance. This will be localised and will not affect roosts but is likely to have a displacement effect on bats over an area of circa 150m x 50m where light levels exceed 1 lux. This may lead to localised impacts on the flight paths of Pipistrelle species recorded nearby.

- Ch. 15+150 – Ch. 15+300 of the proposed N6 GCRR: Western end of Galway Racecourse Tunnel entrance. This will be localised and will not affect roosts but is likely to have a displacement effect on bats over an area of circa 150m x 50m where light levels exceed 1 lux. This may lead to localised impacts on the flight paths of Pipistrelle species recorded nearby.

- Ch. 15+500 – Ch. 17+483 of the proposed N6 GCRR (end of the Project): Scattered records of Pipistrelle species and Leisler's bats in this location suggest that the widened illuminated corridor in this location will result in localised displacement. This impact is not regarded to be significant as most of the bat records suggest activity is focused to the northeast away from the Project.

The potential impact of vehicle lighting has been assessed in the context of the potential illumination of Menlo Castle (PBR06). This would have particularly high sensitivity due to the absence of any notable lighting at present and the presence of both a maternity roost and hibernacula for Lesser horseshoe bats, a maternity roost for Daubenton's bat and a former Brown long-eared roost; all species which would be susceptible to lighting impacts. In a worst case scenario, the cumulative impact of many vehicles on the River Corrib Bridge on Menlo Castle is less than 0.01 lux and this would only result on the top section of the castle. Given that the Lesser horseshoe bats generally flew at heights of 1-3m above the ground at and near the roost location this is not predicted to affect their flight paths. This level of illumination is also well within the tolerance range for this species.[131].

[131] Average light levels recorded along preferred commuting routes of *Rhinolophus hipposideros* under natural unlit conditions were 0.04 lux across eight sites. Stone E.L. (2011) *Bats and development: with a particular focus on the impacts of artificial lighting.* (Ph.D. Thesis) University of Bristol, UK (2011)

There are no roosts that will be directly illuminated by the proposed operational lighting to the extent that any likely significant effects are predicted.

8.5.7.3 Badger

Construction Phase Impacts

There were a total of 24 badger setts recorded across the study area. Four of these setts (S9, S11, S14 and S24) were within the Assessment Boundary. Four setts (S3, S10, S18, and S20) were within the ZoI of general construction activities (i.e. within 50m) based upon the impact distance bands described in the TII guidance (National Roads Authority, 2006c). A further 11 setts (S2, S4, S8, S13, S15, S16, S17, S19, S21, S22, and S23) were within the ZoI of any potential pile driving or blasting works, i.e. within 150m. The remaining setts (S1, S5, S6, S7 and S12) are beyond the ZoI of any construction activities.

Although it cannot be predicted if Badger will establish new setts within the ZoI of the Project before construction works commence, it is a possibility and this scenario has been taken into account in the mitigation strategy (refer to Section 8.6.5.3).

Based on interpretation of the survey results, the directly affected badger setts (S9, S11, S14 and S24) were considered to be within the territories of three badger groups. S9 and S11 are considered to be part of one badger group to the east of Lackagh Quarry (hereafter, referred to as the Lackagh badger group). S14 is considered to be part of a separate badger group west of the N83 Tuam Road Junction at Cappanabornia (hereafter, referred to as the Cappanabornia badger group). S24 is considered to be part of a separate badger group west of Barna in Knocknagreana (hereafter, referred to as the Knocknagreana badger group).

Loss of Foraging Habitat

Construction will result in the permanent loss of foraging habitat within the territories of up to ten badger groups across the study area[132]. The loss of habitat is likely to affect each of the badger groups to some degree, at least temporarily, as it will reduce the foraging area and feeding resource available within their existing territories. This is also likely to have a knock-on consequence of increased conflict with neighbouring Badger groups in competition for resources - although this territorial behaviour is a natural dynamic between neighbouring Badger groups in response to many other factors that affect population numbers, territorial behaviour, and dispersion of individuals.

There is an abundance of alternative suitable foraging habitat locally which is likely to be sufficient to maintain the local population in the long-term. Although the actual effect of foraging habitat loss cannot be quantified in terms of any threshold value that could be predicted, each of the affected Badger groups would be expected to adapt to the changed landscape. It is therefore predicted that, despite any temporary effects, the loss of foraging habitat associated with the Project is unlikely to affect the conservation status of the local badger population and will not result in a likely significant negative effect, at any geographic scale.

Loss of breeding/resting sites

The Project will result in the permanent loss of four badger setts, affecting three badger groups: the main sett (S9) and a subsidiary sett (S11) of the Lackagh Quarry badger group; a subsidiary sett (S14) of the Cappanabornia badger group; and a sett (S24) of the Knocknagreana badger group whose status is undefined.

The significance of sett loss in relation to any badger group is based upon consideration of the type of sett, its importance to the badger group, and the availability of either alternative setts for affected badgers to relocate to or the availability of alternative suitable sett building habitat within the territory. Locally, given the underlying karst nature of the area, limestone is generally overlain by thin soils and frequently outcrops locally as limestone pavement; offering limited opportunities for sett building habitat. As a consequence, the significance of sett loss with respect to both badger groups is largely dependent on the presence of existing alternative setts within their territories. As discussed above in relation to loss of foraging habitat, sett loss may also lead to increased conflict with neighbouring Badger groups if alternatives, in the form of existing

[132] This territory number estimate is based upon an interpretation of the survey results – sett locations, sett types, and the distribution of signs such as tracks, foraging and latrine sites

setts or suitable habitat to construct setts, are not available within the existing territory. There is also the potential for Badgers to be killed during site clearance works where setts are being removed.

The Lackagh Quarry badger group will lose two out of three setts (S9 and S11) recorded within their territory - including the main sett. The remaining subsidiary sett (S10) lies within the ZoI of what will likely be significant disturbance effects resulting from rock breaking and blasting associated with excavating the eastern approach to Lackagh Quarry, from the N59 Moycullen Road. Considering those factors and that there is little alternative suitable sett building habitat in the immediate vicinity, the Project may have a long-term effect on this Badger group. On that basis, it is considered that the Project has the potential to negatively affect the conservation status of this badger group and result in a likely significant negative effect, at a local geographic scale.

In relation to the Cappanabornia badger group, the Project will result in the loss of a single subsidiary sett (S14) within its territory. There are two other Badger setts nearby, S13 and S15, both of which were also classified as subsidiary setts. Whilst it is not known whether all three setts are used by the same Badger group, based on their relative locations and distance from one another, it's probable that at least one of those setts is and would therefore provide a suitable alternative to S14. Given there are alternative setts, and alternative suitable sett building habitat, available beyond the ZoI of general construction activities the loss of sett S14 is not likely to affect the species ability to maintain itself on a long-term basis locally, will not affect its conservation status locally, and will not result in a likely significant negative effect, at any geographic scale.

In relation to the Knocknagreana badger group, the Project will result in the loss of a single sett (S24), of unknown type, within its territory. There is one badger sett nearby (S23), classed as a subsidiary sett. S24 was noted as a rock mound with anecdotal evidence of badgers using it as a sett; however, no digging or fresh evidence was identified. It is likely S24 is only used sporadically by badgers, if at all, and given the distance between the setts, it is probable that S23 would provide a suitable alternative to S24. Given there are alternative setts, and alternative suitable sett building habitat available beyond the ZoI of general construction activities, the loss of S24 is not likely to affect the species ability to maintain itself on a long-term basis locally, will not affect its conservation status locally, and will not result in a likely significant negative effect, at any geographic scale.

Given the legal protection afforded to Badgers under the Wildlife Acts, which prohibits their intentional killing or injury, or the wilful interference with their breeding or resting places, a mitigation strategy has been developed (see Section 8.6.5.3).

Disturbance/displacement

In conjunction with any displacement effects associated with habitat loss, increased human presence and/or noise and vibration associated with construction works, has the potential to displace badgers from both breeding/resting places and from foraging habitat. As construction works will typically be undertaken during normal daylight working hours and badgers are nocturnal in habit, displacement of badgers from foraging areas (outside of areas where foraging habitat will be lost as a result of the Project) is extremely unlikely to affect the local badger population and will not result in a likely significant negative effect, at any geographic scale.

Four badger setts (S3, S10, S18 and S20) outside the Assessment Boundary were within 50m of construction works and therefore, likely to be subject to temporary disturbance/displacement effects. Any disturbance/displacement impact is likely to be more significant during the badger breeding season (December to June inclusive) if the sett is in use at that time. A further 11 setts were located within 150m of the Assessment Boundary and therefore, likely to be subject to temporary disturbance/displacement construction effects associated with any rock breaking, blasting or pile driving works that may be required. If undertaken during the breeding season, this could result in the displacement of badgers from occupied setts, potentially affecting breeding success.

On a precautionary basis, disturbance/displacement effects during construction have the potential to negatively affect the conservation status of local badger groups/populations (at least in the short-term) and could result in a likely significant negative effect, at a local geographic scale.

Given the legal protection afforded to Badgers under the Wildlife Acts, which prohibits their intentional killing or injury, or the wilful interference with their breeding or resting places, a mitigation strategy has been developed (see Section 8.6.5.3).

Severance/barrier effect

It is considered near-certain that the physical disturbance to the existing landscape during site-clearance and construction will result in some initial temporary severance of Badger territories through which the Project traverses; most notable where it severs the network of setts within a given territory (as is the case with the Cappanabornia Badger group), or setts from foraging areas (as in the case of the Lackagh Badger groups and Knocknagreana badger group).

However, given that Badgers are nocturnal in habitat and works will be carried out during normal daylight working hours, affected Badger groups would be expected to habituate to the altered landscape. The severance/barrier effect of construction works will be temporary in nature and is not likely to affect the local population, over even the short-term, and will not result in a likely significant negative effect, at any geographic scale.

Operational Phase Impacts

Habitat Severance/Barrier Effect

The presence of a new road along the off-line sections of the proposed N6 GCRR, where it severs existing Badger territories, has the potential to act as a permanent barrier to Badger movements: either acting as a physical barrier or through traffic deterring Badgers from attempting to cross.

However, some sections of the proposed N6 GCRR will be either elevated above ground level on piers or will pass through a subterranean tunnel (e.g. the proposed River Corrib Bridge, Menlough Viaduct and the proposed Lackagh Tunnel). In these locations, an accessible link will be maintained across the proposed N6 GCRR either beneath viaduct/bridge structures or above tunnels, which will serve to maintain habitat connectivity within each affected Badger territory (Eldridge & Wynn, 2011).

Nevertheless, there will be extensive lengths of the Project that may act as a barrier to Badger movements within the study area. This has the potential to have a long-term impact on local Badger population dynamics, affecting both local foraging behaviour and competition for resources and larger scale movements associated with dispersal and/or with breeding behaviour and genetic exchange between populations.

The habitat severance/barrier effect to Badgers associated with the Project has the potential to affect local Badger populations over the long-term and result in a likely significant negative effect, at a local geographic scale. Mitigation measures have been designed to reduce the effects of this impact (see Section 8.6.5.3.).

Mortality Risk

The introduction of the Project into a rural landscape will permanently increase the risk of road traffic collisions with Badger, across the study area. The risk is likely to be higher in areas where the Project is in close proximity to Badger setts, is severing Badger territories, or is passing through habitats where high levels of Badger activity were recorded (see Figures 8.4.1 to 8.4.15).

Although it is not possible to quantify the magnitude of the effect, the increased collision risk would likely result in a long-term suppression of the local Badger population in these areas and would negatively affect the conservation status of the local Badger population.

Collision risk to Badgers associated with the Project is predicted to result in a likely significant negative effect, at a local geographic scale. Mitigation measures have been designed to avoid this potential impact (see Section 8.6.5.3).

Light Spill

Nocturnal mammals, such as the badger, are likely to be disturbed by the introduction of artificial light into established breeding and foraging areas (Rich & Longcore, 2005). Along the Project, lighting is proposed only at the Bearna West Roundabout, the Bearna East Roundabout, the Cappagh Road Junction, the Ballymoneen Road Junction, the N59 Link Road North and South, the western and eastern portals to the Lackagh Tunnel, the N84 Headford Road Junction to the N83 Tuam Road Junction including the junctions at the Galway Racecourse Tunnel and the Coolagh Junction. The majority of the Project will remain unlit,

minimising the potential for light spill to affect fauna species. The lighting design of the Project controls light emissions such that along the majority of the alignment light spill does not extend beyond the Assessment Boundary and where it does, this is at tie-ins with the existing road network or at residential properties (Figures 5.4.01 to 5.4.15). There are no badger setts, or areas of high badger activity, beyond the Assessment Boundary that are located within the modelled light spill zone for the Project.

Therefore, lighting associated with the Project will not disturb or displace Badgers from habitat areas beyond the Assessment Boundary, will not affect the species conservation status in that regard and will not result in a likely significant negative effect, at any geographic scale.

8.5.7.4 Other Mammal Species

Construction Phase Impacts

Habitat Loss

Road construction will result in the permanent loss of mammal habitat within the Assessment Boundary of the Project, which includes the loss of stone walls as habitat for wildlife. Given the relatively low numbers of individuals of each species that are likely to be affected (Pine marten, Wood mouse, Red squirrel, Irish stoat, Hedgehog, Pygmy shrew, Fox, Rabbit, Mink and Bank vole), and the abundance of alternative suitable habitat available locally, the effects of habitat loss associated with construction works are unlikely to affect the long-term viability of their local populations. Therefore, habitat loss is unlikely to affect the species' conservation status or result in a significant negative effect, at any geographic scale.

The assessment presented in Appendix 4 of An Bord Pleanála's Inspector's Report dated 22 June 2021 assessed the impact of habitat loss on these other mammal species as follows:

"Menlough woods will be directly impacted by the proposed road and so there is also the risk of pine marten dens, including breeding dens, being destroyed during site clearance and therefore a risk of killing pine marten, especially when kits are present in the den (March to June, inclusive).

Like the red squirrel, the pine marten is primarily a woodland species. The pine marten has large territories with females 14-25ha and males 50-80ha. The loss of woodland habitat at Menlough is equivalent to up to 35% of a female's territory and 10% of a male's territory. The landscape is largely unwooded which means there is not much alternative habitat available for this species.

Given the risks from traffic, new woodland along the proposed road is not suitable habitat for pine marten. Moreover, the proposed road divides Menlough Woods into two, which may further compromise its continued suitability for pine marten. The loss, rather than displacement, of one breeding female territory seems likely."

It is not clear from the assessment completed in An Bord Pleanála's Inspector's Report dated 22 June 2021, what the level of impact significance on these species is, although a likely significant negative effect is assumed:

"Generally, the most significant effects would occur in the western part of the route from the start to the route to the junction with the N59, with a further set at Menlough, which supports limestone pavement, red squirrel, pine marten, lesser horseshoe bat, Natterer's bat and barn owl."

The author's view remains that habitat loss is unlikely to affect the species' conservation status or result in a significant negative effect, at any geographic scale.

Mortality Risk

Site clearance works have the potential to result in the mortality of mammal species. The potential for impact would be expected to be greater during the breeding season when juveniles would be present in nests, or in the case of Hedgehog impacts may be greater during their hibernation period. Given the relatively low numbers of individuals of each species that are likely to be affected, and that they are highly mobile species, site clearance is unlikely to result in a level of mortality that would affect the species' conservation status, and result in a significant negative effect, even at a local geographic scale.

Habitat Severance/Barrier Effect

As discussed above in relation to Badgers, the presence of a new road along the off-line sections of the Project has the potential to act as a permanent barrier to many other terrestrial mammal species. Either acting as a physical barrier or through traffic deterring mammals from attempting to cross.

Sections of the proposed N6 GCRR elevated on piers and above tunnels will serve to maintain habitat connectivity. Nevertheless, there will be extensive lengths of the proposed N6 GCRR that may act as a barrier to the movements of other terrestrial mammal species within the study area. This has the potential to have a long-term impact on local mammal population dynamics, affecting both local foraging behaviour and competition for resources and larger scale movements associated with dispersal and/or with breeding behaviour and genetic exchange between populations.

The habitat severance/barrier effect to these other terrestrial mammal species associated with the Project has the potential to affect local mammal populations over the long-term and result in a significant negative effect, at a local geographic scale. Mitigation measures have been designed to minimise the long-tern effects of any barrier effect posed by the Project (see Section 8.6.5.4).

Disturbance/displacement

In conjunction with any displacement effects associated with habitat loss, increased human presence and/or noise and vibration associated with construction works, has the potential to displace mammal species from both breeding/resting places and from foraging habitat.

However, as disturbance will be intermittent and temporary (in the majority of locations) it is extremely unlikely to result in any long-term effects on the local mammal population or their conservation status. Therefore, disturbance/displacement during construction is unlikely to result in a significant negative effect, at any geographic scale.

Habitat degradation - water quality

During construction, contaminated surface water runoff and/or an accidental spillage or pollution event into any surface water feature has the potential to have a significant negative impact on water quality in Galway Bay and consequently an impact upon marine mammals; either directly (e.g. acute or sub-lethal toxicity from pollutants) or indirectly (e.g. affecting their food supply or supporting habitats).

However, it is considered unlikely that a pollution event of such a magnitude would occur during construction that would have any perceptible effect on water quality in the marine environment, or be any more than temporary in nature. Nevertheless, a precautionary approach is being taken in assuming a level of risk of water quality impacts and detailed mitigation measures have been designed to further minimise the risk of the Project having any perceptible effect on water quality during construction or affecting the conservation status of the marine mammal species in Galway Bay (see Section 8.6.2).

Operational Phase Impacts

Habitat Severance/Barrier Effect

The presence of a new road along the off-line sections of the proposed N6 GCRR, would be certain to act as a permanent barrier to mammal movements locally, either through acting as a physical barrier or as a consequence of road traffic acting as a crossing deterrent.

As discussed above for Badger, elevated sections of the proposed N6 GCRR (e.g. the proposed River Corrib Bridge and the Menlough Viaduct structures) will serve to maintain a degree of habitat connectivity within each affected Badger territory (Eldridge & Wynn, 2011).

Nevertheless, there will be extensive lengths of the proposed N6 GCRR that will act as a barrier to species movements within the study area. This has the potential to have a long-term impact on population dynamics, affecting both local foraging behaviour and competition for resources and larger scale movements associated with dispersal and/or with breeding behaviour and genetic exchange between populations.

The habitat severance/barrier effect associated with the Project has the potential to affect local mammal populations over the long-term and result in a significant negative effect, at a local geographic scale.

Mitigation measures have been designed to minimise the long-tern effects of any barrier effect posed by the Project (see Section 8.6.5.4).

Disturbance/displacement

The operation of the Project is likely to have some level of long-term effects on mammal usage of habitat in the vicinity of the Project (Benítez-López *et al*. 2010). However, this is not likely to affect the species' conservation status nor result in a likely significant negative effect, at any geographic scale.

Habitat degradation - water quality

There will be outfall points to surface water features from the proposed road drainage network during operation and therefore, a potential impact pathway to affect water quality in Galway Bay. This in turn could affect the marine mammal species therein. The proposed drainage design for the proposed N6 GCRR incorporates pollution control measures (this includes petrol interceptors, wetland and other measures, such as SuDS) followed by either infiltration ponds (where discharging to ground) or attenuation ponds (where drainage will be discharged to the existing surface water/storm sewer), as described in detail in Chapter 5, Project Description.

Those sections of the proposed road drainage that are to be discharged to ground, pose no risk to surface water quality. It is extremely unlikely that the normal operating water quality of the drainage outfalls discharging to the existing surface water/drainage network, even in the unlikely event of a pollution incident, would have any perceptible impact on water quality in receiving watercourses. The functioning and effectiveness of both elements of the road drainage network are discussed in more detail in Chapter 11, Hydrology.

Habitat degradation as a result of effects on water quality in Galway Bay during operation is not likely to have any effect on the marine mammal populations or their conservation status, and therefore will not result in a likely significant negative effect, at any geographic scale.

Mortality Risk

The Project will permanently increase the risk of road traffic collisions with mammal species[133]. For some species, such as rodents, the risk may be higher as many such species forage in rough grassland and scrub habitats and may be attracted to foraging along the road margins. However, the hard surfaces of the road infrastructure offer little in the way of potential foraging habitat for mammal species, other than opportunistic scavenging by larger mammal species. The rates of mammal fatality recorded by Haigh (2012) were low (1.2 per 100km) although the presence of dedicated mammal passage facilities were present on sections of the studied roads which is likely to have positively influenced this figure. In the absence of being able to fully quantify the impact on an unmitigated road scheme, a precautionary approach is to conclude that the Project does have the potential to affect the local mammal populations in the long-term, if even only in a local context. Therefore, the Project has the potential to affect the local conservation status of many mammal species, and result in a significant negative effect, at the local geographic scale. Mitigation measures have been designed to reduce this potential impact (see Section 8.6.5.4.).

8.5.8 Invertebrates

8.5.8.1 White-clawed crayfish

As the White-clawed crayfish is not present within the ZoI of the Project, no impacts are predicted.

8.5.8.2 Freshwater pearl mussel

As the Freshwater pearl mussel is not present within the ZoI of the Project, no impacts are predicted.

Although no freshwater pearl mussel were present with the ZoI of the Project, impacts to salmonid fish species could indirectly affect the Freshwater pearl mussel population in Lough Corrib SAC; the QI

[133] Haigh (2012) recorded the following mammal road kill species in a study undertaken along the road network between Bandon in County Cork and Caherlistraine in Co. Galway: Rabbit, Hedgehog, Badger, Fox, rodents, Mink, Hare, Otter, Pine marten and Stoat. However, in terms of the protected mammal species discussed in this section, all bar Hedgehog and rodents were infrequently recorded.

population is in the Owenriff River, c.23km to the north, see Section 8.6.10 below for impacts on fish species.

8.5.8.3 Swan mussel

Swan mussel has not been confirmed within the ZoI of the Assessment Boundary, and was not discussed in the 2018 EIAR; however it was discussed at the Oral Hearing, and mentioned in Appendix 4 of ABP's Inspector's Report dated 22 June 2021 that "*Records of mussels in the River Corrib were discussed at the oral hearing. These are most likely to be swan mussel Anodonta cygnea."* As such, Swan mussel are now included as a KER.

Construction Phase Impacts

Habitat Degradation – Surface Water Quality

During construction, contaminated or heavily silted surface water runoff, pump discharges and/or an accidental spillage or pollution event into any surface water feature has the potential to have a significant negative impact on water quality and consequently on aquatic habitats and swan mussel. This could be either directly (e.g. acute or sub-lethal toxicity from pollutants or siltation events damaging spawning habitat downstream) or indirectly (e.g. affecting their food supply or supporting habitats).

The effects of frequent and/or prolonged pollution events in a river system have the potential to be extensive and far-reaching and could potentially have significant long-term effects. It is considered unlikely that a pollution event of such a magnitude would occur during construction, or be any more than temporary in nature. Nevertheless, a precautionary approach is being taken in assuming a level of risk of water quality impacts and detailed mitigation measures are required to further minimise the risk of the Project having any perceptible effect on water quality during construction.

Habitat degradation as a result of effects on surface water quality during construction has the potential to affect the conservation status of affected swan mussel populations and result in a likely significant negative effect, at a local geographic scale. Mitigation measures have been designed to protect water quality during construction (see Section 8.6.6.1).

Mortality Risk

Instream works on the River Corrib are limited to construction of the drainage outfalls (one on each river bank) which will require the installation of a head wall and concrete base. Given the scale of the works, they do not pose a risk of swan mussel mortality such that it is likely to affect the conservation status of any of the species present in the River Corrib catchment.

The mortality risk from construction works is not likely to have any long-term effect on the local swan mussel population or their conservation status, and therefore will not result in a likely significant negative effect, at any geographic scale.

Operational Phase Impacts

Habitat Degradation – Surface Water Quality

There will be drainage outfalls to all river/stream catchments crossed by the Project. Therefore, there is a risk that discharges from the proposed road drainage network could affect water quality, potentially over the long-term, and consequently impact upon aquatic habitats and swan mussel populations. In a worst-case-scenario, this could result in a permanent decline in swan mussel abundance and distribution.

The proposed drainage design for the proposed N6 GCRR incorporates pollution control measures (this includes petrol interceptors, wetland and other measures, such as SuDS) followed by either infiltration ponds (where discharging to ground) or attenuation ponds (where drainage will be discharged to the existing surface water/storm sewer), as described in detail in Chapter 5, Project Description.

Those sections of the proposed road drainage that are to be discharged to ground, pose no risk to surface water quality. It is extremely unlikely that the normal operating water quality of the drainage outfalls discharging to the existing surface water/drainage network, even in the unlikely event of a pollution incident, would have any perceptible long-term effect on water quality in receiving watercourses. The functioning and

effectiveness of both elements of the proposed road drainage network are discussed in more detail in the hydrology chapter (Chapter 11, Hydrology).

Habitat degradation because of effects on surface water or groundwater during operation is not predicted to affect the conservation status of swan mussel and will therefore, not result in a likely significant negative effect, at any geographic scale.

8.5.8.4 Marsh whorl snail

Construction Phase Impacts

Habitat Degradation – Surface Water Quality

An accidental spillage or pollution event affecting the River Corrib, the Coolagh Lakes and surrounding drainage features and springs, and Ballindooley Lough has the potential to negatively impact upon water quality and consequently on the fringing wetland habitat that supports the Marsh whorl snail.

The magnitude and significance of such an impact would be entirely dependent on the nature, scale and duration of the pollution event. Although unlikely, in a worst case scenario this could potentially result in extensive degradation of fringing aquatic habitat in receiving watercourses/waterbodies such that it could, at least in the short-term, no longer support the species. There is the potential for such impacts to have long-term effects on the local Marsh whorl snail population, potentially resulting in localised extinctions. Habitat degradation therefore, has the potential to affect the species' conservation status and result in a significant negative effect, at the local geographic scale. Mitigation measures have been designed to protect water quality during construction (see Section 8.6.6.2).

Habitat Degradation – Groundwater

Any effects on the existing hydrogeological regimes at the Coolagh Lakes and Ballindooley Lough have the potential to negatively impact upon the fringing wetland vegetation that supports the Marsh whorl snail.

Based on the findings of the hydrogeological impact assessment in Chapter 10, Hydrogeology, the Project does not pose a risk to the groundwater supply to Ballindooley Lough. The Project does however, have the potential to affect the quantity and quality of groundwater supplying the Coolagh Lakes. Although the magnitude of the impact cannot be fully quantified, on a precautionary basis it is assessed as having has the potential to affect the species' conservation status and result in a likely significant negative effect, at the local geographic scale. Mitigation measures have been designed to protect the existing hydrogeological regime during construction (see Section 8.6.6.2).

Habitat Loss & Mortality Risk

Two wetland habitat areas that will be directly impacted by the Project supported the Marsh whorl snail: at Ballindooley Lough (Ch. 12+350 of the proposed N6 GCRR) and a marsh area at Castlegar (Ch. 13+000 of the proposed N6 GCRR).

Overall, the Marsh whorl snail was relatively common locally: recorded at 33 sampling sites out of a total of 120. The relatively minor loss of habitat at Ballindooley Lough and at the Castlegar marsh will not reduce the local wetland habitat resource for the species such that it would be likely to affect its ability to maintain the local population on a long-term basis. Similarly, although there is likely to be some level of mortality associated with construction works at these locations, the species' conservation status locally is not likely to be affected.

Habitat loss and mortality risk during construction are not likely to affect the species' conservation status and will not result in a likely significant negative effect at any geographic scale.

This valuation was disagreed with Appendix 4 of the Inspector's Report dated 22 June 2021, their conclusion being, the loss of the Marsh whorl snail at Castlegar, has the potential to result in a significant negative effect, at the county geographic scale. It is the professional opinion of Scott Cawley Ltd., that this conclusion is not agreed with, due to the reasons mentioned above, and therefore, habitat loss and mortality risk during construction are not likely to affect the species' conservation status and will not result in a likely significant negative effect at any geographic scale.

Operational Phase Impacts

Habitat Degradation – Surface Water & Groundwater

There will be drainage outfall points to two surface water features supporting the Marsh whorl snail: the River Corrib and Ballindooley Lough. Therefore, there is a risk that discharges from the proposed road drainage network could affect water quality and consequently impact upon the Marsh whorl snail or its supporting habitat.

The proposed drainage design consists of a petrol interceptor followed by either attenuation and infiltration ponds (where discharging to ground) or attenuation and constructed wetland (where drainage will be discharged to the existing surface water/drainage network), as described in detail in Chapter 11, Hydrology.

Those sections of the proposed road drainage that are to be discharged to ground, pose no risk to surface water quality. It is extremely unlikely that the normal operating water quality of the drainage outfalls discharging to the existing surface water/drainage network, even in the unlikely event of a pollution incident, would have any perceptible long-term effect on water quality in receiving watercourses. The functioning and effectiveness of both elements of the proposed road drainage network are discussed in more detail in Chapter 11, Hydrology.

Although the drainage design will ensure that groundwater quality will be maintained during operation, it is important that infiltration basins are inspected to ensure that karst features do not affect the functioning of them during operation. If this is identified during routine inspections of the infiltration basins then mitigation is required to ensure any issues are addressed so that they continue to function as designed for the operational lifespan of the Project.

Habitat degradation as a result of effects on surface water quality during operation is not predicted to affect the conservation status of the Marsh whorl snail and will therefore, not result in a likely significant negative effect, at any geographic scale.

Habitat degradation as a result of effects on groundwater during operation has the potential to affect the conservation status of the Marsh whorl snail locally and therefore, has the potential to result in a significant negative effect, at the local geographic scale.

8.5.8.5 Marsh fritillary butterfly

The Marsh fritillary butterfly exists in a metapopulation structure, i.e. individual colonies, or populations, that are spatially separated yet interact with one another on some level. Survival and persistence of the metapopulation relies on there being a sufficient network and density of interconnected suitable habitat areas, such that the individual colonies can readily interact and recolonise new habitat patches in response to (what can be) frequent local extinctions. These local extinction events occur in response to factors such as changes in habitat management and condition, weather, resources and intraspecific competition, and/or parasite infestations. In assessing the impacts on the Marsh fritillary butterfly, given the species' population structure, areas of suitable habitat are equally as important to consider as areas where larval webs were recorded.

The natural fluctuations and variations in Marsh fritillary populations are reflected in the larval web records across the four survey years. Comparing the results of the 2013 and 2014 surveys (as both years covered the larger Scheme Study Area): in 2013, only a single habitat patch supported larval webs yet in 2014, 111 larval webs were recorded across the network of suitable habitat patches[134]. This pattern suggests that there was a core population (either in an area within the Scheme Study Area that was not surveyed, or beyond it) which, despite the apparent population crash in 2013, was robust enough to recolonise the locality in 2014. Even comparing the 2015 and 2016 surveys, which both covered a smaller, more targeted survey area focussed on the Project and lands in the immediate vicinity, the number of larval webs recorded increased from 12 in 2015, to 56 in 2016. The same area in 2014 held 39 webs.

The area of suitable habitat mapped for the species across the Scheme Study Area in 2014 totalled c.110ha, spread over 139 distinct habitat patches, the densest clusters of which were concentrated around the bog/heath/scrub/wet grassland habitat mosaics at Na Foraí Maola, Lough Inch, An Chloch Scoilte, Ballard,

[134] The majority of the two core areas at Cappagh and Tonabrocky which supported significant numbers of larval webs in 2014 were not surveyed in 2013.

Na hAille, Cappagh and Tonabrocky. Of the suitable habitat patches in these areas, larval webs were recorded in 39 (in total covering an area of c.60ha).

In 2023, approximately 104 hectares of land was either confirmed as having suitability for marsh fritillary (50.5ha) or assumed suitable, from the results of the surveys undertaken to inform the 2018 EIAR, due to lack of access (55.37ha).

In comparison to previous surveys undertaken to inform the 2018 EIAR, it was observed that changes had occurred in habitat suitable for marsh fritillary, including land abandonment, scrub encroachment and new development, with the result that 14.55 ha of habitat was no longer suitable.

Additionally, in June 2023, a significant gorse fire, resulting from the prolonged hot dry weather experienced in the locality that summer, caused extensive fire-damage to areas of scrub and grassland in various areas west of Knocknacarra, including areas of commonage between the townlands of Tonabrocky and Boleybeg, which were previously assessed as suitable for Marsh Fritillary.

Of the suitable habitat identified, 50.5ha was surveyed for Phase 2 of the surveys during September 2023, of which c.1.63ha of that area surveyed was within the Assessment Boundary.

A total of 75 larval webs were located from seven specific sites with a combined area of c.13.3ha. Larval webs were identified across the Project, with circa 95% of larval webs recorded in the Boleybeg locality.

The closest larval webs identified were in the Forramoyle West locality, c.120m from the Project. Other localities of larval webs included one larval web in Roscam (eastern side of the Assessment Boundary) and one larval web in suitable lands to the north of Ballard West.

Construction Phase Impacts

Habitat Loss

The Project will result in the permanent loss of suitable Marsh fritillary habitat, including habitat patches supporting larval webs. The resulting impact will increase habitat fragmentation, not only within individual suitable habitat patches, but also amongst the local network of suitable habitat areas supporting the local Marsh fritillary metapopulation.

The total area of suitable habitat in the Scheme Study Area (2023) was estimated to be 104ha, which includes accessible parcels, parcels where access was restricted and parcels where access was denied.

In September 2023 50.5ha of suitable habitat was surveyed for Phase 2 of which, c.1.63 ha of that area surveyed was within the Assessment Boundary. The remaining suitable habitat was inaccessible and so was not subject to targeted larval web surveys.

A total of 75 larval webs were located from seven specific sites with a combined area of c.13.3ha. Larval webs were identified across the Project, with circa 95% of larval webs recorded in the Boleybeg locality.

It is noted in the literature (Bulman 2001; Fowles & Smith 2006) that within 16km^2 sample areas, it was estimated that a minimum area greater than 71ha (and probably 100ha) of suitable habitat was required to give a high degree of probability that a metapopulation would persist long-term. The total coverage of suitable habitat, across the western part of the Scheme Study Area, approximates an area of 16km^2. Therefore, even with the loss of c.1.63ha, the remaining 102.37ha[135] present within the Scheme Study Area (consisting suitable areas surveyed and suitable areas not accessed but assumed suitable based on the 2014-2018 results) is more than the quoted threshold and will probably be sufficient to maintain the local metapopulation in the long-term.

[135] The total area of suitable Marsh fritillary habitat recorded within the Scheme Study Area is likely to only represent a proportion of the actual coverage of suitable habitat available to support the local metapopulation. Although no surveys were undertaken for this project beyond the Scheme Study Area, based on a review of recent orthophotography it would appear that a similar habitat mosaic to that within the Scheme Study Area, extends to the west and north. This, along with the rapid recolonization of the Scheme Study Area between the "crash" year of 2013 and 2014, suggests that a core colony persisted in suitable habitat, within close proximity. Therefore, the quoted area of available habitat, post-construction, is probably a very conservative underestimate.

Additionally, the total coverage of suitable habitat in the Scheme Study Area (from the period 2014-2023) remaining after the loss of c.1.63 ha, c.78.51 ha, is more than the quoted minimum threshold sufficient to maintain the local metapopulation in the long-term, though it is acknowledged that this estimate is on the lower end of the threshold.

This is evident in the findings of the 2014-2018 surveys which demonstrate that even despite localised "crashes" in the local population year on year, there is a sufficient habitat network, and a persisting core colony or population within recolonization range, to allow the metapopulation to recover. Also of note in that regard is that the larger and consistently more densely populated habitat complexes at Lough Inch, Cappagh, and Tonabrocky will remain unaffected by the Project.

Therefore, habitat loss associated with the Project is not likely to affect the species conservation status or result in a likely significant negative effect, at any geographic scale.

Habitat Fragmentation/Severance

The key to Marsh fritillary being able to recolonise or relocate to alternative habitat areas is the spatial relationship between areas of suitable habitat in a network of suitable habitat sites; and principally, their proximity to one another. Therefore, the loss of suitable habitat patches, regardless of their size or whether the species has been recorded there previously, has the potential to result in fragmentation, or habitat isolation, that could potentially affect the long-term viability of the local Marsh fritillary metapopulation.

The Marsh fritillary butterfly is generally a sedentary species. Many studies have reported that the maximum distances over which the species will readily colonise/disperse between habitat areas is 1-2km (Betzholtz *et al*. 2007; Fowles and Smith 2006); although longer distance movements have been recorded, they are likely to be more infrequent (Warren 1994; Hula *et al*. 2004; Zimmermann *et al*. 2011). In applying the more conservative 1km threshold to considering how habitat loss could affect the future prospects of the affected Marsh fritillary metapopulation to colonise suitable habitat areas, the resulting fragmentation would not result in any of the unaffected suitable habitat areas being permanently isolated by this distance, or greater.

The fragmentation of an individual suitable habitat patch by the Project may also render the remaining fragments unsuitable for the species, due to their small size or due to increased edge effects. Bulman (2001) found that Marsh fritillary did not breed in habitat patches less than 0.1ha in area and this minimum area is considered to be the threshold below which isolated habitat patches would become unusable by the species. This is reflected in the findings of the surveys where all of the seven suitable habitat patches where larval webs had been recorded were greater than 0.1ha in area. Therefore, any remaining suitable habitat fragments below this threshold have been included in the habitat loss calculation. Small, isolated habitat patches are likely to be more susceptible to edge effects and scrub encroachment/succession which could, over the longer-term, result in them becoming unsuitable to support the species. However, even if all such areas were to ultimately become unavailable to the local Marsh fritillary butterfly as a consequence of the habitat fragmentation impact, the areas involved only total c.2ha. In the context of the area of suitable habitat that will likely be available post-construction (48.87ha) and the additional areas of suitable habitat likely to be present beyond the Scheme Study Area, given the mosaic of heath, bog and wet grassland evident from the orthophotography, this loss is unlikely to affect the long-term viability of the local population or metapopulation.

Therefore, given the ongoing changes in land use across the Scheme Study Area and wider environs, on a precautionary basis, habitat fragmentation/severance as a result of construction is likely is to have a significant impact on a local scale on the conservation status of marsh fritillary (a receptor of National Importance) taking in account the remaining suitable habitat located in the Scheme Study Area and further afield.

Mitigation measures for this potential impact are detailed in Section 8.6.6.3.1.

Mortality Risk

Site clearance works have the potential to result in the mortality of Marsh fritillary butterflies and/or disturb their breeding/resting places; either adults, eggs or larvae, depending on the time of year works are undertaken. The magnitude of the potential impact would be dependent on the species' distribution and abundance across the area in any given year.

Given the distribution of breeding sites across the study area over the survey period, and the resilient nature of the species' natural response to frequent local extinction events, any mortality or disturbance that may result from construction works will most likely be confined to the season within which site clearance works are undertaken and is likely to only affect the local population[136]. Although unlikely, it is possible that the suitable habitat patches affected by the Project could support a significant proportion of the local metapopulation in a given year. If this were to occur, it could potentially affect the species' conservation status locally and result in a significant negative effect, at the local geographic scale. Given the current distribution of the Marsh fritillary butterfly at the county scale (c.46 10km squares) and considering the scale and short-term nature of the predicted impact and the resilient nature of the species' natural response to frequent local extinction events, it would not be likely to affect the species' conservation status at the county geographic scale, at which the local Marsh fritillary population has been valued.

However, this conclusion was not agreed with by the Inspector appointed by ABP, and whilst is not clear what the level of impact significance on these species is from their assessment presented in ABP's Inspector's Report dated 22 June 2021, a likely significant negative effect is assumed at the national geographic scale.

"The applicant reports a direct loss of 5.2ha of marsh fritillary habitat, all in the western part of the route corridor, which is 4.7% of the total that was recorded by the applicant in the route corridor and obviously a smaller proportion of that in the county, etc. A population decline commensurate with the habitat loss would be expected, with the possibility, when combined with other impacts, of losing this species from one (M2424) of the 705 1km2 in which it currently occurs."

Mitigation measures to for this potential impact are detailed in Section 8.6.6.3.

Operational Phase Impacts

Barrier Effect

From the available literature, there is no definitive evidence to conclude whether the construction or operation of the Project will create a permanent barrier to Marsh fritillary movements. Along the length of the proposed N6 GCRR, there are two locations where the Project will sever areas of Marsh fritillary habitat: in the western part of the study area, between Ch. 0+750 and Ch. 8+000 of the proposed N6 GCRR; in Dangan south of the N59, and at the Galway Racecourse where the proposed N6 GCRR surrounds it on three sides.

The Marsh fritillary butterfly is a species capable of long-distance dispersal movements (Warren 1994; Hula *et al*. 2004; Zimmermann *et al*. 2011). It has also evidently crossed the existing road network in the past to colonise habitat at the Galway Racecourse. Considering the above and also that (at least in the western part of the study area) the Project consists of a relatively narrow single carriageway (c.20m), the Project would not be expected to pose a physical barrier to Marsh fritillary movements between the existing network of suitable habitat patches such that it would affect the long-term prospects for either the local populations or the greater metapopulation. Even taking a very precautionary approach, and assuming that the full area of suitable habitat south of the Project would become unavailable, the loss of 10.17ha is not likely to reduce the area of suitable habitat that the local metapopulation is likely to require to ensure it persists over the long-term (see discussion on habitat area requirements above, under the heading of construction phase impacts).

Therefore, any barrier effect associated with the Project is not likely to affect the species' conservation status or result in a significant negative effect, at any geographic scale.

Mortality Risk

It is likely that during operation the Project will result in some level of mortality risk to Marsh fritillary butterfly crossing the proposed road carriageway; although from the available published literature, it is not possible to quantify what that level of risk might be. Of the c.48.87ha of suitable Marsh fritillary habitat that will remain post-construction, only 10.17ha lies to the south of the proposed road carriageway. The majority, which includes the core areas at Cappagh and Tonabrocky, lies to the north. This limits the potential, or

[136] The current distribution for the species within, or adjacent to, the County Galway border covers c.46 10km squares (NPWS, 2013c)

need, for Marsh fritillary butterflies to cross the proposed road carriageway and it is not likely that there would be frequent movement of Marsh fritillary butterflies across the Project.

Therefore, it is not likely that any population level effects would arise as a consequence of road mortality that would affect the species' conservation status or result in a significant negative effect, at any geographic scale.

8.5.8.6 Other Invertebrate Species

The Project will result in the loss of a range of habitat types in the Menlough-Coolagh area, some of which are likely to support local bee populations in providing both nesting opportunities and a food resource. However, in this area the Project impacts upon woodland and scrub of relatively low diversity, as well as improved agricultural fields. These habitats play a limited role in supporting local bee populations compared with, for example, species rich meadows.

Thus, the extensive landscape planting and the creation of extensive areas of species rich calcareous grassland habitat in the Menlough-Coolagh area will improve the extent and availability of pollinator friendly plant species and habitat as a food resource and nesting opportunities for the local bee populations.

No significant impacts are predicted on local bee population due to the availability of suitable habitat in the wider landscape and the creation of suitable habitat as a result of the Project.

8.5.9 Birds

8.5.9.1 Breeding Birds

The assessment carried out in the updated NIS for the Project considers the potential for the Project to affect the bird species listed as SCIs of Lough Corrib SPA and Inner Galway Bay SPA for their breeding populations: Black-headed gull, Common Gull Cormorant and Common tern. That assessment concluded that the Project would not affect their breeding colonies or have any long-term effects on the local breeding populations which for the purposes of that assessment took a precautionary approach in assuming that all SCI bird species recorded within the Scheme Study Area formed part, or were linked to, the SPA populations. Therefore, for these species, the Project will not affect the conservation status of the breeding populations and will not result in a likely significant negative effect at any geographic scale.

Construction Phase Impacts

Habitat Loss & Loss of Breeding/Resting Sites

The Project will result in the loss of breeding bird nesting and foraging habitat across the study area. The areas of habitat loss along across the Project are given in Section 8.5.5.3 and tabulated in Table 8.34 for KER habitat types[137]. In the western part of the study area, this is predominantly habitat blocks comprised of mosaics of bracken, scrub, heath and wet grassland. There are sections where the Project crosses more intensively managed agricultural lands, with little vegetation cover for nesting breeding birds, and habitat loss in these areas will have a much lower effect on local bird populations than the more semi-natural habitat mosaics. From the N59 Moycullen Road through to Lackagh Quarry, the habitats affected are amenity grassland and small agricultural fields and a mix of amenity planted woodland (at UoG) and semi-natural Ash and Hazel woodland (east of the River Corrib). East of Lackagh Quarry a small area of scrub and wet grassland will be lost at Ballindooley Lough. At Castlegar a small area of scrub surrounding a marsh will be affected, near the N83 Tuam Road a small area of Ash/Hazel woodland, and some scrub around the existing N6 Junction at Coolagh. Aside from these areas, the majority of the Project, east of Lackagh Quarry, will largely result in the loss of improved agricultural grassland fields or artificial surfaces associated with the existing road network, business parks and Galway Racecourse. Stone walls as a habitat will also be lost.

The primary consequence of habitat loss will be increased competition for resources (e.g. nesting habitat or prey/food source) both between and amongst breeding bird species. The magnitude of this effect will be largely defined by many unquantifiable factors such as future land use changes and whether the local habitat

[137] The loss of these KER habitat types are those most likely to directly affect breeding birds – comprising more than 99ha of scrub, woodland, semi-natural grasslands, wetland habitats (e.g. fens, marsh and reed swamp) and heath habitats, along with almost 17km of hedgerows and treelines.

resource has currently reached its carrying capacity or not, in terms of breeding bird species. For species with larger home ranges during the breeding season (such as Peregrine falcon, which hunt within 2km of the nest site) habitat loss at the scale of the Project is not likely to have any perceptible effects on breeding success or population dynamics.

Another example is Barn owl, a species that generally focus foraging activities within 4 kilometres of the nest site, with an average home range of 3,000 hectares in Ireland (Lusby *et al*., 2021). However, the foraging range of Barn owl from the nest site can be up to 5km and this is the distance used to calculate the Barn owl habitat losses and gains associated with the Project. Within 5km of the nest site at Menlo Castle (the only nesting site within 5km of the Project), c.27.3km of linear edge habitat is being lost and c.51.9ha of rough grassland/heathland habitat. Applying a 1m grass verge estimate to that 27.3km of linear edge habitat equates to an area of c.2.7ha of grassland margin. Therefore, the total estimate of Barn owl habitat loss is c.54.6ha within the 5km foraging range (or <0.13% of the total area). Within the immediate vicinity of Menlo Castle, most of the habitats affected are woodland or residential development and not the favoured permanent rough grassland as hedgerow habitats selected by Barn owls. Therefore, no likely significant residual effects on Barn owl are predicted during construction as a result of vegetation clearance. Nevertheless, habitat enhancement measures will be implemented to improve the quality of Barn owl habitat in the vicinity of the next site at Menlo Castle.

The habitat areas that will be lost as a result of the Project form a relatively small part of what are much larger expanses of similar habitat types and mosaics nearby. In that regard, none of the habitat areas that will be lost are unique in the sense that they are not the only areas of that habitat type locally and, either individually or collectively, are not likely to support a significant proportion, or the only population, of any given breeding bird species locally. Although a decline in overall breeding bird abundance could potentially occur at a local level, this is unlikely to affect the local range of the breeding bird species present nor is it likely to affect the ability of these breeding bird populations to maintain their local populations in the long-term. Mitigation measures will be implemented to reduce the effects of habitat loss on breeding birds species locally (see Section 8.6.7.1).

Mortality Risk

If site clearance works were to be undertaken during the bird breeding season (March to August, inclusive) it is likely that nest sites holding eggs or chicks will be destroyed and birds killed.

Mortality of birds at the scale of the Project, over what is likely to be a single breeding bird season in terms of completing site clearance works, will probably have a short-term effect on local breeding bird population abundance. However, in the longer-term this would be unlikely to affect the ranges of the breeding bird species recorded in the study area nor would it be likely to affect the long-term viability of the local populations.

Mortality of birds during site clearance works is not predicted to affect the conservation status of any of the breeding bird species present within the study area.

Disturbance/displacement

The noise, vibration, increased human presence and the visual deterrent of construction traffic associated with site clearance and construction will disturb breeding bird species and is likely to displace breeding birds from habitat areas adjacent to the Assessment Boundary. The magnitude of the impact will be dependent on the type of construction works and their duration; general construction activities will have a less pronounced affect than blasting, in terms of its ZoI, but will be on-going from periods of several months to several years and breeding seasons. Although it is not possible to quantify the magnitude of this potential impact (or the potential effect zone) it could potentially extend for several hundred metres from the Project.

In terms of nesting sites, the most sensitive in terms of disturbance effects (given their low numbers locally, conservation status and proximity of nest sites to the construction works) are Barn owl and Peregrine falcon.

There is one confirmed Barn owl breeding site in close proximity to the Project at Menlo Castle. All other sites at which evidence of Barn owl was confirmed during the survey period are located at sufficient distance from the Project that there will be no disturbance impacts during the construction phase. The other confirmed Barn owl breeding site is located more than 4km from the Project. There were no occupied Barn owl sites

within 400m of the Project and no sites for which permissions to access to undertake the Barn owl survey were not granted within immediate proximity (<250m) of the Project.

The Barn owl nest site at Menlo Castle is c.150m from the main construction works with landscape planting and installation of a boundary fence proposed adjacent to the castle. Disturbance associated with construction works, particularly the operation of heavy machinery, could affect breeding success or result in the abandonment of the nest site for the duration of construction, potentially resulting in a short-term likely significant negative effect, at the local geographic scale.

The Peregrine falcon nest site at Lackagh Quarry is immediately adjacent to the Project and construction activities here include rock breaking and rock blasting, and the installation of rock bolts on the exposed cliff faces (for more detail refer to Chapter 7, Construction Activities and Chapter 9, Soils and Geology). There is therefore a high risk that the resident pair of Peregrine falcons will abandon the quarry, if works commence part way through the breeding season. As works will be ongoing in the vicinity for a period of c.3 years, this has the potential to have long-term effects on recruitment within the local Peregrine falcon population if the pair repeatedly fail to breed.

The other breeding site confirmed (Twomileditch) is located more than 400m from the Assessment Boundary. Due to this distance and the fact that this is an active quarry where the breeding pair are already habituated to disturbance activities, the impacts of construction to Peregrine at this site will not result in a likely significant negative effect, at any geographic scale.

Given the temporary to short-term nature of the construction works, disturbance or displacement effects will also be over the short-term and are therefore not likely to affect the conservation status of the majority of affected breeding bird species and will not result in a likely significant negative effect, at any geographic scale.

However, there is the potential for long-term effects on the local Peregrine falcon population and significant negative effects at a county geographic scale. Mitigation measures will be implemented to reduce the effects of construction related disturbance on nesting Peregrine falcon (see Section 8.6.7.1).

Operation Phase Impacts

Mortality Risk & Disturbance/Displacement

Road traffic, has been shown to negatively influence local bird populations (Reijnen & Foppen, 2006; Summers *et al*., 2011): new roads increase mortality risk, road traffic acts as a visual deterrent, and noise associated with road traffic has a negative impact upon bird abundance and occurrence. The magnitude of the potential impact is related to the interaction between a multitude of factors such as species and traffic density (which influences noise levels and mortality risk) and is also influenced by habitat type. Roadside habitat can have a positive effect on bird abundance (e.g. the provision of scrub, either through planting or as a result of edge effects, wetland habitat, or rank grassland habitat). Although any benefits associated with this type of habitat creation are generally on quiet, low-traffic roads and the impacts associated with high density traffic on bird densities generally outweigh any potential benefits.

It is likely that the abundance of breeding bird species will permanently decline near to the Project as a consequence of increased disturbance and mortality from road traffic; the effects of which will reduce to a neutral impact with increasing distance from the Project. Although it is not possible to quantify the magnitude of the potential impact (or the potential road effect zone) based upon the available literature for most breeding bird species, in general it could potentially extend for several hundred metres from the Project. However, where the Project crosses a landscape which is already highly disturbed (i.e. where it will be constructed alongside the existing road network) or of low habitat quality for breeding birds (e.g. the business parks at Ballybrit and Parkmore), the road effect zone will be minimal.

The road effect zone may also act as a population sink during good breeding bird years; where fecundity and juvenile survival rates are high. Less experienced juveniles may be attracted to the poorer quality habitat affected by road traffic disturbance and with a relatively higher associated mortality risk due to the proximity of the Project. This in turn is likely to affect their breeding success and survival. Another likely consequence of the displacement of breeding birds from the road effect zone is increased competition for resources (e.g. nesting habitat or prey/food sources) both between and amongst breeding bird species.

One exception to this predicted road effect zone is the Barn owl which is likely to be affected at a much greater distance and is discussed separately below. Another, is the Peregrine falcon; a species which is relatively tolerant of human disturbance and road traffic.

Although the Project is predicted to have a long-term effect on local breeding bird populations, even at a local level this is not predicted to affect the ability of almost all local breeding bird species to persist within their current ranges or to maintain their populations long-term, the exception being the Barn owl.

Therefore, the Project is not likely to affect the conservation status of breeding bird species generally (excluding Barn owl and Peregrine falcon, which are discussed separately below) and will not result in a likely significant negative effect, at any geographic scale.

Barn owl

It is unlikely that operational noise levels will result in any disturbance to nesting Barn owl at Menlo Castle (Lden 50-60dB).

Barn owl are a nocturnal species and therefore, disturbance from road traffic at night (particularly from headlights) and from artificial lighting along the Project is likely to result in some level of displacement of Barn owl from foraging habitat near the Project. However, given the relatively small impact zone of the lighting when compared with the home range of the species (up to 3,000ha in the breeding season and likely more extensive in the winter (Lusby *et al*., 2021)), and that Barn owl are known to hunt along major roads where they are exposed to light and noise impacts, disturbance from lighting associated with road traffic during operation is not likely to result in any decline in the local Barn owl population or affect its ability to maintain itself over the long-term.

It is considered very likely that Barn owl road deaths would occur as a result of the Project during operation as:

- The distribution of Barn owl sites identified by this survey within 5km of the Project, including one breeding site located c.150m from the road edge associated with the Project
- The known distribution of Barn owls in the surrounding area (Balmer *et al*., 2013; Lusby *et al*., 2022)
- The availability of potentially suitable foraging habitat in close proximity to the Project
- Data on the extent and patterns of mortality on similar road types in Ireland, including the N22 Tralee Bypass (Lusby *et al*., 2021). The majority of Barn owl road fatalities in Ireland are juveniles which are killed during the post-breeding dispersal phase in late autumn and winter. As juveniles can travel extensive distances, the young which disperse from breeding sites throughout the country can be affected by roads, regardless of proximity of nesting sites to roads (Lusby *et al*., 2021)
- Data on Barn owl road mortalities in this area (Lusby *et al*., 2021), including Barn owl road mortalities recorded within the survey area

It is, therefore, expected that there would be medium to high levels of mortality as a result of the Project (within the region of 20 – 40 Barn owl mortalities per 100km per year). Predicted mortality rates along the Project are estimated at 3 – 7 Barn owl road mortalities per year based on the length of the proposed N6 GCRR (c.17.5km). This is likely to represent more than 1% of all Barn owl road mortalities in the County per year (Lusby *et al*., 2021). The operational impacts in relation to Barn owl road mortality are, therefore, considered to be a likely significant negative effect, at the county geographic scale.

Mitigation measures will be implemented to reduce the mortality risk to Barn owl posed by the Project (see Section 8.6.7.1).

Peregrine falcon

Although the nest site at Lackagh Quarry used between 2015 and 2017 will not be lost, the nest site used by the breeding pair of Peregrine falcon between May and September 2018 will likely be directly impacted. Despite the retention of the 'traditional' nesting ledge, the presence of a new road at such close proximity and elevated above the existing ground levels, has the potential to permanently displace nesting Peregrine falcon from that nest site. The absence of any alternative suitable nesting sites within the quarry may result in the permanent loss of the quarry as local Peregrine falcon nest site. There are two other quarry sites present

locally which are currently not occupied by a Peregrine falcon pair. However, it cannot be predicted with any degree of certainty that Peregrine displaced from Lackagh Quarry would take up residence at these other sites, even with interventions such as creating suitable nesting ledges. The potential loss of one out of three local Peregrine falcon nest sites has the potential to have long-term effects on the local population, affecting the species conservation status locally.

The potential loss of this nesting site is also significant at the county geographic scale. The actual number of nest sites known across counties Galway and Clare is not known[138] but current estimates are on the region of 60-70 nest sites. The loss of one site, that has been regularly in use for many years, is significant in that context.

The potential loss of the nest site at Lackagh Quarry has the potential to result in a likely significant negative effect, at the county geographic scale.

Habitat Degradation – Water Quality

There will be drainage outfalls to all river/stream catchments crossed by the Project. Therefore, there is a risk that discharges from the proposed road drainage network could affect water quality, potentially over the long-term, and consequently impact upon aquatic habitats and bird species, and their prey. In a worst-case-scenario, this could result in a long-term decline in aquatic/wetland bird species abundance and distribution on affected rivers or streams.

The proposed drainage design for the proposed N6 GCRR incorporates pollution control measures (this includes petrol interceptors, wetland and other measures, such as SuDS) followed by either infiltration ponds (where discharging to ground) or attenuation ponds (where drainage will be discharged to the existing surface water/storm sewer), as described in detail in Chapter 5, Project Description.

Those sections of the proposed road drainage that are to be discharged to ground, pose no risk to surface water quality. It is extremely unlikely that the normal operating water quality of the proposed drainage outfalls discharging to the existing surface water/drainage network, even in the unlikely event of a pollution incident, would have any perceptible long-term effect on water quality in receiving watercourses. The functioning and effectiveness of both elements of the proposed road drainage network are discussed in more detail in Chapter 11, Hydrology).

Habitat degradation is not predicted to affect the conservation status of aquatic or wetland bird species because of effects on surface water or groundwater during operation and will therefore, not result in a likely significant negative effect, at any geographic scale.

8.5.9.2 Wintering Birds

This section of the impact assessment deals with wintering bird species - i.e. those bird species which are SCIs of SPAs for their wintering populations, or are listed on either the BoCCI Red or Amber lists for their wintering populations.

Local bird population figures are based on the sum of the mean populations from I-WeBS summary data for Lough Corrib and Inner Galway Bay (accessed July 2024). However, local bird population figures are likely to be an underestimate of the actual local population due to patchy/incomplete I-WeBS counts and that only two wetland areas are covered in the local area (Inner Galway Bay and Lough Corrib).

Construction Phase Impacts

Habitat Loss

The Project will result in the loss of suitable wintering bird habitat area in a number of wintering bird sites surveyed over the winter of 2014/15, 2022/23 and 2023/24. For the surveys between 2022 – 2024, the study area covered the lands within a 300m buffer of the proposed N6 GCRR between the townlands of Knocknagreana in the west and Garraun North in the east, shown in Figure 8.13.1. The survey area was

[138] At the time of writing, a national Peregrine falcon census is underway but the results are not yet known.

divided into three separate survey areas; an eastern section, a central section, and a western section, which are described separately below for ease.

Eastern Section: Knocknagreana – Keeraun

The Project will result in the loss of a mosaic of wet grassland/heathland/scrub habitat within this area, totalling c.25.8ha. In most cases, the habitat loss is along the southern margins of suitable habitat areas, and will therefore not result in fragmentation of these areas. There are two areas where the proposed N6 GCRR will dissect areas of suitable habitat, in Forramoyle East, and Ballard. None of these areas were identified as important foraging or roosting areas for birds, with snipe and pheasant being the most frequently encountered species during the surveys. Curlew (on the BoCCI Red List for its wintering population) were observed in low numbers in two areas within this section; nine in February 2023, one in January 2024, and two in October 2024. On three occasions, flocks of curlew (one group of four, and one group of 20), flew over the survey sites but did not land within. Curlew were not observed within the Assessment Boundary in 2014/15 but were observed in the wider Scheme Study Area.

Snipe (on the BOCCI Red List for its wintering and breeding population) were recorded frequently across most of this area in 2022/23/24, but in relatively low numbers (between one and six individuals, with more than half being one or two birds). Snipe were not identified within the Assessment Boundary 2014/15 but were identified in the wider Scheme Study Area.

Redwing, (on the BOCCI Red List for its wintering population) were noted within the Assessment Boundary during surveys in 2023/24 during two surveys, in January 2024 (three individuals perched in scrub/transitional woodland habitat), and in November 2023 (two individuals).

Mallard and Whooper swan (both on the BOCCI Amber List for its wintering and breeding populations), were observed once (in the case of Mallard) and twice (for Whooper swan) flying over the Assessment Boundary in 2023/24. Neither species landed within the Assessment Boundary on any occasion.

Kestrel (on the BOCCI Red List for its breeding population) were observed soaring and hunting over the Assessment Boundary, on three separate occasions during surveys in September, October and November 2023.

Common gull, Black-headed gull and Herring gull (all on the BOCCI Amber List for its wintering and breeding populations) were observed flying over the Assessment Boundary on numerous occasions between 2022 – 2024, most of which were soaring at height, with one flock of nine herring gulls noted foraging in improved grassland in Ballard in January 2023. No other birds of conservation concern, or Annex I species were recorded in the Eastern Section of the Assessment Boundary during wintering bird surveys in 2022/23/24, and none of the aforementioned or other species were noted within the Assessment Boundary during surveys in 2014/15.

Middle Section: Keeraun - Coolough

The Project will result in the loss of a mosaic of agricultural grassland/scrub/amenity grassland/woodland in this area, totalling c.31.7ha. The survey results from this area recorded low number of wintering birds utilising the lands. Curlew were observed at two areas in Letteragh between November 2022 and February 2023 within the Assessment Boundary. Snipe were commonly recorded throughout the Assessment Boundary, in low numbers of 1-2 individuals during wintering bird surveys between 2022 – 2024. Redwing and Fieldfare were each recorded within the Assessment Boundary during wintering bird surveys between 2022 – 2024 in very low numbers (i.e. one or two individuals), with the exception of December 2022 when eight Redwing were noted. A Mute swan pair (on the BOCCI Amber List for its wintering and breeding populations) were observed foraging adjacent to the Assessment Boundary in the River Corrib in December 2022. One swan was recorded again in the same location in February 2024. Herring gull, Black-headed gull, and common gull were recorded across the middle section, but were mainly concentrated in the habitats adjacent to the River Corrib. The majority of observations of these species were overflying the survey sites between 2022 – 2024. A kestrel pair (on the BOCCI Red List for its breeding populations) were observed in February 2023 in the Menlo area. No other birds of conservation concern or Annex I bird species were recorded in the Middle Section of the Assessment Boundary during wintering bird surveys in 2022/23/24, and none of the aforementioned or other species were noted within the Assessment Boundary during surveys in 2014/15.

At the UoG Sporting Campus, c.2.3ha of the amenity grassland habitat used by wintering birds will be affected by construction phase (for c.18 months). Considering the availability of alternative amenity grassland habitat on the complex, and elsewhere in Galway City, long-term effects on local wintering bird populations at this site are not likely as a consequence of the habitat loss.

Eastern Section: Coolough – Doughiska/Ardaun

The Project will result in the loss of a mosaic of agricultural grassland/amenity grassland/scrub/wet grassland in this areas, totalling c.108ha. Common gull, Herring gull and black-headed gull were recorded frequently across the Eastern Section during surveys in 2022/23/24 and 2024/15, with the majority recorded foraging and overflying the amenity grassland habitat within the Galway Racecourse. Curlew were also observed in Galway Racecourse in the agricultural grassland habitat, with; two birds roosting/loafing in October 2023, two birds foraging in February 2024, 15 birds foraging in January 2024, six birds foraging in November 2023, three in October 2014, two in November 2014, and 37 in January 2015. Golden plover (on the BOCCI Red List for its breeding and wintering populations) were also recorded within Galway Racecourse, with two groups observed in January 2024, one of 74 birds roosting/loafing within the improved grassland, and 28 observed flying into the improved grassland adjacent to Ballybrit Castle. Snipe were also recorded in the improved grassland habitat of Galway Racecourse, in November and December 2023, and March 2024, with a peak count of 32. No other birds of conservation concern or Annex I bird species were recorded in the Middle Section of the Assessment Boundary during wintering bird surveys in 2022/23/24, and none of the aforementioned or other species were noted within the Assessment Boundary during surveys in 2014/15.

The Project will potentially result in the permanent loss of c.0.9ha of wet grassland habitat from the southern end of the Ballindooley Lough survey site. This represents c.0.7% of the lake and wetland complex. As this portion of habitat was not recorded as being used by wintering birds during the surveys, and the loss of habitat will not fragment the wetland complex, the habitat loss associated with the Project at Ballindooley Lough is not likely to affect the local wintering bird populations using the site.

A number of bird species were recorded at the Galway Racecourse. Within the racecourse lands, c.10ha (c.20%) of the suitable habitat area within that survey site will be lost. However, no wintering bird species were recorded using the affected habitat area and as it is on the northeastern edge, the Project will not fragment the site. All of the birds species observed within Galway Racecourse were recorded within the improved grassland habitats in the central area of the site, near Ballybrit Castle, and therefore the areas of habitat loss are not likely to be of importance for wintering bird species.

At Lackagh Quarry, Kestrel were the only bird of conservation concern (BOCCI Red List for breeding population) recorded over the winter of 2014/15, three were recorded overflying the site in February 2015. Kestrel were not observed in Lackagh Quarry during any of the surveys between 2022/23/24. Although not confirmed, it is likely that the Menlough/Coolough area is a winter home range for a local pair recorded nesting at Angliham Quarry in 2014, 2015 and 2016. Lackagh Quarry has not been recorded as a roosting site for the species and offers little in the way of foraging habitat for the species. Considering this and given the availability of alternative foraging habitat within the local area (e.g. open wet grassland and peatland habitats at Coolanillaun), the loss of habitat to the Project is not likely to have any perceptible effect on local wintering Kestrel.

Peregrine falcon nest/roost at Lackagh Quarry during the breeding season, and a single bird was observed on two occasions during surveys in December 2022, and December 2023 and therefore are resident during the winter. With a large hunting range (2-6km from nest site – Hardy *et al.* 2009), and given the availability of alternative foraging habitat within the local area for such an adaptable species in terms of habitat preference, the loss of habitat to the Project is not likely to have any perceptible effect on local wintering Peregrine falcon.

Overall, considering the cumulative effect of habitat loss across all affected winter bird survey sites across the three sections, and the low numbers of birds recorded within suitable areas of habitat observed 2014/15 and 2022/23/24, habitat loss is not likely to affect the conservation status of wintering bird species and will not result in a likely significant negative effect, at any geographic scale.

Disturbance/displacement

As the majority of works will be carried out during normal working daylight hours, the potential for construction to disturb wintering birds at night, either foraging or roosting, will not arise. Therefore, the discussion below is focussed on daytime disturbance.

For the purposes of impact assessment and defining disturbance effect distances, construction related disturbance is considered in relation to general construction activities (e.g. visual impact of construction workers and machinery and the associated vibration and more constant/continuous noise levels) and impulse noise disturbance from infrequent noise sources with a high noise level, such as blasting.

General Construction Activity Disturbance

In a report prepared for Humber INCA, Cutts *et al.* (2009) investigated the effects of disturbance on foraging and roosting waterbirds. Based on the findings of that study, in terms of a response to third party disturbance (e.g. human presence), minimal effects would be expected beyond 300m. In terms of construction noise, levels below 50dB would not be expected to result in any response from foraging or roosting birds. Noise levels between 50dB and 70dB would provoke a moderate effect/level of response from birds i.e. birds becoming alert and some behavioural changes (e.g. reduced feeding activity) but birds would be expected to habituate to noise levels within this range. Noise levels above 70dB would likely result in 8.31 birds moving out of the affected zone, or leave the site altogether. This is supported by the findings of Wright *et al.* (2010) which found that average noise levels above 60dB resulted in behavioural responses, with birds abandoning the site in response to noise levels above 70dB.

Noise levels associated with typical construction activity have been calculated in accordance with the methodology set out in BS 5228: Part 1. This standard sets out sound power levels for plant items normally encountered on construction sites, which in turn enables the prediction of noise levels. A variety of items of plant will be in use during the construction works. These will include breakers, excavators, dump trucks, and generators in addition to general road surfacing and levelling equipment. The key phases of works will involve ground breaking, excavation works, fill works, piling of structures, and general road works.

Calculations of indicative noise levels for typical noise sources associated with road construction works at set distances from the construction activity were calculated using the source data from BS 5228:2009 Code of Practice for Noise and Vibration Control on Construction and Open Sites – Part 1 Noise. The calculations assume that plant items are operating for 66% of the time to obtain an LAeq, 1 hour value. Noise levels are presented in Table 8.39 for the individual items of plant at specific distances in addition to a cumulative level assuming all plant items associated with the individual phases are operating simultaneously, and at the same distance, for any one scenario. The calculations do not take account of any screening afforded by intervening structures, construction site hoarding etc. and therefore represent a “worst case” scenario.

Table 8.39 Indicative Noise Levels Associated with Construction Works

Site Clearance & Preparation	Calculated $L_{Aeq,T}$ at Distance from Works (m)							
	50m	100m	150m	200m	250m	300m	350m	400m
Pneumatic breaker C.1.6	67	61	58	55	53	52	50	49
Wheeled loader C2-26	63	57	54	51	49	48	46	45
Tracked excavator (loading dump truck) C1-10	69	63	60	57	55	54	52	51
Dozer C.2.10	64	58	55	52	50	49	47	46
Dump Truck (C2.30)	63	57	54	51	49	48	46	45
Combined L_{Aeq} from all works	**73**	**67**	**64**	**61**	**59**	**58**	**56**	**55**
Fill Works	**Calculated $L_{Aeq,T}$ at Distance from Works (m)**							
	50m	**100m**	**150m**	**200m**	**250m**	**300m**	**350m**	**400m**
Tracked excavator (loading dump truck) C1-10	69	63	60	57	55	54	52	51
Articulated dump truck (dumping rubble) C1-11	64	58	55	52	50	49	47	46
Wheeled loader C2-26	63	57	54	51	49	48	46	45
Dozer C.2.10	64	58	55	52	50	49	47	46
Dump Truck Tipping fill (C2.30)	63	57	54	51	49	48	46	45
Combined L_{Aeq} from all works	**73**	**66**	**63**	**60**	**59**	**57**	**56**	**54**
Piling Works	**Calculated $L_{Aeq,T}$ at Distance from Works (m)**							
	50m	**100m**	**150m**	**200m**	**250m**	**300m**	**350m**	**400m**
Crawler Mounted Rig (C3.22)	64	58	55	52	50	49	47	46
Tracked Excavator inserting metal cage, (C3.24)	58	52	49	46	44	43	41	40
Concrete Pump & Cement Mixer Truck (C4.24)	51	45	42	39	37	36	34	33
Piling Works	**Calculated $L_{Aeq,T}$ at Distance from Works (m)**							
	50m	**100m**	**150m**	**200m**	**250m**	**300m**	**350m**	**400m**
Diesel Generator (C4.76)	45	39	36	33	31	30	28	27
Angle Grinder (C4.93)	64	58	55	52	50	49	47	46
Combined L_{Aeq} from all works	**68**	**62**	**58**	**56**	**54**	**52**	**51**	**50**
Road Works	**Calculated $L_{Aeq,T}$ at Distance from Works (m)**							
	50m	**100m**	**150m**	**200m**	**250m**	**300m**	**350m**	**400m**
Tracked excavator (C2.21)	55	49	46	43	41	40	38	37
Dump Truck (C2.30)	63	57	54	51	49	48	46	45
vibration rollers (C5.20)	59	53	50	47	45	44	42	41
Asphalt Paver & Tipping Lorry (C.5.31)	61	55	52	49	47	46	44	43

Diesel Generator (C4.76)	45	39	36	33	31	30	28	27
Road Rollers (C5.19)	64	58	55	52	50	49	47	46
Combined L_{Aeq} from all works	**69**	**63**	**59**	**57**	**55**	**53**	**52**	**51**

None of the construction activities listed above would be expected to result in any more than a moderate level of disturbance effect on waterbirds at distances beyond 150m. At 300m, noise levels are below 60dB or, in most cases, are approaching the 50dB threshold. Low, or no, effects would be expected for those noise levels. Any landscape features, vegetation cover or buildings between the construction site and winter bird sites would contribute to further reducing the ambient noise at any given distance. Therefore, 300m is considered to be a precautionary buffer in defining the ZoI of disturbance effects.

Impulse Noise Disturbance

In terms of noise levels associated with blasting, behavioural response thresholds would be expected to be similar to those described above for general construction related disturbance i.e. greater than 60dB. However, calculating a distance whereby blasting would attenuate to below 60dB is less certain given the large number of variables that would influence that calculation (e.g. size of charge used).

Rees *et al.* (2005) found that impulsive noise disturbance (e.g. airport bird scaring) alerted Whooper swans at distances of up to c.800m. As a precautionary approach, this distance is the zone within which some level of disturbance would be expected from rock blasting. However, it is worth noting that in that study less than a third of birds were alerted and disturbance events were also temporary, with birds resuming undisturbed behaviour within minutes. Therefore, the magnitude of any disturbance effects is likely to be greatest where blasting is occurring regularly, over a prolonged period, and probably at distances less than 800m. The only location along the Project where regular, prolonged blasting is likely to occur in the vicinity of an important wintering bird site (i.e. with high numbers of birds, frequently present) is in the zone between the western approach to Lackagh Tunnel and the proposed N83 Tuam Road Junction. Therefore, Ballindooley Lough is the only winter bird site where blasting may have a significant negative effect on wintering bird species and this is reflected in the discussions below, under the individual species headings.

Impacts on Winter Bird Species of Conservation Concern

In terms of effects on each of the wintering bird species recorded within the ZoI of the Project, the updated NIS for the Project presents a detailed assessment of those species listed as SCIs of either Lough Corrib SPA (SCIs confirmed during the 2014/2015 and 2022-2024 surveys include Gadwall, Shoveler, Tufted duck, Hen harrier, Coot, Golden plover, Black-headed gull and Common gull) or Inner Galway Bay SPA (SCIs confirmed during the 2014/2015 and 2022-2024 surveys Bar-tailed godwit, Black-headed gull, Common gull, Cormorant, Curlew, Golden plover, Great northern diver, Grey heron, Lapwing, Light-bellied brent goose, Ringed plover, Redshank, Teal, Turnstone and Wigeon). The 2005/2006 surveys also had single records of Dunlin and Red-breasted merganser, also SCIs for Inner Galway Bay SPA. Based on the abundance and frequency of these bird species recorded at each affected winter bird site, and the assessment methodology relating to disturbance outlined above, it was concluded that there would not be any population level effects. Therefore, for these species disturbance/displacement from construction works will not affect the species' conservation status or result in a likely significant negative effect, at any geographic scale.

The non-SCI wintering bird species of conservation concern present within the ZoI of the Project were: Bittern, Great crested grebe, Little grebe, Merlin, Mute swan, Oystercatcher, Peregrine falcon, Snipe, and Redwing. The potential impact of the Project on the wintering populations of each of these species are discussed below.

Bittern

A single Bittern was recorded at the Coolagh Lakes (WB04) in February 2015, initially in flight and landing in reed beds on the eastern side of the larger northern lake. Bittern is a scarce winter visitor to Ireland and is not included within the BoCCI lists. Ad hoc observations of Bittern in County Galway suggest it was last

recorded near Lough Corrib in December 2011[139]; with only two records in the county in the 5 years up to winter 2015. Bittern was not recorded during surveys between 2022 – 2024. It is likely that construction works will take place over the winter period within 300m of the Coolagh Lakes and therefore, there is the potential for disturbance and displacement of wintering birds, including Bittern. However, only the very northern end of the wetlands at the Coolagh Lakes falls within the ZoI of general construction related disturbance. Blasting may be required during construction within 800m of the Coolagh Lakes, but the requirements are likely to be minimal: i.e. likely to be carried out over periods of days, or a few weeks, with infrequent blasting events at any given location. Thus, displacement from any blasting is unlikely to cause any more than a brief effect at any instance. Given the extensive woodland cover that lies between the wetland/lake habitats and the Project the disturbance effects during construction are likely to be significantly reduced from the 300m and 800m distances related to the construction effects described. Even if Bittern were temporarily displaced from the area, there is an abundance of alternative suitable habitat available to accommodate the species, both surrounding the Coolagh Lakes and to the north of Menlo Castle. Therefore, disturbance from construction works is not likely to affect the species' conservation status and will not result in a likely significant negative effect, at any geographic scale.

Great crested grebe

Two Great crested grebe were recorded on a single occasion during the winter bird surveys on the River Corrib corridor (WB12), near the Glenlo Abbey Hotel's boat landing stage in 2014/15. During the surveys in 2023, a pair was also identified in Ballindooley Lough. This species was only recorded outside of the Assessment Boundary. 1% of the national population is 20. The mean[140] number of Great crested grebe from the I-WeBS surveys (Crowe and Holt, 2013) at Lough Corrib is five individuals, and therefore well below the threshold of the national population. Ballindooley Lake is not a survey site covered by I-WeBS, however the Inner Galway Bay is, with a mean count of 23 individuals. In the area between the Glenlo Abbey Hotel and Menlo Pier, the River Corrib is within the ZoI of general construction works. Any disturbance effects associated with construction works in this area are likely to be temporary given that it is a pipeline, attenuation facilities and a drainage outfall, and that only a small proportion of the works are within 300m of the River Corrib. Given the scarce records for the species from that part of the River Corrib within the ZoI of the Project, and the temporary nature of the works in the vicinity, there is a low risk of any disturbance or displacement effects. The majority of the river corridor (locally) is beyond the ZoI of any disturbance effects and would be available to accommodate displaced grebes. Ballindooley Lake is c.240m from the Assessment Boundary, and therefore is within the ZoI of construction works. As Ballindooley Lough is within the ZoI of (potentially) long-term blasting activity between Lackagh Quarry and the N83 Tuam Road Junction there is the potential for construction works to displace wintering birds from Ballindooley Lough over several winter seasons (estimated/predicted to be three). Prolonged blasting will occur in this area, and therefore, disturbance from construction works could affect the species' conservation status and has the potential to result in a likely significant negative effect, at a local geographic scale. Mitigation measures will be implemented to limit noise related disturbance during construction (see Section 8.6.7.1).

Little grebe

Little grebe were recorded at four winter bird sites within the ZoI of general construction works and potentially prolonged blasting at Lackagh Quarry: Ballindooley Lough (WB02), the Coolagh Lakes (WB02), west of Lough Inch (WB08)(2014/15 only) and along the River Corrib corridor (WB12), during surveys in 2014/15 and 2022/23/24.

Lough Inch is c.740m from the Project, at its nearest point. At this distance, and given that the nearest potential blasting location is c.800m from the lake shore, construction works are not likely to have any perceptible disturbance effects at this site.

Little grebe were recorded frequently at Ballindooley Lough, Coolagh Lakes and on the River Corrib; although five was the maximum number recorded at any one location or on any given survey visit (estimated to be c.4.3% of the local population). As discussed above in relation to Bittern, construction related

[139] According to www.irishbirding.com 'Sightings' records Accessed 18 December 2015

[140] The mean is based only on available survey data from the most recent 5-season period, i.e. for the period 2016/17 - 2020/21, using I-WeBS core counts.

disturbance at the Coolagh Lakes is not likely to displace wintering birds from most of the lake habitat, even as a consequence of any blasting that might be required, and the effects of which would be of a brief duration.

On the River Corrib, Little grebe were recorded along the river corridor from Galway City to Menlough; the majority of records were from upstream of the UoG Sporting Campus and between the Coolagh Lakes and Waterside in the city. Both locations are beyond the ZoI of general construction activities and any blasting requirements that may be associated with works within 800m of the River Corrib are likely to be minimal and with only a brief disturbance effect. Construction works near the River Corrib will probably result in some level of construction related disturbance but this will be short-term (c.18 months). Considering that most of the river habitat will be beyond the ZoI of construction related disturbance, and given the low numbers of Little grebe potentially affected along the river, any disturbance/displacement will not have any long-term effects on the species.

As Ballindooley Lough is within the ZoI of (potentially) long-term blasting activity between Lackagh Quarry and the N83 Tuam Road Junction there is the potential for construction works to displace wintering birds from Ballindooley Lough over several winter seasons (estimated/predicted to be three). This could potentially have long term effects on the local population and result in a likely significant negative effect, at the local geographic scale. Mitigation measures will be implemented to limit noise related disturbance during construction (see Section 8.6.7.2).

Merlin

A single Merlin was recorded in the area west of Lough Inch (WB08) in December 2014; flying to the south of the site. This species was not recorded during surveys in 2022/23/24. The area covered by the winter bird surveys here that lies within the ZoI of construction works, represents only a small proportion of what is an extensive upland habitat complex extending for more than 50km to the northwest, including the Connemara Bog Complex SPA, c.9km away, for which Merlin is a SCI species. Given the scarce presence of the species in habitats near to the Project, and the temporary nature of the works and any potential for disturbance, construction works are not likely to have any long-term effects on the species.

Therefore, disturbance from construction works is not likely to affect the species' conservation status and will not result in a likely significant negative effect at any geographic scale.

Mute swan

Mute swans were recorded at five winter bird sites within the ZoI of general construction works and potentially prolonged blasting between Lackagh Quarry and the N83 Tuam Road Junction during surveys in 2014/15 and 2022/23/24: Ballindooley Lough (WB02), the Coolagh Lakes (WB02), west of Lough Inch (WB08) (2014/15 only) and along the River Corrib corridor (WB12).

As discussed above, Lough Inch is beyond the disturbance ZoI of the Project and at the Coolagh Lakes disturbance/displacement effects are likely to be minimal and short-term.

On the River Corrib, Mute swan were frequently recorded with the exception of a single record of 14 birds in February 2014 (estimated to be c.2.9% of the local population), numbers present ranged from four to eight individuals in 2014/15 and one to four individuals in 2022/23/24.

Construction works near the River Corrib will probably result in some level of construction related disturbance but this will be short-term (c.18 months). Considering this, that most of the river habitat will be beyond the ZoI of construction related disturbance, and given the low numbers of Mute swan potentially affected along the river, any disturbance/displacement will not have any long-term effects on the species.

In Ballindooley Lough, Mute swan was recorded in 2023/24 only, as one or two individuals. As Ballindooley Lough is within the ZoI of (potentially) long-term blasting activity between Lackagh Quarry and the N83 Tuam Road Junction there is the potential for construction works to displace wintering birds from Ballindooley Lough over several winter seasons (estimated/predicted to be three). This could potentially have long term effects on the local population and result in a likely significant negative effect, at the local geographic scale. Mitigation measures will be implemented to limit noise related disturbance during construction (see Section 8.6.7.1).

Oystercatcher

Oystercatcher were recorded widely across the study area: the River Corrib corridor (WB12), Merlin Park (WB21), Galway Racecourse (WB23), Ballybane Playing Fields (WB24), UoG Sporting Campus (WB45), Gort na Bró Playing Fields (WB48) and the Bearna Woods Playing Fields (WB50) between 2014/15. The species was only recorded in four locations between 2022/23/24, along the shoreline between Furbo and Barna, in the playing fields in Ballybane, in the amenity grassland in Merlin Park, and in an area of improved grassland in Bearna (single bird observed).

The Merlin Park and Ballybane sites have a significant buffer of urban development between them and the Project, and works in these areas are predominantly on-line. Therefore, no disturbance effects at those sites are likely because of construction works.

Although Galway Racecourse grounds lie within the potential disturbance ZoI, Oystercatcher were only recorded here on one occasion (and only a single individual) in 2014, and were not recorded again. Along the River Corrib, the species was only recorded on a single occasion and in low numbers (in lands at Menlo Castle where seven individuals were recorded in February 2014). At the Bearna Woods Playing Fields, numbers recorded were also low, one in November 2014, two in December 2014 and five in February 2015. The frequency of use and numbers recorded were similar at the Gort na Bró site, five in both November 2014 and January 2015, three in February 2015 and 20 in March 2015. In the intertidal area between Bearna and Furbo, a number of birds were observed foraging along the shoreline, in low numbers (1 to six) during surveys in 2022/23/24. Therefore, any temporary displacement at these sites during construction will not affect the local population which is estimated to be c.740.

Oystercatcher were recorded at the UoG Sporting Campus on nine separate occasions over the winter of 2014/15 and it was the most frequently used of the winter bird survey sites by the species. The majority of records ranged between three and 22 individuals; the exception being a record of 34 in December 2014 which is estimated to represent c.4.6% of the local population. It was noted during the surveys at this site that birds were regularly disturbed and temporarily displaced from the playing fields by users of the sports facilities, returning to the same field or to another nearby. This would suggest that Oystercatcher using this site have adapted to a certain degree of habitual disturbance and despite this, frequently use the playing fields. Construction works at the UoG Sporting Campus will result in some level of construction related disturbance but this will be short-term (c.18 months). Considering this, that there are alternative sites available locally beyond the ZoI of construction related disturbance, and given the relatively low numbers of Oystercatcher potentially affected here, any disturbance/displacement will not have any long-term effects on the species.

Therefore, disturbance from construction works is not likely to affect the species' conservation status and will not result in a likely significant negative effect, at any geographic scale.

Peregrine falcon

During the winter of 2014/15, Peregrine falcon were recorded at one winter bird survey site within the potential ZoI of construction works at the Roadstone Quarry (WB17), on three occasions in December, February and March when a single bird was observed. The results of the Peregrine falcon survey carried out in 2016 confirmed the presence of three local breeding pairs, and it would be expected that they would maintain a local presence over the winter period. Surveys in 2022/23 at the Lackagh Quarry identified peregrine during two surveys in December 2022 and December 2023, with a single bird identified on both occasions.

Peregrines are highly adaptable species and not highly sensitive to construction related disturbance away from the nest site; as evidenced by the species regularly breeding in active quarry sites and in the urban environment. Therefore, construction works are not likely to have any perceptible effect on the local population during the winter period, is not likely to affect the species' conservation status and will not result in a likely significant negative effect, at any geographic scale.

Snipe

Snipe were distributed widely across the study area during surveys in 2014/15 and 2022/23/24. Although Snipe were frequently recorded across these sites, the numbers were generally low (<10 birds). The exception being records of 28 and 34 at Ballindooley Lough in December 2014 and March 2015,

respectively; 35 and 60 in Knocknagreana in two separate areas in 2023; and 32 in the Galway Racecourse in March 2024.

In the western part of the study area, a number of winter bird sites within the ZoI of construction related disturbance supported wintering Snipe; in Cappagh, An Chloch Scoilte, west of Lough Inch and Ballagh. The areas within those sites potentially affected by disturbance during construction represent only a small proportion of the locally available habitat resource for the species during the winter (i.e. rough wet grassland/heath habitat offering good ground cover). Given the low numbers potentially affected at these sites, and the temporary nature of any construction related disturbance, disturbance/displacement effects are not likely to affect the local Snipe population in the long-term.

Where the Project crosses the River Corrib, there is little habitat suitable for the species within the disturbance ZoI. As discussed above for Bittern, Little grebe and Mute swan, at Coolagh Lakes disturbance/displacement effects are likely to be minimal and short-term at most. Therefore, even temporary effects during construction are unlikely to affect the local population.

The Terryland River Valley is beyond the ZoI of general construction works with a buffer of residential development between it and the Project. Even if prolonged blasting in this area were required during construction, the effects would remain brief and most of this winter bird site would remain unaffected by disturbance.

As Ballindooley Lough is within the ZoI of (potentially) long-term blasting activity between Lackagh Quarry and the N83 Tuam Road Junction there is the potential for construction works to displace wintering birds from Ballindooley Lough over several winter seasons (estimated/predicted to be three). This could potentially have long term effects on the local population and result in a significant negative effect, at the local geographic scale. Mitigation measures will be implemented to limit noise related disturbance during construction (see Section 8.6.7.2).

Redwing

Redwing were recorded across the study area during surveys in 2022/23/24. Some large flocks between 10 – 30 birds were observed in a number of areas, but the majority of records were between one and ten birds.

In the east of the study area, flocks were observed foraging in the improved grassland habitats and within the bordering hedgerows. Redwings can be found in a variety of urban and rural habitats, and redwing habitat is within the ZoI of general constructions works throughout the Project and could be displaced and/or disturbed. However, given the amount of surrounding suitable habitat in the immediate and wider environs, construction works are not likely to have any perceptible effect on the local population during the winter period, is not likely to affect the species' conservation status and will not result in a likely significant negative effect, at any geographic scale.

Impacts on Important Winter Bird Sites

Given their SPA status, Lough Corrib SPA and Inner Galway Bay SPA are the most sensitive sites for wintering birds locally. A detailed assessment of the potential for the Project to affect both Lough Corrib SPA and Inner Galway Bay SPA is presented in the updated NIS. This assessment concluded that the Project would not result in an adverse effect on the integrity of either SPA. However, this conclusion was dependant on the implementation of mitigation measures relating to the protection of surface water, groundwater and disturbance which are also reflected in the mitigation strategy presented in Section 8.6.3 of this chapter.

Ballindooley Lough is also considered to be a locally important wintering bird site given the diversity of bird species of conservation concern for their wintering populations recorded there; fourteen in total, which included species listed as SCIs for Lough Corrib SPA and Inner Galway Bay SPA. The site regularly supported Coot, Curlew, Teal, Tufted duck and Shoveler, all species listed as SCIs for the nearby Lough Corrib SPA and/or Inner Galway Bay SPA. Although recorded less frequently and/or in low numbers, other SCI bird species recorded over the winter period were Bar-tailed godwit, Black-headed gull, Cormorant, Grey heron, Lapwing and Wigeon. The BoCCI Amber listed wintering species Little grebe, Mute swan and Snipe were also regularly recorded at Ballindooley Lough. As Ballindooley Lough is within the ZoI of (potentially) long-term blasting activity between Lackagh Quarry and the N83 Tuam Road Junction there is the potential for construction works to displace wintering birds from Ballindooley Lough over several winter seasons (estimated/predicted to be three). This could potentially have long term effects on the local

population and result in a significant negative effect, at the local geographic scale. Mitigation measures will be implemented to limit noise related disturbance during construction (see Section 8.6.7.2).

The River Corrib corridor (including the UoG Sporting Campus) and Coolagh Lakes were also important sites for wintering birds of conservation concern. Between them they supported three BoCCI Red list species (Black-headed gull, Curlew and Redshank) and ten Amber listed species - Cormorant, Coot, Great-black backed gull, Little grebe, Mute swan, Snipe, Teal, Common gull, Great crested grebe and Oystercatcher. The areas where most of these species were most frequently recorded (and recorded in the greatest numbers) are generally in the lower parts of the river between Coolagh Lakes and the Salmon Weir, or upstream of Menlo Castle. The exception being Oystercatcher who were frequently recorded at the UoG Sporting Campus but there are alternative amenity grassland areas available to the species elsewhere in the complex.

As discussed above, and in the updated NIS, in relation to the species recorded at each of these sites, the potential impacts associated with the Project, either at each site or cumulatively, are not likely to affect the conservation status of the local wintering populations at these winter bird sites and will not result in a likely significant negative effect, at any geographic scale.

Habitat Degradation – Surface Water Quality

During construction, contaminated or heavily silted surface water runoff, pump discharges and/or an accidental spillage or pollution event into any surface water feature has the potential to have a significant negative impact on water quality and consequently on aquatic habitats and species supporting the wintering bird populations. This could be either directly (e.g. bird species coming into direct contact with pollutants) or indirectly (e.g. acute or sub-lethal toxicity from pollutants affecting their food supply or supporting habitats).

The effects of frequent and/or prolonged pollution events in lake systems could potentially have significant long-term effects. It is considered unlikely that a pollution event of such a magnitude would occur during construction, or be any more than temporary in nature. Nevertheless, a precautionary approach is being taken in assuming a level of risk of water quality impacts and detailed mitigation measures are required to further minimise the risk of the Project having any perceptible effect on water quality during construction.

Habitat degradation as a result of effects on surface water quality during construction has the potential to affect the conservation status of affected wintering bird species and result in a likely significant negative effect, at a local geographic scale. Mitigation measures have been designed to protect water quality during construction (see Section 8.6.3.4).

Habitat Degradation – Groundwater

Any effects on the existing hydrogeological regimes at Coolagh Lakes and Ballindooley Lough have the potential to negatively impact upon the aquatic habitats and wintering bird species they support.

Based on the findings of the hydrogeological impact assessment in Chapter 10, Hydrogeology, the Project does not pose a risk to the groundwater supply to Ballindooley Lough. The Project does however, have the potential to affect the quantity of groundwater supplying the Coolagh Lakes. Although the magnitude of the impact cannot be fully quantified, on a precautionary basis it is assessed as having has the potential to affect winter bird usage of the Coolagh Lakes and result in a likely significant negative effect, at the local geographic scale. Mitigation measures have been designed to protect the existing groundwater regime during construction (see Section 8.6.3.5).

Operation Phase Impacts

Disturbance/displacement

During operation, the Project has the potential to disturb and displace wintering bird species from habitat near the Project because of the noise and visual disturbance associated with road traffic. The focus of research, and attempting to quantify, the effect of operational roads on bird populations has been largely focussed on breeding populations. Although the operational disturbance/displacement effect cannot be quantified it would be expected to be much less than the 300m ZoI associated with construction works. Most species of wintering birds are likely to habituate to the presence of a new road, particularly when there is a barrier in place, as is the case for the Project in the form of the boundary fencing or where the proposed N6 GCRR is in a deep cutting. Also, background noise levels are predicted to increase in the western part of the study area from a current range of 45-55dB to between 50 and 60dB during operation - a noise level at which

birds would not be expected to be displaced from the area. In the zone between the N83 Tuam Road and the existing N6, background noise levels are currently in the 50-60dB range and any operational noise/traffic is not likely to alter the existing baseline effect on wintering birds using habitats locally.

Although there is still likely to be some level of displacement effect, a perceptible effect would be expected to be limited to habitats immediately adjacent to the Project. Although it is likely to add to the effect of habitat loss, in terms of additional habitat area unavailable or unlikely to be used by wintering birds, it is not predicted to have a detrimental population level effect, particularly given the relatively infrequent and/or low numbers of wintering birds generally recorded at affected winter bird sites.

Therefore, any displacement of birds from habitat areas during operation of the Project is not likely to affect the conservation status of wintering bird species and will not result in a likely significant negative effect, at any geographic scale.

Mortality Risk

Surveys carried out in 2005/2006 as part of the 2006 Galway City Outer Bypass Project (RPS, 2006) recorded the following SCI species flying through the proposed bridge site for that project over the survey period (52 surveys encompassing 104 hours of observations): Hen harrier, Coot, Black-headed gull, Common gull, and Common tern. The most frequently recorded of these were Black-headed gull, Common gull and Cormorant; Hen harrier and Coot were only recorded once, Common tern were observed crossing the bridge site on only 43 occasions and generally low over the water (<5m).

Although the 2005/06 surveys did not cover the location of the proposed River Corrib Bridge for the proposed N6 GCRR, the results of those surveys (undertaken just a few hundred metres from the location of the proposed River Corrib Bridge) provide useful baseline data on birds, and their flight behaviour, that use the river corridor, and therefore this data is considered relevant and applicable to the assessment of the Project. The bird surveys undertaken from 2014 to 2024 for the Project did cover the location of the proposed River Corrib Bridge.

From the literature review carried out, bird collisions with man-made structures are common and well documented (Banks, 1979; Klem, 1990; Klem, 2009a; Jenkins *et al.*, 2010; Lucas *et al.*, 2008; Longcore *et al.*, 2012; Erickson *et al.*, 2001). Buildings and windows (Klem, 2009a), power lines (Jenkins *et al.*, 2010), wind turbines (Lucas *et al.*, 2008) and communication towers (Longcore *et al.*, 2012) are all documented as the primary structures causing bird collisions leading to mortality (Erickson *et al.*, 2001). Less widely documented are avian collisions with bridges.

The Fehmarnbelt Fixed Link EIA (FEBI, 2013) details results of a bird collision study carried out at the Oresund Bridge by Nilsson *et al.* (2009 (as reported in FEBI, 2013). The bridge connects Denmark and Sweden, includes cable-stay sections and is c.8km in length. In 2000, shortly after the bridge opened, 344 bird carcasses were recovered following one collision event. The incident was assumed to be an effect of low visibility in combination with high pylons. After opening of the bridge in 2000, a collision of estimated thousands of birds occurred on the night of the 8 October 2000 (Bengtsson, 2000 in FEBI, 2013). Subsequent studies on bird movements around the bridge recorded collision events in autumn of 2001 (291 birds), 2002 (103 birds), 2003 (65 birds) and 2008 (21 birds) as reported in FEBI (2013). A review of the 2001 data showed that passerine species comprised 94% of collision victims, a finding that has similarly been reported at lighted towers and associated guy wires in the US and Canada (Longcore *et al.*, 2013), 96% of victims were migrating birds and 73% were nocturnal migrants (Nilsson and Green 2002 as reported in FEBI 2013).

The composition of collision victims in later studies (Nilsson 2003 as reported in FEBI 2013, Nilsson 2004 as reported in FEBI 2013, Nilsson and Green 2009 as reported in FEBI 2013, Nilsson *et al.* 2009 as reported in FEBI 2013) changed with a marked reduction in the number of passerine carcasses recovered and an increase in gull species carcasses. The data indicated that lighting changes in 2002, turning bridge lights off at high pylons during foggy conditions, may have reduced passerine collision numbers, and that scavenging species (e.g. gulls) may have a greater collision risk with traffic due to their behaviour. The studies have also inferred that bird collisions with the bridge mainly occur during adverse weather conditions (Nilsson *et al.* 2009 as report in FEBI 2013). To put this study into context it has been estimated 100 million individuals pass over the Oresund area every autumn (Nilsson and Green 2011), with 10 million migrants passing the Oresund Bridge during autumn migration, and that numbers of collision victims reported in the above studies

did not represent more than a minor effect on species considered (Nilsson *et al.* 2009 as report in FEBI 2013).

Migratory passerine species are the most prevalent collision victim (Bing *et al.*, 2012; Longcore *et al.*, 2013), a trend that has also been recorded at the Sabo Bridge over Sabo Estuary in Portugal (Godinho *et al.*, 2017). Bird mortality was estimated at three sections of the railway, over a total distance of 16.3km. As with the above case studies, 27,000 bird movements (c.83% re water fowl and aquatic birds, with passerine species accounting for most of the remainder of species) were recorded crossing the Sabo Bridge during 400 hours of observation (Godinho *et al.*, 2017), suggesting that bridges over wetlands present a relatively low collision risk to waterbirds and mortality occurred at such low numbers that it did not represent more than a minor effect. Despite the greater proportion of aquatic birds, passerine birds accounted for 15 of the 25 bird species identified in the mortality survey. As with the Oresund Bridge, the Sabo Bridge is also a cablestay and bowstring structure, which pose a greater collision risk to birds than the proposed clear span bridge structure over the River Corrib as part of the Project.

As part of the Hong Kong-Shenzhen Western Corridor EIA for a 5.5km bridge (Ove Arup & Partners Hong Kong Ltd., 2002) a short study was carried out during the migration period (November 2001 to March 2002) to assess flight behaviour and altitudes over three selected bridges, all *c.*15m in height. The study found that birds tended to flyover the structure in the evening and below the structure during the midday, and that birds actively avoided the structure by changing their altitude on approach. No collisions with the studied bridges were observed. However, it should be noted that nocturnal surveys were not carried out.

A study of the M4 Severn Bridge Crossing, UK, found that many bird species (including Dunlin) changed their flight patterns to fly over the bridge, gaining height within 100m of the bridge, before dropping to their normal flight altitude (The Mersey Gateway Project Environmental Statement, 2008). Mallard and Mute swans were recorded flying under the bridge, in a straight line (The Mersey Gateway Project Environmental Statement, 2008). The M4 Severn Bridge Crossing is a cable-stayed bridge that is 2.2km in length, and has a height of 136m, and a clearance of 47m above water level. This study did not include observation periods during poor visibility conditions or nighttime periods.

A short-term study at the Golden Gate Bridge, California, showed birds actively avoided the bridge structure with most flying over or around the cable-stay structures rather than through them. No collisions were recorded and similarly these surveys were carried out during the diurnal period (Golden Gate Bridge EIA - EDAW and AECOM, 2009).

The findings of these studies support an argument that bridge structures, although they may result in some degree of bird mortality through collision, do not pose a collision risk of a magnitude that would kill large numbers of birds or result in any population level effects as a consequence. These findings also support avoidance of structures by birds in flight.

The risk of birds colliding with a bridge structure is dependent on factors such as the location and attributes of the man-made structures (Lucas *et al.* 2008), visibility and detectability of the structure (bridge strikes are more likely during poor weather conditions or at night), the structure and use of the surrounding habitat (Zuberogoita *et al.*, 2015), their frequency of occurrence within the impact zone (and flight height relative to the bridge structure), and the bird species present and their species-specific characteristics such as morphology and behaviour which influence their relative susceptibility to colliding with structures (Janss, 2000); scavenging behaviour is also associated with higher mortality due to traffic collisions. The effects of collision risk at night can be magnified by disorientation caused by artificial lighting (Kahlert *et al*., 2005; Molenaar *et al.*, 2006) It has also been inferred that a bird's individual experience or inexperience can influence collision risk (Barrios and Rodriguez, 2004).

Wind direction and wind speed can have a significant effect on collision risk. Collision risk with traffic and bridge structures is greater during windy weather (Jacobson, 2005; Otero *et al*., 2023; Owens and James, 1990). Downdrafts can also occur when bridges are perpendicular to wind direction and can increase collision risk with traffic or bridge structures (Jacobson, 2005).

Larger, less agile species such as geese, swans, cranes and Cormorant would be expected to be more susceptible to colliding with a bridge structure; particularly in relation to the risk of colliding with supporting cables. In terms of design criteria, bridges lit at night and with a dense and/or expansive network of supporting cables and towers across the river valley pose the highest risk.

Collision events with suspension cables are generally comparable to the collision risk with power lines (Kahlert *et al*., 2005), but collisions with bridges are less frequent than with overhead power lines. Flight activity studies at three transmission line sites in central Ireland recorded no collision events between birds and overhead lines during 108 hours of observation (217 flocks and 1040 target species crossings), which is line with findings of other similar studies (EirGrid, 2020). In addition to the lack of collisions, some avoidance behaviour by birds was noted, with the majority of birds flying above the power lines; the exception was at the 400 kV site (with the tallest towers), where a third of all birds flew beneath the lines (EirGrid, 2020). Targeted mortality searches indicated the majority of bird remains were of corvids and pigeon species (common, widespread species) with small numbers of gulls, waders, ducks and passerines (EirGrid, 2020).

A study of mute swan mortality in Dublin and Wicklow found that 57% of swan deaths of a known cause were caused by collision events (Collins and Whelan, 1994, cited in Keville and O'Sullivan Associates Ltd., 2006). 10% of these deaths were caused by bridges, and 72% were a result of collisions with overhead wires (Collins and Whelan, 1994, cited in Keville & O'Sullivan Associates Ltd., 2006). It is thought that bridge designs with stays or tendons are more difficult for swans to avoid than those without, although swan collision events with bridges are rare, and are not significant at the population level (Collins and Whelan, 1994, cited in Keville & O'Sullivan Associates Ltd., 2006).

The only structure associated with the Project which is of a scale as to pose a collision risk to birds is the proposed River Corrib Bridge. It is elevated above ground across the entire River Corrib floodplain (c.620m) which is a prominent natural corridor used by birds for foraging and commuting between Lough Corrib and Galway Bay. Along with more local daily bird movements, the River Corrib corridor is also likely to be used during the seasonal movement of birds to and from Galway Bay. With the exception of the proposed Menlough Viaduct, all of the other structures associated with the Project are either tunnels or (relatively) small river/stream culverts and pose no risk to birds at a population level. The Menlough Viaduct spans an area of Limestone pavement and woodland across the top of a low hill but given that it is only slightly elevated above the surrounding land (generally the deck is between 0.75m and 2.5m above ground), is mostly flanked by woodland on both sides (minimising the collision potential by directing birds over the structure), it poses a minimal collision risk to birds.

The design for the proposed River Corrib Bridge consists of prefabricated, precast box girders supporting a cast concrete bridge deck. Refer to Chapter 5, Project Description for more detail. In terms of design, this poses a minimal risk to birds when compared with bridge structures which present a network of supporting cable structures across the river corridor. The structural depth of the main span of the bridge deck that crosses the River Corrib ranges from 3-7m, which is generally thicker (and therefore likely to be more visible to birds) than the existing Quincentenary Bridge c.1.7km downstream. It will also not be lit, which further reduces the risk of bird collision.

Waterbirds frequenting the River Corrib, such as indicted above, commuting between Galway Bay and Lough Corrib, successfully navigate four existing road bridges during each one way flight. The proposed bridge over the River Corrib is elevated over the entire floodplain (c.620m wide) and depth of the main span ranges from 3-7m, which is generally thicker (and therefore likely to be more visible to birds) than the existing Quincentenary Bridge c.1.7km downstream. The scale of the proposed clear span bridge is insignificant in comparison to the examples in Denmark, Sweden, Portugal, Hong-Kong and San Francisco discussed above and poses minimal risk to birds due to the absence of a network of supporting cable structures.

It is worth noting in terms of collision risk and population level effects locally, that the Quincentenary Bridge (an elevated structure above the River Corrib with supporting piers in the river channel) has been in operation since 1984 and population trends for the SCI bird species of Inner Galway Bay SPA recorded along the River Corrib corridor are currently assessed as stable or increasing (NPWS 2013b) – similar population trends were not available for Lough Corrib SPA at the time of writing.

In terms of nocturnal birds, the fact has been considered that visibility and detectability of structures influence a bird's relative susceptibility to colliding with the structure (Janss, 2000). Strikes are more likely to occur during poor weather conditions or at night (Nilsson *et al.* 2009 as report in FEBI 2013). However, increasing the detectability of a bridge at night by artificial lighting can magnify the collision risk by causing disorientation (Molenaar *et al*., 2006; Nilsson *et al*. 2009 as report in FEBI 2013). To minimise the risk of

collision even further, and protect other sensitive ecological features from impacts (i.e. bats), the proposed bridge will not be lit. The depth of the main span (3-7m) of the proposed bridge, which will be a concrete finish, is considered to be sufficiently visible in varied weather conditions and low light levels that it will be detectable to birds.

In general night-time migrating birds fly large distances during the night and at high altitudes – i.e. at altitudes greater the 1km (Gauthreaux, 1991; Dokter *et al.* 2010). The proposed bridge at 8m above the River Corrib will not pose a collision risk to migrating birds flying at night at high altitudes. Daily commuting birds moving between Lough Corrib and Galway Bay are expected to fly during daylight hours and often shortly after dawn and shortly before dusk. Night-time flying birds, either nocturnal species or night-time migrating birds, are not considered at risk to collision with the proposed bridge due to the reasons above.

The bridge structure is clear-span with no supporting cable structures and as such, poses a minimal risk to wintering birds passing along the river corridor. Given the bird numbers and crossing frequencies observed during the 2006 surveys, a bridge such as that proposed in the design (refer to Chapter 5, Project Description) would not be expected to pose a collision risk of a magnitude that it would result in long-term effects on local bird populations, nor would the presence of the Project outside of the River Corrib corridor be expected to pose any significant collision risk to winter birds moving between the coast, Lough Corrib or any of the other winter bird survey sites at which they were recorded. Particularly given that to move between sites outside of the river corridor at present birds must fly over the existing road network and urban infrastructure in Galway City.

Therefore, any collision risk posed by the Project is not likely to affect the conservation status of wintering bird species and will not result in a likely significant negative effect, at any geographic scale.

Habitat Degradation – Surface Water

There are proposed drainage outfalls to all river/stream catchments crossed by the Project. Therefore, there is a risk that discharges from the proposed road drainage network could affect water quality, potentially over the long-term, and consequently impact upon the aquatic environment and supported bird species. In a worst-case-scenario, this could result in a long-term decline in aquatic/wetland bird species abundance and distribution on affected rivers or lakes.

The proposed drainage design for the proposed N6 GCRR incorporates pollution control measures (this includes petrol interceptors, wetland and other measures, such as SuDS) followed by either infiltration ponds (where discharging to ground) or attenuation ponds (where drainage will be discharged to the existing surface water/storm sewer), as described in detail in Chapter 5, Project Description.

Those sections of the proposed road drainage that are to be discharged to ground, pose no risk to surface water quality. It is extremely unlikely that the normal operating water quality of the drainage outfalls discharging to the existing surface water/drainage network, even in the unlikely event of a pollution incident, would have any perceptible long-term effect on water quality in receiving watercourses. The functioning and effectiveness of both elements of the proposed road drainage network are discussed in more detail in the hydrology chapter (Chapter 11, Hydrology).

Habitat degradation because of effects on surface water or groundwater during operation are not predicted to affect the conservation status of aquatic or wetland bird species and will therefore, not result in a likely significant negative effect, at any geographic scale.

8.5.10 Amphibians

Construction Phase Impacts

Habitat Loss

The construction of the Project will result in the permanent loss of both confirmed and potentially suitable amphibian habitat within the Assessment Boundary. The presence of potentially suitable amphibian breeding habitat is of note as, even though both Common frog and Smooth newt were only confirmed at a small number of sites within the Assessment Boundary (see Figures 8.14.1 to 8.14.8), it is possible that any wetland/peatland habitat or drainage ditches could be colonised and used by this species at the time of construction.

Given the low number of habitat features supporting amphibian species directly impacted by the Project, and that these areas supported relatively few individuals, and the abundance of alternative suitable habitat available locally, the effects of habitat loss associated with construction works are unlikely to affect the ability of the local frog or newt populations to maintain themselves in the long-term.

Therefore, habitat loss associated with the Project is not likely to affect the species' conservation status or result in a likely significant negative effect, at any geographic scale.

As amphibian breeding habitat will be directly impacted by the Project, and given the legal protection afforded to amphibian species under the Wildlife Acts (which prohibits wilful destruction or interference with an amphibian breeding or resting places), a mitigation strategy has been developed (see Section 8.6.8).

Disturbance & Mortality Risk

Site clearance works also have the potential to result in disturbance to, and the direct mortality of, Common frog and Smooth newt. The potential for direct mortality to occur, and the magnitude of any effects, would be expected to be greater where (a) suitable habitat exists and either Common frog and/or Smooth newt have been previously recorded (b) works affecting suitable habitat are undertaken during the breeding season, when adults and/or frog spawn/newt eggs may be present, or during the winter hibernation period when individuals are in refugia. Based on the survey results, the number of individuals that would potentially be at risk is low and would be unlikely to affect the local populations in the long-term.

Therefore, the Project is not likely to affect the species' conservation status in that regard or result in a likely significant negative effect, at any geographic scale.

Amphibian species have been confirmed using habitat areas within, and immediately adjacent to, the Project that have the potential to be killed, injured, or affected by construction related disturbance. Given the legal protection afforded to amphibian species under the Wildlife Acts, which prohibits their intentional killing or injury, or the wilful interference with an amphibian breeding or resting places, a mitigation strategy has been developed (see Section 8.6.8).

Habitat Severance/Barrier Effect

The temporary to short-term physical disruption of the existing landscape during site clearance and construction will fragment wetland and peatland habitats used by amphibian species. As a temporary to short-term impact, this is unlikely to present a significant barrier to the movement of amphibian species such that it would affect the local Common frog or Smooth newt populations in the long-term. Therefore, habitat severance during construction and any associated barrier effect are not predicted to result in a likely significant negative effect to amphibian species, at any geographic scale.

Habitat Degradation – Surface Water Quality

An accidental spillage or pollution event into a surface water feature supporting Common frog or Smooth newt will probably have a negative impact. The magnitude and significance of such an impact would be entirely dependent on the nature, scale and duration of the pollution event. Although unlikely, in a worst case scenario this could result in extensive degradation of amphibian habitat and/or the mortality of amphibians in affected habitats. There is the potential for such impacts to have long-term effects on the local populations of both the Common frog and the Smooth newt and result in a likely significant negative effect, at the local geographic scale. Habitat degradation therefore, has the potential to affect the species' conservation status and result in a likely significant negative effect, at the local geographic scale. Mitigation measures have been designed to protect water quality during construction (see Section 8.6.3.4).

Operational Phase Impacts

Habitat Severance/Barrier Effect

The presence of the Project will create a permanent barrier in the landscape to the movement of Common frog and Smooth newt. This is likely to affect foraging behaviour and dispersal corridors, e.g. the movement of species between breeding and hibernation sites. Populations on the fringes of Galway City may be isolated from habitat areas and populations beyond, having long-term effects on genetic diversity and gene flow, at a local geographic scale.

Habitat severance and barrier effect has the potential to have long-term effects on the local populations of both the Common frog and the Smooth newt, affect the species' conservation status and result in a likely significant negative effect, at the local geographic scale. Mitigation measures have been designed to minimise the long-tern effects of any barrier effect posed by the Project (see Section 8.6.8).

Mortality Risk

Amphibians species are vulnerable to road mortality and the presence of the Project will pose a permanent mortality risk to Common frog and Smooth newt. Although it is not possible to quantify the magnitude of this impact, it is unlikely to have long-term effects that would result in a decline of the local Common frog and Smooth newt populations. Particularly, given the high degree of permeability across the Project included within the design which will minimise the potential interaction of amphibians with the proposed road carriageway.

Therefore, mortality risk is not likely to affect the species' conservation status or result in a likely significant negative effect, at any geographic scale.

Habitat Degradation – Surface Water Quality

There will be outfall points to surface water features from the proposed road drainage network during operation. Therefore, there is a risk that discharges from the proposed road drainage network could affect water quality in receiving surface water features and consequently impact upon amphibian habitat.

The proposed drainage design for the proposed N6 GCRR incorporates pollution control measures (this includes petrol interceptors, wetland and other measures, such as SuDS) followed by either infiltration ponds (where discharging to ground) or attenuation ponds (where drainage will be discharged to the existing surface water/storm sewer), as described in detail in Chapter 5, Project Description.

Those sections of the proposed road drainage that are to be discharged to ground, pose no risk to surface water quality. It is extremely unlikely that the normal operating water quality of the drainage outfalls discharging to the existing surface water/drainage network, even in the unlikely event of a pollution incident, would have any perceptible long-term effect on water quality in receiving watercourses. The functioning and effectiveness of both elements of the proposed road drainage network are discussed in more detail in Chapter 11, Hydrology.

Habitat degradation as a result of effects on surface water quality during operation is not predicted to affect the conservation status of amphibian species and will therefore, not result in a likely significant negative effect, at any geographic scale.

8.5.11 Reptiles

Construction Phase Impacts

Habitat Loss

In total 28 habitat types are potentially suitable for Common lizard. These habitats are listed in Table 8.40, together with the total amount of area of each habitat type that will be lost due to the Project. A total of 267.11ha of potentially suitable Common lizard habitat will be lost due to the Project.

Table 8.40 Total Area of Common lizard Habitat Types that will be lost due to the Project

Habitat Code	Area (ha) Lost
BL1	0.02
BL3	39.39
ED2	3.42
ED3	18.20
ER1	0.02

Habitat Code	Area (ha) Lost
ER2	0.30
FL8	0.90
FW1	0.05
FW4	0.08
GA1	73.47
GA2	12.88
GM1	0.02
GS1	27.43
GS2	9.05
GS3	6.14
GS4	16.33
HD1	14.26
HH1	1.94
HH3	1.74
PB3	0.01
PF2	0.00
Residential	10.59
WD1	0.35
WL1	0.40
WL2	0.35
WN2	1.35
WS1	28.39
WS3	0.03
TOTAL	**267.11**

Construction of the Project will result in the permanent loss of Common lizard habitat within the Assessment Boundary (see Figures 8.14.1 to 8.14.8). There are four distinct areas, where Common lizard were recorded, that are affected directly by the Project: Forramoyle East and West (Site 10 & 12), and a mosaic of heath, scrub, bracken and wet grassland at Na Foraí Maola/An Chloch Scoilte (Area A); a similar habitat mosaic between Bearna Woods and na hAille (Areas B & C / Areas 1, 2 & 11); at Ballagh (Areas E & F / 4 & 5); and in an area adjacent to the Lackagh Quarry east of Menlo (Area 8). This is consistent with the species favouring structurally diverse habitat mosaics to provide foraging areas, refuges and hibernacula, and basking sites within their territories. Aside from the urban environment and large open expanses of bare ground or improved agricultural grassland (due to the lack of refuges), all other areas of semi-natural habitat, or habitat areas that offer a mix of cover and exposed locations for basking, are potentially suitable to support Common lizard. These habitat types make up the majority of the landscape west of the River Corrib, and to the north and west of the Project; habitat areas which will be available to support the local Common

lizard population during construction and operation. Figures 8.14.1 to 8.14.8 evidence the range and extent of these suitable, alternative habitat areas that will be available for Common lizard in the vicinity of the Project. In general terms, the comparatively small area of common lizard habitat that will be lost within the Assessment Boundary will not compromise the long term viability of the local population as a result of the area of heathland habitat being created, and the vast areas of habitat locally that will remain unaffected by the Project.

In terms of habitat area, c.5.63ha of peatland and heathland suitable habitat mosaic will be directly affected. This would be the minimum amount of lizard habitat lost, as it does not include other habitats including wet grassland, dense bracken, acid grassland, and scrub, which are interspersed between the heathland habitat types and may support lizard populations along the margins (Marnell, 2002). To put the loss of *c.*5.63ha of peatland and heathland habitat mosaic into the wider context, this represents <2% of the peatland/heathland habitat recorded in the wider Scheme Study Area in 2014 (refer to Figures 8.20.1 to 8.20.15 for the Fossitt habitat classifications and Figures 8.22.1 to 8.22.15 for Annex I habitat classifications). There are also extensive blocks of peatland/heathland habitat to the immediate north and northwest of the 2014 habitat map extent covering an area of c.40km^2. Despite the comparatively small extent of common lizard habitat that will be lost as a result of the Project, c.4ha of heathland habitat will be created within lands in the Applicant's control as part of the mitigation reducing the loss of common lizard habitat locally to c.1.54ha (<0.3% of the peatland/heathland habitat recorded in the wider Scheme Study Area) associated with the Project.

In all areas, only single individual Common lizard were recorded on any given visit. Given the relatively low numbers of Common lizard that are likely to be affected, and the abundance of alternative suitable habitat available locally coupled with the additional habitat created, the effects of habitat loss associated with construction works are unlikely to affect the long-term viability of the local Common lizard population. Therefore, habitat loss is not likely to affect the species' conservation status or result in a likely significant negative effect, at any geographic scale.

As Common lizard habitat will be directly impacted by the Project, and given the legal protection afforded to the species under the Wildlife Acts (which prohibits wilful destruction or interference with their breeding or resting places), a mitigation strategy has been developed (see Section 8.6.9).

Disturbance & Mortality Risk

Site clearance works have the potential to result in disturbance to, and the direct mortality of, Common lizard. The potential for direct mortality to occur, and the magnitude of any effects, would be expected to be greatest where (a) suitable habitat exists and Common lizard have been previously recorded (b) works affecting suitable habitat are undertaken during the winter hibernation period (October to mid-March) and affect potential hibernacula (e.g. stone walls), when lizards are less active and therefore less able to escape any works being undertaken.

Based on the survey results, the number of individuals that would potentially be at risk is low and would be unlikely to affect the local populations in the long-term. Therefore, disturbance or mortality risk are not likely to affect the species' conservation status or result in a likely significant negative effect, at any geographic scale.

Common lizard have been confirmed using habitat areas within, and immediately adjacent to, the Project and there is therefore, the potential for individuals to be killed, injured, or affected by construction related disturbance. Given the legal protection afforded to the Common lizard under the Wildlife Acts (which prohibits their intentional killing or injury, or the wilful interference with their breeding or resting places) and a mitigation strategy has been developed (see Section 8.6.9).

Habitat Severance/Barrier Effect

The temporary to short-term physical disruption of the existing landscape during site clearance and construction will fragment habitat used by Common lizard. As a temporary to short-term impact, this is unlikely to present a significant barrier to the movement of the species such that it would affect the local Common lizard population in the long-term. Therefore, habitat severance during construction and any associated barrier effect are not likely to affect the species' conservation status and are not predicted to result in a likely significant negative effect to the Common lizard, at any geographic scale.

Operational Phase Impacts

Habitat Severance/Barrier Effect

The presence of the Project will create a permanent barrier in the landscape to the movement of Common lizard. This is likely to affect foraging behaviour and dispersal corridors, e.g. the movement of individuals within their territories and between breeding and hibernation sites. Populations on the fringes of Galway City may be isolated from habitat areas and populations beyond, having long-term effects on genetic diversity and gene flow, at a local geographic scale.

Habitat severance and barrier effect has the potential to have long-term effects on the local Common lizard population, affect the species' conservation status and result in a likely significant negative effect, at the local geographic scale. Mitigation measures have been designed to minimise the long-tern effects of any barrier effect posed by the Project (see Section 8.6.9).

Mortality Risk

Common lizard are vulnerable to road mortality and the presence of the Project will pose a permanent mortality risk to the species. Although it is not possible to quantify the magnitude of this impact, it is unlikely to have long-term effects that would result in a decline of the local Common lizard population. Particularly, given the high degree of permeability across the Project included within the proposed design which will minimise the potential interaction of lizards with the proposed road carriageway.

Therefore, mortality risk is not predicted to affect the species' conservation status or result in a likely significant negative effect to amphibians, at any geographic scale.

8.5.12 Fish

Construction Phase Impacts

Habitat Loss

The Project will result in the permanent loss of fisheries habitat where it crosses Sruthán na Líbeirtí, the Trusky Stream, the Bearna Stream (and tributary), the Tonabrocky Stream, the Knocknacarra Stream. A reduction in habitat availability could potentially have long-term effects on fish populations within a given river/stream catchment.

Sruthán na Líbeirtí

Sruthán na Líbeirtí is crossed by the Project at two locations: between Ch. 0+650 and Ch. 0+750 of the proposed N6 GCRR (refer to Figure 5.1.01) where the length of channel directly affected is c.130m, and between Ch. 0+850 and Ch. 1+000 of the proposed N6 GCRR where c.120m will be lost. There is an additional 240m of the watercourse that lies within, or along, the Assessment Boundary and is likely to be affected to some degree by construction, construction works could potentially result in further habitat loss. Construction works to install the proposed drainage outfall and road carriageway near where the stream passes beneath the R336 has the potential to result in further habitat loss, although the areas involved are likely to be small (<10m^2). The impact associated with the loss of instream habitat will be offset slightly by the creation of a new section of river channel, c.40m in length.

Sruthán na Líbeirtí is a seasonal watercourse with low fisheries value in the upper reaches, where it is impacted by the Project. Considering this and the design requirements relating to new crossing structures and the proposed realigned channel, the loss of habitat is predicted not to affect the conservation status of the fish species within that catchment and will not therefore, result in a likely significant negative effect, at any geographic scale.

Trusky Stream

Approximately 160m of instream habitat will be lost on the Trusky Stream (Ch. 2+750 to Ch. 2+900 of the proposed N6 GCRR - refer to Figure 5.1.01 and Figure 5.1.02) with a new channel, c.60m in length, being constructed in its place. There is also an additional 65m of the watercourse that lies within the Assessment Boundary and is likely to be affected to some degree by construction works, e.g. the construction of the proposed drainage outfall will require installing a permanent structure on the stream bank.

The Trusky Stream is a seasonal watercourse with low fisheries value in the upper reaches, where it is impacted by the Project. Considering this, the loss of habitat is not likely to affect the conservation status of the fish species within that catchment and will not therefore, result in a likely significant negative effect, at any geographic scale.

Bearna Stream

The Bearna Stream is crossed by the proposed N6 GCRR at Ch. 4+125 (refer to Figure 5.1.03) where c.40m of existing instream habitat will be lost. There is an additional 285m of the watercourse that lies within, or along, the Assessment Boundary and is likely to be affected to some degree by construction. Construction works could potentially result in further habitat loss such as that associated with installing the drainage outfall from the attenuation ponds. At Ch. 3+950 of the proposed N6 GCRR, c.40m of instream habitat in a small tributary of the Bearna Stream will be lost; there is also c.110m of additional stream channel within the Assessment Boundary with the same potential construction impacts as outlined above for the main channel of the Bearna Stream.

The main channel of the Bearna Stream is more than 4km in length. Considering that the linear length of stream channel that will be lost represents less than 1% of the total, the habitat loss is not likely to be of a magnitude to affect the conservation status of the fish species within that catchment and will not therefore, result in a likely significant negative effect, at any geographic scale. The unnamed tributary of the Bearna Stream is a seasonal watercourse with a relatively lower fisheries value in the upper reaches, where it is crossed by the Project. Considering this, the loss of habitat is not likely to affect the conservation status of the fish species within that catchment and will not therefore, result in a likely significant negative effect, at any geographic scale.

Tonabrocky Stream

Approximately 450m of the Tonabrocky Stream channel will be lost as a result of the proposed N6 GCRR between Ch. 4+850 and Ch. 5+225 (refer to Figure 5.1.04). As with many of the other watercourses crossed by the Project, a further c.80m of the stream channel lie within the Assessment Boundary and may also be directly impacted by construction works. A new section of stream channel, c.250m in length, which will offset the habitat loss to a degree.

The main channel of the Tonabrocky Stream is more than 5km in length. Although the linear length of stream channel that will be lost represents c.9% of the total, when the new length of stream channel is considered (reducing the permanent loss to c.4%) the habitat loss is not likely to be of a magnitude to affect the conservation status of the fish species within that catchment, particularly given that the impacted area is in the upper reaches of the catchment where the fisheries value was assessed as low. Habitat loss on the Tonabrocky Stream will not therefore, result in a likely significant negative effect, at any geographic scale.

Knocknacarra Stream

As a seasonal stream with a low fisheries value (where impacted by the Project), the loss of habitat is predicted not to affect the conservation status of the fish species within that catchment and will not therefore, result in a likely significant negative effect, at any geographic scale.

River Corrib

There are no instream works proposed at the River Corrib. Habitat loss here will be restricted to the permanent loss of riparian/bankside habitat to install the drainage outfalls; one on each bank of the river which will affect c.3m of riparian habitat (refer to Figure 5.1.07 and for habitats Figures 8.20.7 and 8.22.7). In the context of the River Corrib, where there is no spawning habitat or habitat suitable to support lamprey ammocoetes present in the immediate vicinity of the proposed River Corrib Bridge, this level of habitat loss is not likely to have any perceptible impact upon the fish species using the river. Therefore, habitat loss is not likely to have any long-term effect on the fish populations of the River Corrib or their conservation status, and therefore will not result in a likely significant negative effect, at any geographic scale.

Even though habitat loss is not predicted to result in any likely significant negative effect on affected watercourses/catchments, mitigation measures are proposed to minimise the loss of fisheries habitat, to protect that which is being retained within the Assessment Boundary, and through the design of new channels and the culverts, minimise its effects on the local fish populations.

Coolagh Lakes, Ballindooley Lough and Galway Bay

There will be no habitat loss associated with the Project at the Coolagh Lakes, Ballindooley Lough or in Galway Bay.

Habitat Degradation – Surface Water Quality

During construction, contaminated or heavily silted surface water runoff, pump discharges and/or an accidental spillage or pollution event into any surface water feature has the potential to have a significant negative impact on water quality and consequently on aquatic habitats and fish species, and potentially also in the marine environment downstream. This could be either directly (e.g. acute or sub-lethal toxicity from pollutants or siltation events damaging spawning habitat downstream) or indirectly (e.g. affecting their food supply or supporting habitats).

The effects of frequent and/or prolonged pollution events in a river system have the potential to be extensive and far-reaching and could potentially have significant long-term effects. It is considered unlikely that a pollution event of such a magnitude would occur during construction, or be any more than temporary in nature. Nevertheless, a precautionary approach is being taken in assuming a level of risk of water quality impacts and detailed mitigation measures are required to further minimise the risk of the Project having any perceptible effect on water quality during construction.

Habitat degradation as a result of effects on surface water quality during construction has the potential to affect the conservation status of affected fish species and result in a likely significant negative effect, at a local geographic scale. Mitigation measures have been designed to protect water quality during construction (see Section 8.6.3.4).

Habitat Degradation – Groundwater

Any effects on the existing hydrogeological regimes at the Coolagh Lakes and Ballindooley Lough have the potential to negatively impact upon the aquatic habitats and the fish species they support.

Based on the findings of the hydrogeological impact assessment in Chapter 10, Hydrogeology, the Project does not pose a risk to the groundwater supply to Ballindooley Lough. The Project does however, have the potential to affect the quantity and quality of groundwater supplying the Coolagh Lakes. Although the magnitude of the impact cannot be fully quantified, on a precautionary basis it is assessed as having the potential to affect fish species' conservation status in the Coolagh Lakes and result in a likely significant negative effect, at the local geographic scale. Mitigation measures have been designed to protect the existing hydrogeological regime during construction (see Section 8.6.3.5).

Mortality Risk

Construction works to install culverts on Sruthán na Líbeirtí, the Trusky Stream, the Bearna Stream (and tributary), the Tonabrocky Stream and the Knocknacarra Stream will require instream works, and in some cases realignment of a section of the stream channel. Instream works, or works associated with channel diversions, stream realignments or general construction activities (e.g. dewatering channels or water abstraction for dust control), have the potential to result in the direct mortality of fish species. This section assesses the risk associated with mortality due to species interacting with construction vehicles, machinery such as pumps, or as a result of dewatering. The potential effects of accidental pollution events, which can also result in fish mortality, are discussed separately under the heading of *Habitat Degradation – Surface Water*.

Given the seasonal nature of the upper reaches of many of the streams, where the Project will be impacting upon the channel, and the low numbers of fish species recorded there during the electrofishing surveys, the mortality risk posed by the construction works is unlikely to affect the conservation status of any of the fish species present in the catchments of Sruthán na Líbeirtí, the Trusky Stream, the Bearna Stream (and tributary), the Tonabrocky Stream, or the Knocknacarra Stream.

Instream works on the River Corrib are limited to construction of the drainage outfalls (one on each river bank) which will require the installation of a head wall and concrete base. Given the scale of the works, they do not pose a risk of fish mortality such that it is likely to affect the conservation status of any of the fish species present in the River Corrib catchment.

The mortality risk from construction works is not likely to have any long-term effect on the local fish populations or their conservation status, and therefore will not result in a likely significant negative effect, at any geographic scale.

Given the legal protection afforded to fish species under the Fisheries Acts, a mitigation strategy has been developed to avoid an offence being committed during construction works (see Section 8.6.10).

Disturbance/Displacement

Increased human presence, and noise and vibration associated with the construction works (e.g. the installation of culverts and piles) is likely to result in the displacement of fish species from the area. Long-term disturbance/displacement effects on the local fish populations are not likely given the temporary nature of any vibration associated with the pile driving, and the short-term nature of general construction works (which if carried out during normal working hours, would be of a limited duration each day), that there are no spawning grounds near any of the proposed watercourse crossings.

Disturbance/displacement during construction is not predicted to affect the conservation status of the local fish populations and therefore, will not result in a likely significant negative effect, at any geographic scale.

Habitat Severance/Barrier Effect

Instream construction works have the potential to sever fisheries habitat and result in a barrier to fish passage, at least temporarily. Restricting fish access to food resources, or spawning grounds, could have long-term effects on the local fish populations.

The habitat affected by, and upstream of, the Project in the catchments of Sruthán na Líbeirtí, the Trusky Stream, the Bearna Stream (and tributary), the Tonabrocky Stream, and the Knocknacarra Stream were considered to be of a low fisheries value, most being seasonal in nature with few, or no, fish species recorded during the fisheries surveys. Therefore, any temporary severance or barrier effect during construction is not likely to result in long-term effects on the local fish populations in these catchments.

As the proposed River Corrib Bridge is a clear span bridge structure with no instream structures or works with the potential to block the river channel, no habitat severance or barrier effect will occur on the River Corrib.

Overall, habitat severance and barrier effect during construction is not likely to have any long-term effect on the local fish populations or their conservation status, and therefore will not result in a likely significant negative effect, at any geographic scale.

Operation Phase Impacts

Habitat Degradation – Surface Water

There will be drainage outfalls to all river/stream catchments crossed by the Project. Therefore, there is a risk that discharges from the proposed road drainage network could affect water quality, potentially over the long-term, and consequently impact upon aquatic habitats and fish species. In a worst-case-scenario, this could result in a permanent decline in fish species abundance and distribution.

The proposed drainage design for the proposed N6 GCRR incorporates pollution control measures (this includes petrol interceptors, wetland and other measures, such as SuDS) followed by either infiltration ponds (where discharging to ground) or attenuation ponds (where drainage will be discharged to the existing surface water/storm sewer), as described in detail in Chapter 5, Project Description.

Those sections of the proposed road drainage that are to be discharged to ground, pose no risk to surface water quality. It is extremely unlikely that the normal operating water quality of the drainage outfalls discharging to the existing surface water/drainage network, even in the unlikely event of a pollution incident, would have any perceptible long-term effect on water quality in receiving watercourses. The functioning and effectiveness of both elements of the proposed road drainage network are discussed in more detail in the hydrology chapter (Chapter 11, Hydrology).

Habitat degradation because of effects on surface water or groundwater during operation is not predicted to affect the conservation status of fish species and will therefore, not result in a likely significant negative effect, at any geographic scale.

Habitat Severance/Barrier Effect

The structures have been designed in consultation with IFI and the design criteria set out in *Guidelines for the Crossing of Watercourses during the Construction of National Road Schemes* (National Roads Authority, 2005) and the *Guidelines on Protection of Fisheries During Construction Works in and Adjacent to Waters* (IFI, 2016). This will maintain fish passage during the operation of the Project and therefore, will result in a neutral impact to fish species.

8.5.13 Local Biodiversity Areas

The Coast Road (R336) to the N59 Moycullen Road (which includes the Cappagh – Ballymoneen and the Ballagh – Barnacranny Hill local biodiversity areas from the draft Galway City Biodiversity Action Plan 2014-2024)

In terms of biodiversity effects, the Project will result in habitat loss across this area, including the loss of areas of the Annex I habitats Wet heath, Dry heath and Molinia meadow (see Section 8.5.5 above for habitat impacts). It will also impact upon mammal species including Otter and Badger (see Section 8.5.7 above), bat species (see Section 8.5.7.2 above), the Marsh fritillary butterfly (see Section 8.5.8.5), breeding and wintering birds (see Section 8.5.9 above), the Common frog and Smooth newt (see Section 8.5.10), the Common lizard (see Section 8.5.11 above), and fish species in Sruthán na Líbeirtí, the Trusky Stream, the Bearna Stream, the Tonabrocky Stream and the Knocknacarra Stream (see Section 8.5.12 above).

Rusheen Bay – Barna Woods – Illaunafamona

The Project has the potential to affect habitats and species in Rusheen Bay if it were to result in a deterioration in water quality in the receiving surface water network, which discharges to Rusheen Bay (the Bearna Stream, the Tonabrocky Stream and the Knocknacarra Stream). For example, this is discussed above in Section 8.5.5.3 in relation to habitats (including watercourses), in Section 8.5.7.1 in relation to Otter, and in Section 8.5.9.2 in relation to wintering birds. The Project also has the potential to present a barrier to Otter movement in watercourses connected to Rusheen Bay (features that are important in supporting the local Otter populations), and road traffic has the potential to present a mortality risk to Otter (see Section 8.5.7.1 above).

The River Corrib and the Coolagh lakes (which includes the River Corrib and adjoining wetlands local biodiversity areas from the draft Galway City Biodiversity Action Plan 2014-2024)

In terms of biodiversity effects, the Project will result in habitat loss in the vicinity of the proposed River Corrib crossing, has the potential to affect water quality in the receiving environment, has the potential to affect groundwater quality and quantity supplying the Coolagh Lakes, to disturb species using the River Corrib corridor and the Coolagh Lakes (e.g. aquatic species and breeding/wintering birds). These impacts have the potential to affect both habitats and the assemblage of fauna species supported by those habitats; which include Otter, fish species, wintering and breeding birds, bats (including the Lesser horseshoe bat) and mollusc species. Construction of the River Corrib Bridge has the potential to affect aquatic species through the risk of construction materials dropping into the river, with operation of the Project posing a mortality risk to Otter.

The effects on the River Corrib and the Coolagh Lakes are discussed briefly in Section 8.5.4.1 in relation to Lough Corrib SAC and in Section 8.5.4.2 in relation to Lough Corrib pNHA. However, a more detailed assessment is presented in the updated NIS in the context of impacts on the River Corrib/Coolagh Lakes and Lough Corrib SAC, which considers all of the aforementioned potential impacts, as the SAC designation includes the River Corrib and the Coolagh Lakes. This area is also included within the Lough Corrib pNHA.

Menlough to Coolough Hill (including Lackagh Quarry)

In terms of biodiversity effects, the Project will result in habitat loss across this area, including semi-natural grasslands, woodland, scrub, calcareous springs and exposed limestone rock, this includes the loss of areas of the Annex I habitats Petrifying springs, Limestone pavements, Calcareous grasslands and Residual alluvial forests. There is also the potential for groundwater impacts to affect a Turlough feature (see Section 8.5.5.3 above for habitat impacts). It will also impact upon mammal species including Badger (see Section 8.5.7.3 above), bat species (and in particular the Lesser horseshoe bat and the maternity roost at Menlo Castle, see Section 8.5.7.2 above), breeding birds (including Barn owl, see Section 8.5.9 above), and potentially amphibian species (see Section 8.5.10).

A portion of this area also lies within Lough Corrib SAC, this is discussed briefly in Section 8.5.4.1 in relation to Lough Corrib SAC. However, a more detailed assessment is presented in the updated NIS in the context of impacts on that portion of this area that lies within Lough Corrib SAC.

Ballindooley – Castlegar (which is linked to the River Corrib by the Terryland River valley)

In terms of biodiversity effects, the Project will result in habitat loss at Ballindooley Lough, including the loss of an area of *Molinia* meadow, and also has the potential to affect surface water quality in the lakes during construction (see Section 8.5.5.1 above for habitat impacts). These impacts will also likely impact upon mammal species generally (see Section 8.5.7 above), bat species including the Lesser horseshoe bat (see Section 8.5.7.2 above), breeding and wintering birds (see Section 8.5.9.2 above), fish species in the lakes (see Section 8.5.12 above), and potentially amphibian species (see Section 8.5.10).

Galway Racecourse, Ballybrit

The semi-natural habitats present at this site are not directly impacted or likely to be affected in any way by the Project.

Doughiska

In terms of biodiversity effects, the Project will result in habitat loss within this area, including the loss of areas of the Annex I habitat Limestone pavement (see Section 8.5.5 above for habitat impacts). It is also likely to impact upon mammal species generally (see Section 8.5.7 above), bat species (see Section 8.5.7.2 above) and breeding and wintering birds (see Section 8.5.9.2 above).

Galway Bay (which includes the Mutton Island and Nearby Shoreline local biodiversity areas from the draft Galway City Biodiversity Action Plan 2014-2024)

The Project has the potential to affect habitats and species in Galway Bay if it were to result in a deterioration in water quality in the receiving surface water network, which discharges to Galway Bay. The Project also has the potential to present a barrier to Otter movement in watercourses connected to Galway Bay (features that are important in supporting the local Otter populations), and road traffic has the potential to present a mortality risk to Otter.

City Canal System

In terms of biodiversity effects, the Project has the potential to affect water quality in the receiving environment. These impacts have the potential to affect both habitats and the assemblage of fauna species supported by those habitats in this local biodiversity area; which are likely to include Otter, wintering and breeding birds, amphibians, fish species and bats (including the Lesser horseshoe bat).

The potential effects via water quality impacts on Otter (see Section 8.5.7.1 above), wintering and breeding birds (see Section 8.5.9.1 and 8.5.9.2 above), amphibians (see Section 8.5.10 above), fish species (see Section 8.5.12 above) and bats (including the Lesser horseshoe bat, see Section 8.5.7.2 above).

Waterbody

In terms of biodiversity effects, the Project has the potential to affect surface water quality in this waterbody. These impacts also have the potential to impact upon Otter, wintering and breeding birds, amphibians, fish species and bats (including the Lesser horseshoe bat).

The potential effects via water quality impacts on Otter (see Section 8.5.7.1 above), wintering and breeding birds (see Section 8.5.9.1 and 8.5.9.2 above), amphibians (see Section 8.5.10 above), fish species (see Section 8.5.12 above) and bats (including the Lesser horseshoe bat, see Section 8.5.7.2 above).

Terryland Glenanail

In terms of biodiversity effects, the Project has the potential to affect water quality in the receiving environment. These impacts have the potential to affect both habitats and the assemblage of fauna species supported by those habitats in this local biodiversity area; which are likely to include Otter, wintering and breeding birds, amphibians, fish species and bats (including the Lesser horseshoe bat).

The potential effects via water quality impacts on Otter (see Section 8.5.7.1 above), wintering and breeding birds (see Section 8.5.9.1 and 8.5.9.2 above), amphibians (see Section 8.5.10 above), fish species (see Section 8.5.12 above) and bats (including the Lesser horseshoe bat, see Section 8.5.7.2 above).

Cooper's Cave Terryland

Cooper's Cave is used as both a winter hibernation and summer breeding site for the local population of Lesser horseshoe bats and the cave is an important feature in the Menlo Castle-Cooper's Cave complex for this population of bats. The Project has the potential to affect the local population of Lesser horseshoe bats (see Section 8.5.7.2 above) at this local biodiversity area by acting as a barrier to flight paths.

8.5.14 Summary of Potential Impacts

Table 8.41 below presents an overall summary of the likely significant effects of the Project on biodiversity, in the absence of mitigation measures.

The impact assessment has been updated to incorporate all relevant clarifications, amendments and updates made since the 2018 EIAR in response to changes in the biodiversity baseline and queries raised by An Bord Pleanála, statutory consultees, and other participating third parties, and the assessment undertaken by the Inspector appointed by ABP presented in their report dated 22 June 2021.

Although the baseline changes have required some level of minor updates to the impact assessment to capture the biodiversity baseline variances recorded between the 2018 EIAR and this updated EIAR, the updates are largely not material and do not affect the conclusions of the impact assessment. This is with the exception of Barn owl as described in Section 8.5.9.1. Minor amendments include:

- Additional designated areas for nature conservation (as discussed in the NIS) due to additional impact pathways considered
- Changes in habitat loss impact calculations due to changes in the design
- Addition of rare and protected plant species
- Addition of Swan mussel as a KER
- Changes in suitable Marsh fritillary butterfly habitat due to changes in land use

Table 8.41 Summary of Likely Significant Effects of the Project on Biodiversity (in the absence of mitigation measures)

Ecological Receptor	Ecological Valuation (after National Roads Authority, 2009)	Impacts with the Potential to result in Likely Significant Effects	Potential Impact Significance
Designated Areas for Nature Conservation			
Lough Corrib SAC (including Lough Corrib pNHA)	International (National)	**Construction** Habitat loss Habitat degradation – tunnelling/excavation Habitat degradation – hydrogeology Habitat degradation – hydrology Habitat degradation – air quality Habitat degradation – non-native invasive plant species Mortality risk **Operation** Habitat degradation – hydrogeology Habitat degradation – air quality	Likely significant effect at the international geographic scale

Ecological Receptor	Ecological Valuation (after National Roads Authority, 2009)	Impacts with the Potential to result in Likely Significant Effects	Potential Impact Significance
		Habitat degradation – non-native invasive plant species Mortality risk	
Galway Bay Complex SAC (including Galway Bay Complex pNHA)	International (National)	**Construction** Habitat degradation – hydrology Habitat degradation – non-native invasive plant species Barrier effect Mortality risk	Likely significant effect at the international geographic scale
Lough Corrib SPA (including Lough Corrib pNHA)	International (National)	**Construction** Habitat degradation – hydrogeology Habitat degradation – hydrology Disturbance/displacement **Operation** Habitat degradation – hydrogeology	Likely significant effect at the international geographic scale
Inner Galway Bay SPA (including Galway Bay Complex pNHA)	International (National)	**Construction** Habitat degradation – hydrogeology Habitat degradation – hydrology Disturbance/displacement **Operation** Habitat degradation – hydrogeology	Likely significant effect at the international geographic scale
Inishmore Island SAC, Kilkieran Bay and Island SAC	International	**Construction** Habitat degradation – hydrology	Likely significant effect at the international geographic scale
Ardrahan Grassland SAC, Castletaylor Complex SAC, Cregganna Marsh SPA, Kiltiernan Turlough SAC, Lough Fingall Complex SAC, Rahasane Turlough SPA, Rahasane Turlough SAC	International	**Construction** Habitat degradation – hydrogeology Habitat degradation – hydrology Habitat degradation – air quality Habitat degradation – non-native invasive plant species	Likely significant effect at the international geographic scale
Connemara Bog Complex SAC, Connemara Bog Complex SPA, East Burren Complex SAC, Moneen Mountain SAC, Black Head-Poulsallagh Complex SAC, Gortnandarragh Limestone Pavement SAC and Ross Lake and Woods SAC, Maumturk Mountains SAC and The Twelve	International	**No impact pathways exist**	No significant effects (refer to Section 8.5.4.1 above)

Ecological Receptor	Ecological Valuation (after National Roads Authority, 2009)	Impacts with the Potential to result in Likely Significant Effects	Potential Impact Significance
Bens/Garraun Complex SAC			
Inishmore Island pNHA	National	**Construction** Habitat degradation – hydrology	Likely significant effect at the national geographic scale
Mason Island Machair pNHA, Mweenish Island Machair pNHA, Finish Island Machair pNHA, Duck Island pNHA, Inishmuskerry pNHA, Ardmore Point pNHA, Geabhrog Island pNHA, Oilean na Ngeabhrog (Glencoh Rock) pNHA, Kinvarra Saltmarsh pNHA, Oilean na Ngeabhrog (Illuangurraig) pNHA, Eagle Rock pNHA	National	**No impact pathways exist**	No significant effects (refer to Section 8.5.4.2 above)
Cregganna Marsh pNHA	National	**Construction** Habitat degradation – hydrogeology Habitat degradation – hydrology Habitat degradation – air quality Habitat degradation – non-native invasive plant species	Likely significant effect at the national geographic scale
Castletaylor Complex pNHA	National	**Construction** Habitat degradation – hydrology Habitat degradation – air quality Habitat degradation – non-native invasive plant species	Likely significant effect at the national geographic scale
Furbogh Wood pNHA, Kiltullagh Turlough pNHA, Ballycuirke Lough pNHA, Drimcong Wood pNHA, Turloughcor pNHA	National	**Construction** Habitat degradation – hydrogeology Habitat degradation – hydrology Habitat degradation – air quality Habitat degradation – non-native invasive plant species	Likely significant effect at the national geographic scale
Connemara Bog Complex pNHA, Ross Lake and Woods pNHA, Kiltiernan Turlough pNHA, Lough Fingall Complex pNHA, Rahasane Turlough pNHA, Black Head-Poulsallagh Complex pNHA, Gortnandarragh Limestone Pavement pNHA, Moneen	National	**No impact pathways exist**	No significant effects (refer to Section 8.5.4.2 above)

Ecological Receptor	Ecological Valuation (after National Roads Authority, 2009)	Impacts with the Potential to result in Likely Significant Effects	Potential Impact Significance
Mountain pNHA, East Burren Complex pNHA, Maumturk Mountains pNHA, The Twelve Bens/Garraun Complex pNHA			
Moycullen Bogs NHA	National	**Construction** Habitat degradation – air quality Habitat degradation – non-native invasive plant species Habitat degradation – hydrology **Operation** Habitat degradation – non-native invasive plant species	Likely significant effect at the national geographic scale
Habitats (outside of designated areas for nature conservation)			
Limestone pavement [*8240]	International Importance	**Construction** Habitat loss Habitat degradation – air quality Habitat degradation – non-native invasive plant species **Operation** Habitat degradation – air quality Habitat degradation – non-native invasive plant species	Likely significant effect at the international geographic scale
Blanket bog (active) [*7130]	International Importance	**Construction** Habitat loss Habitat degradation – air quality Habitat degradation – non-native invasive plant species **Operation** Habitat degradation – non-native invasive plant species Habitat degradation - groundwater	Likely significant effect at the international geographic scale
Petrifying springs [*7220]	International Importance	**Construction** Habitat loss	Likely significant effect at the county geographic scale (see Section 8.5.5.3 under petrifying springs)
Calcareous grassland [*6210/6210]	International/National Importance	**Construction** Habitat loss Habitat degradation – air quality Habitat degradation – non-native invasive plant species **Operation** Habitat degradation – air quality	Likely significant effect at the national geographic scale (No *6210 affected – see Section 8.5.5.3 under Calcareous grassland))

Ecological Receptor	Ecological Valuation (after National Roads Authority, 2009)	Impacts with the Potential to result in Likely Significant Effects	Potential Impact Significance
		Habitat degradation – non-native invasive plant species	
Dry heath [4030]	National Importance	**Construction** Habitat loss Habitat degradation – air quality Habitat degradation – non-native invasive plant species **Operation** Habitat degradation – air quality Habitat degradation – non-native invasive plant species	Likely significant effect at the national geographic scale
Wet heath [4010][141]	National Importance	**Construction** Habitat loss Habitat degradation – air quality Habitat degradation – groundwater **Operation** Habitat degradation – air quality Habitat degradation – groundwater	Likely significant effect at the national geographic scale
Molinia meadow [6410]	National Importance	**Construction** Habitat loss Habitat degradation – air quality Habitat degradation – non-native invasive plant species **Operation** Habitat degradation – groundwater Habitat degradation – non-native invasive plant species	Likely significant effect at the national geographic scale
Residual alluvial forest [*91E0]	International Importance	**Construction** Habitat loss Habitat degradation – surface water quality Habitat degradation – groundwater Habitat degradation – non-native invasive plant species **Operation** Habitat degradation – groundwater Habitat degradation – non-native invasive plant species	Likely significant effect at the international geographic scale
Turloughs [*3180]	International Importance	**Construction** Habitat loss Habitat degradation – surface water quality	Likely significant effect at the international geographic scale

[141] Including areas of Wet heath/Dry heath/*Molinia* meadow [4010/4030/6410] mosaic

Ecological Receptor	Ecological Valuation (after National Roads Authority, 2009)	Impacts with the Potential to result in Likely Significant Effects	Potential Impact Significance
		Habitat degradation – groundwater Habitat degradation – air quality Habitat degradation – non-native invasive plant species **Operation** Habitat degradation – groundwater Habitat degradation – air quality Habitat degradation – non-native invasive plant species	
Hard water lakes [3140]	National Importance	**Construction** Habitat degradation – surface water quality (Ballindooley Lough)	Likely significant effect at the national geographic scale
Mesotrophic lakes (FL4) Part of Ballindooley complex	County Importance[142]	**Construction** Habitat degradation – surface water quality	Likely significant effect at the county geographic scale
Eutrophic lakes (FL5) Part of Ballindooley complex	County Importance[143]	**Construction** Habitat degradation – surface water quality Habitat degradation – groundwater	Likely significant effect at the county geographic scale
Calcareous springs (FP1) Non-Annex I habitat type	Local Importance (Higher Value)	**Construction** Habitat loss	Likely significant effect at the local geographic scale
Cladium fen [*7210]	International Importance	**Construction** Habitat degradation – surface water quality (Ballindooley Lough)	Likely significant effect at the international geographic scale
Hydrophilous tall herb [6430]	International Importance	(see Lough Corrib SAC above) **Construction** Habitat degradation – hydrogeology Habitat degradation – hydrology **Operation** Habitat degradation – hydrogeology	Likely significant effect at the international geographic scale
Alkaline fens [7230]	National Importance	**Construction** Habitat degradation – surface water quality (Ballindooley Lough)	Likely significant effect at the national geographic scale
Reed and large sedge swamps (FS1) Non-Annex I habitat type	Local Importance (Higher Value)	**Construction** Habitat degradation – surface water quality	Likely significant effect at the local geographic scale

[142] On the basis that it forms part of the wetland complex at Ballindooley Lough

[143] On the basis that it forms part of the wetland complex at Ballindooley Lough

Ecological Receptor	Ecological Valuation (after National Roads Authority, 2009)	Impacts with the Potential to result in Likely Significant Effects	Potential Impact Significance
Tall-herb swamps (FS2) Non-Annex I habitat type	Local Importance (Higher Value)	None	No likely significant effect at any geographic scale
Eroding/upland rivers (FW1)	Local Importance (Higher Value)	**Construction** Habitat degradation – surface water quality	Likely significant effect at the local geographic scale
Depositing /lowland rivers (FW2) River Corrib	International Importance	The River Corrib forms part of see Lough Corrib SAC (see above and NIS)	Likely significant effect at the international geographic scale
Terryland River	Local Importance (Higher Value)	None	No likely significant effect at any geographic scale
Drainage ditches (FW4)	Local Importance (Higher Value)	None	No likely significant effect at any geographic scale
Marsh (GM1)	Local Importance (Higher Value)	None	No likely significant effect at any geographic scale
Dry calcareous and neutral grassland (GS1) Non-Annex I habitat type	Local Importance (Higher Value)	None	No likely significant effect at any geographic scale
Dry meadows and grassy verges (GS2) Non-Annex I habitat type	Local Importance (Higher Value)	None	No likely significant effect at any geographic scale
Dry-humid acid grassland (GS3) Non-Annex I habitat type	Local Importance (Higher Value)	**Construction** Habitat loss Habitat degradation – air quality Habitat degradation – non-native invasive plant species **Operation** Habitat degradation – non-native invasive plant species	Likely significant effect at the local geographic scale
Wet grassland (GS4) Non-Annex I habitat type	Local Importance (Higher Value)	None	No likely significant effect at any geographic scale
Rich fen and flush (PF1) Non-Annex I habitat type	County Importance	**Construction** Habitat degradation – surface water quality Habitat degradation – air quality	Likely significant effect at the county geographic scale
Poor fen and flush (PF2) Non-Annex I habitat type	Local Importance (Higher Value)	**Construction** Habitat loss Habitat degradation – air quality **Operation**	Likely significant effect at the local geographic scale

Ecological Receptor	Ecological Valuation (after National Roads Authority, 2009)	Impacts with the Potential to result in Likely Significant Effects	Potential Impact Significance
		Habitat degradation – groundwater	
(Mixed) broadleaved woodland (WD1)	Local Importance (Higher Value)	**Construction** Habitat loss Habitat degradation – air quality Habitat degradation – non-native invasive plant species **Operation** Habitat degradation – non-native invasive plant species	Likely significant effect at the local geographic scale
Mixed broadleaved/conifer woodland (WD2)	Local Importance (Higher Value)	None	No likely significant effect at any geographic scale
(Mixed) conifer woodland (WD3)	Local Importance (Higher Value)	None	No likely significant effect at any geographic scale
Hedgerows (WL1)	Local Importance (Higher Value)	**Construction** Habitat loss Habitat degradation – air quality Habitat degradation – non-native invasive plant species **Operation** Habitat degradation – non-native invasive plant species	Likely significant effect at the local geographic scale
Treelines (WL2)	Local Importance (Higher Value)	**Construction** Habitat loss Habitat degradation – air quality Habitat degradation – non-native invasive plant species **Operation** Habitat degradation – non-native invasive plant species	Likely significant effect at the local geographic scale
Oak-ash-hazel woodland (WN2) Non-Annex I habitat type	Local Importance (Higher Value)	**Construction** Habitat loss Habitat degradation – air quality Habitat degradation – non-native invasive plant species	Likely significant effect at the local geographic scale
Scrub (WS1) Non-Annex I habitat type	Local Importance (Higher Value)	None	No likely significant effect at any geographic scale
Clusters of important habitats			
Habitat Clusters 1-12	The value of the biodiversity receptors recorded within the Assessment Boundary, across the	Combinations of all of the potential impacts noted above. The specific impacts are related to and dependent upon the potential impacts of the Project on each of the individual ecological	Likely significant effects from local up to the international geographic scale

Ecological Receptor	Ecological Valuation (after National Roads Authority, 2009)	Impacts with the Potential to result in Likely Significant Effects	Potential Impact Significance
	Habitat Clusters 1-12 areas, range from Local Importance (Lower Value) to Internationally Important	receptors that make up the biodiversity resource within a given habitat cluster.	
Rare and Protected Flora			
Imbricate bog-moss *Sphagnum affine*	National importance	**Construction** Loss of local population through removal Loss of local population -hydrogeological or hydrological effects Loss of local population - air quality effects Loss of local population - non-native invasive plant species **Operation** Loss of local population through removal Loss of local population -hydrogeological or hydrological effects Loss of local population - air quality effects Loss of local population - non-native invasive plant species	Likely significant effect at the national geographic scale
Red bog-moss *Sphagnum capillifolium*	National importance	**Construction** Loss of local population through removal Loss of local population -hydrogeological or hydrological effects Loss of local population - air quality effects Loss of local population - non-native invasive plant species **Operation** Loss of local population through removal Loss of local population -hydrogeological or hydrological effects Loss of local population - air quality effects Loss of local population - non-native invasive plant species	Likely significant effect at the county geographic scale
Woodsy thyme moss *Plagiomnium cuspidatum*	National importance	**Construction** Loss of local population through removal Loss of local population - air quality effects Loss of local population - non-native invasive plant species **Operation** Loss of local population through removal Loss of local population - air quality effects Loss of local population - non-native invasive plant species	Likely significant effect at the county geographic scale

Ecological Receptor	Ecological Valuation (after National Roads Authority, 2009)	Impacts with the Potential to result in Likely Significant Effects	Potential Impact Significance
Lesser striated feathermoss *Plasteurhynchium striatulum*	National importance	**Construction** Loss of local population through removal Loss of local population - air quality effects Loss of local population - non-native invasive plant species **Operation** Loss of local population through removal Loss of local population - air quality effects Loss of local population - non-native invasive plant species	Likely significant effect at the county geographic scale
Spring gentian *Gentiana verna*	National importance	**Construction** Loss of local population through removal Loss of local population - air quality effects Loss of local population - non-native invasive plant species **Operation** Loss of local population through removal Loss of local population - air quality effects Loss of local population - non-native invasive plant species	Likely significant effect at the local geographic scale
Eyebright *Euphrasia arctica*	Local Importance (Higher Value)	**Construction** Loss of local population through removal Loss of local population - air quality effects Loss of local population - non-native invasive plant species **Operation** Loss of local population through removal Loss of local population - air quality effects Loss of local population - non-native invasive plant species	Likely significant effect at the local geographic scale
Fauna Species			
Badger	Local Importance (Higher Value)	**Construction** Loss of breeding/resting sites Disturbance/displacement **Operation** Habitat severance/barrier effect Mortality risk	Likely significant effect at the local geographic scale
Otter	International Importance	**Construction** Habitat degradation - water quality **Operation** Habitat severance/barrier effect Mortality risk	Likely significant effect at the local geographic scale

Ecological Receptor	Ecological Valuation (after National Roads Authority, 2009)	Impacts with the Potential to result in Likely Significant Effects	Potential Impact Significance
Other mammal species protected under the Wildlife Acts	Local Importance (Higher Value)	**Construction** Habitat severance/barrier effect Habitat degradation - water quality **Operation** Habitat severance/barrier effect Mortality risk	Likely significant effect at the local geographic scale
Lesser horseshoe bat	National Importance	**Construction** Roost loss Habitat loss Habitat fragmentation Disturbance/displacement **Operation** Mortality Barrier/severance effects Disturbance/displacement	Likely significant effect at the national geographic scale
All other bat species	Local Importance (Higher Value)		Likely significant effect at the local geographic scale
Marsh whorl snail	Local Importance (Higher Value)	**Construction** Habitat degradation – surface water quality Habitat degradation – groundwater **Operation** Habitat degradation – groundwater	Likely significant effect at the local geographic scale
Swan mussel	National Importance	**Construction** Habitat degradation – surface water quality	Likely significant effect at the local geographic scale
Marsh fritillary butterfly	County Importance	**Construction** Habitat fragmentation/ severance Mortality risk	Likely significant effect at the national geographic scale
SCI bird species	International	see Lough Corrib SPA and Inner Galway Bay SPA above	see Lough Corrib SPA and Inner Galway Bay SPA above
Barn owl	County Importance	**Operation** Mortality risk	Likely significant effect at the county geographic scale
Peregrine falcon	County Importance	**Construction** Disturbance/displacement **Operation** Disturbance/displacement	Likely significant effect at the county geographic scale
All other breeding bird species (non SCI)	Local Importance (Higher Value)	**Construction** Mortality risk Disturbance/displacement **Operation** Mortality risk	Likely significant effect at the local geographic scale

Ecological Receptor	Ecological Valuation (after National Roads Authority, 2009)	Impacts with the Potential to result in Likely Significant Effects	Potential Impact Significance
		Disturbance/displacement	
All other wintering bird species (non-SCI)	Local Importance (Higher Value)	**Construction** Disturbance/displacement (Ballindooley Lough) Habitat degradation – surface water quality Habitat degradation – groundwater	Likely significant effect at the local geographic scale
Smooth newt Common frog	Local Importance (Higher Value)	**Construction** Habitat degradation – surface water quality **Operation** Habitat severance/barrier effect	Likely significant effect at the local geographic scale
Common lizard	Local Importance (Higher Value)	**Construction** Disturbance & mortality risk **Operation** Habitat severance/barrier effect	Likely significant effect at the local geographic scale
Atlantic salmon European eel	International Importance	**Construction** Habitat degradation – surface water quality Habitat degradation – groundwater	Likely significant effect at the local geographic scale
All other fish species recorded	Local Importance (Higher Value)	**Construction** Habitat degradation – surface water quality Habitat degradation – groundwater	Likely significant effect at the local geographic scale
Local Biodiversity Areas			
Local biodiversity areas	The value of the biodiversity receptors recorded in the vicinity of the Project, across the local biodiversity areas, range from Local Importance (Lower Value) to Internationally Important	Combinations of all of the potential impacts noted above. The specific impacts are related to and dependent upon the potential impacts of the Project on each of the individual ecological receptors that make up the biodiversity resource within a given local biodiversity area	Likely significant effects from local up to the international geographic scale

8.6 Mitigation Measures

It should be noted from the outset, that whilst additional measures were recommended within the Ecological Impact Assessment Report prepared by the ecologist appointed by ABP, Dr Arnold, [appended (as Appendix 4) to the ABP Inspector's Report, dated 22 June 2021], the following was also recognised by Dr. Arnold:

"the mitigation and compensation measures do lessen the severity or likelihood of many of the identified impacts, and many of the measures such as the use of viaducts and tunnels, habitat creation and the provision of overpasses and underpasses are beneficial."

This section presents the mitigation measures to avoid or reduce the potential impacts of the Project on biodiversity. Section 8.6.2.1 summarises the mitigation measures that relate to the protection of European sites. All other mitigation measures are described in Sections 8.6.3 to 8.6.10 below. All of these mitigation measures are included in the Schedule of Environmental Commitments included in Chapter 23 of this updated EIAR which will be implemented by the contractor under supervision of both the Project Ecologist (employed by the Employer) and/or the Ecological Clerk of Works (employed by the Contractor). Moreover, Galway County Council/Transport Infrastructure Ireland will have a Site Monitoring Team which will include the Project Ecologist, who will be available for the duration of the construction phase for the Project.

Galway County Council (GCoC) will ensure that the results of monitoring will be used to inform the long-term ecological mitigation programme and any necessary timely corrective action. During construction, monitoring and any required corrective action, will be GCoC's responsibility as outlined in the Schedule of Environmental Commitments. During operation, GCoC will engage the services of a suitable contractor to monitor the ecological mitigation measures for the lifetime of the project. All the relevant requirements set out in the Schedule of Environmental Commitments, in relation to monitoring and maintenance of the ecological mitigation measures over the lifetime of the project, will be included as conditions in the contract(s) entered into with the appointed contractor. GCoC shall ensure that provision is made, in the contract(s) entered into with the appointed contractor, for corrective action to be undertaken if any aspects of the implementation of the ecological mitigation measures and monitoring commitments proposals are not effective. These provisions shall include a requirement for a suitably qualified ecologist/biodiversity expert to review the efficacy of any corrective actions required.

It will be the responsibility of the Site Environmental Manager (SEM) to procure the advice and services of suitably qualified ecological experts to oversee ecologically sensitive elements of the construction works, ecological derogation licensing requirements and ecological monitoring. Any non-performance, non-compliances or other issues that arise shall be promptly addressed to ensure compliance with the mitigation strategy and all derogation licence requirements.

Any new considerations that may arise as a result of pre-construction surveys will be addressed and managed in accordance with the mitigation measures as discussed in this section.

In response to the requests for real-time/live mapping systems, making reports on the implementation and monitoring of measures available, mapping locations of key ecological mitigation measures and interfacing with the planning authority's GIS and planning systems, and monitoring of the wildlife overpass and hedgerow planting to continue for five years, GCoC proposes the following:

- A GIS mapping system will be developed, to allow the Project Ecologist to track the progress, completion and monitoring of the ecological mitigation measures
- At the end of each month, any mapping relating to ecological mitigation measures, including results of pre-construction surveys (e.g. locations of badger setts) or design changes for mitigation measures (e.g. change in location of artificial badger sett), will be uploaded to the dedicated project website. In addition, at the end of each month any ecological monitoring reports will be uploaded to a dedicated project website
- Notwithstanding the point above ecological monitoring reports will be submitted to the Planning Authority and copied to the NPWS
- The Project Ecologist in conjunction with 'permits to work' will sign off the correct completion and functioning of the measures, where works are in ecologically sensitive locations and/or are ecologically sensitive activities, which are likely to include, but may not be limited to, the following:

- works involving vegetation removal/site clearance
- works involving installation of site fencing
- works in or adjacent to the Lough Corrib SAC
- works in or adjacent to any watercourses
- works in or adjacent to any known breeding, resting or hibernating locations of any species protected under either the Birds and Habitats Regulations 2011 or Wildlife Act, in particular bats and otter
- works in areas where mitigation measures (including either habitat creation/mitigation or provision of nest and bat boxes) are proposed
- works in or adjacent to donor and receptor sites identified for the creation of habitats, until such time as any donor material required for the receptor sites has been transported

- Once ecological mitigation measures have been implemented and installed, GIS mapping files of their final as-built locations will be sent to the Project Ecologist to be uploaded into the Local Authority's GIS and planning systems
- Interactive or real-time/live mapping systems would be onerous to provide and manage. It is not deemed either necessary or appropriate to provide such systems given the above proposals which together will achieve the same function, purpose and results as a real-time/live mapping system.

GCoC and Transport Infrastructure Ireland will be responsible for implementing and delivering the post-construction monitoring programme, and any maintenance required in relation to same, for the lifetime of the Project.

8.6.1 Changes since 2018 EIAR

The mitigation strategy from the 2018 EIAR has been reviewed and updated to incorporate all relevant clarifications, amendments and medications made during the Oral Hearing in 2020.

The minor updates made to the impact assessment resulting from the updated baseline results, and the conclusions of the updated impact assessment, have not resulted in any material changes to the mitigation strategy.

Dr. Arnold, the ecologist appointed by An Bord Pleanála, recommended additional mitigation measures for biodiversity in the Ecological Impact Assessment Report [appended (as Appendix 4) to the ABP's Inspector's Report dated 22 June 2021] and accepted by ABP's Inspector. The following measures (some with minor modifications from the wording proposed by ABP) have been incorporated into this updated EIAR:

- The planting and sowing scheme does not include non-native tree species, as specified in Section 8.6.3
- Scots pine *Pinus sylvestris* will not be used for landscape planting west of the River Corrib, as specified in Section 8.6.3.2
- Grassland seeding that is suitable for the specific soil types in question, will only be used, and negative indicator species for grassland Annex I habitats will be avoided, as specified in Section 8.6.3.2
- A clear commitment to the management of peatland habitats in included in the CHMP (Appendix A.8.27)
- The six red data book plant species will be recorded and mapped pre-construction, and safeguarded through the use of fencing etc., as discussed in Section 8.6.3
- *Plagiomnium cuspidatum* and *Plasteurhynchium striatulum* will be moved and relocated if being directly impacted, as discussed in Section 8.6.3

- The identification and native status of oat-grass *Helictochloa pratensis* and marsh valerian *Valeriana dioica* will be checked pre-construction and mitigation measures will be implemented if required, as discussed in Section 8.6.3
- The marsh at Castlegar will be retained and protected during construction, as discussed in Sections 8.6.3.1 and 8.6.6.2
- Bat boxes for the replacement of lost tree roosts will be installed on trees as close to each felled tree as possible, with a mixture of bat boxes proposed, as discussed in Section 8.6.5.2
- The EIAR has been updated to include for 10 years of monitoring of replacement bat roosts, as discussed in Section 8.6.5.2
- Safe passage through the construction site will be maintained for bats along the riparian corridors, as discussed in Section 8.6.5.2
- Mammal ledges are proposed at all watercourse crossings, as discussed in Section 8.6.5.1
- Monitoring of the effectiveness of mammal ledges will be monitored for three years, as discussed in Section 8.6.5.1 and 8.6.5.3
- Earth banks will be used to guide amphibians towards crossing structures, as discussed in Section 8.6.8
- The landscape planting and the creation of extensive areas of species rich calcareous grassland habitat in the Menlough-Coolagh area will improve the extent and availability of pollinator friendly plant species and habitat as a food resource and nesting opportunities for the local bee populations.

The following 'additional mitigation measures' proposed by Dr Arnold, the ecologist appointed by ABP and accepted by ABP's Inspector have not been incorporated into this updated EIAR for the following reasons:

- *"The infiltration basins at Castlegar to be planted with suitable vegetation for marsh whorl snail with hydrology adjusted to suit whilst maintaining the function of the basins".* This measure , which focuses on mitigating for the loss of supporting habitat for the Marsh whorl snail, has not been included for two reasons: firstly there is no likely significant effect on this species' conservation status as a result of habitat loss and therefore this mitigation is not required; and secondly it would compromise the intended and required functioning of the infiltration basins and the drainage design. For the avoidance of doubt mitigation is required and included for indirect impact to habitat from surface water and groundwater impact pathways.
- *"Translocation of ant hills impacted by the road to a suitable receptor site within the soft estate."* As is described in Section 8.3.9 of this updated EIAR, and in accordance with CIEEM and TII guidelines (CIEEM, 2018 and National Roads Authority, 2009), ants along with other invertebrate species that are not protected or known to be rare or threatened, are not considered to be Key Ecological Receptors and therefore were not subject to dedicated survey techniques (which in the case of ants would require non-standard and specialist survey methodologies for which there is no precedent in Ireland for undertaking for EIAR of transport infrastructure projects), and for the same reason were not subjected to impact assessment nor do they require mitigation.

8.6.2 Designated Areas for Nature Conservation

8.6.2.1 European Sites

The environmental commitments required to ensure that the Project will not result in a likely significant effect (i.e. adversely affect the integrity of) on the European sites within its ZoI are:

- Habitat loss/fragmentation: mitigation measures to minimise habitat loss in Lough Corrib SAC and to avoid loss of QI habitats within Lough Corrib SAC during construction and operation (refer to the Habitats Section 8.6.3)
- Habitat degradation – tunnelling/excavation: mitigation measures to maintain the structural integrity of rock mass supporting QI habitats in Lough Corrib SAC during the construction of the proposed Lackagh Tunnel (and its western approach) during construction and operation

- Habitat degradation – hydrogeology: mitigation measures to avoid habitat degradation in Lough Corrib SAC, Galway Bay Complex SAC, Lough Corrib SPA, Inner Galway Bay SPA, as a result of potential hydrogeological impacts during construction and operation (refer to Chapter 10, Hydrogeology)
- Habitat degradation – hydrology: mitigation measures to protect water quality in receiving watercourses during construction and operation (Lough Corrib SAC, Galway Bay Complex SAC, Lough Corrib SPA, Inner Galway Bay SPA) (refer to Chapter 10, Hydrogeology)
- Habitat degradation – air quality: mitigation measures to control dust emissions during construction to prevent impacts on vegetation in Lough Corrib SAC (refer to Chapter 16, Air Quality and Climate)
- Habitat degradation – non-native invasive plant species: mitigation measures to avoid the introduction or spread of non-native plant invasive species to European sites (Lough Corrib SAC, Galway Bay Complex SAC, Lough Corrib SPA, Inner Galway Bay SPA) during construction or operation
- Disturbance/displacement: mitigation measures to avoid/reduce the disturbance/displacement effects of blasting on wintering birds using Ballindooley Lough (Lough Corrib SAC, Galway Bay Complex SAC, Lough Corrib SPA, Inner Galway Bay SPA) (refer to Wintering Birds Section 8.6.7.2)
- Barrier effect: mitigation measures to avoid the proposed N6 GCRR restricting Otter movement within the Bearna Stream catchment (Lough Corrib SAC, Galway Bay Complex SAC, Lough Corrib SPA, Inner Galway Bay SPA) (refer to Otter Section 8.6.5.1)
- Mortality risk: mitigation measures to avoid mortality of the QI species (Lough Corrib SAC, Galway Bay Complex SAC). These include both measures to ensure that construction materials are not introduced into the River Corrib and to remove the risk of Otter being killed/injured due to collisions with road traffic (refer to Otter Section 8.6.5.1)
- Construction-related traffic: Mitigation measures to ensure that habitats are not degraded through impacts related to construction-related traffic on the wider, existing road network (Lough Corrib SAC, Lough Corrib SPA, Galway Bay Complex SAC, Inner Galway Bay SPA, Ardrahan Grassland SAC, Castletaylor Complex SAC, Kiltiernan Turlough SAC, Lough Fingall Complex SAC, Rahasane Turlough SPA, Rahasane Turlough SAC and Cregganna Marsh SPA)

8.6.2.2 Natural Heritage Areas and proposed Natural Heritage Areas

As discussed in Section 8.5.4.2, the potential for the Project to significantly affect Lough Corrib pNHA, Galway Bay Complex pNHA, Cregganna Marsh NHA, Castletaylor Complex pNHA, Kiltiernan Turlough pNHA, Logh Fingall Complex pNHA, Rahasane Turlough pNHA, Connemara Bog Complex pNHA, East Burren Complex pNHA, Moneen Mountain pNHA, Black Head- Poulsallagh Complex pNHA, Gortnandarragh Limestone Pavement pNHA, Ross Lake and Woodland pNHA, Maumturk Mountains pNHA, The Twelve Bens/Garraun Complex pNHA and Inishmore Island pNHA is as per the corresponding European sites (refer to Table 8.41).

The potential for the Project to significantly affect Mason Island Machair pNHA, Mweenish Isladn Machair pNHA, Finish Island Machair pNHA, Duck Island pNHA, Inishmuskerry pNHA, Ardmore Point pNHA, Geabhrog Island pNHA, Oilean Na Ngeabhrog (Glencoh Rock) pNHA, Kinvarra Saltmarsh pNHA, Oilean Na Ngeabhrog (Illaungurraig) pNHA and Eagle Rock pNHA is as per that assessed for Kilkieran Bay and Islands SAC as these pNHAs all overlap with the boundary of this SAC (refer to Section 8.5.4.2).

Therefore, the mitigation measures outlined above in Section 8.6.2.1, and as detailed in Section 10 of the updated NIS, will prevent the Project resulting in a significant negative effect on the above mentioned NHA and pNHAs at the national geographic scale.

The mitigation measures that are required to ensure that the Project will not significantly affect Moycullen Bogs NHA are as follows:

- Measures to control dust emissions during construction to prevent impacts to vegetation/habitats within Moycullen Bogs NHA at Tonabrocky – see Section 8.6.3.3 below and Chapter 16, Air Quality. These include control measures such as spraying of exposed earthwork activities and site haul roads during dry weather, wheel washes, control of site vehicle speeds, road sweeping and dust screens

- Measures to avoid the introduction or spread of non-native invasive plant species to Moycullen Bogs NHA during construction or operation. These are detailed in the Non-native Invasive Species Management Plan which forms part of the Construction Environmental Management Plan (CEMP) – (Appendix A.7.5)
- Measures to ensure that the planting and sowing scheme does not include non-native tree species in proximity to Moycullen Bogs NHA
- Measures to control surface water runoff from the construction site to prevent an accidental pollution event affecting peatland habitats within Moycullen Bogs NHA at Tonabrocky – see Section 11.6.2 of Chapter 11, Hydrology
- In the unlikely event of significant flow paths (fault or fracture zones) being encountered in the Galway Granite Batholith during construction, measures set out in the Karst Protocol included in the CEMP in Appendix A.7.5 will be implemented.

As detailed in Section 8.5.4.2 the Project also has the potential to significantly affect Furbogh Wood pNHA, Kiltullagh Turlough pNHA, Ballycuirke Lough pNHA, Drimcong Wood pNHA and Turloughcor pNHA as a result of effects of construction-related traffic. Measures to control dust emissions during construction to prevent impacts to vegetation/habitats within these pNHAs are presented in Section 8.6.3.3 below and Chapter 16, Air Quality. These include control measures such as spraying of exposed earthwork activities and site haul roads during dry weather, wheel washes, control of site vehicle speeds, road sweeping and dust screens.

8.6.3 Habitats

8.6.3.1 Mitigation Measures to Minimise Habitat Loss

To minimise the loss of Annex I habitat, areas of these habitat types within the Assessment Boundary but which are not required to construct the Project will be retained and fenced off for the duration of construction. Although, these areas will also not be directly impacted during the operation of the Project, a proportion of one area of wet heath [4010] to be retained (c. 0.08ha, accounting for 32.5% of the total area to be retained at Ch. 3+000 of the proposed N6 GCRR) is likely to be affected by operational air quality effects. As a result of this, this area may not retain its Annex I classification (this area has been excluded from the area of wet heath to be retained calculation when accounting for residual impacts in Section 8.7.3). The other areas of habitat to be retained will not be directly impacted during the operation of the Project as they will not form part of the proposed N6 GCRR. These are shown on Figures 8.38.1 to 8.38.15. There will be no fencing within Annex I habitats that are located within Lough Corrib SAC either during construction or operation.

To minimise the loss of habitat associated with the Project, there are also areas within the Assessment Boundary which are included for mitigation planting where general construction works will not be undertaken. These are shown on Figures 8.38.1 to 8.38.15.

The minimum working area to facilitate the construction of the supporting structures associated with the proposed River Corrib Bridge will be used. This area will be clearly delineated and fenced off at the outset of works and maintained for the duration of the construction programme. No works for the construction of the River Corrib Bridge within Lough Corrib SAC boundary will be undertaken outside of this zone.

Where possible, woodland, scrub, treelines and hedgerows which lie within, or along the boundary of the proposed N6 GCRR, that are not directly impacted by the proposed road alignment or drainage will be retained. These areas will be protected for the duration of construction works and fenced off at an appropriate distance. Vegetation to be retained is shown on Figures 8.38.1 to 8.38.15 and on Figures 12.1.01 to 12.1.15 (landscape design).

Areas of river channel and bankside vegetation which lie within, or along the boundary of the proposed N6 GCRR, that are not directly impacted by the proposed road alignment or drainage will be retained. These areas will be protected for the duration of construction works and fenced off at a distance of 5m from the stream/river bank.

The Petrifying spring feature present in Lackagh Quarry, which lies c.25m to the north of the proposed N6 GCRR at Ch. 11+400, will be retained and shotcrete[144] will not be used as part of the quarry face stabilisation measures at the spring site. Moreover, there is potential for new petrifying spring features to develop in Lackagh Quarry as they occur where recharge pathways through the limestone have been intersected by the quarry face, which can mitigate the loss of the non-annex calcareous springs at the location of the proposed access road c.30m south of the proposed N6 GCRR at Ch. 11+380 and between Ch. 11+700 and Ch. 11+750, as well as the potential loss of the Petrifying spring feature which lies c.25m to the north of the proposed N6 GCRR at Ch. 11+400. The construction works at the quarry face comprise of the material deposition area (MDA) placement and the slope stability measures and both facilitate the development of new petrifying springs in the following manner:

- As part of the MDA placement the groundwater regime (both discharge and recharge) will be maintained by the inclusion of a free draining material where the MDA is in contact with the rock face and the quarry base
- As part of the slope stability measures for the exposed rock face the groundwater regime will be maintained through existing cracks and fissures as much as possible or through weep holes where shotcrete is required. These weep holes will permit free drainage of groundwater from the rock face and are likely to form new spring locations

Equally, there are existing water inflows into the quarry, as shown in Appendix A.8.21, which have the potential to become Petrifying springs as the natural hardness of the recharge waters will lead to CaCO3 precipitation and petrification will occur. This process could take up to 10 years. Finally, if required by ABP, new spring features will be created by installing drill holes (<5cm diameter and c.1-2m in length) from the quarry face into the rock mass. These drill holes will be installed in accordance with the rock bolt measures as set out in the Construction Environmental Management Plan in Appendix A.7.5. Where these drill holes intersect natural recharge pathways then the flow will be diverted, and new springs will occur. The natural hardness of the recharge waters will lead to CaCO3 precipitation and petrification will occur. Precipitation is expected to commence from new springs with the build-up of the CaCO3, to a comparable thickness to the existing petrification, expected to take c.10 years.

Excavated blocks of Limestone pavement will be retained for reuse for general wildlife and habitat creation within those lands along the east bank of the River Corrib in Menlough which are proposed for habitat retention, enhancement and creation.

8.6.3.2 Measures to Reduce the Potential for Impacts on Vegetation to be retained

Any vegetation (including trees, hedgerows or scrub adjacent to, or within, the Assessment Boundary) which is to be retained shall be afforded adequate protection during the construction phase in accordance with the *Guidelines for the Protection and Preservation of Trees, Hedgerows and Scrub Prior to, During and Post Construction of National Road Schemes* (National Roads Authority, 2006b), as follows:

- All trees along the Assessment Boundary that are to be retained, both within and adjacent to the Assessment Boundary (where the root protection area of the tree extends into the Assessment Boundary), will be fenced off at the outset of works and for the duration of construction to avoid structural damage to the trunk, branches or root systems of the trees. Temporary fencing will be erected at a sufficient distance from the tree so as to enclose the Root Protection Area (RPA) of the tree. The RPA will be defined based upon the recommendation of a qualified arborist
- Where fencing is not feasible due to insufficient space, protection for the tree/hedgerow will be afforded by wrapping hessian sacking (or suitable equivalent) around the trunk of the tree and strapping stout buffer timbers around it
- The area within the RPA will not be used for vehicle parking or the storage of materials (including soils, oils and chemicals). The storage of hazardous materials (e.g. hydrocarbons) or concrete washout areas will not be undertaken within 10 m of any retained trees, hedgerows and treelines

[144] A concrete product which is sprayed at high velocity into a rock face as a structural/stabilising component.

- A qualified arborist shall assess the condition of, and advise on any repair works necessary to, any trees which are to be retained or that lie outside of the Assessment Boundary but whose RPA is impacted by the works. Any remedial works required will be carried out by a qualified arborist
- A buffer zone of at least 5m will be maintained between construction works and retained hedgerows to ensure that the root protection areas are not damaged

As per ABP's Inspector's report dated 22 June 2021, the planting and sowing scheme will not include non-native tree species.

Scots pine, which is invasive in heathland, will not be used for landscape planting west of the River Corrib.

8.6.3.3 Measures to Reduce the Potential for Air Quality Impacts during Construction

To control dust emissions during construction works standard mitigation measures shall include: spraying of exposed earthwork activities and site haul roads during dry and/or windy conditions; provision of wheel washes at exit points; control of vehicle speeds and speed restrictions (20km/h on any un-surfaced site road); covering of haulage vehicles; and, sweeping of hard surface roads. These procedures will be strictly monitored and assessed on a daily basis.

Dust screens will be implemented at locations where there is the potential for air quality impacts during the construction phase i.e. at locations where sensitive receptors are located within 100m of the works. In addition, a 2m dust screen will be provided at the locations in the areas of the overlap of the Project and the Lough Corrib SAC and adjacent to Moycullen Bogs NHA.

These measures are detailed further in Section 16.6.2 of Chapter 16, Air Quality and in the CEMP in Appendix A.7.5.

8.6.3.4 Mitigation Measures to Reduce the Potential for Impacts to Water Quality in Receiving Watercourses

The mitigation measures to protect surface water during construction are detailed in Section 11.6.2 of Chapter 11, Hydrology.

As is normal practice the Construction Environmental Management Plan (CEMP) included in Appendix A.7.5 will be finalised by the Contractor in advance of the commencement of construction and the following will be implemented as part this plan:

- An Incident Response Plan detailing the procedures to be undertaken in the event of spillage of chemical, fuel or other hazardous wastes, logging of non-compliance incidents and any such risks that could lead to a pollution incident, including flood risks (Refer to Section 10 of the CEMP in Appendix A.7.5)
- A Sediment Erosion and Pollution Control Plan (Refer to Section 8 of the CEMP in Appendix A.7.5). This shall include water quality monitoring and method statements to ensure compliance with environmental quality standards specified in the relevant legislation (i.e. surface water regulations and Salmonid Regulations 1988)

Refer to Section 11.6.2 of Chapter 11, Hydrology for further mitigation measure details.

8.6.3.5 Measures to Protect Groundwater Quantity and Groundwater Quality

The mitigation measures to protect groundwater quantity and quality during construction and operation are detailed in Section 10.6.2 (construction) and Section 10.6.3 (operation) of Chapter 10, Hydrogeology.

Mitigation measures are included in Section 9.6 of Chapter 9, Soils and Geology to restrict the use of fill material in areas where there is the potential for run off/infiltration to affect pH levels in adjoining peatland habitats within the operational hydrogeological ZoI.

8.6.3.6 Measures to Control and Prevent the Spread of Non-native Invasive Plant Species

The mitigation strategy in relation to non-native invasive plant species is based on the *Guidelines on the Management of Noxious Weeds and Non-native Invasive Plant Species on National Roads* (National Roads Authority, 2010) with the objectives of managing non-native invasive plant species within the working area and preventing the spread of any established populations present within the Assessment Boundary (a legal requirement for species such as Japanese knotweed).

A Non-native Invasive Species Management Plan has been prepared and included in the CEMP (see Appendix A.7.5) and will be implemented sufficiently far in advance of the proposed construction works commencing so as to allow time to adequately control all target non-native invasive plant species populations within the ZoI of the Project, having regard to the specific timing/seasonal constraints that apply in relation to each individual species. The Non-native Invasive Species Management Plan will direct the construction contractor in implementing the specific mitigation measures required in relation to individual non-native invasive plant species.

As species may have spread, or their distribution may have changed, between the habitat surveys carried out for this updated EIAR and the commencement of construction works, the implementation of the Non-native Invasive Species Management Plan will include a pre-construction re-survey within the Assessment Boundary. In accordance with the NRA guidance this survey will include accurate 1:5,000 scale mapping for the precise location of non-native invasive plant species. The pre-construction surveys will be undertaken by suitable experts with competence in identifying the species concerned.

In accordance with the *Guidelines on the Management of Noxious Weeds and Non-native Invasive Plant Species on National Roads* (National Roads Authority, 2010), where cut, pulled or mown noxious weed or non-native invasive plant species material arises, its disposal will not lead to a risk of further spread of the plants. Care will be taken near watercourses as water is a fast medium for the dispersal of plant fragments and seeds. Material that contains flower heads or seeds will be disposed of either by composting or burial at a depth of no less than 0.5m in the case of noxious weeds, or by incineration (at a licenced facility having regard to relevant legislation) or disposal to licensed landfill in the case of non-native invasive plant species.

The taproots of docks and roots of creeping thistle are not suitable for composting or shallow burial, requiring disposal to landfill, incineration or burying at a depth of no less than 1.5m (practical only during the construction phase). Where burial is being used to dispose of Japanese knotweed, the material will be buried to a depth of 5m and overlain with a suitable geotextile membrane. All disposals will be carried out in accordance with the Waste Management Acts 1996-2024.

In relation to aquatic non-native invasive plant species all construction works, and any aquatic survey work that may be carried out (e.g. electrofishing), will comply with best practice biosecurity protocols for aquatic work – for example IFI's Biosecurity Protocol for Field Survey Work (IFI, 2010).

8.6.4 Rare and protected plant species

As per ABP's Inspector's report dated 22 June 2021, the following mitigation measures have been included.

The extent of the following plant species will be recorded and mapped, pre-construction, to ensure impacts to local populations are minimised and, where retained, are safeguarded by use of fencing, signs and ensuring workforce are aware (toolbox talks, etc) of the locations:

- Woodsy thyme moss *Plagiomnium cuspidatum*
- Lesser striated feather-moss *Plasteurhynchium striatulum*
- Imbricate bog-moss *Sphagnum affine*

- Red bog-moss *Sphagnum capillifolium*
- Spring gentian *Gentiana verna*
- Eyebright *Euphrasia arctica*

The recommendation from ABP's Inspector's report dated 22 June 2021 to map the extent of the population of Brown beak sedge *Rhyncospora fusca* during the construction phase will not be carried out, as this species lies outside of the Assessment Boundary and will not be impacted by the Project.

Where *Plagiomnium cuspidatum* and *Plasteurhynchium striatulum* plants are directly impacted and are growing on moveable substrates (rocks or logs) then the substrates will be relocated to areas of retained vegetation, with precisely the same environmental conditions as the donor site, with follow-up monitoring to confirm success or failure.

Additionally, some populations of these plant species (i.e. three of the six records of Lesser striated feather-moss *Plasteurhynchium striatulum* within the Assessment boundary and all records of Spring gentian *Gentiana verna* within the Assessment boundary) will be retained within the areas of habitat to be retained (Section 8.6.3.1).

Pre-construction, check the identification and native status of meadow oat-grass *Helictochloa pratensis* and marsh valerian *Valeriana dioica* and implement protection measures, if appropriate.

Where grassland seeding will be used, it will be suitable for the soil types and avoid negative indicator species for grassland Annex I habitats, aiming for dry heath/acid grassland to the west of the River Corrib and calcareous grassland to the east of the River Corrib. Grassland habitat creation approaches will favour natural regeneration rather than the use of seed mixes, wherever soil erosion is not a major risk.

8.6.5 Mammals

8.6.5.1 Otter

Otter are listed on Annex II and Annex IV of the EU Habitats Directive. Otter are strictly protected under the Birds and Habitats Regulations. Otter, and their breeding and resting places, are also protected under the Wildlife Acts and it is an offence under that legislation to intentionally kill or injure an Otter or to wilfully interfere with or destroy their breeding or resting places (holts/couches).

Measures to Protect Otter during Construction

Habitat degradation - water quality

The mitigation measures relating to the protection of water quality in receiving watercourses during construction are outlined in Section 8.6.3.4 and detailed in Section 11.6.2 of Chapter 11, Hydrology.

Loss of breeding/resting sites

As Otter, in the future, could potentially establish new holt or couch sites within the ZoI of the Project, a pre-construction check of all suitable Otter habitat will be required within 12 months of any constructions works commencing.

Otter passage facilities

Safe passage will be ensured for otters along all watercourses bisected by the Project during construction, and will include either mammal ledges within a culvert or two dry 600mm culverts parallel to the watercourse, one each side.

Mammal underpasses and Otter passage facilities will be checked and fully inspected before the relevant sections of the proposed N6 GCRR become operational to ensure they are constructed in accordance with the *Guidelines for the Treatment of Otters prior to the Construction of National Road Schemes* (National Roads Authority, 2008c).

Measures to Protect Otter during Operation

Habitat Severance/Barrier Effect and Collision Risk

Otters use many of the watercourses crossed by the Project. To avoid Otter road casualties, Otter passage facilities will be provided at all watercourse crossings (e.g. raised ledges within structures, or separate dry 600mm pipes installed adjacent to culverts) (as per ABP's Inspector's Report dated 22 June 2021). Mammal underpasses will be constructed in accordance with the *Guidelines for the Treatment of Otters prior to the Construction of National Road Schemes* (National Roads Authority, 2008c). The locations where Otter passage facilities will be provided are listed below in Table 8.43 and are shown on Figures 8.38.1 to 8.38.15.

Mammal-resistant fencing will be required to prevent Otter accessing the Project and to guide Otters to the mammal underpasses. Mammal-resistant fencing will be installed in accordance with the specification outlined in *Guidelines for the Treatment of Otters prior to the Construction of National Road Schemes* (National Roads Authority, 2008c) and TIIs mammal resistant fencing specification (currently CC-SCD-00320/00319). The locations where mammal-resistant fencing is to be installed are shown on Figures 8.38.1 to 8.38.15.

In accordance with the recommendations described in the *Guidelines for the Treatment of Otters prior to the Construction of National Road Schemes* (National Roads Authority, 2008c), quarterly monitoring of the effectiveness of the mitigation measures will be undertaken in the first three years after the completion of construction works (for example, fencing inspections to check for gaps and underpass inspection to check for blockages, checking the effectiveness of the ledges installed in culverts). Also, given the scale of the Project, monitoring will continue for at least three years and the maintenance of the ledges will be incorporated into the general road maintenance programme.

8.6.5.2 Bats

Bats are listed on Annex IV of the EU Habitats Directive and are therefore, strictly protected under the Birds and Habitats Regulations. Bats, and their breeding and resting places, are also protected under the Wildlife Acts and it is an offence under that legislation to intentionally kill or injure bats or to wilfully interfere with or destroy their breeding or resting places.

It should be noted that all of the mitigation measures detailed in Section 8.6.5.2, are included in the Bat Derogation Licence application for the Project (Appendix A.8.25 – Part 2) that was submitted to the NPWS for approval on 1 April 2025. It is noted here that a Bat Derogation Licence for the Project was granted by NPWS on 10 April 2024, based on an application made in March 2024 ((see Appendix A.8.25-Part 1) which expired on 31 December 2024), and no issues were raised regarding the mitigation or compensation strategies proposed therein.

Measures to Protect Bats during Construction

Measures to Protect Bats during removal of Roosts

The following mitigation measures (refer to Figures 8.39.1 to 8.39.15) are proposed in relation to structures either confirmed as supporting bat roosts or considered to have the potential to support roosting bats:

- Prior to demolition of the 19 structures containing confirmed bat roosts, replacement artificial roosts will be in place to ensure that bats are able to access alternative resting places at the earliest opportunity.
- Where possible, buildings with the confirmed bat roosts will not be demolished during the breeding period or hibernation period (April to mid-August and November-March) as the risk of accidental death or injury is higher at this time. Bats may use roosts in smaller numbers in winter but may nevertheless be present. Outside of these periods, the approach to demolition of bat roosts will be determined on a case-by-case basis and subject to relevant licence conditions.
- Buildings confirmed as bat roosts proposed for demolition will be marked on the ground with agreed paint marking to permit identification by Contractors.
- Prior to demolitions, all structures that were confirmed as either having bats or having high suitability for bats will be re-examined immediately prior to demolition to assess whether bats are present at the time of demolition. This will be an all-night examination to determine if bats enter the building during the night or early morning. This will provide adequate information to proceed with demolitions unless weather

conditions were unsuitable for feeding bats. If bats are present, they will require exclusion from the property over several nights or if possible physical removal by hand by a licenced bat specialist to be placed in a bat box or similar for release in the evening after capture. For structures which have not been confirmed as bat roosts but regarded to have high suitability for bats and due for demolition, a bat detector assessment of the property to be demolished will be carried out, (note demolitions will not be permitted during the period May to August (the breeding period) in the case of the confirmed bat roosts, as the risk of accidental death or injury to bats is too great at this time). This will be an all-night examination to determine if bats enter the building during the night or early morning. This will provide adequate information to proceed with demolition unless weather conditions were unsuitable for feeding bats. If bats are present, then they will require exclusion from the property over several nights or if possible physical removal by hand by a licenced bat specialist to be placed in a bat box or similar for release in the evening after capture.

- Once structures containing roosts are deemed to be clear of bats, the bat specialist will be on site to supervise the demolition procedure until the structure is no longer deemed able to support a bat roost. Bats may re-enter a partially demolished structure overnight so the bat specialist may be required to be present during demolition works until they are completed.

The following mitigation measures are proposed in relation to those trees identified as having high suitability to support roosting bats. These include the three trees confirmed to have had bats present (PTR43, PTR48, and PTR45) and the eight other trees to have high suitability, where either obvious potential roosting features are present, or where obscured by dense ivy cover, the tree is of an age and condition that there is a high chance that roosting features are present.

Figures 8.25.1 to 8.25.15 show the locations of these trees but a more detailed drawing will be provided to the contractor prior to any felling works. Bats could occupy suitable roosting features at any time prior to the commencement of works. Therefore, there is an inherent risk that bats could be affected by the proposed felling works. The proposed mitigation measures for this potential impact are as follows:

- Felling of confirmed and potential tree roosts will be undertaken during the period September – October as during this period bats are capable of flight and may avoid the risks from tree felling if proper measures are undertaken, but also are neither breeding or in hibernation.

- Use of detectors alone may not be sufficient to record bat emergence and re-entry in darkness. Therefore, prior to felling of confirmed and potential tree roosts, an emergence survey using night vision aids such as infrared or thermal imaging cameras and bat detectors will be carried out on the night immediately preceding the felling operation to determine if bats are present.

- Where it is safe and appropriate to do so for both bats and humans, such trees may be felled using heavy plant to push over the tree. In order to ensure the optimum warning for any roosting bats that may still be present, the tree will be pushed lightly two to three times, with a pause of *c.*30 seconds between each nudge to allow bats to become active. The tree should then be pushed to the ground slowly and should remain in place until it is inspected by a bat specialist.

- Trees should only be felled “in section” or “soft felled” where the sections can be rigged to avoid sudden movements or jarring of the sections.

- Where remedial works (e.g. pruning of limbs) are to be undertaken to trees deemed to be suitable for bats, the affected sections of the tree will be checked by a bat specialist (using endoscope, where applicable and necessary) for potential roost features before removal. For limbs containing potential roost features high in the tree canopy, this will necessitate the rigging and lowering of the limb to the ground (with the potential roost feature intact) for inspection by the bat specialist before it is cut up or mulched. If bats are found to be present, they will be removed by a bat specialist licenced to handle bats and released in the area in the evening following capture.

- Prior to felling the three confirmed tree roosts (PTR43, PTR48, PTR45), and any other trees with potential for a bat roost, at least two replacement bat boxes will be installed on trees, as close to each felled tree as possible (ss per ABP’s Inspector’s report dated 22 June 2021), with potential for a bat roost, as close as possible but away from the carriageway of the proposed road and before the end of July in the year of felling. These boxes will be a mixture of hollow (for Leisler’s) and crevice types (for pipistrelles)

in accordance with the potential roost that is lost. The location of the bat boxes in these instances will be within the Assessment Boundary and their precise location will be determined by the bat specialist. Where a suitable tree cannot be identified in close proximity to a known bat tree roost/potential bat tree roost, the next most suitable tree, within the Assessment Boundary, in an appropriate location (i.e. avoiding the roadside) will be selected by the bat specialist.

Measures to preserve flight paths across Construction areas

It has been identified that during the construction phase, the removal of woodland and hedgerows and other intervention in the landscapes used by bats can open up habitats to the extent that bats will not want to risk crossing the new open space to reach other roosts and foraging areas on the other side. This severance of flight paths will continue throughout the construction phase.

The Report WC1060 *Development of a Cost-Effective Method for Monitoring the Effectiveness of Mitigation for Bats crossing linear infrastructure* includes best practice principles to address the general lack of evidence to show that many "conventional" mitigation measures work. These principles are reproduced below and have been adopted in the mitigation strategy for the Project.

- "*Mitigation should be integrated into the scheme from the earliest opportunity*
  - *Mitigation should be considered during the planning and design stage of the infrastructure so that it can be incorporated effectively*
- *Crossing structures should be placed on the exact location of existing bat commuting routes*
  - *Attempts should not be made to divert bats from their existing commuting routes*
- *Crossing structures should not require bats to alter flight height or direction*
  - *This will depend on the topography of the site. If the road is to be elevated above ground level an underpass may be used to preserve the commuting route below it, or if the road is in a cutting a green bridge may be used to carry the commuting route over the road*
- *Crossing structures should maintain connectivity with existing bat commuting routes*
  - *Connectivity must be maintained with undisturbed bat flight paths (e.g. treelines, hedgerows, woodland rides and streams), and bat habitat (e.g. woodland) within the surrounding landscape. Crossing structures should not be exposed or sited within open ground*
- *Over-the-road structures such as green bridges should be planted with vegetation*
  - *Vegetation should be continuous and connected (see above) and sufficiently mature before road construction (e.g. by planting either relatively mature trees or fast growing tree species in advance of construction commencing)*
- *Underpasses should be of sufficient height*
  - *Underpasses should be as spacious as possible with height being the critical factor. The minimum requirements for underpass height will be species-specific. Required heights will generally be lower for woodland-adapted species (~3 m) compared to generalist edge-adapted species (~6 m), but larger underpasses will accommodate more species.*
- *Green bridges should be of sufficient width*
  - *In addition to being vegetated, green bridges should be as wide as possible, to provide a large area for bats to commute across. Further research is needed to determine exact dimensions. We found a 30m wide green bridge to be effective in this study*
- *Crossing structures should be unlit*
  - *The effects of light on bats are species-specific and lighting should be avoided*
- *Access and connectivity must be maintained*

  - *It is important that access to crossing structures is maintained (e.g. grilles should not be installed on underpasses) and that connecting vegetation is retained indefinitely or for as long as the mitigation structure is required*

- *Disturbance should be minimised during installation of mitigation structures*
  - *For example, by limiting noise and light pollution along the bat flight path, minimising vegetation clearance, installing suitable temporary crossing structures (which should also be subject to monitoring and evaluation), completing the installation as quickly as possible and ideally avoiding the summer months when bats are most active*"

The installation of temporary fencing across sites to replace connecting features has been used and appears to have only been monitored as part of one project in Switzerland (Britschgi *et al*, 2004)[145]. In this study, a 1m wide x 1.5-2m high artificial hedgerow was recorded to be followed by a proportion of the bats in a roost. It is proposed to apply similar measures in key locations to ensure that there are linear features to connect habitats across the construction footprint.

In order to inform siting of mitigation measures, including the temporary fencing described above during the construction phase, a series of infra-red/thermal camera surveys using a series of cameras and bat detectors along linear features in the following locations will be carried out in the optimum activity season. This will help to identify the preferred crossing points at the following sections:

Area 1: North of Bearna Woods

Area 2: Aughnacurra

Area 3: River Corrib to Coolough Road

Area 4: West of N84 Headford Road

Area 5: Ballindooley to Castlegar

Each area will be surveyed three times to record bats in flight in these locations with the precise vantage points for cameras to be determined during daytime surveys.

Any existing features that are identified as preferred crossing points and are scheduled for removal will be retained until the last moment and a portable artificial crossing structure put alongside it prior to its removal, so at no stage there is a gap across the construction site at night. The use of the temporary fence as an artificial crossing structure will be monitored three times over two weeks following installation. If the artificial crossing structure is not at the same location as a proposed permanent crossing point (e.g. the wildlife overpass at Castlegar) then it shall be moved gradually over several nights to realign it with the permanent crossing point.

The nature of the artificial crossing structure may comprise lengths of camouflage netting, recycled Christmas trees roped together, portable planters or artificial plants that can be easily moved at morning and evening to ensure that the crossing is in place each night.

No artificial lighting will be used at any watercourse crossings during construction to ensure that bats are not displaced or prevented from using the riparian corridors for commuting or foraging.

Measures to Protect Bats during Operation

Measures to reducing mortality risk and barrier effects within the design and operation of the Project

The mitigation to address significant barrier effects has been designed to reflect current best practice. The last 10 years has seen an improvement in the monitoring of the effectiveness of bat mitigation measures for roads and there is considerable evidence that whilst bats may "use" measures designed to get them over or under a road, in the context of the overall population these measures may not be "effective" as they are often

[145] Britschgi A., Theiler A. & Bontadina F. (2004) *Wirkungskontrolle von Verbindungsstrukturen. Teilbericht innerhalb der Sonderuntersuchung zur Wochenstube der Kleinen Hufeisennase in Friedrichswalde-Ottendorf / Sachsen*.

in the wrong place or simply not attractive to bats to use. Measuring bat mortality as a result of collisions has also been studied in greater detail in recent years.

The two main approaches employed for the Project include underpasses of a suitable size where the design of the Project is on embankment and a wildlife overpass where it is in cut. These two measures are the only options that have been demonstrated to be effective at a population level (CEDR, 2016, (Elmeros and Dekker, 2016, Abbott *et al* 2012a, 2012b).

Underpasses are proposed in important crossing point areas and are aligned with existing landscape features that are known to be used by bats as a result of the surveys. Underpasses in the Menlough - Bóthar Nua area and N84 Headford Road areas are regarded to be of critical importance for Lesser horseshoe bat and other bat movements across this landscape.

The section of the proposed N6 GCRR from the N84 Headford Road to N83 Tuam Road is almost entirely in cut and installing underpasses is not possible, therefore the only effective option is a wildlife overpass (referred to throughout this report as the Castlegar Wildlife Overpass).

The Castlegar Wildlife Overpass is a critical component of the strategy. It will allow bats to fly across the Project between the roosts and foraging habitats on the north side and Coopers Cave and foraging areas to the south at this location.

From 2013-2015, bats were recorded using hedgerows at many locations in places between the N84 Headford Road and the N83 Tuam Road – a distance of 1750m. The western section of the proposed N6 GCRR in this area includes for underpasses which would be used by Lesser horseshoe bats and other bat species in areas where they have been recorded, (*c.*400m in length) whilst the remainder of the Project is in a cutting or it is not feasible to include such underpasses.

In the absence of the Castlegar Wildlife Overpass, it is possible that bats would attempt to cross the Project at the location of the existing crossing points[146]. This would increase the risk of collisions with vehicles at this key location and for Lesser horseshoe bats this could have an adverse impact that could deplete the population to an unsustainably low level.

In the absence of the Castlegar Wildlife Overpass the Lesser horseshoe bats would not be able to use Cooper's Cave for mating in late summer and as a result they could be forced to use less suitable locations (no other mating roosts were recorded). Mating sites that are accessible to a geographically wide population and mixes of males and females from different roosts is an essential attribute to ensure genetic heterogeneity in the local bat population. At present, bats are able to get to Cooper's Cave from a variety of directions.

A potential worst case scenario barrier effect isolating the Menlo Castle roost would therefore lead to reduced genetic diversity and possible reduced reproductive rates in that population. Similarly, the bats using Cooper's Cave would be confined to sub-optimal habitats and it is not unreasonable to conclude that, in a worst-case-scenario, the cave would cease to be used by Lesser horseshoe bats.

The location of the Castlegar Wildlife Overpass is crucial to its success. Research published since 2008 by Berthinussen & Altringham (2015[147]) and evidence presented in the CEDR Safe Bat Paths reports (2016[148]) and Natural England (2015[149]) reports have identified that bats will cross a road along existing known flight paths in preference to new artificial crossings at alternative locations. Whilst this may be truer of species that are known to fly across open spaces such as Pipistrelle species, it is not known if Lesser horseshoe bats would also act in the same way. In the absence of data to the contrary the precautionary principle has been applied and the wildlife overpass has been located at known Lesser horseshoe bat crossing points. The proposed location at Ch. 12+690 – Ch. 12+720 of the proposed N6 GCRR ties in with records of Lesser

[146] Lighting of the proposed N6 GCRR at this location may create a barrier effect, making crossing the proposed N6GCRR even more problematic for bats.

[147] *WC1060 Development of a Cost-Effective Method for Monitoring the Effectiveness of Mitigation for Bats crossing Linear Transport Infrastructure*. Final Report 2015. Anna Berthinussen & John Altringham. School of Biology, University of Leeds, Leeds LS2 9JT/

[148] http://bios.au.dk/om-instituttet/organisation/faunaoekologi/projekter/safe-bat-paths/documents/

[149] http://publications.naturalengland.org.uk/publication/6312886965108736

horseshoe bats, Common and Soprano pipistrelle bats recorded by static bat detector in 2015. It will be essential to quantify the number of bats using each crossing point (especially the Castlegar Wildlife Overpass) immediately prior to construction in order to provide data against which post-construction surveys can be compared.

The width and design of the Castlegar Wildlife Overpass has followed simple assumptions that are based on the target species ecology and has followed best available knowledge and information as outlined below.

Guidance from Natural England (2015) can be summarised as follows:

- The COST 341 handbook (2003) identifies four types of 'over structure' to provide faunal passage; landscape bridges, wildlife bridges, modified bridges/multi use bridges and tree top overpasses. A clear distinction between landscape bridges and wildlife bridges is not given, but in terms of design this appears to be based on scale aspects, with landscape bridges being larger structures over 80m wide and wildlife bridges being small in width with a recommendation of between 40 and 50m. The handbook does not use the term 'green bridge' to describe these structures
- Findings of the WC1060 Report (Berthinussen & Altringham, 2015) can be summarised as follows:
  - Although green bridges have the potential to be effective crossing structures for bats over infrastructure, there are other issues that also need to be considered such as the cost, the landtake required for construction of the bridge and the detrimental effects there may be on bats while it is being constructed. However, one expensive yet effective structure will always make more sense than cheaper structures that do not work: mitigation structures must be cost effective and functional. Green bridges may also provide mitigation for other wildlife. Eight mammal species have been found to use Scotney Castle landscape bridge, including deer, badger and breeding dormice (National Trust, 2012), and similar structures are commonly built throughout Europe and North America for large mammals. Combining mitigation for a range of wildlife may be a cost-effective solution, but would require careful planning, project management and monitoring
  - The two most widespread forms of wire bat bridge do not provide effective mitigation and should not be built, particularly since there is evidence that bats do not adapt to them with time. Our results suggest that green bridges and underpasses have the greatest potential but they must be designed correctly and many factors are important such as size, position, connectivity, topography, and the density and maturity of vegetation. Green bridges should be of sufficient width
  - Best practice principles for bat mitigation along linear transport infrastructure include that in addition to being vegetated, green bridges should be as wide as possible, to provide a large area for bats to commute across. Further research is needed to determine exact dimensions. A 30m wide green bridge was found to be effective in this study

A width below 20m is not recommended as although evidence shows that species will still use these bridges, the frequency of use is reduced.

The proposed overpass bridge at Castlegar is 30m wide. The overpass will be landscaped to provide a connective habitat across the Project. The proposed planting design associated with the Castlegar Wildlife Overpass comprises of a central narrow grass pathway bounded on either side by a double hedgerow (to mimic a 4m wide bóithrín); that is, 2m wide tree-lined hedgerows of native tree and shrub species. This planting will tie-in to proposed planting leading east and west along the upper slopes of both sides of the Project. Each of the hedgerows will then diverge out to create a "mouth" at the entrance to the overpass on both sides of the Project to funnel bats into the centre of the overpass. Soil depths will vary from a minimum of 45cm at the edges to 1.5m along the centreline. Tree species will be planted at 3m centres in double rows in each hedgerow and will include alder, birch, rowan, planted as standards (i.e. 8-10cm girth, c.2.4m high) and whips (1.25m high). Sixty percent of shrub planting will comprise blackthorn, hawthorn and hazel, augmented with elder, holly, spindle, willow etc. Hawthorn plants will be 90cm high. Other shrubs will be planted at 60cm high. Plate 8.3 Castlegar Wildlife Overpass shows the schematic design and location of the proposed overpass.

The planting design comprises of a double hedgerow in the middle section of the overpass (to mimic a 4m wide bóithrín).

Each of the hedgerows will then diverge out to create a “mouth" at the entrance to the overpass on both sides of the Project to funnel bats in to the centre of the overpass.

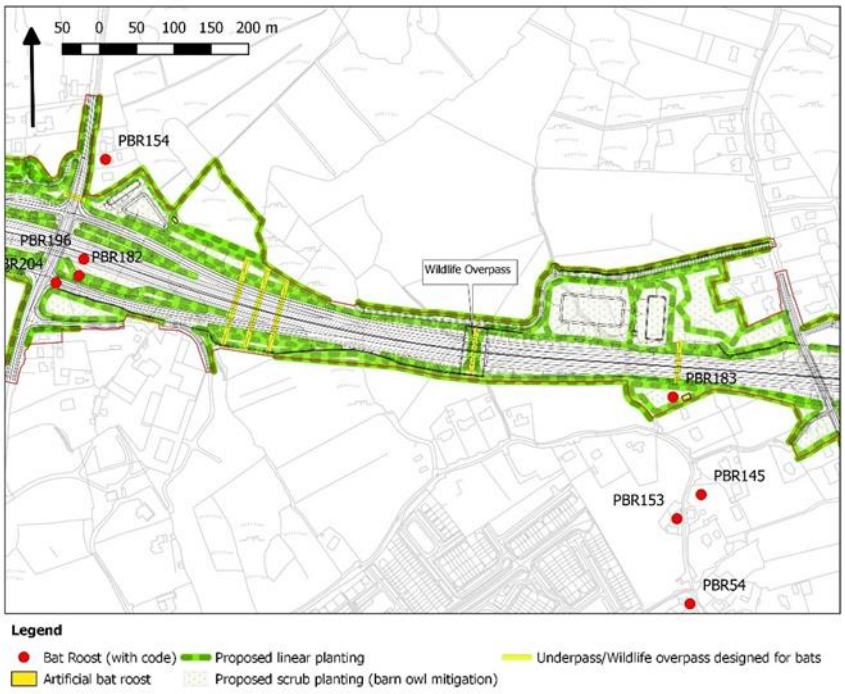

Plate 8.3 Castlegar Wildlife Overpass

No lighting will be provided at or on any of the structures which have been designed to provide bat passage, with the exception of S06/01 where lighting will be provided to allow for safe use by pedestrians. All of the bat underpasses (as well as artificial roosts) that are designed for Lesser horseshoe bats will have connecting woody vegetation features. Other bats species are not as reliant[150] on hedgerows and woodland edges. Whilst there are many existing landscape features outside of the Assessment Boundary, the bat mitigation strategy cannot rely on these in the long term as they may be subject to interventions by third parties. In effect, what will be created is a hedgerow corridor leading up to underpasses in the section of the Project between Aughnacurra and Castlegar.

This planting provides a guaranteed green corridor connecting up the underpasses/overpasses and will allow bats to adapt more easily to any future landscape scale losses of connecting habitat features that may occur. The hedgerow planting leading up to underpasses will be maintained and the growth of the hedgerow monitored for 5 years following completion and remediation works undertaken if deemed necessary.

Table 8.42 below sets out the schedule of structures which provide bat passage and states the function that they serve in terms of mitigating the potential barrier effect; also see Figures 8.39.1 to 8.39.15. The size and location of the underpasses and culverts have taken into account the research carried out by Abbott (2012a, b) and the advice provided in the CEDR, COST341 and WC1060 reports. Design parameters included:

- Identifying where roosts are close to the Project or where bat activity has been identified close to the Project
- Identifying where the proposed vertical profile of the Project (i.e. in cut, on fill or at grade) can permit bat passage underneath the Project
- Where river culverts and minor roads pass under the Project, it was considered if these can fulfil a role in conveying bats underneath the Project

[150] Although it is noted that Lesser horseshoe bats cross the River Corrib over 120m of open water at Menlo Castle.

- New underpasses provided should be a minimum of 2.5m high to permit the passage of bats. Research by Abbott showed that this height would allow 90% of the bats to pass through an underpass 2.5m to 3.1m high as seen in the excerpt from her research below

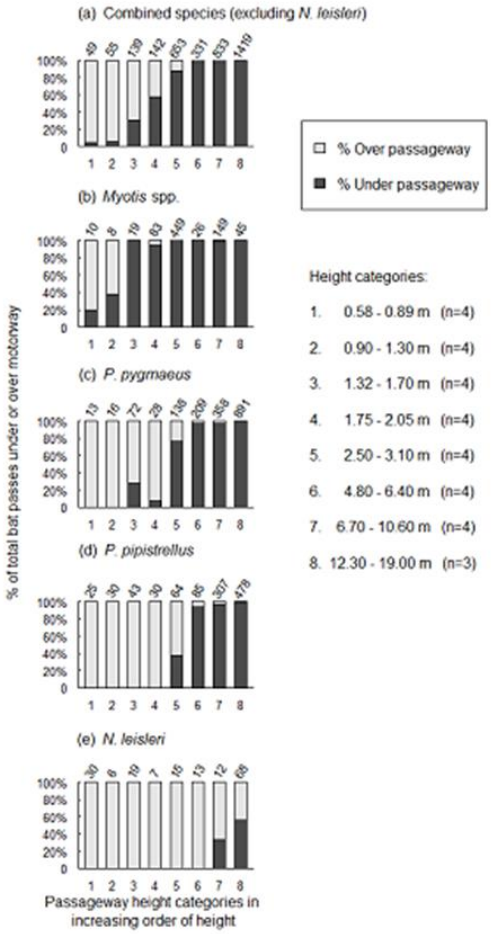

Fig. 4.17 Percentage of bat passes for **(a)** combined species (excluding *N. leisleri*), **(b)** *Myotis* spp., **(c)** *P. pygmaeus*, **(d)** *P. pipistrellus* and **(e)** *N. leisleri* (**b - e** in order of decreasing degree of clutter-adaptation) detected flying through underpasses (% Under) compared to flying over the traffic lanes of the motorway directly above underpasses (% Over) during simultaneously paired recordings. Bat pass counts (Over + Under) per height category (see legend) are shown above each bar for each species

Plate 8.4 Results of Surveys Carried out by Abbott (2012c)

Table 8.42 Schedule of Structures Designed to serve for Bat Passage

Structure	Description	Mitigation Function
Culvert C00/01	A 2.5m wide by 1.35m high culvert designed to provide bat passage beneath the proposed N6 GCRR	Six species of bats recorded near this location. A combined hydraulic and wildlife culvert which will cater for Lesser horseshoe and Myotis species of bats which have been recorded here
Culvert C02/01b	A 2.5m wide by 2.5m high culvert designed to provide for bat passage beneath the proposed N6 GCRR	A combined hydraulic and wildlife culvert which will cater for Pipistrelle species which were recorded nearby
Culvert C03/01	A 2.5m wide by 1.2m high culvert designed to provide for bat passage beneath the proposed N6 GCRR	A combined hydraulic and wildlife culvert which will cater for Pipistrelle species which were recorded nearby

Structure	Description	Mitigation Function
Culvert C03/03	A 2.5m wide by 1.2m high culvert designed to provide for bat passage beneath the proposed N6 GCRR	Records of Pipistrelle, Lesser horseshoe and Myotis species of bats species nearby. A combined hydraulic and wildlife culvert which will cater for bats and will also cater for the commuting route for Lesser horseshoe bats to Bearna Woods
Culvert C03/04	A 2.5m wide by 1.2m high culvert designed to provide for bat passage beneath the proposed N6 GCRR	Records of Pipistrelle, Lesser horseshoe and Myotis species of bats nearby. A combined hydraulic and wildlife culvert which will cater for bats and will also cater for the commuting route for Lesser horseshoe bats to Bearna Woods
Culvert C04/01	A 5m wide by 2.5m high culvert designed to provide for bat passage beneath the proposed N6 GCRR	Records of Pipistrelle, Lesser horseshoe and Myotis species of bats nearby. A combined hydraulic and wildlife culvert which will cater for bats and will also cater for the commuting route for Lesser horseshoe bats to Bearna Woods.
Culvert C04/02	A 3.1m wide by 2.5m high culvert designed to provide for bat passage beneath the proposed N6 GCRR	Records of Pipistrelle, Brown long-eared and Myotis species of bats nearby. A combined hydraulic and wildlife culvert which will cater for bats
Underbridge S06/01	Proposed road underbridge (12.5m wide 5.3m high) will provide for bat passage beneath the proposed N6 GCRR	The existing Rahoon Road will allow continued bat passage underneath the Project. Records of Pipistrelle species of bat nearby. There will be lighting to allow safe pedestrian access
Culvert C06/00	A 2.5m wide by 2.5m high culvert designed to provide for bat passage beneath the proposed N6 GCRR	Culvert will convey bats underneath Project as the Project severs the existing road which is used by Pipistrelle species. Records of Pipistrelle species of bat nearby, culvert connects linear feature each side of the Project
Culvert C06/01	A 2.5m wide by 2.5m high culvert designed to provide for bat passage beneath the proposed N6 GCRR	Culvert allows passage across Project in area of fill whereas there are no areas for underpasses to the west for c.500m. Connects to attenuation ponds which may be used for foraging
Culvert C07/00	A 2.5m wide by 2m high culvert designed to provide for bat passage beneath the proposed N6 GCRR	Culvert will connect across landscape used by Pipistrelle and Brown long-eared bats. Roosts to the east which will be surrounded by the Project will be reconnected via this culvert and also culverts to the north
Culvert C07/02A	A 2.5m wide by 2.5m high culvert designed to provide for bat passage beneath the proposed N6 GCRR	Culvert will connect across landscape used by Pipistrelle and Brown long-eared bats. Roosts to the east which will be surrounded by the Project will be reconnected via this culvert and also culverts to the north. The culvert carries a small stream and ties into a ditch and hedgerow on the eastern side and will join a proposed landscaped strip on the western side, to connect it to the existing Rahoon Road
Culvert C08/01A	A 2.5m wide by 2.5m high culvert designed to provide for bat passage beneath the proposed N6 GCRR	This culvert is in an area of fill west of the N59 Moycullen Road and offers an opportunity for bats to cross under the Project in this section. Pipistrelle and Lesser horseshoe bats have been recorded in the surrounding area
Culvert C08/05	2.5m wide by 2.5m high culverts will provide for bat passage beneath the proposed N6 GCRR	These culverts are close to the artificial roost proposed to address the loss of the bat roosts at Aughnacurra (PBR178, 256, 255, 177, 210). As such it is essential to maximise permeability of the Project in this section. Brown long-eared and Lesser horseshoe bats will be facilitated by this culvert. Proposed landscape planting strips will connect the culvert to retained vegetation at the perimeter
Culvert C08/04		
Culvert C08/02		
Culvert C09/01	A 5m wide by 4m high culvert will provide for bat passage beneath the proposed N6 GCRR	Series of five culverts providing permeability underneath the Project for Lesser horseshoe, Pipistrelle, Brown long-eared and

Structure	Description	Mitigation Function
Culvert C09/02	A 5m wide by 4m high culvert will provide for bat passage beneath the proposed N6 GCRR	other bat species. The culverts will open into the retained edges of Menlough woods with additional planting provided
Culvert C09/03	A 5m wide by 4m high culvert will provide for bat passage beneath the proposed N6 GCRR	
Culvert C09/04	A 5m wide by 4m high culvert will provide for bat passage beneath the proposed N6 GCRR	
Culvert C09/05	A 5m wide by 4m high culvert will provide for bat passage beneath the proposed N6 GCRR	
Road Underbridge S09/01	Proposed road underbridge (10m wide 5.3m high) Menlo Castle Bóithrín will provide for bat passage beneath the proposed N6 GCRR	Key crossing point in the landscape for Lesser horseshoe bats permitting flights between Menlo Castle roost (and future new roost) and foraging areas near the Coolagh Lakes. Proven by radio-tracking data. The unlit existing road will allow continued bat passage underneath the Project. Records of several species of bat nearby including being within the recorded foraging area for Lesser horseshoe bats and being in an important area for crossings
Culvert C09/06	A 2.5m wide by 2.5m high culvert will provide for bat passage beneath the proposed N6 GCRR	This culvert connects woodland edges that will be retained at the edge of the culvert. Records of several species of bat nearby including being within the recorded foraging area for Lesser horseshoe bats and being in an important area for crossings
Culvert C09/07	A 2.5m wide by 2.5m high culvert will provide for bat passage beneath the proposed N6 GCRR	In low area in local topography within the recorded foraging area for Lesser horseshoe bats and being in an important area for crossings
Underpass C10/01	A 18m wide by 2.35m high structure will provide for bat passage beneath the proposed N6 GCRR	This structure connects woodland edges that will be retained at the edge of the culvert. Records of several species of bat nearby including being within the recorded foraging area for Lesser horseshoe bats and being in an important area for crossings as proven by radio-tracking data
Road Underbridge S10/02	Proposed road underbridge (9.8m wide by 5.3m high)	The proposed underbridge will allow continued bat passage beneath the Project. Records of several species of bat nearby including Lesser horseshoe bats and being in an important area for crossings as proven by radio-tracking data
Culvert C12/02	A 2.5m wide by 2.5m high culvert will provide for bat passage beneath the proposed N6 GCRR	Series of 3 culverts, each 25m apart, connects lands north and south and allows bats to cross. A key crossing point for Lesser horseshoe bats, Brown long-eared bats and roosts for both species are nearby
Culvert C12/03	A 2.5m wide by 2.5m high culvert will provide for bat passage beneath the proposed N6 GCRR	
Culvert C12/04	A 2.5m wide by 2.5m high culvert will provide for bat passage beneath the proposed N6 GCRR	
Castlegar Wildlife Overbridge S12/02	The Castlegar Wildlife Overpass (60m long x 30m wide) will provide for bat passage over the proposed N6 GCRR	Key crossing point in the landscape for Lesser horseshoe bats permitting flights between Castlegar and Ballindooley/Menlough areas. See text above this table for rationale for wildlife overpass location and design

Structure	Description	Mitigation Function
Structure S08/04	River Corrib bridge will provide for bat passage over the proposed N6 GCRR	An important crossing point for all bat species especially Lesser horseshoe and Daubenton's bats as proven by radio-tracking data. Roosts for both species are nearby

In addition to the structures specifically designed for bat passage, there are other structures such as where minor roads pass underneath the Project which will be used by bats as safe crossing points.

The structures provided for the passage of bats will be checked prior to the operation of the Project to ensure they are constructed in accordance with the design requirements as set out in this section as well as Section 8.9.2.

Proposed monitoring programme

As the baseline level of bat activity and roost occupancy can change over time, pre-construction monitoring will be carried out in advance of construction works commencing to ensure that the data against which the post-construction monitoring will be compared to is as up-to-date as possible (refer to Bat Derogation Licence application included in Appendix A.8.25 – Part 2, and noting the Bat Derogation Licence previously granted in April 2024 in Appendix A.8.25 – Part 1).

Monitoring of the effectiveness of the bat mitigation and compensation measures will also be undertaken during and post-construction. Where the monitoring identifies issues with either the mitigation or compensation measures (e.g. light spill affecting usage), these will be remediated to ensure that those measures will achieve their aims with respect to mitigating or compensating for impacts on the local bat populations (refer to Bat Derogation Licence application included in Appendix A.8.25-Part 2 of this updated EIAR, and noting the Bat Derogation Licence previously granted in April 2024 in Appendix A.8.25 – Part 1 of this updated EIAR).

Pre- construction monitoring

Pre-construction monitoring is required to provide data against which the post-construction monitoring can be compared. Parameters will include:

- Occupancy levels in roosts (Menlo Castle, proposed artificial roost buildings including retrofitted retained buildings, bat boxes)
- Bat passage structures (culverts, underpasses and the Castlegar Wildlife Overpass)
- Diversity of bat species and abundance of bat activity adjacent to the Project

Occupancy levels in Menlo Castle will be measured by emergence surveys using infra-red video camera recording monthly from mid-April to September in the year of or immediately prior to construction commencing (whichever of the two is closer to the construction commencement).

Monitoring for bat usage of proposed bat passage structures will focus on recording bats using existing flight paths at proposed underpasses near Menlo Castle, the N59 Letteragh Junction and the proposed Castlegar Wildlife Overpass. Pre-construction baseline data is required on numbers of bats and flight height so that this can be compared to a post-construction scenario. Such data will be collected using focused infra-red camera and detector surveys carried out at least on three separate occasions at each location in the optimum survey period. In accordance with CEDR (2016) guidance it is proposed that this pre-construction monitoring involves a minimum of two separate surveys in the breeding season and two separate (in time) surveys in mid-August to late-September, to reflect periods of landscape-scale movements, and that these surveys take place for two bat activity seasons (May-August) following completion of the construction of the Project.

The risk of adverse effects on bat diversity and abundance adjacent to the Project can never be ruled out completely; but not all populations will be affected in the same location in the same way and therefore ongoing monitoring is regarded to be good practice to enhance our understanding of the effects of road developments and the effectiveness of mitigation measures. Diversity of bat species and abundance of bat activity adjacent to the Project will be monitored using standardised survey transects from the edge of the Assessment Boundary outwards as described by Berthinussen & Altringham (2015). These transects will be

used to record bat activity across the lands flanking the corridor of the Assessment Boundary. It is proposed that six transects are surveyed pre-construction in locations of high bat activity where underpasses or an overpass are proposed.

During and post-construction monitoring

Roost monitoring

Monitoring of occupancy of the artificial roost buildings (including retrofitted retained buildings) and bat boxes will commence immediately after their installation to determine how soon they are used. They will be installed prior to the main site clearance phase; therefore, all monitoring can be by visual inspection according to the following schedule:

- Emergence counts at Menlo Castle roost: emergence counts will be undertaken during the construction works and in the 10 years following construction in May, July and August. These counts will be made using infra-red video camera recording at the same time as visual inspections of bats using the proposed new roost site adjacent to Menlo Castle in order to get an overall count of bats at this location
- Artificial roost buildings: Occupancy of the proposed artificial roost buildings (including retrofitted structures) during the works and post-construction will be monitored, and necessary repairs undertaken, in the 10 years following completion of construction (as per ABP's Inspector's report dated 22 June 2021). Surveys will be undertaken in mid-winter for hibernation use and in May and July for use during breeding season. Surveys will include checks for individuals and also for droppings (where necessary using DNA analysis). Droppings will be removed after each check to ensure that the subsequent survey only records usage in the interim period. The roosts will be monitored annually for Lesser horseshoe bats and counts sent to the NPWS as part of the national Lesser horseshoe bat monitoring programme. This monitoring may be undertaken by NPWS staff, Galway bat group or others to be decided by the local authority. Remote modes of monitoring using new technology may mean that visits to the roosts are not always required and that infra-red images inside the roost can be sent wirelessly. Should the monitoring of the roosts suggest that bats are not using them, additional focused surveys will be undertaken to try to understand bat movements in the locality and aim to address any issues. Any changes that may be deemed necessary will be coordinated and communicated to ensure that they do not conflict with any of the impact predictions or mitigation measures prescribed in this report. Temperature and humidity probes coupled with data loggers will be installed in the roosts for two years post construction of the roost and measures taken (e.g. fitting vents, increasing period of water tanks in the hibernation roost area) to address any issues arising
- Bat boxes: The authors are not aware of any minimum or recommended standard for bat box monitoring. After installation, boxes will be visually inspected quarterly per year for the first two years. Research into the effectiveness of mitigation measures has indicated that occupancy of bat boxes averages 50%[151] since bats may prefer existing alternative roost sites in the locality. Any boxes not showing signs of occupancy after that time may be relocated to alternative locations within the Assessment Boundary nearby where they may be of benefit to the local bat population. In years 3-5 after installation the boxes will be checked in late March and September to record usage in winter and summer and to avoid disturbance during the sensitive hibernation times
- Bat boxes will be checked for a minimum of 10 years after erection, with replacement and repair carried out as necessary

[151] Paul Lynott, pers. comm 2017.

Monitoring crossing points

Monitoring will comprise acoustic detector and infra-red camera recording at the culverts at the five locations previously surveyed pre-construction, namely:

- Area 1: North of Bearna Woods
- Area 2: Aughnacurra
- Area 3: River Corrib to Bothár Nua
- Area 4: West of N84 Headford Road
- Area 5: Ballindooley to Castlegar, including the Castlegar Wildlife Overpass

This will quantify the usage by bats compared to non-usage (e.g. using other flight paths). This will allow a determination as to whether the bat passage structures are being effective at a population level (where it is assumed that 90% of the bats are able to pass underneath the Project). Monitoring will be repeated at all locations to provide a robust dataset. In the event that the proposed bat passage structures including the Castlegar Wildlife Overpass are not deemed to be effective, then further focused surveys will be required to determine the causes and address them in a reasonable manner where possible (for example, controlling lighting, addressing local landscape changes). Any changes that may be deemed necessary will need to be coordinated and communicated to ensure that they do not conflict with any of the impact predictions or mitigation measures prescribed in the Environmental Impact Assessment or Appropriate Assessment documentation.

In accordance with CEDR (2016) guidance it is proposed that this post-construction monitoring involves a minimum of two separate surveys in the breeding season and two separate (in time) surveys in mid-August to late-September, to reflect periods of landscape-scale movements, and that these surveys take place for 10 bat activity seasons (May-August) following completion of the construction of the Project.

The monitoring programme described above also relates to the compensation measures for bats described in Section 8.9.2.

Diversity and abundance adjacent to the Project corridor

Transects of bat activity will be taken across the same locations as the pre-construction transects in order to identify any displacement effects caused by disturbance impacts during construction and operation. Whilst the application of the Berthinussen & Altringham (2015) methodology is not without its limitations as it has only been applied to open agricultural landscapes, it is nevertheless a foundation for a reproducible survey method that is appropriate to the Project.

If a displacement effect is detected (decreased abundance and diversity close to the Assessment Boundary) then further focused surveys will be required to determine the causes and address them where possible (for example, controlling lighting, addressing local landscape changes through additional planting).

Any changes that may be deemed necessary will need to be coordinated and communicated to ensure that they do not conflict with any of the impact predictions or mitigation measures prescribed in this report. It is proposed that monitoring takes place during construction and 10 bat activity seasons following completion of the construction of the Project.

8.6.5.3 Badger

Badger, and their breeding and resting places, are protected under the Wildlife Acts and it is an offence under that legislation to intentionally kill or injure a Badger or to wilfully interfere with or destroy their breeding or resting places (setts).

A comprehensive suite of mitigation measures have been incorporated into the Project to ensure that Badgers are not intentionally killed or injured and that any impacts to their breeding or resting places will not affect their conservation status, at any geographic scale, and will not give rise to any likely significant effects on the species.

The mitigation measures described below follow the recommendations set out in the *Guidelines for the Treatment of Badgers during the Construction of National Road Schemes* (National Roads Authority, 2006a). These guidelines set out the best practice approach in considering and mitigating impacts on Badgers during construction works.

Measures to Protect Badger during Construction

A detailed summary of the mitigation measures as they relate to each of the Badger setts within the ZoI of the Project is presented in Appendix A.8.26 and Table 8.44The non-interference zones (30m, 50m and 150m), as they relate to each of the Badger setts within the ZoI of the Project, are shown on Figures 8.38.1 to 8.38.15.

As the usage of setts by Badgers can change over time, a pre-construction check of the activity status of all setts will be required within 12 months of any constructions works commencing within the ZoI of the setts discussed below.

Disturbance/displacement

In order to prevent any disturbance to Badger setts not directly affected by the Project, no heavy machinery shall be used within 30m of Badger setts at any time. No works shall be undertaken within 50m of active setts during the breeding season. Lighter machinery (generally wheeled vehicles) shall not be used within 20m of a sett entrance. Neither blasting nor pile driving shall be undertaken within 150m of active setts during the breeding season (December to June inclusive).

Prior to works commencing, a non-interference zone of 30m will be established around each of the Badger setts within the ZoI of the Project, as shown on Figures 8.38.1 to 8.38.15. If the sett is active, a non-interference zone will be extended to 50m during the breeding season (December to June inclusive). The fencing shall be as noted in Chapter 7, Construction Activities and of a sufficient durability to maintain the exclusion zone throughout the construction period or, if required, until such time as the sett in question is excluded/removed.

The mitigation measures, as they relate to each of the Badger setts within the ZoI of the Project, are summarised in Table 8.44and illustrated on Figures 8.38.1 to 8.38.15.

Badger passage facilities will be checked prior to the operation of the Project to ensure they are constructed in accordance with the *Guidelines for the Treatment of Badgers during the Construction of National Road Schemes* (National Roads Authority, 2006).

Loss of breeding/resting sites

Where setts require exclusion and removal, or temporary exclusion for the duration of the construction period, this will be undertaken in accordance with the methodology detailed in the *Guidelines for the Treatment of Badgers during the Construction of National Road Schemes* (National Roads Authority, 2006a):

- All Badger setts requiring exclusion and removal will require a monitoring period of at least five days to confirm activity status in advance of any construction works commencing
- If the sett is active, then it shall not be removed within the Badger breeding season (December to June inclusive). To exclude or remove an active Badger sett outside of this period, inactive entrances shall be soft and hard-blocked with one-way gates installed on active entrances. One-way gates will be tied open for three days before being set to exclude, and then monitored for a period of at least 21 days before the sett is deemed inactive and destroyed. If at any time during the monitoring period the sett becomes active, the exclusion process/programme must commence again from day 1 of the 21-day monitoring period
- For inactive setts, entrances will be soft-blocked (lightly blocked with vegetation and soil) and if all entrances remain undisturbed for a period of five days the sett should be destroyed immediately. This can be undertaken at any time of the year for inactive setts

An artificial sett is required to mitigate for the loss of the main sett (S9), in conjunction with a subsidiary sett (S11), of the Lackagh Badger group. The requirements relating to the provision and design of the artificial sett are set out in Appendix A.8.26. The location of the artificial sett is shown on Figures 8.38.1 to 8.38.15[152].

Inaccessible areas (see Figures 8.5.1 to 8.5.15) will require a pre-works survey for badger setts in advance of site clearance. If a sett is uncovered, works must cease and a non-interference zone of 30m established; extended to 50m during the breeding season if set is active (December to June inclusive). Sett removal will follow the process outlined above.

Measures to Protect Badger during Operation

Habitat Severance/Barrier Effect and Mortality Risk

Badgers typically follow the same pathways between setts, feeding areas and latrines. To avoid badger road casualties, mammal passage facilities will be provided at strategic locations across the Project. Mammal underpasses will be constructed in accordance with the *Guidelines for the Treatment of Badgers during the Construction of National Road Schemes* (National Roads Authority, 2006). Mammal underpasses which are at least 600mm in width, have adequate drainage, have good vegetation cover around the entrances and good habitat connectivity have been proven to be used by badgers (Eldridge & Wynn, 2011)[153]. Mammal underpasses will extend as far as, and integrate with, the mammal resistant fencing.

Where engineering constraints conflict with the recommended locations at construction, mammal underpasses may be moved to the nearest most suitable location, but not more than c.250 m away. The locations where Badger passage facilities will be provided are listed below in Table 8.43 and are shown on Figures 8.38.1 to 8.38.15.

A number of the mammal passage structures lie within the modelled light spill zone and artificial lighting may affect their usage by Badger: structures C07/04, C07/01(b) and C12/01. Screening will be provided to ensure that the approaches and entrances to these structures are unaffected by light spill.

Table 8.43 Mammal Passage Facilities[154]

Ref. No.	Structure	Species and Description	Drawing Reference
C00/00	Pipe	Badger Dedicated 600mm concrete pipe will provide for mammal passage beneath the proposed N6 GCRR	TII Publications CC-SCD-02504 & CC-SCD-02505
C00/01	Culvert	Bats, Otter, Badger A 2.5m wide by 1.35m high culvert will provide for bat passage beneath the proposed N6 GCRR. Raised mammal ledge, sited above flood water levels, incorporated into structure will provide for Otter and Badger passage beneath the proposed N6 GCRR	Appendix A.5.2 - GCOB-1700-D-GEN-011

[152] The closer an artificial sett is to the main sett being removed, the more likely it is to be used by the affected Badger group. Therefore, the artificial sett is proposed to be located *c*.60m to the north of S9. As the sett must be in place several months before works commence and the sett S9 is removed, the affected Badgers will have sufficient time to either adjust to the construction works in the vicinity of the artificial sett (which will involve blasting and rock breaking), relocate to another sett (e.g. S10), or construct a new sett elsewhere within their territory. Any disturbance from the construction works will be short-term and, even if the artificial sett is vacated during construction, its proximity to the operational road is not likely to deter badgers from occupying the sett at that time.

[153] Eldridge, B. & Wynn, J. (2011) Use of badger tunnels by mammals on Highways Agency schemes in England. *Conservation Evidence 8*. Pages 53-57

[154] Some of these are also included in Table 8.42 Table 8.42 Schedule of Structures Designed to serve for Bat Passage as part of the bat mitigation strategy but will also provide passage for many other mammal species

Ref. No.	Structure	Species and Description	Drawing Reference
C02/01a	Culvert	Otter and Badger A 2.1m wide by 1.8m high culvert with raised mammal ledge, sited above flood water levels, incorporated into structure will provide for Otter and Badger passage beneath the proposed N6 GCRR.	Appendix A.5.2 - GCOB-1700-D-GEN-011
C02/01b	Culvert	Bats and Otter A 2.5m wide by 2.5m high culvert will provide for bat passage beneath the proposed N6 GCRR. Raised mammal ledge, sited above flood water levels, incorporated into structure will provide for Otter and Badger passage beneath the proposed N6 GCRR	Appendix A.5.2 - GCOB-1700-D-GEN-011
C03/01	Culvert	Bats and Otter A 2.5m wide by 1.2m high culvert will provide for bat passage beneath the proposed N6 GCRR. Raised mammal ledge, sited above flood water levels, incorporated into structure will provide for Otter and Badger passage beneath the proposed N6 GCRR	Appendix A.5.2 - GCOB-1700-D-GEN-011
C03/03	Culvert	Bats and Otter A 2.5m wide by 1.2m high culvert will provide for bat passage beneath the proposed N6 GCRR. Raised mammal ledge, sited above flood water levels, incorporated into structure will provide for Otter and Badger passage beneath the proposed N6 GCRR	Appendix A.5.2 - GCOB-1700-D-GEN-011
C03/04	Culvert	Bats and Otter A 2.5m wide by 1.2m high culvert will provide for bat passage beneath the proposed N6 GCRR. Raised mammal ledge, sited above flood water levels, incorporated into structure will provide for Otter and Badger passage beneath the proposed N6 GCRR	Appendix A.5.2 - GCOB-1700-D-GEN-011
C04/01	Culvert	Otter, Badger and Bats Raised mammal ledge, sited above flood water levels, incorporated into structure will provide for Otter and Badger passage A 5m wide by 2.5m high culvert will provide for bat passage beneath the proposed N6 GCRR	Appendix A.5.2 - GCOB-1700-D-GEN-011
C04/02	Culvert	Otter, Badger and Bats Raised mammal ledge, sited above flood water levels, incorporated into structure will provide for Otter and Badger passage A 3.1m wide by 2.5m high culvert will provide for bat passage beneath the proposed N6 GCRR	Appendix A.5.2 - GCOB-1700-D-GEN-011
C05/01	Pipe	Badger Dedicated 600mm concrete pipe will provide for mammal passage beneath the proposed N6 GCRR	TII Publications CC-SCD-02504 & CC-SCD-02505

Ref. No.	Structure	Species and Description	Drawing Reference
S06/01	Road Underbridge	Bats The unlit road underbridge will provide for bat passage across the proposed N6 GCRR	Appendix A.5.2 - GCOB-1700-D-GEN-001
C06/00	Culvert	Bats and Otter A 2.5m wide by 2.5m high culvert will provide for bat passage beneath the proposed N6 GCRR. Raised mammal ledge, sited above flood water levels, incorporated into structure will provide for Otter and Badger passage beneath the proposed N6 GCRR	Appendix A.5.2 - GCOB-1700-D-GEN-011
C06/01	Culvert	Badger, Bats and Otter A 2.5m wide by 2.5m high culvert will provide for bat and badger passage beneath the proposed N6 GCRR. Raised mammal ledge, sited above flood water levels, incorporated into structure will provide for Otter and Badger passage beneath the proposed N6 GCRR	Appendix A.5.2 - GCOB-1700-D-GEN-011
C07/00	Culvert	Bats and Otter A 2.5m wide by 2m high culvert will provide for bat passage beneath the proposed N6 GCRR. Raised mammal ledge, sited above flood water levels, incorporated into structure will provide for Otter and Badger passage beneath the proposed N6 GCRR	Appendix A.5.2 - GCOB-1700-D-GEN-011
C07/02A	Culvert	Bats and Otter A 2.5m wide by 2.5m high culvert will provide for bat passage beneath the proposed N6 GCRR. Raised mammal ledge, sited above flood water levels, incorporated into structure will provide for Otter and Badger passage beneath the proposed N6 GCRR	Appendix A.5.2 - GCOB-1700-D-GEN-011
C07/04	Pipe	Badger Dedicated 600mm concrete pipe will provide for mammal passage beneath the proposed N6 GCRR	TII Publications CC-SCD- 02504 & CC-SCD-02505
C08/01(a)	Culvert	Bats and Badger A 2.5m wide by 2.5m high culvert will provide for bat and badger passage beneath the proposed N6 GCRR.	Appendix A.5.2 - GCOB-1700-D-GEN-011
C08/02	Culvert	Bats and Badger A 2.5m wide by 2.5m high culvert will provide for bat and Badger passage beneath the proposed N6 GCRR.	Appendix A.5.2 - GCOB-1700-D-GEN-011
C08/04	Culvert	Bats and Badger A 2.5m wide by 2.5m high culvert will provide for bat and badger passage beneath the proposed N6 GCRR	Appendix A.5. 2 - GCOB-1700-D-GEN-011
C08/05	Culvert	Bats and Badger A 2.5m wide by 2.5m high culvert will provide for bat and badger passage beneath the proposed N6 GCRR	Appendix A.5.2 - GCOB-1700-D-GEN-011

Ref. No.	Structure	Species and Description	Drawing Reference
C09/01	Culvert	Bats and Badgers A 5m wide by 4m high culvert will provide for bat and badger passage beneath the proposed N6 GCRR	Appendix A.5.2 - GCOBD-ST-C09-1-001 to GCOB-DST-C09-1-002
C09/02	Culvert	Bats and Badgers A 5m wide by 4m high culvert will provide for bat and badger passage beneath the proposed N6 GCRR	Appendix A.5.2 -GCOBD-ST-C09-1-001 to GCOB-DST-C09-1-002
C09/03	Culvert	Bats and Badgers A 5m wide by 4m high culvert will provide for bat and badger passage beneath the proposed N6 GCRR	Appendix A.5.2 -GCOBD-ST-C09-1-001 to GCOB-DST-C09-1-002
C09/04	Culvert	Bats and Badgers A 5m wide by 4m high culvert will provide for bat and badger passage beneath the proposed N6 GCRR	Appendix A.5.2 -GCOBD-ST-C09-1-001 to GCOB-DST-C09-1-002
C09/05	Culvert	Bats and Badgers A 5m wide by 4m high culvert will provide for bat and badger passage beneath the proposed N6 GCRR	Appendix A.5.2 - GCOB- D-ST-C09-1-001 to GCOB-DST-C09-1-002
S09/01	Road Underbridge	Bats and Badgers The road underbridge (10m wide by 5.3m high) will provide for bat and badger passage beneath the proposed N6 GCRR	Appendix A.5.2 - GCOB-1700-D-GEN-001
C09/06	Culvert	Bats and badgers A 2.5m wide by 2.5m high culvert will provide for bat and badgers passage beneath the proposed N6 GCRR	Appendix A.5.2 -GCOB-1700-D-GEN-011
C09/07	Culvert	Bats and Badgers A 2.5m wide by 2.5m high culvert will provide for bat and badgers passage beneath the proposed N6 GCRR	Appendix A.5.2 - GCOB-1700-D-GEN-011
C10/01	Underpass	Bats and Badgers A 18m wide by 2.35m high underpass will provide for bat and badger passage beneath the proposed N6 GCRR	Appendix A.5.2 - GCOB-1700-D-GEN-011
S10/02	Road Underbridge	Bats The road underbridge (9.8m wide by 5.3m high) will provide for bat passage beneath the proposed N6 GCRR	Appendix A.5.2 - GCOB-1700-D-C10-01-001
C10/02a	Pipe	Bats and Badger Dedicated 1200mm concrete pipe will provide for mammal passage beneath the proposed N6 GCRR	TII Publications CC-SCD-02504 & CC-SCD-02505
C12/01	Pipe	Badger Dedicated 600mm concrete pipe will provide for mammal passage beneath the proposed N6 GCRR	TII Publications CC-SCD-02504 & CC-SCD-02505

Ref. No.	Structure	Species and Description	Drawing Reference
C12/02	Culvert	Bats and badger A 2.5m wide by 2.5m high culvert will provide for bat and badger passage beneath the proposed N6 GCRR	Appendix A.5.2 - GCOB-1700-D-GEN-011
C12/03	Culvert	Bats and badger A 2.5m wide by 2.5m high culvert will provide for bat and badger passage beneath the proposed N6 GCRR	Appendix A.5.2 - GCOB-1700-D-GEN-011
C12/04	Culvert	Bats and badger A 2.5m wide by 2.5m high culvert will provide for bat and badger passage beneath the proposed N6 GCRR	Appendix A.5.2 - GCOB-1700-D-GEN-011
S12/02	Green bridge	Bats and Badgers The Green Bridge (30m in width) will provide for bat and mammal passage over the proposed N6 GCRR	Appendix A.5.2 - GCOB-1700-D-S12-02-001
C13/01	Culvert	Bats and Badger A 2.5m wide by 1.5m high culvert will provide for bat and badger passage beneath the proposed N6 GCRR	Appendix A.5.2 - GCOB-1700-D-GEN-011

Mammal-resistant fencing will be required to guide badgers to the underpasses and will be installed in accordance with the specification outlined in *Guidelines for the Treatment of Badgers prior to the Construction of National Road Schemes*, and TIIs mammal resistant fencing specification (currently CC-SCD-00320/00319), and will include badger proofing of emergency access roads and other similar access points, where located in areas where mammal-resistant fencing is to be installed. The locations where mammal-resistant fencing is to be installed are shown on Figures 8.38.1 to 8.38.15. This includes mammal proofing the paladin security fencing proposed around all attenuation ponds/water ponds.

In accordance with the recommendations described in the *Guidelines for the Treatment of Badgers during the Construction of National Road Schemes* (National Roads Authority, 2006), quarterly monitoring of the effectiveness of the mitigation measures will be undertaken in the first three years after the completion of construction works (for example, fencing inspections to check for gaps and underpass inspection to check for blockages, checking the effectiveness of the ledges installed in culverts). Also, given the scale of the project, monitoring will continue for at least three years and the maintenance of the ledges will be incorporated into the general road maintenance programme.

8.6.5.4 Other Mammal Species

Measures to Protect Other Mammal Species during Construction

Habitat degradation - water quality

The mitigation measures relating to the protection of water quality in receiving watercourses during construction are outlined in Section 8.6.3.4 and detailed in Section 11.6.2 of Chapter 11, Hydrology.

Measures to Protect Other Mammal Species during Operation

The schedule of structures to provide for mammal passage, as per Table 8.43and as shown on Figures 8.38.1 to 8.38.15, are required to ensure permeability for all other mammal species across the Project during operation.

Habitat Severance/Barrier Effect

The combination of the network of dedicated mammal passage facilities, along with the bridge and viaduct structures (the proposed River Corrib Bridge and the Menlough Viaduct), and the retained lands above the proposed Lackagh Tunnel and the Galway Racecourse Tunnel provide a high degree of landscape permeability along the route of the Project for all of the other mammal species recorded, or likely to be present, within the study area. As such, the dense network of mammal passage facilities along the entire length of the Project will ensure that landscape permeability is maintained to the highest degree possible, minimising any residual fragmentation and barrier effects. The locations are described above in Table 8.43and are shown on Figures 8.38.1 to 8.38.15.

Wildlife passage facilities have been shown to be used by small mammal species such as Hedgehog, Pygmy shrew and Wood mouse (Dolan 2006; Eldridge & Wynn 2011); although their effectiveness has not been tested. However, it is likely that the high permeability of the Project will reduce the effects of any severance or barrier effect that may be associated with the Project (Haigh, 2012) such that the species' conservation status would not be affected. Therefore, habitat severance and barrier effect are not likely to result in a significant negative residual effect, at any geographic scale.

Collision Risk

There are no practical or effective means of preventing small mammals or arboreal mammal species (such as the Pine marten and Red squirrel, which are highly skilled climbers) from accessing the Project. As discussed above in relation to severance and barrier effect, the design of the Project provides for a high degree of permeability across the Project and this offers the most practical solution to minimise the potential interaction of small mammals with the Project. Collision risk is therefore, not likely to affect the species' conservation status and not likely to result in a significant negative residual effect, at any geographic scale.

However, within the ABP's Inspector's Report dated 22 June 2021, this conclusion is not agreed with and the following is provided:

"The road design includes some locations where safe passage could be achieved, the River Corrib (red squirrel, pine marten, badger and otter), the Menlough Viaduct (red squirrel, pine marten and badger) and over the Lackagh Tunnel (pine marten and badger) and further crossing points are proposed in mitigation or in conjunction with culverts for watercourses. However, this is obviously very different from the situation without the proposed road. Direct mortality or avoidance of the area could suppress populations in proximity to the road, while isolated populations of Irish hare, red squirrel and pine marten to the south of the road of are at increased risk of dying out. The road design includes mammal resistant fencing which will prevent or reduce mortality for some species (e.g. badger, Irish hare) but may have limited effectiveness for others which can easily scale the fence (e.g. fox, pine marten)".

A conclusion on the level of significance of the potential impacts on Red squirrel and Pine marten is not included, however in Table 13 of Appendix 4 of ABP's Inspector's Report dated 22 June 2021, significant impacts are predicted, and the following text on the residual impacts on these species is also provided:

"Significant residual effect on lesser horseshoe bat, red squirrel and pine marten which will not be avoided, fully mitigated, or otherwise addressed by means of condition".

8.6.6 Invertebrates

8.6.6.1 Swan mussel

Habitat Degradation – Surface Water Quality

The mitigation measures relating to the protection of water quality in receiving watercourses during construction are outlined in Section 8.6.3.4 and detailed in Section 11.6.2 of Chapter 11, Hydrology.

8.6.6.2 Marsh whorl snail

Measures to Protect the Marsh whorl snail during Construction

Habitat Degradation – Surface Water Quality

The mitigation measures relating to the protection of water quality in receiving watercourses during construction are outlined in Section 8.6.3.4 and detailed in Section 11.6.2 of Chapter 11, Hydrology.

Habitat Degradation – Groundwater

The mitigation measures relating to the protection of the groundwater regime during construction are described in Section 10.6.2 of Chapter 10, Hydrogeology.

Measures to Protect the Marsh whorl snail during Operation

Habitat Degradation – Groundwater

The mitigation measures relating to the protection of the groundwater regime during operation are described in Section 10.6.3 of Chapter 10, Hydrogeology.

8.6.6.3 Marsh fritillary butterfly

Measures to Protect the Marsh fritillary butterfly during Construction

Mortality Risk

To avoid the destruction of Marsh fritillary eggs or the mortality of Marsh fritillary caterpillars, the following mitigation strategy will be implemented in relation to the site clearance works:

- All areas within the Assessment Boundary, which have been identified as suitable habitat to support the Marsh fritillary butterfly, will be subject to a pre-construction larval web survey. This will be undertaken during the mid-August to the end of September window immediately preceding site clearance works
- If larval webs are present, they will be translocated to another area of suitable habitat; either outside of the Assessment Boundary or, if within, to an area of suitable habitat that will remain unaffected by construction works for the duration. Sufficient suitable Marsh fritillary butterfly habitat exists locally that is in a good or optimal condition for a period long enough to allow translocated larval webs to complete their life-cycle. This is based on the following evidence:
  - A translocation site should be suitable and of a good, or ideally optimal, condition for a single season following any translocation event
  - The extent of suitable Marsh fritillary habitat present locally means that a translocation site in favourable management will be available to accept any larval webs that need to be relocated during construction for at least one season
  - A number of core sites (notably at Lough Inch, Cappagh, and Tonabrocky) either occur on relatively stable peatland blocks or in areas designated for nature conservation and will remain in a suitable condition for the translocation of larval webs over the long term. Apart from these core areas, an extensive network of suitable habitat areas occur within the Scheme Study Area, many of which have a habitat quality that remains stable, according to surveys. Finally, there is likely to be suitable Marsh fritillary habitat associated with the margins of the numerous and extensive peatland habitat blocks that extend to the north and northwest from the study area. The evidence therefore supports the view that sufficient suitable Marsh fritillary butterfly habitat occurs locally, and in the wider area beyond the study area for the Project, such that it is certain that a suitable translocation site can be identified and utilised at the time construction commences to ensure that the mitigation strategy can be delivered and will be successful.
- If larval webs are present, the larval webs will be moved by translocating vegetation turves which contain the host plant species (*Succisa pratensis*) with larval webs present

- The vegetation turves will be moved to the receptor site(s) immediately following excavation to ensure they do not dry out. The translocated turves will be set into existing vegetation immediately adjacent to the area of *Molinia* meadow and/or Wet heath habitat being retained (locations described below) and will be fenced off to prevent any accidental damage from construction works. Care will be taken to ensure that any specimens of *Succisa pratensis* with larval webs present will be at the centre of the turves. Turves will be fully bedded in at the receptor site(s) to ensure there are no exposed edges vulnerable to drying out

- Four locations within the Assessment Boundary that are suitable receptor sites for the translocated turves containing the marsh fritillary butterfly larvae

  – The first location is between Ch. 0+300 and Ch. 0+350 of the proposed N6 GCRR, an area of Annex I Dry heath [4030] habitat that is being retained within the Assessment Boundary (Figure 8.22.1). The second is at Ch. 0+900 of the proposed N6 GCRR, an area of wet grassland (GS4)/Annex I *Molinia* meadow [6410] habitat that is being retained within the Assessment Boundary (Figure 8.22.1). The third location is at is at Ch. 3+000 of the proposed N6 GCRR, a mosaic of Annex I Wet heath [4010], wet grassland (GS4) and Annex I Dry heath [4030] habitat that is being retained within the Assessment Boundary (Figure 8.22.3). The fourth location is between Ch. 12+20 and Ch. 12+400 of the proposed N6 GCRR, an area of wet grassland (GS4)/Annex I Molinia Meadows [6410] habitat that is being retained within the Assessment Boundary (Figure 8.22.9).

- Once all larval webs have been removed from the affected areas, or if no larval webs were recorded, the vegetation will be immediately cleared or cut to ground level to render the area unsuitable for the species to recolonise. The vegetation shall be maintained in this state until such time as the topsoil is removed.

8.6.7 Birds

8.6.7.1 Breeding Birds

Measures to Protect Breeding Birds during Construction

Habitat Loss, Disturbance and Destruction of Breeding Habitat

General

Where feasible, vegetation (e.g. hedgerows, trees, scrub and grassland) will not be removed, between the 1 March and the 31 August, to avoid direct impacts on nesting birds. Where the construction programme does not allow this seasonal restriction to be observed, then these areas will be inspected by a suitably qualified ecologist for the presence of breeding birds prior to clearance. Areas found not to contain nests will be cleared within 3 days of the nest survey, otherwise repeat surveys will be required.

Barn owl

The mitigation measures to reduce the negative impacts of roads on Barn owls are set out in the '*Survey and Mitigation Standards for Barn owls to inform the Planning, Construction and Operation of National Road Projects*' (TII, 2021). The mitigation measures are designed to:

- Reduce the direct effects, disturbance and displacement of breeding Barn owls during the construction phase of National Road Projects

- Reduce incidents of mortality of Barn owls during the operational phase of National Road Projects

To minimise the potential for construction works to affect the nest site at Menlo Castle, all works which have the potential to cause disturbance will be undertaken outside of the Barn owl breeding season (i.e. when there is no breeding activity at the nest site). The Barn owl breeding season is typically from February to July, but can extend into October/November.

Shawyer (2011) recommends a protective buffer zone of 150 – 175m for construction activity involving commercial vehicles and heavy machinery. Based on the specifics of the nature, scale and proximity of the Project to the nest site, the disturbance free zone (i.e. exclusion buffer) will be a minimum of 150m from the nest site during the Barn owl breeding season. Construction works can be carried out outside of this zone at

any time of the year as this will not constitute a disturbance to the breeding pair or nest site. Construction works must only be carried out in proximity to the nest (i.e. within the defined disturbance free zone) when it is confirmed that there is no breeding activity at the nest, which is typically during the months of September to February. However, the breeding status at this site must be assessed by a Barn owl specialist in advance of the commencement of works (within the defined disturbance free zone) to determine breeding activity at the time as Barn owls can breed at any time of the year.

If any potentially suitable Barn owl sites are to be directly affected or lie within 175m of the Project by the construction of the Project (including enabling or site investigation works such as ground investigations), a Pre-Construction survey will be undertaken according to the methods as outlined in the *Survey and Mitigation Standards for Barn owls to inform the Planning, Construction and Operation of National Road Projects* (TII, 2021).

The purpose of the pre-construction survey is to determine Barn owl occupancy and breeding status at a site in advance of the initiation of works, where the construction activities could cause disturbance to a breeding pair, if present. The timing of works will be planned to avoid the main nesting period of Barn owls so that the potential of breeding activity at these sites is considered low. A single visit, according to best practice methods is usually sufficient to determine breeding status. The Pre-Construction survey must be carried out in advance of but in the same year (and timed accordingly to determine breeding activity at a particular time in that year). If breeding activity is recorded, then works which would cause disturbance or negatively impact a site or breeding attempt must not be carried out until after the breeding season (which should be assessed by the Barn owl Specialist). If no breeding activity is recorded, then works can proceed. Barn owls can use sites (particularly buildings) throughout the year and may be present outside of the breeding season, however, if it is confirmed that there is no breeding activity then works can continue.

To further minimise the effects of current levels of disturbance to the Barn owl nest site at Menlo Castle, and thereby reduce any cumulative effect that construction activities nearby may have, alternative nesting sites will be provided in the vicinity. Three Barn owl nest boxes will be erected across the area shown on Figure 8.38.7, at least 500m from the road edge, and will consist of either nest boxes erected on suitable trees or pole-mounted nest boxes. Preference will be given to erecting nest boxes on suitable trees, where possible.

Tree mounted boxes will be erected at least 3m above ground level on a mature tree with few or no low branches to obscure the nest box. The selected tree shall be either isolated in a hedgerow or situated on a woodland edge with the access hole facing open ground.

Pole-mounted nest boxes will be erected at a minimum height of 4.5m above ground.

The nest box design (e.g. entrance hole size, floor area and depth from the bottom of the entrance hole to the nest) shall be in accordance with the design requirements published by The Barn owl Trust (http://www.barnowltrust.org.uk/). Nest boxes will be inspected annually for defects/damage and cleaned out/repaired as required to ensure waterproofness and the internal box depth.

Peregrine falcon

Both of the former Peregrine falcon nest sites in the northeast corner of Lackagh Quarry will be retained. The precise locations have not been divulged in the updated EIAR due to the risk of persecution to the species. Galway County Council and/or BirdWatch Ireland will need to be consulted to ascertain their precise locations to ensure their retention and protection from works.

To minimise the potential for construction works near Lackagh Quarry to disturb the Peregrine falcon nest site, works from the Lackagh Tunnel to the N84 Headford Road Junction will commence prior to mid-February. This will ensure that any construction related disturbance, if its magnitude displaces Peregrine from the quarry for the duration of construction works, can influence the selection of the nest site and will not impact upon an incubating female on the nest. Rock-bolts will not be installed in the immediate vicinity of an active peregrine falcon nest site during the breeding bird season (1 March to 31 August).

An alternative nest site for Peregrine falcon will be provided on Galway City Council owned lands to the southeast of Lackagh Quarry as indicated on Figure 8.38.8. This artificial nest site will be in place prior to the commencement of works which have the potential to disturb or displace breeding Peregrine falcon in Lackagh Quarry. The alternative nest site will be provided in accordance with the design requirements set out in the report prepared by BirdWatch Ireland (Appendix A.8.16 - Part 4).

An artificial peregrine falcon nest box will be installed at each of the two former nest sites in Lackagh Quarry. Remediation works will be carried out at the two ledges to create a level and stable substrate for the nest boxes. The artificial nest boxes will be securely anchored to the cliff face at each location and will be provided in accordance with the design requirements set out in the report prepared by BirdWatch Ireland. The objective of the mitigation is to ensure that Peregrines, if displaced from the previously used nesting ledges in the quarry, can remain and breed in the area. Although it is not possible to guarantee uptake of the artificial nest site, the provision of this site will increase the likelihood of the continued occupation of breeding Peregrine in Lackagh Quarry and its surrounds which would mitigate the significant negative residual effect on Peregrine at the local and county geographic scale.

The combination of providing an alternative nest site in advance of construction works commencing, in conjunction with construction works in Lackagh Quarry commencing in advance of the breeding season, as well as not temporarily making existing nesting ledges unavailable for nesting Peregrine for the duration of construction, will allow the Peregrine falcon a choice of nest sites during the construction period. This strategy will maximise the opportunities for the local breeding pair of Peregrine falcon to retain occupancy of their breeding territory throughout the duration of the construction period.

Monitoring of Peregrine falcon breeding activity at both Lackagh Quarry and the proposed alternative nest site will be undertaken throughout each breeding season over the entire construction period to ascertain any nest success/failure of the local breeding pair and if blasting is affecting numbers of common Peregrine falcon prey species. Use of the artificial nest sites will also be monitored during operation of the Project for a period of three years.

Measures to Protect Breeding Birds during Operation

Habitat loss, Habitat Severance/Barrier Effect and Mortality Risk

General

Planting of woodland, hedgerow and grassland habitats along the Project as detailed in the landscape drawings (Figures 12.1.01 to 12.1.15) will provide compensatory habitat for some bird species. In some instances, such as in large areas of improved agricultural grassland with no vegetated field boundaries, this will improve the diversity of bird habitat.

Many species may not nest near a road development due to disturbance (e.g. drowning out of bird song by traffic noise). Whilst the planting is not likely to fully offset the loss of breeding habitat (due to the proximity of road traffic disturbance on the operational road) it is likely to provide additional foraging habitat for some species.

To further minimise the effects of breeding habitat loss, a total of 20 nest boxes will be erected by a qualified ecologist in suitable locations away from the busy junctions/roadways. The siting and type of nest boxes will be decided on by an ecologist at locations where trees will be planted or retained along the Project; as shown on Figures 12.1.01 to 12..15.

Nest boxes will be monitored annually by an ecologist, and the results reported to Galway County Council, to record their usage by breeding birds for a period of three years post-construction.

Barn owl

Barn owl mitigation measures will be integrated into the landscape design in proximity to, and within a 5km zone surrounding, the breeding site at Menlo Castle, where these measures do not conflict with other landscape and safety requirements and other environmental considerations of the road design. The proposed planting plan for mitigating effects on Barn owl habitat has increased since the 2018 EIAR. This is due to updated guidance published in 2021 (Lusby *et al.*, 2021) and from consultation with John Lusby for this updated.

The immediate roadside verge will be created or maintained as unsuitable foraging conditions to discourage Barn owls from hunting in this area to reduce risk of direct vehicle collision and/or birds becoming caught in the wake of a Heavy Commercial Vehicle (HCV). Within 3m of the road edge immediately adjacent to the hard shoulder/carriageway (in the absence of a hard shoulder), the grass will be maintained to a height not exceeding 10cm or replaced with gravel if appropriate (noting that gravel would generally be considered

inappropriate unless there are issues for access for maintenance, or aesthetic considerations at feature areas, such as roundabouts or entrances to towns).

If possible and suitable to the existing surrounding landscape, a natural barrier of dense shrub and/or tree line will be provided in the wider verge adjacent to the immediate roadside verge to serve as buffer to:

I. Focus the foraging activities of birds further from the road

II. Reduce the wake effect of HGVs

III. Deflect the flight path of Barn owls which are crossing the road above the height of vehicles. Where the width of the verge and other landscape treatment requirements allow, suitable foraging habitat for Barn owl in the form of semi-natural grassland can be provided which is segregated from the traffic by shrub and tree lines

Sections along the Project will be planted with dense low growing scrub cover (e.g. blackthorn) to discourage Barn owls from foraging near the Project. The planting will be of a density to minimise the lag time between planting and obtaining sufficient ground cover to deter foraging Barn owl.

In areas where there is a high probability that Barn owls may regularly attempt to cross the Project (the section of embankment between Ch. 9+600 and Ch. 10+100 of the proposed N6 GCRR lines of closely spaced (c.2m centres) trees, greater than 4m in height, will be planted along the top of the embankments of the Project; outside of the safety barrier and clear zone. The understorey will also be densely planted. This is to present a solid vegetated barrier to deflect Barn owl from these high-risk areas and/or force birds to fly over the Project above the road traffic. In other locations along the Project, where there are areas of suitable barn owl habitat being created or retained, a 2m wide belt of shrubs and trees that will reach a minimum of 4m in height will also be planted to discourage Barn owl from accessing the road carriageway.

This mitigation planting should be varied in composition appropriate to the landscape adjacent and may consist of a mix of fast growing species such as Alder (*Alnus glutinosa*), Silver Birch (*Betula pendula*), Whitebeam (*Sorbus aria*), Mountain Ash (*Sorbus aucuparia*), Hazel (*Corylus avellana*) and Willow species (*Salix aurita, Salix caprea, Salix cinerea*) and understorey species such as Bramble (*Rubus* spp. - 60% of understorey mix), Hawthorn (*Crataegus monogyna*), Holly (*Ilex aquifolium*) and Blackthorn (*Prunus spinosa*). It should be noted that this belt of shrub and trees proposed is within the 'Clear Zone' defined by TII technical guidance (*GE-ENV-01102 A Guide to Landscape Treatments for National Road Schemes in Ireland*). For new plantings or existing trees within the Clear Zone, the maximum allowable diameter shall not exceed 100mm or a girth of 314mm (when measured at 0.3m above the ground). For new plantings, the design shall consider the mature size of the tree. The grouping of trees with trunk diameters ≤ 100mm and/or girths ≤ 314mm together may constitute a hazard due to the cumulative impact of the trees on an errant vehicle for a spacing of less than 1500mm. Thus, to achieve the desired mitigation for Barn owls, the trees should be planted as multi-stem or bush forms in these locations, as they will reach the required height, but will not breach the 314mm girth limit (when measured at 0.3m above the ground). Such trees should be planted at 3.5-4m height from the outset, in order to ensure that the required protection is in place at the earliest possible stage.

In areas of cut, the belt of shrubs and trees will be extended up the sides of the cut slopes so that the Barn owl's flight path is diverted to the required extent.

All mitigatory planting will be in place at the earliest feasible stage during construction to ensure that the mitigation is functioning as soon as possible, following the opening of the Project.

The locations where planting will be used to reduce the risk of Barn owl mortality from road traffic are shown on Figures 8.38.3 to 8.39.15 and on the landscape drawings (Figures 12.1.01 to 12.1.15).

To establish and maintain rough grassland habitat for barn owl, lands covering an area of *c.*8.9 ha to the northwest of the Project at Menlo Castle (see Figure 8.38.7) will be grazed annually by cattle for a three-month period between July and October at a stocking rate of 0.35 livestock units/ha. The strategy, and prescribed stocking density, follows that used by the Barn Owl Conservation Trust at their Nature Reserve in the UK, as detailed in the *Barn Owl Conservation Handbook* (Barn Owl Trust, 2012).

Annual monitoring of the grassland habitat will be undertaken for a period of 5 years post-implementation with the objective of recording the establishment of suitable rough grassland habitat and adjustment of the stocking density, if required.

Following implementation of all environmental commitments for Barn owls and completion of construction of the Project, the following monitoring measures are proposed:

- Surveys will be undertaken of roadside planting schemes at the end of years one and two with the objective of identifying and replacing failed plantings
- A road casualty survey to record barn owl mortalities along the route of the Project will be conducted following that approach set out in REENV-07004 *The interactions between Barn owls and major roads: informing management and mitigation* (Lusby *et al.*, 2021) for a period of two years post-opening
- Monitoring to determine activity and breeding status of all active sites within 5km of the Project over two breeding seasons (February to July). This will be carried out concurrently with the road casualty survey, and will involve visits to known and potential nesting sites to determine brood size and breeding success. Where accessible, nests will be visited in order to ring owlets (subject to an appropriate licence from the NPWS)

A report summarising the findings of the above monitoring will be submitted at the end of year two to the NPWS. The report may include further recommendations pending survey outcomes.

Peregrine

Monitoring of Peregrine falcon breeding activity at both Lackagh Quarry and the proposed alternative nest site will be undertaken throughout each breeding season over the entire construction period to ascertain any nest success/failure of the local breeding pair and if blasting is affecting numbers of common Peregrine falcon prey species. Use of the artificial nest sites will also be monitored during operation of the Project for a period of three years.

8.6.7.2 Wintering Birds

Measures to Protect Wintering Birds during Construction

Construction noise will be kept to a minimum in accordance with BS 5228 (2009).

The contract documents will specify that the Contractor, undertaking the construction of the works, will be obliged to take specific noise abatement measures and will comply with the best practice outlined in British Standard BS 5228 – 1: 2009 +A1 2014: *Code of practice for noise and vibration control on construction and open sites – Noise* and the NRA (now TII) guidelines *Good Practice Guideline for the Treatment of Noise during the planning of National Road Schemes* (National Roads Authority, 2014).

Blasting associated with the eastern approach to Lackagh Quarry (Ch. 11+800 to Ch. 12+100) will be carried out between the months of April to September (inclusive) to minimise the exposure of wintering birds at Ballindooley Lough to blasting-related disturbance.

Blasting associated with the cutting at Castlegar (Ch. 12+550 to Ch. 13+650 of the proposed N6 GCRR) will take approximately nine months to complete, with an estimated five blast events per week. To minimise the exposure of wintering birds at Ballindooley Lough to blasting-related disturbance, all of those nine months must be in the April to September period (inclusive) within consecutive years.

Measures to Protect Wintering Birds during Operation

Disturbance/Displacement

Disturbance during operation of the Project is not likely to result in any population level effects on wintering birds.

8.6.8 Amphibians

Measures to Protect Amphibians during Construction

Habitat Loss, Disturbance & Mortality Risk

If works to clear any of the habitat features suitable to support amphibian species are to begin during the season where frogspawn or tadpoles may be present (February – mid-summer), or where breeding adult newts, their eggs or larvae may be present (mid-March – September), a pre-construction survey will be undertaken to determine whether breeding amphibians are present.

In the case of Common frog, any frog spawn, tadpoles, juvenile or adult frogs present will be captured and removed from affected habitat by hand net and translocated to the nearest area of available suitable habitat, beyond the ZoI of the Project.

In the case of Smooth newt, individuals will be captured and removed from affected habitat either by hand net or by trapping and translocated to the nearest area of available suitable habitat, beyond the ZoI of the Project. If used, the type and design of traps shall be approved by the NPWS. This is a standard and proven method of catching and translocating Smooth newt.

If the size or depth of the habitat feature is such that it cannot be determined whether all amphibians have been captured, it will be drained under the supervision of a suitably experienced ecologist to confirm that no amphibian species remain before it is destroyed or infilled. Any mechanical pumps used to drain the habitat feature will have a screen fitted, and be sited, such that no amphibian species can be sucked into the pump mechanism.

Any capture and translocation works shall be undertaken immediately in advance of site clearance/construction works commencing.

Habitat Degradation – Surface Water Quality

The mitigation measures relating to the protection of water quality in receiving watercourses during construction are outlined in Section 8.6.3.4 and detailed in Section 11.6.2 of Chapter 11, Hydrology.

Measures to Protect Amphibians during Operation

Habitat Severance & Barrier Effect

The combination of the network of wildlife passage facilities, culverts, bridges and viaduct structures (e.g. the proposed River Corrib Bridge and the Menlough Viaduct) provide a high degree of landscape scale permeability along the Project. This will serve to maintain connectivity at a local scale between sites used by amphibian species and is predicted to reduce any long-term severance or barrier effects associated with the Project such that the conservation status of amphibian species is not likely to be negatively affected.

Where tunnels or culverts for mammal passage occur in close proximity to ponds or wetlands, structures, such as earth banks, will be included to guide amphibians to those crossing structures (as per ABP's Inspector's Report dated 22 June 2021).

The locations of the wildlife passage facilities are described above in Table 8.43 and are shown on Figures 8.38.1 to 8.38.15.

The schedule of structures to provide for mammal passage, as per Table 8.43 and as shown on Figures 8.38.1 to 8.38.15, are required to ensure permeability for amphibian species across the Project during operation.

8.6.9 Reptiles

Measures to Protect Reptiles during Construction

Habitat Loss, Disturbance & Mortality Risk

In order to minimise the risk of site clearance and construction works disturbing, or causing the mortality of, Common lizard the following schedule of site clearance works will be followed in the areas highlighted on Figures 8.14.1 to 8.14.8, where the presence of Common lizard has been confirmed:

- grass, scrub or heath vegetation will be removed during the winter period, where possible, avoiding potential Common lizard hibernacula sites (dry sites which provide frost-free conditions e.g. stone walls, underground small mammal burrows, piles of dead wood or rubble)
- where this is not possible and clearance will be undertaken during the active season (March through to September, inclusive), vegetation will be cut first to c.15cm, and then to the ground, under supervision of an ecologist. This will allow the opportunity for lizards to be displaced by the disturbance and leave the affected area
- stone walls (or other potential hibernacula sites) will be removed during the active season (March through to September, inclusive) under the supervision of an ecologist, when they are less likely to be in use by torpid lizards

Measures to Protect Reptiles during Operation

Habitat Severance & Barrier Effect

The guidance document *Wildlife and Traffic: A European Handbook for Identifying Conflicts and Designing Solutions* (Luell, B. *et al*, 2003) examines the barrier and fragmentation effects to wildlife associated with infrastructure projects (including roads) and presents design solutions to minimise those effects, based on the existing knowledge base and current published literature. This guidance document was used to inform the mitigation strategy for the Project.

Little is known about the use of mammal underpasses by Common lizard. However, the *Wildlife and Traffic: A European Handbook for Identifying Conflicts and Designing Solutions* (Luell, B. *et al*, 2003) publication notes that overpasses and viaduct structures are the optimal solutions for lizards with larger underpasses also an option where adapted to local conditions. The series of culverts across the western part of the Project (where Common lizard were recorded) are of a size that are likely to be used by Common lizard and will, therefore, maintain connectivity across the Project.

In the light of this information, it has been comprehensively demonstrated that the proposed wildlife passage facilities, culverts, bridges and viaduct structures are an effective mitigation measure to reduce or prevent isolation of populations of common lizard (Sainsbury *et al.,* 2021).

The combination of the network of wildlife passage facilities, culverts, bridges and viaduct structures (e.g. the proposed River Corrib Bridge and the Menlough Viaduct) provide a high degree of landscape scale permeability along the Project. This will serve to maintain connectivity at a local scale between sites used by reptile species and is predicted to reduce any long-term severance or barrier effects associated with the Project such that the conservation status of reptile species is not likely to be negatively affected.

In the Ecological Impact Assessment Report completed by the ecologist appointed by ABP [appended (as Appendix 4) to the ABP's Inspector's Report dated 22 June 2021] , Dr Arnold discounts the above mitigation "*as it is highly unlikely these will be used by common lizard (the culverts are dark and most in the western section where common lizard was recorded have the dual purpose of carrying water under the road)".* As noted above in reference to the paper written by Sainsbury *et al*., 2021, research which has been published since the preparation of the 2018 EIAR and ABP's Inspector's Report dated 22 June 2021. This research surmises the use of culverts by lizards across a multitude of studies worldwide. Therefore, it is the opinion of the authors that this mitigation measure will maintain connectivity between sites, and reduce any long-term severance or barrier effects associated with the Project such that the conservation status of reptile species is not likely to be negatively affected.

The locations of the wildlife passage facilities are described above in Table 8.43 and are shown on Figures 8.38.1 to 8.38.15.

The schedule of structures to provide for mammal passage, as per Table 8.43and as shown on Figures 8.38.1 to 8.38.15, are required to ensure permeability for the Common lizard across the Project during operation.

8.6.10 Fish

Measures to Protect Fish Species during Construction

Habitat Loss

The structures have been designed in consultation with IFI and in accordance with the design criteria set out in *Guidelines for the Crossing of Watercourses during the Construction of National Road Schemes* (National Roads Authority**,** 2005) and the *Guidelines on Protection of Fisheries During Construction Works in and Adjacent to Waters* (IFI, 2016). These measures, which include, in broad terms replicating the existing channel profile and substrate, will likely minimise the effects of habitat loss to a degree but it is acknowledged that this will be limited by the fact that they are artificial channels within a light limiting box structure.

To minimise the effects of habitat loss on fish species, all sections of river/stream channel within the Assessment Boundary, but not within the footprint of the Project and associated infrastructure, will be protected from site clearance and construction works. Rivers/streams will be fenced off at a minimum distance of 5m from the river bank and within this zone the natural riparian vegetation will be retained.

Habitat Degradation – Surface Water Quality

The mitigation measures relating to the protection of water quality in receiving watercourses during construction are outlined in Section 8.6.3.4 and detailed in Section 11.6.2 of Chapter 11, Hydrology.

Habitat Degradation – Groundwater

The mitigation measures relating to the protection of the groundwater regime during construction are described in Section 10.6.2 of Chapter 10, Hydrogeology.

Mortality Risk & Disturbance/Displacement

To minimise the potential effects of construction works on fish species the following mitigation measures will be implemented:

- No instream works will be carried out between the months of October and June (inclusive) to avoid the most sensitive time for fish species and fish species movements
- Design of new sections of river channel shall be in accordance with the principles outlined in *Channels & Challenges. Enhancing Salmonid Rivers*. (O'Grady, 2006)
- Immediately prior to rivers/streams being diverted into a newly constructed river channel or culvert, they will be electrofished (if required) to capture and transfer fish from the original channel to the new one. Once the watercourse has been diverted this will be followed by a manual search of the original watercourse to transfer any remaining fish to the new river/stream channel
- Any water abstraction points required for dust suppression will be agreed with IFI and the suction head shall be screened to ensure that fish are not removed during the abstraction process

Habitat Severance/Barrier Effect

All temporary crossing structures used to cross watercourses during construction will be designed in accordance with the *Guidelines on Protection of Fisheries During Construction Works in and Adjacent to Waters* (IFI, 2016) and *Guidelines for the Crossing of Watercourses during the Construction of National Road Schemes* (National Roads Authority**,** 2005) to maintain fish and macroinvertebrate passage, and to prevent sedimentation and erosion.

8.6.11 Summary of Mitigation Measures

Table 8.44 below presents an overall summary of the mitigation measures and how these relate to the likely significant effects of the Project on biodiversity. Additional mitigation measures provided in the ABP Inspector's Report dated June 2021, is provided in Section 8.6.1 above.

Table 8.44 Summary of the Mitigation Measures Required to address the Likely Significant Effects of the Project on Biodiversity

Ecological Receptor	Ecological Valuation (after National Roads Authority, 2009)	Impacts with the Potential to result in Likely Significant Effects	Potential Impact Significance	Mitigation Measures
Designated Areas for Nature Conservation				
Lough Corrib SAC (including Lough Corrib pNHA)	International (National)	**Construction** Habitat loss Habitat degradation – tunnelling/excavation Habitat degradation – hydrogeology Habitat degradation – hydrology Habitat degradation – air quality Habitat degradation – non-native invasive plant species Mortality risk **Operation** Habitat degradation – hydrogeology Habitat degradation – air quality Habitat degradation – non-native invasive plant species Mortality risk	Likely significant effect at the international geographic scale	see Section 10 of the updated NIS and Section 8.6.2.1, above
Galway Bay Complex SAC (including Galway Bay Complex pNHA)	International (National)	**Construction** Habitat degradation – hydrology Habitat degradation – non-native invasive plant species Barrier effect Mortality risk	Likely significant effect at the international geographic scale	see Section 10 of the updated NIS and Section 8.6.2.1, above
Lough Corrib SPA (including Lough Corrib pNHA)	International (National)	**Construction** Habitat degradation – hydrogeology Habitat degradation – hydrology Disturbance/displacement	Likely significant effect at the international geographic scale	see Section 10 of the updated NIS and Section 8.6.2.1, above

Ecological Receptor	Ecological Valuation (after National Roads Authority, 2009)	Impacts with the Potential to result in Likely Significant Effects	Potential Impact Significance	Mitigation Measures
		Operation Habitat degradation – hydrogeology		
Inner Galway Bay SPA (including Galway bay Complex pNHA)	International (National)	**Construction** Habitat degradation – hydrogeology Habitat degradation – hydrology Disturbance/displacement **Operation** Habitat degradation – hydrogeology	Likely significant effect at the international geographic scale	see Section 10 of the updated NIS and Section 8.6.2.1, above
Inishmore Island SAC, Kilkieran Bay and Island SAC	International	**Construction** Habitat degradation – hydrology	Likely significant effect at the international geographic scale	see Section 10 of the updated NIS and Section 8.6.2.1, above
Ardrahan Grassland SAC, Castletaylor Complex SAC, Cregganna Marsh SPA, Kiltiernan Turlough SAC, Lough Fingall Complex SAC, Rahasane Turlough SPA, Rahasane Turlough SAC	International	**Construction** Habitat degradation – hydrogeology Habitat degradation – hydrology Habitat degradation – air quality Habitat degradation – non-native invasive plant species	Likely significant effect at the international geographic scale	see Section 10 of the updated NIS and Section 8.6.2.1, above
Inishmore Island pNHA	National	**Construction** Habitat degradation – hydrology	Likely significant effect at the national geographic scale	Water quality during construction – Section 8.6.3.4
Cregganna Marsh pNHA	National	**Construction** Habitat degradation – hydrogeology Habitat degradation – hydrology Habitat degradation – air quality Habitat degradation – non-native invasive plant species	Likely significant effect at the national geographic scale	Groundwater quality and quantity- Section 8.6.3.5 Water quality during construction – Section 8.6.3.4 Air quality during construction - Section 8.6.3.3 Non-native invasive plant species during construction

Ecological Receptor	Ecological Valuation (after National Roads Authority, 2009)	Impacts with the Potential to result in Likely Significant Effects	Potential Impact Significance	Mitigation Measures
				and operation – Section 8.6.3.6 and Appendix A.7.5
Castletaylor Complex pNHA	National	**Construction** Habitat degradation – hydrology Habitat degradation – air quality Habitat degradation – non-native invasive plant species	Likely significant effect at the national geographic scale	Water quality during construction – Section 8.6.3.4 Air quality during construction - Section 8.6.3.3 Non-native invasive plant species during construction and operation – Section 8.6.3.6 and Appendix A.7.5
Furbogh Wood pNHA, Kiltullagh Turlough pNHA, Ballycuirke Lough pNHA, Drimcong Wood pNHA, Turloughcor pNHA	National	**Construction** Habitat degradation – hydrogeology Habitat degradation – hydrology Habitat degradation – air quality Habitat degradation – non-native invasive plant species	Likely significant effect at the national geographic scale	Groundwater quality and quantity- Section 8.6.3.5 Water quality during construction – Section 8.6.3.4 Air quality during construction - Section 8.6.3.3 Non-native invasive plant species during construction and operation – Section 8.6.3.6 and Appendix A.7.5
Moycullen Bogs NHA	National	**Construction** Habitat degradation – air quality Habitat degradation – non-native invasive plant species Habitat degradation – hydrology **Operation** Habitat degradation – non-native invasive plant species	Likely significant effect at the national geographic scale	Air quality during construction - Section 8.6.3.3 Non-native invasive plant species during construction and operation – Section 8.6.3.6 and Appendix A.7.5 Water quality during construction – Section 8.6.3.4

Ecological Receptor	Ecological Valuation (after National Roads Authority, 2009)	Impacts with the Potential to result in Likely Significant Effects	Potential Impact Significance	Mitigation Measures
Habitats (outside of designated areas for nature conservation)				
Limestone pavement [*8240]	International Importance	**Construction** Habitat loss Habitat degradation – air quality Habitat degradation – non-native invasive plant species **Operation** Habitat degradation – air quality Habitat degradation – non-native invasive plant species	Likely significant effect at the international geographic scale	To reduce the scale of habitat loss – see Section 8.6.3.1 Air quality during construction - Section 8.6.3.3 Non-native invasive plant species during construction and operation – Section 8.6.3.6 and Appendix A.7.5
Blanket bog (active) [*7130]	International Importance	**Construction** Habitat loss Habitat degradation – air quality Habitat degradation – non-native invasive plant species **Operation** Habitat degradation – non-native invasive plant species Habitat degradation - groundwater	Likely significant effect at the international geographic scale	To reduce the scale of habitat loss – see Section 8.6.2.1 Air quality during construction - Section 8.6.3.3 Non-native invasive plant species during construction and operation – Section 8.6.3.6 and Appendix A.7.5
Petrifying springs [*7220]	International Importance	**Construction** Habitat loss	Likely significant effect at the county geographic scale (see Section 8.5.5.3 under petrifying springs)	To reduce the scale of habitat loss – see Section 8.6.3.1
Calcareous grassland [*6210/6210]	International/National Importance	**Construction** Habitat loss Habitat degradation – air quality	Likely significant effect at the national geographic scale	To reduce the scale of habitat loss – see Section 8.6.3.1 Air quality during construction - Section 8.6.3.3

Ecological Receptor	Ecological Valuation (after National Roads Authority, 2009)	Impacts with the Potential to result in Likely Significant Effects	Potential Impact Significance	Mitigation Measures
		Habitat degradation – non-native invasive plant species **Operation** Habitat degradation – air quality Habitat degradation – non-native invasive plant species	(No *6210 affected – see Section 8.5.4.3 under Calcareous grassland))	Non-native invasive plant species during construction and operation – Section 8.6.3.6 and Appendix A.7.5
Dry heath [4030]	National Importance	**Construction** Habitat loss Habitat degradation – air quality Habitat degradation – non-native invasive plant species **Operation** Habitat degradation – air quality Habitat degradation – non-native invasive plant species	Likely significant effect at the national geographic scale	To reduce the scale of habitat loss – see Section 8.6.3.1 Air quality during construction - Section 8.6.3.3 Non-native invasive plant species during construction and operation – Section 8.6.3.6 and Appendix A.7.5
Wet heath [4010][155]	National Importance	**Construction** Habitat loss Habitat degradation – air quality Habitat degradation – groundwater **Operation** Habitat degradation – air quality Habitat degradation – groundwater	Likely significant effect at the national geographic scale	To reduce the scale of habitat loss – see Section 8.6.3.1 Air quality during construction - Section 8.6.3.3 Groundwater during construction and operation – Section 8.6.3.5
Molinia meadow [6410]	National Importance	**Construction** Habitat loss Habitat degradation – air quality	Likely significant effect at the national geographic scale	To reduce the scale of habitat loss – see Section 8.6.3.1

[155] Including areas of Wet heath/Dry heath/*Molinia* meadow [4010/4030/6410] mosaic

Ecological Receptor	Ecological Valuation (after National Roads Authority, 2009)	Impacts with the Potential to result in Likely Significant Effects	Potential Impact Significance	Mitigation Measures
		Habitat degradation – non-native invasive plant species **Operation** Habitat degradation – non-native invasive plant species		Air quality during construction - Section 8.6.3.3 Groundwater during construction and operation – Section 8.6.3.5
Residual alluvial forest [*91E0]	International Importance	**Construction** Habitat loss Habitat degradation – air quality Habitat degradation – non-native invasive plant species **Operation** Habitat degradation – non-native invasive plant species	Likely significant effect at the international geographic scale	Air quality during construction - Section 8.6.3.3 Non-native invasive plant species during construction and operation – Section 8.6.3.6 and Appendix A.7.5
Turloughs [*3180]	International Importance	**Construction** Habitat loss Habitat degradation – surface water quality Habitat degradation – groundwater Habitat degradation – air quality Habitat degradation – non-native invasive plant species **Operation** Habitat degradation – groundwater Habitat degradation – air quality Habitat degradation – non-native invasive plant species	Likely significant effect at the international geographic scale	To reduce the scale of habitat loss – see Section 8.6.3.1 Air quality during construction – Section 8.6.3.3 Water quality during construction – Section 8.6.3.4 Groundwater during construction and operation – Section 8.6.3.5 Non-native invasive plant species during construction and operation – Section 8.6.3.6 and Appendix A.7.5
Hard water lakes [3140]	National Importance	**Construction** Habitat degradation – surface water quality (Ballindooley Lough)	Likely significant effect at the national geographic scale	Water quality during construction – Section 8.6.3.4

Ecological Receptor	Ecological Valuation (after National Roads Authority, 2009)	Impacts with the Potential to result in Likely Significant Effects	Potential Impact Significance	Mitigation Measures
Mesotrophic lakes (FL4) Part of Ballindooley complex	County Importance[156]	**Construction** Habitat degradation – surface water quality	Likely significant effect at the county geographic scale	Water quality during construction – Section 8.6.3.4
Eutrophic lakes (FL5) Part of Ballindooley complex	County Importance[157]	**Construction** Habitat degradation – surface water quality Habitat degradation – groundwater	Likely significant effect at the county geographic scale	Water quality during construction – Section 8.6.3.4 Groundwater during construction – Section 8.6.3.5
Calcareous springs (FP1) Non-Annex I habitat type	Local Importance (Higher Value)	**Construction** Habitat loss	Likely significant effect at the local geographic scale	To reduce the scale of habitat loss – see Section 8.6.3.1
Cladium fen [*7210]	International Importance	**Construction** Habitat degradation – surface water quality (Ballindooley Lough)	Likely significant effect at the international geographic scale	Water quality during construction – Section 8.6.3.4
Hydrophilous tall herb [6430]	International Importance	(see Lough Corrib SAC above) **Construction** Habitat degradation – hydrogeology Habitat degradation – hydrology **Operation** Habitat degradation – hydrogeology	Likely significant effect at the international geographic scale	see Section 10 of the updated NIS
Alkaline fens [7230]	National Importance	**Construction** Habitat degradation – surface water quality (Ballindooley Lough)	Likely significant effect at the national geographic scale	Water quality during construction – Section 8.6.3.4

[156] On the basis that it forms part of the wetland complex at Ballindooley Lough

[157] On the basis that it forms part of the wetland complex at Ballindooley Lough

Ecological Receptor	Ecological Valuation (after National Roads Authority, 2009)	Impacts with the Potential to result in Likely Significant Effects	Potential Impact Significance	Mitigation Measures
Reed and large sedge swamps (FS1) Non-Annex I habitat type	Local Importance (Higher Value)	**Construction** Habitat degradation – surface water quality	Likely significant effect at the local geographic scale	Water quality during construction – Section 8.6.3.4
Tall-herb swamps (FS2) Non-Annex I habitat type	Local Importance (Higher Value)	None	No likely significant effect at any geographic scale	None
Eroding/upland rivers (FW1)	Local Importance (Higher Value)	**Construction** Habitat degradation – surface water quality	Likely significant effect at the local geographic scale	Water quality during construction – Section 8.6.3.4
Depositing/lowland rivers (FW2) River Corrib	International Importance	The River Corrib forms part of see Lough Corrib SAC (see above and NIS)	Likely significant effect at the international geographic scale	see Section 10 of the updated NIS
Terryland River	Local Importance (Higher Value)	None	No likely significant effect at any geographic scale	None
Drainage ditches (FW4)	Local Importance (Higher Value)	None	No likely significant effect at any geographic scale	None
Marsh (GM1)	Local Importance (Higher Value)	None	No likely significant effect at any geographic scale	None
Dry calcareous and neutral grassland (GS1) Non-Annex I habitat type	Local Importance (Higher Value)	None	No likely significant effect at any geographic scale	None
Dry meadows and grassy verges (GS2) Non-Annex I habitat type	Local Importance (Higher Value)	None	No likely significant effect at any geographic scale	None
Dry-humid acid grassland (GS3) Non-Annex I habitat type	Local Importance (Higher Value)	**Construction** Habitat loss Habitat degradation – air quality	Likely significant effect at the local geographic scale	Air quality during construction - Section 8.6.3.3 Non-native invasive plant species during construction

Ecological Receptor	Ecological Valuation (after National Roads Authority, 2009)	Impacts with the Potential to result in Likely Significant Effects	Potential Impact Significance	Mitigation Measures
		Habitat degradation – non-native invasive plant species **Operation** Habitat degradation – non-native invasive plant species		and operation – Section 8.6.3.6 and Appendix A.7.5
Wet grassland (GS4) Non-Annex I habitat type	Local Importance (Higher Value)	None	No likely significant effect at any geographic scale	None
Rich fen and flush (PF1) Non-Annex I habitat type	County Importance	**Construction** Habitat degradation – surface water quality Habitat degradation – air quality	Likely significant effect at the county geographic scale	Water quality during construction – Section 8.6.3.4 Air quality during construction – Section 8.6.3.3
Poor fen and flush (PF2) Non-Annex I habitat type	Local Importance (Higher Value)	**Construction** Habitat loss Habitat degradation – air quality **Operation** Habitat degradation – groundwater	Likely significant effect at the local geographic scale	Air quality during construction – Section 8.6.3.3
(Mixed) broadleaved woodland (WD1)	Local Importance (Higher Value)	**Construction** Habitat loss Habitat degradation – air quality Habitat degradation – non-native invasive plant species **Operation** Habitat degradation – non-native invasive plant species	Likely significant effect at the local geographic scale	To reduce the scale of habitat loss – see Section 8.6.3.1 Air quality during construction – Section 8.6.3.3 Non-native invasive plant species during construction and operation – Section 8.6.3.6 and Appendix A.7.5
Mixed broadleaved/conifer woodland (WD2)	Local Importance (Higher Value)	None	No likely significant effect at any geographic scale	None

Ecological Receptor	Ecological Valuation (after National Roads Authority, 2009)	Impacts with the Potential to result in Likely Significant Effects	Potential Impact Significance	Mitigation Measures
(Mixed) conifer woodland (WD3)	Local Importance (Higher Value)	None	No likely significant effect at any geographic scale	None
Hedgerows (WL1)	Local Importance (Higher Value)	**Construction** Habitat loss Habitat degradation – air quality Habitat degradation – non-native invasive plant species **Operation** Habitat degradation – non-native invasive plant species	Likely significant effect at the local geographic scale	To reduce the scale of habitat loss – see Section 8.6.3.1 Air quality during construction – Section 8.6.3.3 Non-native invasive plant species during construction and operation – Section 8.6.3.6 and Appendix A.7.5
Treelines (WL2)	Local Importance (Higher Value)	**Construction** Habitat loss Habitat degradation – air quality Habitat degradation – non-native invasive plant species **Operation** Habitat degradation – non-native invasive plant species	Likely significant effect at the local geographic scale	To reduce the scale of habitat loss – see Section 8.6.3.1 Air quality during construction – Section 8.6.3.3 Non-native invasive plant species during construction and operation – Section 8.6.3.6 and Appendix A.7.5
Oak-ash-hazel woodland (WN2) Non-Annex I habitat type	Local Importance (Higher Value)	**Construction** Habitat degradation – air quality Habitat degradation – non-native invasive plant species	Likely significant effect at the local geographic scale	Air quality during construction – Section 8.6.3.3 Non-native invasive plant species during construction and operation – Section 8.6.3.6 and Appendix A.7.5
Scrub (WS1) Non-Annex I habitat type	Local Importance (Higher Value)	None	No likely significant effect at any geographic scale	None
Habitat Clusters 1-12				

Ecological Receptor	Ecological Valuation (after National Roads Authority, 2009)	Impacts with the Potential to result in Likely Significant Effects	Potential Impact Significance	Mitigation Measures
Important Habitat Clusters 1-12	The value of the biodiversity receptors recorded within the Assessment Boundary across the habitat clusters 1 - 12, range from Local Importance (Lower Value) to Internationally Important	Combinations of all of the potential impacts noted above in Habitats (outside of designated areas for nature conservation) and Rare and Protected Flora. The specific impacts are related to and dependent upon the potential impacts of the Project on each of the individual ecological receptors that make up the biodiversity resource within a given habitat cluster.	Likely significant effects from local up to the international geographic scale	All of the mitigation measures included within Section 8.6.3 and 8.6.4 The specific mitigation measures are related to and dependent upon the potential impacts of the Project on each of the individual ecological receptors that make up the biodiversity resource within a given habitat cluster
Rare and protected Flora Species				
Imbricate bog-moss *Sphagnum affine*	National importance	**Construction** Loss of local population through removal Loss of local population -hydrogeological or hydrological effects Loss of local population - air quality effects Loss of local population - non-native invasive plant species **Operation** Loss of local population through removal Loss of local population -hydrogeological or hydrological effects Loss of local population - air quality effects Loss of local population - non-native invasive plant species	Likely significant effect at the national geographic scale	Sections 8.6.3 (8.6.3.3, 8.6.3.5, 8.3.3.6) and 8.6.4
Red bog-moss *Sphagnum capillifolium*	National importance	**Construction** Loss of local population through removal Loss of local population -hydrogeological or hydrological effects	Likely significant effect at the county geographic scale	Sections 8.6.3 (8.6.3.3, 8.6.3.5, 8.3.3.6) and 8.6.4

Ecological Receptor	Ecological Valuation (after National Roads Authority, 2009)	Impacts with the Potential to result in Likely Significant Effects	Potential Impact Significance	Mitigation Measures
		Loss of local population - air quality effects Loss of local population - non-native invasive plant species **Operation** Loss of local population through removal Loss of local population -hydrogeological or hydrological effects Loss of local population - air quality effects Loss of local population - non-native invasive plant species		
Woodsy thyme moss *Plagiomnium cuspidatum*	National importance	**Construction** Loss of local population through removal Loss of local population - air quality effects Loss of local population - non-native invasive plant species **Operation** Loss of local population through removal Loss of local population - air quality effects Loss of local population - non-native invasive plant species	Likely significant effect at the county geographic scale	Sections 8.6.3 (8.6.3.3, 8.6.3.5, 8.3.3.6) and 8.6.4
Lesser striated feathermoss *Plasteurhynchium striatulum*	National importance	**Construction** Loss of local population through removal Loss of local population - air quality effects Loss of local population - non-native invasive plant species **Operation** Loss of local population through removal Loss of local population - air quality effects	Likely significant effect at the county geographic scale	Sections 8.6.3 (8.6.3.1, 8.6.3.2, 8.6.3.3, 8.6.3.5, 8.3.3.6) and 8.6.4

Ecological Receptor	Ecological Valuation (after National Roads Authority, 2009)	Impacts with the Potential to result in Likely Significant Effects	Potential Impact Significance	Mitigation Measures
		Loss of local population - non-native invasive plant species		
Spring gentian *Gentiana verna*	National importance	**Construction** Loss of local population through removal Loss of local population - air quality effects Loss of local population - non-native invasive plant species **Operation** Loss of local population through removal Loss of local population - air quality effects Loss of local population - non-native invasive plant species	Likely significant effect at the local geographic scale	Sections 8.6.3 (8.6.3.1, 8.6.3.2, 8.6.3.3, 8.6.3.5, 8.3.3.6) and 8.6.4
Eyebright *Euphrasia arctica*	Local importance	**Construction** Loss of local population through removal Loss of local population - air quality effects Loss of local population - non-native invasive plant species **Operation** Loss of local population through removal Loss of local population - air quality effects Loss of local population - non-native invasive plant species	Likely significant effect at the local geographic scale	Sections 8.6.3 (8.6.3.1, 8.6.3.2, 8.6.3.3, 8.6.3.5, 8.3.3.6) and 8.6.4
Fauna Species				
Badger	Local Importance (Higher Value)	**Construction** Loss of breeding/resting sites Disturbance/displacement **Operation**	Likely significant effect at the local geographic scale	Measures to protect Badger during construction – Section 0

Ecological Receptor	Ecological Valuation (after National Roads Authority, 2009)	Impacts with the Potential to result in Likely Significant Effects	Potential Impact Significance	Mitigation Measures
		Habitat severance/barrier effect Mortality risk		Measures to protect Badger during operation – Section 8.6.5.3
Otter	International Importance	**Construction** Habitat degradation - water quality **Operation** Habitat severance/barrier effect Mortality risk	Likely significant effect at the local geographic scale	Measures to protect Otter during construction – Section 8.6.5.1 Measures to protect Otter during operation – Section 8.6.5.1
Other mammal species protected under the Wildlife Acts	Local Importance (Higher Value)	**Construction** Habitat severance/barrier effect Habitat degradation - water quality **Operation** Habitat severance/barrier effect Mortality risk	Likely significant effect at the local geographic scale	Measures to protect other mammal species (excl. bats) during construction – Section 8.6.5.4 Measures to protect other mammal species (excl. bats) during operation – Section 8.6.5.4
Lesser horseshoe bat	National Importance	**Construction** Roost loss Habitat loss Habitat fragmentation Disturbance/displacement **Operation** Mortality Barrier/severance effects Disturbance/displacement	Likely significant effect at the national geographic scale	Measures to protect bats during construction – Section 8.6.5.2 Measures to protect bats during operation – Section 8.6.5.2
All other bat species	Local Importance (Higher Value)		Likely significant effect at the local geographic scale	Measures to protect bats during construction – Section 8.6.5.2 Measures to protect bats during operation – Section 8.6.5.2
Marsh whorl snail	Local Importance (Higher Value)	**Construction** Habitat degradation – surface water quality	Likely significant effect at the local geographic scale	Measures to protect the Marsh whorl snail during

Ecological Receptor	Ecological Valuation (after National Roads Authority, 2009)	Impacts with the Potential to result in Likely Significant Effects	Potential Impact Significance	Mitigation Measures
		Habitat degradation – groundwater **Operation** Habitat degradation – groundwater		construction – Section 8.6.6.2 Measures to protect the Marsh whorl snail during operation – Section 8.6.6.2
Marsh fritillary butterfly	National Importance	**Construction** Mortality risk	Likely significant effect at the local geographic scale	Measures to protect the Marsh fritillary butterfly during construction – Section 8.6.6.3
SCI bird species	International	see Lough Corrib SPA and Inner Galway Bay SPA above	Likely significant effect at the international geographic scale	see Section 10 of the updated NIS
Barn owl	County Importance	**Construction** Disturbance/displacement **Operation** Mortality risk	Likely significant effect at the county geographic scale	Measures to protect breeding birds during operation – Section 8.6.7.1
Peregrine falcon	County Importance	**Construction** Disturbance/displacement **Operation** Disturbance/displacement	Likely significant effect at the county geographic scale	Measures to protect breeding birds during construction – Section 8.6.7.1 Measures to protect breeding birds during operation – Section 8.6.7.1
All other breeding bird species (non SCI)	Local Importance (Higher Value)	**Construction** Disturbance/displacement **Operation** Disturbance/displacement	Likely significant effect at the local geographic scale	Measures to protect breeding birds during construction – Section 8.6.7.1 Measures to protect breeding birds during operation – Section 8.6.7.1
All other wintering bird species (non-SCI)	Local Importance (Higher Value)	**Construction** Disturbance/displacement (Ballindooley Lough)	Likely significant effect at the local geographic scale	Measures to protect wintering birds during

Ecological Receptor	Ecological Valuation (after National Roads Authority, 2009)	Impacts with the Potential to result in Likely Significant Effects	Potential Impact Significance	Mitigation Measures
		Habitat degradation – surface water quality Habitat degradation – groundwater		construction – Section 8.6.7.2 Measures to protect wintering birds during operation – Section 8.6.7.2
Smooth newt Common frog	Local Importance (Higher Value)	**Construction** Habitat loss Disturbance & mortality risk Habitat degradation – surface water quality **Operation** Habitat severance/barrier effect	Likely significant effect at the local geographic scale	Measures to protect amphibians during construction – Section 8.6.8 Measures to protect amphibians during operation – Section 8.6.8
Common lizard	Local Importance (Higher Value)	**Construction** Habitat loss Disturbance & mortality risk **Operation** Habitat severance/barrier effect	Likely significant effect at the local geographic scale	Measures to protect reptiles during construction – Section 8.6.9 Measures to protect reptiles during operation – Section 8.6.9
Atlantic salmon European eel	International Importance	**Construction** Habitat degradation – surface water quality Habitat degradation – groundwater	Likely significant effect at the local geographic scale	Measures to protect fish species during construction – Section 8.6.10
All other fish species recorded	Local Importance (Higher Value)	**Construction** Habitat degradation – surface water quality Habitat degradation – groundwater	Likely significant effect at the local geographic scale	Measures to protect fish species during construction – Section 8.6.10
Local Biodiversity Areas				
Local biodiversity areas	The value of the biodiversity receptors recorded in the vicinity of the proposed N6 GCRR,	Combinations of all of the potential impacts noted above The specific impacts are related to and dependent upon the potential impacts of the proposed N6 GCRR	Likely significant effects from local up to the international geographic scale	All of the mitigation measures included within Section 8.6

Ecological Receptor	Ecological Valuation (after National Roads Authority, 2009)	Impacts with the Potential to result in Likely Significant Effects	Potential Impact Significance	Mitigation Measures
	across the local biodiversity areas, range from Local Importance (Lower Value) to Internationally Important	on each of the individual ecological receptors that make up the biodiversity resource within a given local biodiversity area		The specific mitigation measures are related to and dependent upon the potential impacts of the proposed N6 GCRR on each of the individual ecological receptors that make up the biodiversity resource within a given local biodiversity area

8.7 Residual Impacts

8.7.1 Changes since 2018 EIAR

For the most part, there are no changes to the mitigation strategy that alter the conclusions of the residual impact assessment presented in the 2018 EIAR. This is with the exception of Barn owl and Marsh fritillary. Due to the absence of evidence regarding the efficacy of the mitigation measures on Barn owl to reduce the mortality risk, there remains the potential for permanent impacts on the Menlo Castle nest site due to its proximity to the Project and local Barn owl population as a result of the mortality risk which may result a significant negative residual effect on Barn owl, at the local geographic scale.

8.7.2 Designated Areas for Nature Conservation

8.7.2.1 European Sites

The assessment, presented in the updated NIS, of the potential for the Project to impact upon European sites concluded that, with the implementation of the mitigation measures proposed, the Project does not pose a risk of adversely affecting (either directly or indirectly) the integrity any European site, either alone or in combination with other plans or projects.

Although the Project will not adversely affect the integrity of any European sites, the Project will have some level of residual impact on biodiversity within the boundary of Lough Corrib SAC. This is not the case for other European sites in the vicinity of the Project, which are remote from the Assessment Boundary, as the potential impact pathways connecting the Project to these European sites are fully mitigated, as assessed in the updated NIS (and throughout this chapter).

The residual impacts on non QI habitats and species within Lough Corrib SAC are as follows:

- At the proposed drainage outfall for the N59 Link Road North at Kentfield c.0.03ha of a Treeline (WL2), Scrub (WS1) and Dry meadows and grassy verges (GS2) mosaic
- At the site of the proposed River Corrib Bridge between Dangan and Menlough the loss of c.0.10ha of a Dry calcareous and neutral grassland (GS1), Improved agricultural grassland (GA1) and Buildings and artificial surfaces (BL3) mosaic and 0.01 ha of Scrub (WS1) on the west bank and, on the east bank, c.0.55ha of Dry calcareous and neutral grassland (GS1), 0.23ha of Dry calcareous and neutral grassland (GS1) and Dry meadows and grassy verges (GS2) mosaic, 0.02ha of dry meadows and grassy verges (GS2), treelines (WL2) and Stone walls and other stonework (BL1), c.0.68ha of Mixed broadleaved woodland (WD1) and loss of a small area of gravel track
- In the Menlough/Coolagh Lakes area c.0.05ha of Oak-Ash-Hazel Woodland (WN2), along with some local road and gravelled access track
- In the vicinity of the proposed Lackagh Tunnel c.0.08ha of Oak-Ash-Hazel Woodland (WN2) and Scrub (WS1), c.0.01ha of Scrub (WS1), c.0.01ha of Dry calcareous and neutral grassland (GS1), a short section (c.20m) of Treeline (WL2), c.0.06 ha of a mosaic of Spoil and Bare Ground (ED2), Recolonising bare ground (ED3), Dry calcareous and neutral grassland (GS1) and Scrub (WS1), and c.0.07ha of a mosaic of Treelines (WL2), Scrub (WS1), Dry meadows and grassy verges (GS2) and Spoil and Bare Ground (ED2) habitat
- Impacts of the Project on the local bat populations
- The Project also traverses a number of groundwater bodies that support groundwater dependant wetland habitats within European sites and traverses a number of watercourses that lie within or drain to a European site.

None of these residual biodiversity effects compromise the overall biodiversity resource of Lough Corrib SAC in any way that relates to the integrity of that European site and therefore, no likely significant effects are predicted at any geographic scale.

Therefore, the Project will not result in a likely significant residual effect on any European site(s).

8.7.2.2 Natural Heritage Areas & proposed Natural Heritage Areas

The residual impacts of the Project on Lough Corrib pNHA are as per the assessment for Lough Corrib SAC in Section 8.7.2.1. As per the conclusions of that assessment the Project is not likely to have a significant residual effect on either Lough Corrib pNHA.

Mitigation measures will be implemented to ensure that the peatland habitats for which Moycullen Bogs NHA is designated, and the species they support, will not be affected by the Project during construction or operation.

Mitigation measures will be implemented to ensure that habitats and species for which Furbogh Wood pNHA, Kiltullagh Turlough pNHA, Ballycuirke Lough pNHA, Drimcong Wood pNHA and Turloughcor pNHA are designated are not affected by construction-related traffic.

Therefore, the Project will not affect the integrity of, or result in a likely significant negative residual effect on, any Natural Heritage Areas or proposed Natural Heritage Areas.

8.7.3 Habitats

A mitigation strategy will be implemented during construction and operation to minimise the effects of habitat loss and habitat degradation on biodiversity (Section 8.6.3).

Despite these mitigation measures, the Project will result in permanent area loss of a number of Annex I habitat types. None of the areas of Annex I habitat that will be permanently lost are located with any European sites. In the case of the priority Annex I habitats affected, this results in a likely significant negative residual effect at the international geographic scale, as it is adding to an ongoing trend of habitat loss for these habitats of highest conservation concern that are in danger of disappearance at a European level. For non-priority Annex I habitat types, the habitat loss is considered to constitute a likely significant negative residual effect at the national geographic scale, as loss of habitat area affects the conservation status of each of these habitats nationally. The habitat types, and areas affected, are summarised in Table 8.45 below.

Table 8.45 Summary of *Annex I/Annex I habitat loss

Annex I habitat type	Total Area within the Assessment Boundary Potentially Impacted	Area to be Retained	Actual Permanent area of habitat loss	Residual Impact Significance
Turlough [*3180]		All (c.0.04ha)	None	No likely significant residual effect
Petrifying springs [*7220]	Six Petrifying spring feature at Lackagh Quarry	Two features to be retained	Four Petrifying spring feature	Likely significant residual effect at the county geographic scale
Active Blanket Bog [*7130]	c.0.01ha	None	c.0.01ha	Likely significant residual effect at the international geographic scale
Wet heath/Dry heath/Active Blanket Bog	c.0.01ha	None	c.0.01ha	Likely significant residual effect at the national geographic scale
Residual alluvial forest [*91E0]	c.0.14ha	None	c.0.14ha	Likely significant residual effect at the international geographic scale
Limestone pavement[*8240]	c.2.73ha	c.1.19ha	c.1.54ha	Likely significant residual effect at the

Annex I habitat type	Total Area within the Assessment Boundary Potentially Impacted	Area to be Retained	Actual Permanent area of habitat loss	Residual Impact Significance
				international geographic scale
Limestone pavement/Calcareous grassland [*8240/6210]	c.0.03ha		0.03ha	Likely significant residual effect at the international geographic scale
Wet heath [4010]	c.2.72ha	c.0.17 ha[158]	c.2.54ha	Likely significant residual effect at the national geographic scale
Dry heath [4030]	c.1.76ha	None	c.1.76ha	Likely significant residual effect at the national geographic scale
Dry heath/Wet heath mosaic [4030/4010]	c.0.96	None	c.0.96	Likely significant residual effect at the national geographic scale
Wet heath/Dry heath/Molinia mosaic [4010/4030/6410]	c.0.45	None	c.0.45	Likely significant residual effect at the national geographic scale
Calcareous grassland [6210]	c.0.25ha	None	c.0.25ha	Likely significant residual effect at the national geographic scale
Molinia meadow [6410]	c.1.03ha	c.0.74ha	c.0.29ha	Likely significant residual effect at the national geographic scale
Total area	**c.10.66ha of Annex I habitats and 6 Petrifying spring features**	**c.2.26ha of Annex I habitats and 2 Petrifying spring features**	**8.4ha of Annex I habitats and 4 Petrifying spring features**	

Similarly, despite the mitigation measures the Project will result in likely significant negative residual effects, at the local geographic scale, on the habitats of local biodiversity value summarised in Table 8.46 below.

[158] This area accounts for operational air quality effects. The affected area of wet heath habitat to be retained that may be affected by air quality effects has been excluded from this calculation.

Table 8.46 Summary of Loss of Habitats of Local Biodiversity Value

Habitats	Total Area within the Assessment Boundary Potentially Impacted	Area of Habitat to be Retained	Actual Permanent Area of Habitat Loss
Eutrophic lakes (FL5)	c. 0.05ha	All to be retained	None
Calcareous springs (FP1)	29 features	11 features	18 features
Dry calcareous and neutral grassland (GS1)	c.16.51ha	c.1.65ha	c.14.86ha
Dry meadows and grassy verges (GS2)	c.10.36ha	c.2.51ha	c.7.85ha
Dry-humid acid grassland (GS3)	c.5.24ha	None	c.5.24ha
Wet grassland (GS4) –	c.10.85ha	c.1.42haa	c.9.43ha
Marsh (GM1)	c.0.42ha	None	c.0.42ha
Dry calcareous and neutral grassland/Scrub mosaic (GS1/WS1)	c.4.89ha	c.0.02ha	c.4.87ha
Rich fen and flush (PF1)	c.0.2ha	None	c.0.2ha
Poor fen and flush (PF2)	c.1.30ha	None	c.1.30ha
(Mixed) broadleaved woodland (WD1)	c.4.77ha	c.2.68ha	c.2.09ha
Mixed broadleaved/conifer woodland (WD2)	c.0.04ha	None	c.0.04ha
Mixed) conifer woodland (WD3)	c.0.01ha	None	c.0.01ha
Oak-ash-hazel woodland (WN2)	c.3.37ha	c.0.44ha	c.2.93ha
Scrub (WS1)	c.27.76ha	c.1.23ha	c.26.53ha
Scrub/ Dry meadows and grassy verges (WS1/GS2)	c.2.92ha	c.0.03ha	c.2.89ha
Scrub/Oak-ash-hazel woodland/ Exposed calcareous rock (WS1/WN2/ER2)	c.0.74ha	c.0.25ha	c.0.49 ha
Reed and large sedge swamps (FS1)	c.0.12ha	c.0.09ha	c.0.03ha
Drainage ditches (FW4)	c.0.08ha	None	c.0.08ha

Habitats	Total Area within the Assessment Boundary Potentially Impacted	Area of Habitat to be Retained	Actual Permanent Area of Habitat Loss
Hedgerows (WL1) -	c.10.64km	c.2.76km	c.7.88km
Treelines (WL2)	c.6.24km	c.2.19km	c.4.05km
Sections of stream/River Channel (FW1)	c.120m of Sruthán na Líbeirtí, c.220m of the Trusky Stream, c.140m of the Bearna Stream (and tributary), c.475m of the Tonabrocky Stream	None	c.120m of Sruthán na Líbeirtí, c.220m of the Trusky Stream, c.140m of the Bearna Stream (and tributary), c.475m of the Tonabrocky Stream

8.7.3.1 Clusters of Important Habitats

The 2018 EIAR did not assess the habitat Clusters that were discussed within Appendix 4 of ABP's Inspector's Report dated June 2021. Likely significant effects on these habitat clusters are assessed as per Table 8.44 above and Table 8.48 below. Residual impacts ranging from a local to International geographic scale is predicted and summarised below.

All of the habitat clusters traversed by the Project will be affected to some degree by the likely significant effects associated with the Project on the KERs that have been identified in each of those areas. These likely significant effects are accounted for, and described, above separately in Table 8.41 and Table 8.46 and this section provides some context for these residual impacts with respect to the locations of the habitat clusters through which the Project passes.

Cluster 1 Forramoyle (Ch. 0+000 to Ch. 1+6001 of the Proposed N6 GCRR)

The residual impact of the loss of c.0.01ha of *7130 active blanket bog within this habitat cluster has a likely significant residual effect at the international geographic scale. The loss of c.0.11 ha of 4010 Wet heath and c.0.78ha 4030 Dry heath within this habitat cluster has a likely significant residual effect at the national geographic scale. The entire area of 6410 Molinia meadow habitat within this habitat cluster (c.0.09 ha) and a section of 4030 Dry heath (c.0.10ha) is to be retained in Habitat Cluster 1. The residual impact of the loss of c.0.07ha of Marsh (GM1), c.0.30ha of Dry meadows and grassy verges (GS2), c.1.79ha of Dry humid acid grassland (GS3), c.3.18ha of Wet grassland (GS4), c.0.13ha of Poor fen and flush (PF2), c.0.35ha of mixed broadleaved woodland (WD1), c.0.83ha of Scrub (WS1), c.0.01 km of hedgerows (WL1) and c.0.19 km of treelines (WL2) and c.120m of Sruthán na Líbeirtí stream on Habitat Cluster 1 Forramoyle has been assessed as significant at the local geographic scale. The loss of Imbricate bog-moss *Sphagnum affine* and Red bog-moss *Sphagnum capillifolium* within this cluster has been assessed as significant at the National and county geographic scale respectively.

Cluster 2 Troscaigh (Ch. 1+600 to Ch. 2+800 of the Proposed N6 GCRR)

The loss of c.0.57ha of 4010 Wet heath and c.0.22ha 4030 Dry heath within this habitat cluster has a likely significant residual effect at the national geographic scale. The residual impact of the loss c.0.04ha of Dry meadows and grassy verges (GS2), c.0.47ha of Dry humid acid grassland (GS3), c.0.56ha of Wet grassland (GS4), c.0.03ha of mixed broadleaved/conifer woodland (WD2), c.0.01ha of mixed conifer woodland (WD3), c.2.41ha of Scrub (WS1) on Habitat Cluster 2 Troscaigh has been assessed as significant at the local geographic scale.

Cluster 3 Cloughscoltia (Ch. 2+800 to Ch. 4+400 of the Proposed N6 GCRR)

The loss of c.1.28ha of 4010 Wet heath (including c.0.2ha which occurs in a mosaic with rich fen and flush (PF1) and poor fen and flush (PF2)), c.0.13 ha 4030 Dry heath, c.0.02ha of 4010 Wet heath/6410 *Molinia* meadow mosaic and c.0.18ha of 4030 Dry heath/4010 Wet heath/6410 Molinia meadow mosaic within this habitat cluster has a likely significant residual effect at the national geographic scale. A section of 4030 Dry heath/4010 Wet heath/6410 Molinia meadow mosaic (c.0.26ha) is to be retained in Habitat Cluster 3. The

residual impact of the loss of c.0.30ha of Marsh (GM1), c.0.28ha of Dry meadows and grassy verges (GS2), c.1.34ha of Dry humid acid grassland (GS3), c.2.86 ha of Wet grassland (GS4), c.0.22ha of mixed broadleaved woodland (WD1), c.1.22ha of Scrub (WS1), c.0.11km of hedgerows (WL1) and c.0.40km of treelines (WL2) as well as c.220m of the Trusky Stream, c.140m of the Bearna Stream (and tributary) on Habitat Cluster 3 Cloughscoltia has been assessed as significant at the local geographic scale. The loss of Woodsy thyme moss *Plagiomnium cuspidatum* within this cluster has been assessed as significant at the county geographic scale.

Cluster 4 Cappagh Road to Ballymoneen Road (Ch. 4+400 to Ch. 5+600 of the Proposed N6 GCRR)

The loss of c.0.57 ha of 4010 Wet heath, c.0.59ha 4030 Dry heath c.0.88ha of 4030 Dry heath/4010 Wet heath mosaic within this habitat cluster has a likely significant residual effect at the national geographic scale. The residual impact of the loss of c.0.18ha of Dry calcareous grassland (GS1), c.0.31 ha of Dry meadows and grassy verges (GS2), c.0.21ha of Wet grassland (GS4), c.0.02ha of oak-ash-hazel woodland (WN2), c.0.42ha of Scrub (WS1), c.0.23km of hedgerows (WL1) and c.0.37km of treelines (WL2) on Habitat Cluster 4 Cappagh Road to Ballymoneen Road has been assessed as significant at the local geographic scale. The loss of Downy oat-grass *Avenula pubescens* within this cluster has been assessed as not significant at any geographic scale.

Cluster 5 East of Ballymoneen Road (Ch.5+750 to Ch. 5+950 of the Proposed N6 GCRR)

The residual impact of the loss of c.0.02ha of Wet grassland (GS4), c.0.79ha of Scrub (WS1) and c.0.03km of treelines (WL2) on Habitat Cluster 5 East of Ballymoonen Road has been assessed as significant at the local geographic scale.

Cluster 6 Knocknabrona/Knocknafrosca (Ch. 7+700 to Ch. 8+300 of the Proposed N6 GCRR)

The loss of c.0.14ha of 4010 Wet heath within this habitat cluster has a likely significant residual effect at the national geographic scale. The residual impact of the loss of c.0.95ha of Dry calcareous grassland (GS1), c.1.79ha of Dry humid acid grassland (GS3), c.0.74ha of Wet grassland (GS4), c.0.97ha Poor fen and flush (PF2), c.3.06ha of Scrub (WS1), c.0.17km of hedgerows (WL1) and c.0.25km of treelines (WL2) on Habitat Cluster 6 Knocknabrona/Knocknafrosca has been assessed as significant at the local geographic scale. The loss of Downy oat-grass *Avenula pubescens* within this cluster has been assessed as not significant at any geographic scale.

Cluster 7 Menlough (Ch. 9+600 to Ch. 10+450 of the Proposed N6 GCRR)

The loss of c.1.23ha of *8240 Limestone pavement, c.0.005ha *8240 Limestone pavement/6210 Calcareous grassland mosaic and c.0.14ha *91E0 Alluvial woodland has a likely significant residual effect at the international geographic scale. A section of *8240 Limestone pavement (c.0.27ha), *8240 Limestone pavement/6210 Calcareous grassland mosaic (<0.01ha) and the entire *3180 Turlough is to be retained in Habitat Cluster 7. The residual impact of the loss of c.0.78ha of Dry calcareous grassland (GS1), c.1.94ha of Dry meadows and grassy verges (GS2), c.0.16ha of Wet grassland (GS4), c.0.82ha of mixed broadleaved woodland (WD1), c.1.59ha oak-ash-hazel woodland (WN2), c.0.34ha of Scrub (WS1), c.0.28km of hedgerows (WL1) and c.0.46km of treelines (WL2) on Habitat Cluster 7 Menlough has been assessed as significant at the local geographic scale. The loss of Lesser striated feathermoss *Plasteurhynchium striatulum* within this cluster has been assessed as significant at the county geographic scale.

Cluster 8 Lackagh (Ch. 11+800 to Ch. 12+100 of the Proposed N6 GCRR)

The loss of c.0.11ha of 6210 Calcareous grassland within this habitat cluster has a likely significant residual effect at the national geographic scale. The residual impact of the loss of c.0.08 ha of Dry calcareous grassland (GS1), c.0.43ha of Oak-ash-hazel woodland (WN2), c.1.68ha of Scrub (WS1) and c.0.67km of hedgerows (WL1) on Habitat Cluster 8 Lackagh has been assessed as significant at the local geographic scale.

Cluster 9 Ballindooley Lough and surrounding land (Ch. 12+300 to Ch. 12+500 of the Proposed N6 GCRR)

The loss of c.0.28ha of 6410 *Molinia* meadows within this habitat cluster has a likely significant residual effect at the national geographic scale. A section of 6410 *Molinia* meadows (c.0.65ha), and a section of Oak-ash-hazel woodland (WN2) (0.03 ha), and the entire area of Eutrophic lake (FL5) and Reed and large sedge

swamps (FS1) is to be retained in Habitat Cluster 9. The residual impact associated with the loss of c.0.03ha of Oak-ash-hazel woodland (WN2), c.0.005ha of Scrub (WS1) and c.0.67km of hedgerows (WL1) from Habitat cluster 9 Ballindooley Lough has been assessed as significant at the local geographic scale.

Cluster 10 Castlegar (Ch. 13+500 of the Proposed N6 GCRR)

The residual impact of the loss of c.0.24km of hedgerows (WL1) will have a residual impact on Habitat Cluster 10 Castlegar. The residual impact associated with this habitat loss has been assessed as significant at the local geographic scale.

Cluster 11 Briarhill (Ch. 15+900 to Ch. 16+300 of the Proposed N6 GCRR)

The loss of c.0.26ha of *8240 Limestone pavement has a likely significant residual effect at the international geographic scale. A few areas of *8240 Limestone pavement (c.0.36ha) is to be retained in Habitat Cluster 11. The residual impact of the loss of c.2.76ha of Dry calcareous grassland (GS1), c.0.23ha of Dry meadows and grassy verges (GS2), c.0.24ha of mixed broadleaved woodland (WD1), c.0.22ha oak-ash-hazel woodland (WN2), c.2.31ha of Scrub (WS1), c.0.46 km of hedgerows (WL1) and c.0.24km of treelines (WL2) within Habitat Cluster 11 Briarhill has been assessed as significant at the local geographic scale.

Cluster 12 Ardaun (Ch. 16+950 to Ch. 17+150)

The residual impact of the loss of c.0.04ha of Dry meadows and grassy verges (GS2) and c.0.03km of hedgerows (WL1) within Habitat Cluster 12 Ardaun has been assessed as significant at the local geographic scale.

8.7.4 Rare and protected plant species

The 2018 EIAR predicted no residual impacts on rare and protected plant species. However the ABP's Inspector's Report dated 22 June 2021 disagreed with this valuation and determined likely significant negative residual effects on four rare plant species, i.e., Woodsy thyme moss *Plagiomnium cuspidatum*, Lesser striated feather-moss *Plasteurhynchium striatulum*, Imbricate bog-moss *Sphagnum affine*, and Red bog-moss *Sphagnum capillifolium*, at the National geographic scale. There is also a potential significant residual effect on Eyebright *Euphrasia arctica* at a local geographic scale.

The residual impact for this updated EIAR has been revised to a county geographic scale for Red bog-moss *Sphagnum capillifolium*, Woodsy thyme moss *Plagiomnium cuspidatum*, Lesser striated feather-moss *Plasteurhynchium striatulum* (see Section 8.5.5)

A mitigation strategy will be implemented (and monitored) to minimise the risk of the Project affecting Imbricate bog-moss *Sphagnum affine*, Red bog-moss *Sphagnum capillifolium*, Woodsy thyme moss *Plagiomnium cuspidatum*, Lesser striated feather-moss *Plasteurhynchium striatulum*, Spring gentian *Gentiana verna* and Eyebright *Euphrasia arctica.* Remaining residual impacts remain due to potential indirect hydrological and hydrogeological impacts for Imbricate bog-moss *Sphagnum affine*, Red bog-moss *Sphagnum capillifolium*, as well as potential indirect air quality impacts on Imbricate bog-moss *Sphagnum affine*, Red bog-moss *Sphagnum capillifolium*, Woodsy thyme moss *Plagiomnium cuspidatum* and Lesser striated feather-moss *Plasteurhynchium striatulum* and Eyebright *Euphrasia arctica.*

8.7.5 Mammals

8.7.5.1 Otter

A mitigation strategy will be implemented (and monitored) to minimise the risk of the Project affecting water quality in receiving watercourses/waterbodies during construction which will ensure that there is not a likely significant negative residual effect on the local Otter population (Section 8.6.5.1).

Mitigation measures will be implemented (and monitored) to ensure that, during operation, the Project does not result in a significant negative effect on the local Otter population as a result of severance/barrier effects or mortality risk: the provision of mammal passage facilities in conjunction with mammal resistant fencing (Section 8.6.5.1).

Therefore the Project will not result in a likely significant negative residual effect on Otter, at any geographic scale.

8.7.5.2 Bats

A mitigation strategy will be implemented (and monitored) prior to and during construction to minimise the risk of direct harm to bats during demolition and tree felling, to provide temporary linear features to reduce the effects of severance of flight paths during construction. Significant residual impacts will still remain as some of the activities are unavoidable and can only be mitigated to a certain level of certainty:

- Demolition of 19 buildings within the Assessment Boundary which will affect 23 bat roosts of Soprano pipistrelle bats, Common pipistrelle bats, Brown long-eared bats and Lesser horseshoe bats, Leisler's bat roosts and unidentified Myotis species including:
  - One satellite roost for Lesser horseshoe bats will be demolished at Aughnacurra (PBR178) (a satellite roost for the Menlo Castle (PBR06) Lesser horseshoe maternity roost) and the loss of another Lesser horseshoe bat night roosts (PBR210) within their foraging area could result in an impact on the Lesser horseshoe bat at a national geographic scale, in the absence of any measures to address this impact.
- Trees will be felled (PTR48, PTR45, PTR43) that have been confirmed as supporting bats (Leisler's bat (PTR48) and Pipistrelle bats, respectively (PTR45 and PTR43) and an additional eight trees have high (or category 1 as per the 2018 EIAR classification) potential to support bats and will also be felled.
- Loss of foraging habitat is regarded to be most significant in the Menlough area where woodland-pasture-hedgerow habitat is being lost and is within the CSZ for the nationally-important population of Lesser horseshoe bats
- Inevitable elevated mortality rates due to vehicle collisions
- Mortality and severance/barrier effects caused by the Project on individual bats. Whilst best practice has been followed in the design of the Project and the inclusion of underpasses/culverts and a wildlife overpass, a small proportion of the local bat population will inevitably fly over the Project and be vulnerable to vehicle collisions. A small proportion of the population will also be adversely affected by the barrier effect posed by the Project across the landscape. The effect of this residual impact on Lesser horseshoe bats is predicted to be significant at a national geographic scale. The impact on other bat species is predicted to be significant at a local geographic scale
- Design measures are proposed to minimise the potential for significant negative effect at a local geographic scale from compound lighting effects

These residual impacts have been addressed further by the proposal for specific compensatory measures.[159]

8.7.5.3 Badger

The provision of an artificial sett is required to mitigate the potential significant negative effects at a local geographic scale on the Lackagh Quarry badger group, due to the loss of two setts at Lackagh Quarry. A mitigation strategy will be implemented (and monitored) during construction to ensure that the removal of badger setts and the predicted disturbance to Badger that will occur during construction does not contravene the protection afforded to the breeding and resting places of wild animals (including Badger) under Section 23 (5)(d) of the Wildlife Acts (Section 8.6.5.3.1).

Mitigation measures will be implemented (and monitored) to ensure that, during operation, the Project does not result in a significant negative effect on the local Badger population as a result of severance/barrier effects or mortality risk: the provision of mammal passage facilities in conjunction with mammal resistant fencing (Section 8.6.5.3).

Therefore, the Project will not result in a likely significant negative residual effect on Badger, at any geographic scale.

[159] Compensation describes measures taken to make up for residual effects resulting in the loss of, or permanent damage to ecological features despite mitigation" (CIEEM, 2016)

8.7.5.4 Other Mammal Species

A mitigation strategy will be implemented to minimise the risk of the Project affecting water quality in receiving watercourses/waterbodies during construction which will ensure that there is not a significant negative effect on local aquatic or marine mammal populations (Section 8.6.3.4).

Mitigation measures will be implemented to ensure that, during operation, the Project does not result in a significant negative effect on local mammal populations (excluding bats) as a result of severance/barrier effects or mortality risk: the provision of mammal passage facilities in conjunction with mammal resistant fencing (Section 8.6.5.4).

Therefore, the Project will not result in a likely significant negative residual effect on any other mammal species (excluding bats), at any geographic scale.

8.7.6 Invertebrates

8.7.6.1 White-clawed crayfish

As there are no records of White-clawed crayfish from within the ZoI of the Project they will not be affected. Therefore, no mitigation measures are required and no residual impacts are predicted.

8.7.6.2 Freshwater pearl mussel

As there are no records of Freshwater pearl mussel from within the ZoI of the Project they will not be affected. Therefore, no mitigation measures are required and no residual impacts are predicted.

8.7.6.3 Swan mussel

In conjunction with the design of the Project, mitigation measures will be implemented to minimise the effects of habitat loss on swan mussel, such that no population level effects are predicted (Section 8.6.6.1).

A mitigation strategy will be implemented during construction to minimise the risk of the Project affecting water quality in receiving watercourses/waterbodies and to ensure that the existing groundwater regime is not affected. This will ensure that there is not a likely significant negative effect on swan mussel during construction (Section 8.6.6.1).

No likely significant negative effects on swan mussel are predicted during operation, and no mitigation measures are required.

Therefore the Project will not result in a likely significant negative residual effect on swan mussel, at any geographic scale.

8.7.6.4 Marsh whorl snail

A mitigation strategy will be implemented during construction to minimise the risk of the Project affecting water quality in receiving watercourses/waterbodies and to ensure that the existing groundwater regime is not affected. This will ensure that there is not a significant negative impact on the habitats supporting the Marsh whorl snail during construction (Section 8.6.6.2).

Mitigation measures will be implemented to ensure that the existing groundwater regime is not affected during operation (Section 8.6.6.2).

Therefore, the Project will not result in a likely significant negative residual effect on the Marsh whorl snail, at any geographic scale.

8.7.6.5 Marsh fritillary

A mitigation strategy will be implemented during construction to avoid any Marsh fritillary mortality during site clearance works (Section 8.6.6.3).

No other likely significant effects on the Marsh fritillary butterfly are predicted during construction.

No likely significant negative effects on Marsh fritillary are predicted during operation and no mitigation measures are required.

Therefore the Project will not result in a likely significant negative residual effect on the Marsh fritillary butterfly, at any geographic scale.

8.7.6.6 Other Invertebrate Species

The Project will remove some habitats in the Menlough-Coolagh area that may support local bees, but these habitats are of low diversity and less important for bees compared to species-rich meadows.

No likely significant negative effects on bees are predicted during operation and no mitigation measures are required. Significant residual effects on the local bee populations are not predicted to occur.

8.7.7 Birds

8.7.7.1 Breeding birds

A mitigation strategy will be implemented during construction to minimise the mortality risk and the effects of habitat loss and disturbance to breeding birds (Section 8.6.7.1). This includes retaining and enhancing the ledges used as the Peregrine falcon nest sites between 2015 and 2023 within the design and a seasonal restriction on construction works in the vicinity of the nest site. It also includes a seasonal restriction on construction works in the vicinity of the Barn owl nest site at Menlo Castle.

Therefore, the Project will not result in a likely significant negative residual effect on breeding bird species, at any geographic scale, with the exception of Barn owl and the Peregrine falcon.

Due to the likely permanent loss of Lackagh Quarry as a nesting site, the Project is likely to result in a significant negative residual effect on Peregrine falcon, at the county geographic scale.

A mitigation strategy will be implemented (and monitored) to reduce and minimise the mortality risk to the local Barn owl population posed by the Project during operation (Section 8.6.7.1). This includes the provision of additional nesting structures and planting to discourage Barn owl from foraging along the proposed road carriageway and enhance Barn owl foraging habitat in the vicinity of the nesting site at Menlo Castle.

Whilst the Project will result in an estimated loss of c.49.1ha of barn owl habitat within 5km of the Menlo Castle nest site, the creation of: (i) c.8.9ha of rough grassland habitat at Menlough (by applying the revised cattle grazing approach); (ii) c.1.81ha of Calcareous grassland habitat at Menlough; and (iii) c.0.4ha of Dry heath habitat west of the River Corrib will result in c.11.11ha of barn owl habitat being created/enhanced.

However, in the absence of an evidence regarding the efficacy of the mitigation measures to reduce the mortality risk, there remains the potential for permanent impacts on the Menlo Castle nest site due to its proximity to the Project and local Barn owl population as a result of the mortality risk which may result a significant negative residual effect on Barn owl, at the local geographic scale. This residual impact is additional since the 2018 EIAR, due to new guidance published in 2021 (Lusby, *et al.*, 2021).

8.7.7.2 Wintering birds

A seasonal restriction on blasting near Ballindooley Lough will ensure that there are no long-term effects on wintering bird populations from construction works associated with the Project (Section 8.6.7.2).

No likely significant negative effects on wintering bird species are predicted during operation, and no mitigation measures are required.

Therefore the Project will not result in a likely significant negative residual effect on wintering bird species, at any geographic scale.

8.7.8 Amphibians

A mitigation strategy will be implemented during site clearance works to minimise the risk of the Project affecting water quality in receiving watercourses/waterbodies, to minimise the mortality risk, and to minimise the effects of habitat loss and disturbance, on the local Common frog and Smooth newt populations. This will ensure that construction of the Project will not have any long-term effects, or affect the conservation status, of these amphibian species. It will also ensure that site clearance works will not

contravene the protection afforded to the breeding and resting places of wild animals (including the Common frog and Smooth newt) under Section 23 (5)(d) of the Wildlife Acts (Section 8.6.8).

The design of the Project, in conjunction with the network of mammal passage facilities, will ensure that there are no long-term severance or barrier effects to the local Common frog and Smooth newt populations associated with the Project (Section 8.6.8).

Within Appendix 4 of ABPs' Inspector's Report dated 22 June 2021, a significant residual impact is identified on Smooth newt and Common frog, at a local level (see Table 13 of Appendix 4 of ABPs' Inspector's Report dated June 2021). However, it is the professional opinion of the authors, that this is not likely due to the mitigation measures proposed in Section 8.6.8, and therefore, the Project will not result in a likely significant negative residual effect on Common frog or Smooth newt, at any geographic scale.

8.7.9 Reptiles

A mitigation strategy will be implemented during site clearance works to minimise the mortality risk, and to minimise the effects of habitat loss and disturbance, on the local Common lizard population. This will ensure that construction of the Project will not have any long-term effects, or affect the conservation status, of the Common lizard. It will also ensure that site clearance works will not contravene the protection afforded to the breeding and resting places of wild animals (including the Common lizard) under Section 23 (5)(d) of the Wildlife Acts (Section 8.6.9).

The design of the Project, in conjunction with the network of mammal passage facilities, will ensure that there are no long-term severance or barrier effects to the local Common lizard population associated with the Project (Section 8.6.9).

Therefore the Project will not result in a likely significant negative residual effect on the Common lizard, at any geographic scale.

8.7.10 Fish

In conjunction with the design of the Project, mitigation measures will be implemented to minimise the effects of habitat loss on fish species, and to maintain fish passage along all watercourses crossed by the Project, such that no population level effects are predicted (Section 8.6.10).

A mitigation strategy will be implemented during construction to minimise the risk of the Project affecting water quality in receiving watercourses/waterbodies and to ensure that the existing groundwater regime is not affected. This will ensure that there is not a likely significant negative effect on fish species during construction (Section 8.6.10).

Mitigation measures will also be implemented to minimise the potential for disturbance or mortality of fish species during construction, such that no population level effects are predicted.

No likely significant negative effects on fish species are predicted during operation, and no mitigation measures are required.

Therefore the Project will not result in a likely significant negative residual effect on fish species, at any geographic scale.

8.7.11 Local Biodiversity Areas

All of the local biodiversity areas traversed by the Project will be affected to some degree by the likely significant effects associated with the Project on the KERs that have been identified in each of those areas. These likely significant effects are accounted for, and described, above separately and this section provides some context for these residual impacts with respect to the locations of the local biodiversity area through which the Project passes.

The residual impact of the loss of c.0.14ha of Residual alluvial forest [*91E0] habitat will have a residual impact on the Menlough to Coolough Hill local biodiversity area. The residual impact associated with this habitat loss has been assessed as significant at the international geographic scale.

The residual impact of the loss of c.1.54ha of Limestone pavement [*8240] habitat will have a residual impact on the Menlough to Coolough Hill local biodiversity area and the Doughiska local biodiversity area.

The residual impact associated with this habitat loss has been assessed as significant at the international geographic scale.

The residual impact of the loss of c.5.63ha of peatland habitat mosaic (Blanket bog [*7130], Wet heath [4010], Dry heath [4030] and *Molinia* meadow [6410]) will have a residual impact on the Coast Road (R336) to the N59 Moycullen Road local biodiversity area. The residual impact associated with this habitat loss has been assessed as significant at the national geographic scale.

The residual impact of the loss of c.0.25ha of Calcareous grassland [6210] habitat will have a residual impact on the Menlough to Coolough Hill local biodiversity area and the Doughiska local biodiversity area. The residual impact associated with this habitat loss has been assessed as significant at the national geographic scale.

The residual impact of the loss of c.0.29ha of *Molinia* meadow [6410] habitat will have a residual impact on the Ballindooley – Castlegar local biodiversity area. The residual impact associated with this habitat loss has been assessed as significant at the national geographic scale.

The residual impact of the loss of 18 calcareous springs (FP1) and four Petrifying springs [*7220] at Lackagh Quarry will have a residual impact on the Menlough to Coolough Hill local biodiversity area. The residual impact associated with this habitat loss has been assessed as significant at the local and county geographic scales, respectively.

The residual impact of the loss of c.5.24ha of dry-humid acid grassland (GS3) and c.1.30ha of Poor fen and flush habitat (PF2) will have a residual impact on the Coast Road (R336) to the N59 Moycullen Road local biodiversity area. The residual impact associated with this habitat loss has been assessed as significant at the local geographic scale.

Hedgerows and treelines will be impacted throughout the local area with the greatest concentrations affected in parts of the Coast Road (R336) to the N59 Moycullen Road local biodiversity area around Ballagh, in the Menlough to Coolough Hill local biodiversity area, and in the Doughiska local biodiversity area. The residual impact associated with this habitat loss has been assessed as significant at the local geographic scale.

The residual impact of the loss of Broadleaved woodland (WD1) and Oak-ash-hazel woodland (WN2) will have a residual impact on the Menlough to Coolough Hill local biodiversity area. The residual impact associated with this habitat loss has been assessed as significant at the local geographic scale.

The residual impact on the local Lesser horseshoe bat population will have a residual impact principally on the Menlough to Coolough Hill and Cooper's Cave Terryland local biodiversity areas, but is also likely to affect the River Corrib and the Coolagh Lakes local biodiversity area, the Cooper's Cave Terryland local biodiversity area, Ballindooley – Castlegar local biodiversity area, and the Terryland Glenanail local biodiversity area. This residual impact associated has been assessed as potentially significant at the national geographic scale.

The residual impact on all other bat species recorded within the study area will have a residual impact on the Coast Road (R336) to the N59 Moycullen Road local biodiversity area, the River Corrib and the Coolagh Lakes local biodiversity area, the Menlough to Coolough Hill local biodiversity area, the Ballindooley – Castlegar local biodiversity area, and the Doughiska local biodiversity area, the City Canal System local biodiversity area, the Waterbody local biodiversity area and the Terryland Glenanail local biodiversity area.. This residual impact associated has been assessed as significant at the local geographic scale.

The residual impact on the local Peregrine falcon population will have a residual impact on the Menlough to Coolough Hill local biodiversity area. This residual impact associated has been assessed as significant at the county geographic scale.

The residual impacts of the Project, as they relate to each of the local biodiversity area, are summarised below:

- **Coast Road (R336) to the N59 Moycullen Road local biodiversity area**
  - Residual impact at the national geographic scale

    - Peatland habitat mosaic (Blanket bog (active) [*7130], Wet heath [4010], Dry heath [4030] and *Molinia* meadow [6410])
  - Residual impact at the local geographic scale
    - Dry-humid acid grassland (GS3), Poor fen and flush habitat (PF2), Hedgerows and treelines (WL1/WL2), bats other than the Lesser horseshoe bat

- **River Corrib and the Coolagh Lakes local biodiversity area**
  - Residual impact at the national geographic scale
    - Lesser horseshoe bat
  - Residual impact at the local geographic scale
    - Bat species other than the Lesser horseshoe bat

- **Menlough to Coolough Hill local biodiversity area**
  - Residual impact at the international geographic scale
    - Limestone pavement [*8240] and Residual alluvial forest [*91E0]
  - Residual impact at the national geographic scale
    - Calcareous grassland [6210] and the Lesser horseshoe bat
  - Residual impact at the county geographic scale
    - Petrifying springs [*7220] and the Peregrine falcon
  - Residual impact at the local geographic scale
    - Calcareous springs (FP1), Broadleaved woodland (WD1), Hedgerows and treelines (WL1/WL2), Oak-ash-hazel woodland (WN2) and bats other than the Lesser horseshoe bat

- **Ballindooley – Castlegar local biodiversity area**
  - Residual impact at the national geographic scale
    - Molinia meadow [6410] and the Lesser horseshoe bat
  - Residual impact at the local geographic scale
    - Bats other than the Lesser horseshoe bat

- **Doughiska local biodiversity area**
  - Residual impact at the international geographic scale
    - Limestone pavement [*8240]
  - Residual impact at the national geographic scale
    - Calcareous grassland [6210]
  - Residual impact at the local geographic scale
    - Hedgerows and treelines (WL1/WL2) and bats other than the Lesser horseshoe bat

- **Cooper's Cave Terryland local biodiversity area**
  - Residual impact at the national geographic scale
    - Lesser horseshoe bat

- **Terryland Glenanail local biodiversity area.**
  - Residual impact at the national geographic scale
    - Lesser horseshoe bat
  - Residual impact at the local geographic scale
    - Bat species other than the Lesser horseshoe bat
- **City Canal System local biodiversity area,**
  - Residual impact at the national geographic scale
    - Lesser horseshoe bat
  - Residual impact at the local geographic scale
    - Bat species other than the Lesser horseshoe bat
- **Waterbody local biodiversity area**
  - Residual impact at the national geographic scale
    - Lesser horseshoe bat
  - Residual impact at the local geographic scale
    - Bat species other than the Lesser horseshoe bat

8.8 Cumulative Impacts

This section of this updated EIAR presents the assessment carried out to examine whether the Project along with any other projects or plans could cumulatively result in a likely significant effect on biodiversity. Cumulative impacts are defined as the combination of many minor impacts creating one larger, more significant impact (NRA, 2009 and EPA 2022). Cumulative impacts consider existing stresses on the natural environment as well as developments that are underway and in planning. This section considers and assesses the direct, indirect and cumulative effects of any projects approved and any pending planning applications that might have the potential for likely significant impacts.

Cumulative effects can result from individually insignificant but collectively significant actions/developments taking place over a period of time or concentrated in a location. The following development types are included in considering cumulative effects:

- Existing projects (under construction or operational)
- Projects which have been granted consent but not yet started
- Projects for which consent has been applied for which are awaiting a decision, including those under appeal
- Projects proposed at a plan level, if relevant (e.g. future strategic infrastructure such as roads or greenways)

A review has been carried out of live and approved applications contained in the planning files for:

- Galway City Council
- Galway County Council
- County Councils in neighbouring counties (County Clare)
- An Bord Pleanála
- Department of Housing, Planning and Local Government EIA Portal

A number of live and/or approved projects (as listed in Chapter 21 and with the detailed assessment in Appendix A.8.28) have been identified which have the potential for significant cumulative impacts with the Project, either on its own, or in combination with the Project and all of the other projects and plans considered in this updated EIAR. In particular, large projects such as transport infrastructure and coastal protection were assessed, including the following projects:

- N59 Maigh Cuilinn (Moycullen) Bypass Road Project
- Galway to Dublin Cycleway
- Connemara Greenway (from Galway City to Clifden))
- Galway to Spiddal Greenway (Bearna to Spiddal Cycleway)
- R336 Bearna to Scríb via Ros an Mhíl Upgrade/Improvements
- Sáilín to Silverstrand Coastal Protection Scheme
- Proposed Galway Harbour Port Extension

While the potential for cumulative impacts were identified in relation to the residual effects of the Project, alongside other projects, plans, programmes, and strategies, there is no real likelihood of significant cumulative effects on biodiversity that would alter the conclusions of the environmental impact assessment presented in this updated EIAR.

The potential for cumulative impacts has been ruled out for a number of these projects, either due to the low ecological value of many sites or the location, design, or nature of the other projects. There are other applications which have been refused planning consent or have been withdrawn or invalidated and these have not been considered or assessed in this section.

8.8.1 Designated Sites

This section presents the assessment carried out to examine whether any other plans or projects have the potential to act in combination with the Project to adversely affect the integrity of the designated sites where impacts may still have an in combination effect and include the following sites: Lough Corrib SAC, Lough Corrib SPA, Galway Bay Complex SAC, Inner Galway Bay SPA, Inishmore Island SAC, Kilkieran Bay and Islands SAC, Ardrahan Grassland SAC, Castletaylor Complex SAC, Kiltiernan Turlough SAC, Lough Fingall Complex SAC, Rahasane Turlough SPA, Rahasane Turlough SAC, Cregganna Marsh SPA, Maumturk Mountains SAC, The Twelve Bens/Garraun Complex SAC, Connemara Bog Complex SAC, Connemara Bog Complex SPA, Ross Lake and Woods SAC, East Burren Complex SAC, Moneen Mountain SAC, Black Head-Poulsallagh Complex SAC and Gortnandarragh Limestone Pavement SAC, and their associated NHAs and pNHAs, as well as the following isolated NHAs and pNHAs; Moycullen Bog NHA, Furbogh Wood pNHA, Kiltullagh Turlough pNHA, Ballycuirke Lough pNHA, Drimcong Wood pNHA and Turloughcor pNHA.

All other designated sites fall beyond the zone of influence of the Project. Therefore, there is no potential for any other plans or projects to act cumulatively or in combination with the Project to adversely affect the integrity of any other designated sites.

The potential for other plans or projects to act cumulatively or in combination with the Project to adversely affect the integrity of European sites, is considered in Section 12 of the updated NIS (termed “in combination effects” in the context of the updated NIS assessment).

The potential for in combination effects to arise in the receiving environment, including River Corrib and Galway Bay, from any existing or proposed land use plans or developments is regulated and controlled by the environmental protective policies and objectives of the Galway City Development Plan 2023-2029 and Galway County Development Plan 2022-2028. Any existing/proposed plan or project that could potentially affect European sites in Galway Bay, or any other European site, in combination with the Project, must adhere to these overarching environmental protective policies and objectives. These policies and objectives will ensure the protection of the European site within the zone of influence of the Project, and include the requirement for any future plans or projects to undergo Screening for Appropriate Assessment and/or

Appropriate Assessment to examine and assess their effects on European sites, alone and in combination with other plans and projects.

There are specific objectives and policies in the Galway City Development Plan 2023-2029 and Galway County Development Plan 2022-2028 to protect biodiversity, and specifically European sites. Policies within the Galway City Development Plan 2023-2029 Policy 5.2 (1), Policy 5.2 (2), and Policy 5.2 (11) relate to the protection of European sites, AA and commitments to not permitting projects giving rise to adverse effects on the integrity of European sites without demonstrating there are no alternatives, there are imperative reasons of overriding public interest, and undertaking all compensation measures necessary to ensure the overall coherence of the network of European sites.

Policies within the Galway County Development Plan 2022-2028 NHB 1, NHB 2, and NHB 3 relate to the protection of European sites, AA and commitments to not permitting projects giving rise to adverse effects on the integrity of European sites without demonstrating there are no alternatives, there are imperative reasons of overriding public interest, and undertaking all compensation measures necessary to ensure the overall coherence of the network of European sites.

The Galway City Development Plan 2023-2029 also includes policies for protection of European sites regarding its integrity relating to waters (Policy 5.2 (2), Policy 5.2 (4), Policy 5.2 (7), Policy 5.2 (12), Policy 5.2 (18), Policy 9.2 (6)).

The Galway County Development Plan 2022-2028 also includes policies to protect water quality, wetland sites and peatlands (from pollution via surface and ground water) (WR 1, WR 2, WTWF 1 and P 1).

Although other plans and projects have the possibility to act in combination with the proposed project to affect air quality locally in the vicinity of the Lough Corrib SAC, considering the land use zonings and objectives that relate to lands in this area in the Galway City Development Plan 2023-2029 (Recreation and Amenity, Agriculture and High Amenity and Agricultural), and the protective policies and objectives included within the Plan to protect air quality and European sites, developments in Galway City will not act in combination with the Project to affect the integrity of any European sites due to impacts on air quality.

Land use plans for the other local authorities (e.g. Clare County Council) whose functional areas include surface water features which drain to the Galway Bay, were examined and analysed and those land use plans also include protective environmental policies to protect European sites and the receiving groundwater, and surface water environments. The potential cumulative impacts on those European sites within the ZoI of the Project from the proposed works in combination with other plans and projects, as identified from Galway City Council's and Galway County Council's planning e-portals and An Bord Pleanála mapviewer are identified and assessed in Appendix R of the updated NIS.

The full assessment of the potential in combination effects of the land use plans presented in Appendix R of the updated NIS. The full assessment of live and/or approved projects are also detailed in Appendix R of the updated NIS, indicating a sample of the projects, in particular, large projects such as transport infrastructure projects and coastal protection projects which were assessed.

The updated NIS concludes that the Project will not affect the integrity of any European sites including specifically the 22 which fall within the ZoI of the Project. Furthermore, having considered and assessed the Project in combination with all plans and projects listed in Section 12 of the updated NIS, there is no potential for the Project in combination with other plans and projects to undermine the conservation objectives, or adversely affect the integrity, of any European sites, particularly in light of the mitigation measures included as part of the Project. The Project level mitigation in tandem with the environmental protective policies set out in the overarching land use plans, ensures there is no potential for projects individually (pairwise) or cumulatively with all the other projects or plans as well as with the Project, to act in combination to impact on the conservation objectives of any European sites.

Similarly, for the same reasons, having considered and assessed the Project alongside all plans and projects listed in Appendix A.8.28, there is no potential for the Project to act cumulatively in combination with other plans and projects to significantly affect any pNHA sites, particularly in light of the mitigation measures included as part of the Project. The Project level mitigation in tandem with the environmental protective policies set out in the overarching land use plans, ensures there is no potential for projects individually

(pairwise) or cumulatively with all the other projects or plans as well as with the Project, to act in combination to impact on the conservation objectives of any pNHA sites.

8.8.2 Cumulative Impact Assessment

The potential for likely significant cumulative impacts to arise are limited to those residual impacts associated with the Project and those effects the Project will have on the receiving environment, that are measurable in some way, but themselves will not result in a likely significant residual effect on biodiversity.

The residual impacts associated with the Project relate to the following:

- Habitat loss, including both the permanent loss of Annex I habitats (outside of any European Site) and habitats valued as being of local importance
- The potential loss of a Peregrine falcon nest site due to long-term disturbance/displacement impacts
- The potential for impacts on the Menlo Castle Barn Owl nest site
- Impacts on bats as a result of the construction and operation of the Project

The other impacts associated with the Project that are measurable in some way, but themselves will not result in a likely significant effect on biodiversity, are also discussed below:

- Impacts on the existing hydrological and hydrogeological regimes
- Impacts on air quality
- Impacts to species as a result of disturbance or displacement

Avoidance, design requirements, mitigation measures and compensation strategy detailed therein (Chapter 4, Chapter 5, Section 8.6 and Section 8.9) of this updated EIAR, will be implemented throughout all phases of the Project. A Construction Environment Management Plan (Appendix A.7.5) has been created and its requirements will be put in place to mitigate impacts relating to habitats, surface water, groundwater, dust and air quality noise and vibration, service diversions, non-native invasive species, and waste.

8.8.3 Impacts from habitat loss

As outlined in Section 8.5.5, habitat loss to development and land use change has been an ongoing impact locally which may have already had effects on local biodiversity. Those projects listed in Appendix A.8.28 have, or are likely to, result in habitat impacts (including those of a high biodiversity value such as Annex I habitat types) which may also have knock-on effects on fauna species. Therefore, land use change and habitat losses are likely to continue to some degree and the loss and fragmentation of habitat associated with the Project will contribute to this trend locally.

The most notable habitat loss impacts are the losses of areas of internationally or nationally valued habitats: Limestone pavement [*8240], Residual alluvial forest [*91E0], Blanket bog (active) [*7130], Wet heath [4010], Dry heath [4030], Calcareous grassland [6210], *Molinia* meadow [6410] and four Petrifying springs [*7220]. There are also significant areas of habitat types of a local biodiversity value that will be lost: calcareous springs, reed and large sedge swamps, dry-humid acid grassland, poor fen and flush, broadleaved woodland, hedgerows and treelines. Habitat losses, regardless of their own habitat value, also have the potential to have an effect on the local flora and fauna populations that they support. The most significant impact in that regard are the likely effects of habitat loss on the local bat populations; particularly the Menlo Castle Lesser horseshoe bat population (impacts on bats are discussed separately below).

The losses of areas of Annex I habitat associated with the Project are considered to be at the highest level of geographic significance for the habitats involved. In addition, the Project will be contributing to an existing trend of Annex I habitat loss locally. While the cumulative effect of habitat losses would increase the magnitude of the impact, it does not increase the geographic scale of the impact significance associated with

the Project. The protective polices in the *Bearna Local Area Plan 2015-2021*[160], the *Galway City Council Development Plan 2017-2023/ 2023-2029* and the *Galway County Development Plan 2015-2021/ 2022-2028* to protect biodiversity will moderate any future impacts on biodiversity, including those related to Annex I habitat types. Where the losses can be compensated for (see Section 8.9 below), this offsets the contribution of the Project to existing losses of the habitat type in question whilst ensuring that there is no potential for other developments to result in a likely significant cumulative impact either pairwise with any other projects or collectively.

In relation to areas of locally important habitats that will be lost, given the habitat types involved and that at any greater geographic scale they are likely to remain in a favourable conservation condition, any cumulative losses of these habitat types are not likely to increase the impact significance already assessed for the Project itself. The protective polices in place in the land use plans will also moderate any future losses of habitats of a biodiversity value. Where habitat losses can be compensated for this would also reduce the impact significance and the potential for any cumulative impacts with any future developments.

8.8.4 Impacts on rare and protected plants

The potential for cumulative impacts on the rare plant species Imbricate bog-moss *Sphagnum affine*, Red bog-moss *Sphagnum capillifolium*, Woodsy thyme moss *Plagiomnium cuspidatum*, Lesser striated feather-moss *Plasteurhynchium striatulum*, Spring gentian *Gentiana verna* and Eyebright *Euphrasia arctica* may arise from habitat loss to development and land use change. This has been an ongoing impact locally which may have already had effects on local biodiversity (see section 8.8.3 above). The land use zonings and protective polices for biodiversity in the *Bearna Local Area Plan 2015-2021*[149], the *Galway City Council Development Plan 2017-2023/ 2023-2029* and the *Galway County Development Plan 2015-2021/ 2022-2028* will moderate any future impacts on biodiversity (see section 8.8.3 above), including those related to Annex I habitat types, such as Limestone pavement [*8240], Calcareous grassland [6210], and peatland habitats (e.g. wet heath [4010]) which support the following rare plant species within the Assessment Boundary: Imbricate bog-moss *Sphagnum affine*, Red bog-moss *Sphagnum capillifolium*, Lesser striated feather-moss *Plasteurhynchium striatulum* and Spring gentian *Gentiana verna*. The protective polices in place in the land use plans will also moderate any future losses of other locally important habitats of a biodiversity value, which includes habitat types which support Woodsy thyme moss *Plagiomnium cuspidatum* and Eyebright *Euphrasia arctica*.

8.8.5 Impacts on Peregrine falcon

Due to the potential for long-term disturbance and displacement of the Lackagh Quarry Peregrine falcon pair from the existing nest site, the Project is likely to result in a significant negative residual effect on Peregrine falcon, at the county geographic scale.

The two other Peregrine falcon nest sites that are present locally are likely to continue to support breeding Peregrine falcon. One site is a disused quarry which is zoned for agricultural use and is therefore, not likely to see any increased disturbance from development; the second nest site is a regularly occupied site in an active quarry and the baseline levels of disturbance, to which the resident Peregrine pair are habituated, are likely to remain. Neither of these sites are likely to be affected by any of the projects assessed and detailed in Appendix A.8.28, given their locations relative to where those strategies/projects will be implemented. Existing pressures at the county level on suitable nest site availability are expected to continue and may act cumulatively at the county geographic scale, but there is not sufficient data available to quantify this. However, any additional pressures on the Peregrine falcon population will not increase the overall significance of the impact of the Project above the county level assessed impact given that the species is currently considered to be of a low conservation concern for its national population.

Therefore, there are no other planned and/or committed projects that are likely to cumulatively act along with the Project (either pairwise with any other projects or collectively), to increase the predicted impact

[160] Bearna Local Area Plan 2015-2021 was incorporated into the Galway County Development Plan, by way of a variation to the Galway County Development Plan 2015-2021. Within the current Galway County Development Plan 2022-2028, the area of Bearna is included in the Galway County Metropolitan Area Settlement Plan (Volume 2, Section 2.6 of the Galway County Development Plan 2022-2028).

significance of the Project on Peregrine falcon from the likely significant negative residual effect, at the county geographic scale.

8.8.6 Impacts on bats

The predicted residual impacts on bats include loss of roosts, loss of foraging habitat and the barrier/severance effect posed by roads.

Some proportion of existing roost sites in the vicinity of the Project may deteriorate over time and become unsuitable for bats to use (e.g. derelict structures and old trees). Therefore, the roost sites that will be affected by the Project could potentially contribute to such natural declines in other roost sites locally.

Loss of foraging habitat and barriers to bat movements may result from development of zoned land within the east, northern and northwestern fringes of Galway City. Lands used by bats which are also zoned for development include residential zoning (R) at Letteragh Road, Community and Institutional Zoning (CF) at Merlin University Hospital, and light industrial zoning (C2.1/CI) near the N84 Headford Road and Ballindooley, which may affect the proposed artificial roost via increased light spill. The recreation and amenity zoning at UoG may also interact with the flight paths of bats moving between the Aughnacurra roosts and Menlo Castle and the use of those lands by foraging bats (e.g. where additional lighting may be proposed in the future).

However, all of these impacts would be controlled by the assessment of individual planning applications which would consider the effects on protected species such as bats as part of their appraisal by the competent authority, having regard to the protective environmental policies outlines in the *Bearna Local Area Plan 2015- 2021*, the *Galway City Development Plan 2017-2023/2023-2029*, the *Galway County Development Plan 2015-2021/ 2022-2028* and the *Ardaun Local Area Plan 2018-2024* to protect biodiversity[161]. Therefore, there are no likely significant cumulative impacts (either pairwise with any other projects or collectively), predicted in addition to the residual impacts for the Project regarding loss of foraging habitat or from barriers to bat movement.

8.8.7 Impacts on the existing hydrological or hydrogeological regimes

The Project will not have any residual impacts on the existing hydrological regime in those surface water catchments crossed by the Project or the receiving marine environment in Galway Bay, either through affecting existing flow conditions or affecting flooding regimes. The Project will also not have any residual impact on the existing hydrogeological regime.

All of the surface water catchments, the groundwater bodies and the transitional waters of Galway Bay lie within the National River Basin District; what was formerly the Western River Basin District (WRBD)[162]. The *River Basin Management Plan for the Western River Basin District in Ireland (2009-2015)*, *The River Basin Management Plan for Ireland (2018-2021)*, and *The Water Action Plan 2024: A River Basin Management Plan for Ireland* (2022-2027) aims to protect all waters within the district and, where necessary, improve waters and achieve sustainable water use. The purpose of the River Basin Management Plan is to reduce pollution levels, to restore good water quality status and to prevent deterioration in water quality in the river basins and groundwater bodies. There are many land use plans and projects that lie within the WRBD that have the potential to affect surface water and groundwater bodies. However, all of the overarching land use plans have environmental protective policies, consistent with the aforementioned regional plans to protect the existing surface water and groundwater network in considering planning applications.

[161] For example, Policy 4.2 of the *Galway City Council Development Plan 2017-2023* which states

"Protect and conserve rare and threatened flora and fauna and their key habitats, (wherever they occur) listed on Annex I and Annex IV of the EU Habitats Directive (92/43EEC) and listed for protection under the Wildlife Acts 1976-2000."

[162] For the current cycle of river basin management plans (2022-2027) the Eastern, Southeastern, Southwestern, Western and Shannon River Basin Districts are merged to form one national River Basin District.

Therefore, there are no other planned and/or committed projects that will result in a likely significant cumulative effect on biodiversity, cumulatively with the Project, as a consequence of surface water or groundwater impacts.

8.8.8 Impacts on air quality

There will be some change in air quality in the immediate vicinity of the Project during operation, although it will not in itself result in a likely significant effect on biodiversity. The potential for likely significant cumulative impacts to occur through air quality effects is limited to the receiving environment in the immediate vicinity of the Project and any future developments that would introduce air quality pollutants to this local area. There are no planned and or committed projects that would be likely to contribute to the air quality baseline in any notable way in the vicinity of the Project. Considering the land use zonings and objectives that relate to this area in the *Bearna Local Area Plan 2015-2021*, the *Galway City Council Development Plan 2017-2023/ Galway City 2023-2029*, the *Galway County Development Plan 2015-2021/ 2022-2028* and the *Ardaun Local Area Plan 2018-2024*, and the protective policies and objectives in both the *Galway City Development Plan 2017*-2023/ *2023-2029* and the overarching *Galway County Development Plan 2015-2021/ 2022-2028* to protect air quality and biodiversity, there are no projects that will result in a likely significant cumulative effect on biodiversity, cumulatively with the Project, as a consequence of air quality impacts (either pairwise with any other projects or collectively).

8.8.9 Impacts on fauna species (excluding bats) as a result of disturbance or displacement

The Project will not result in a likely significant residual effect on any fauna species (excluding bats) as a result of disturbance or displacement effects during either construction or operation.

Disturbance or displacement impacts during construction are temporary or short-term and are not likely to have long-term population level effects, even cumulatively with any future development projects that might be proposed. During operation, the predicted ZoI from the Project is limited to the immediate vicinity and will not result in a likely significant residual effect on any fauna species (excluding bats) as a result of disturbance or displacement effects. Considering the land use zonings in the areas through which the Project passes (predominantly rural fringe, recreational amenity, amenity and agri-amenity), and the minimal effect of operational disturbance from road traffic, and the abundance of alternative suitable habitat locally to support those fauna species present, future development is not likely to result in in a significant effect on biodiversity, cumulatively with the Project, as a consequence of disturbance or displacement impacts (either pairwise with any other projects or collectively).

Considering all of the above and the pairwise assessments presented in Appendix A.8.28, the overall conclusion is that the Project will not give rise to any likely significant cumulative effects either pairwise or collectively with any other projects.

8.8.10 Impacts on Barn owl as a result of mortality

In the absence of an evidence regarding the efficacy of the mitigation measures to reduce the mortality risk, there remains the potential for permanent impacts on the Menlo Castle nest site due to its proximity to the Project and local Barn owl population as a result of the mortality risk which may result a significant negative residual effect on Barn owl, at the local geographic scale.

Cumulative impacts on Barn owl are most likely to arise from other major roads projects increasing the mortality risk and/or additional large scale losses of suitable Barn owl habitat (i.e. mosaics of semi-natural grasslands, hedgerows/treelines and/or heathland) within the foraging range (i.e. within 5km) of the Menlo Castle nest site. However, there are no other major roads projects within 5km of Menlo Castle that would impact on or cross areas of suitable Barn owl habitat. There are also no other projects within this zone likely to give rise to large scale losses of suitable Barn owl habitat, either individually or cumulatively.

Additionally, and as concluded above under habitat loss generally (Section 8.8.3) the land use zonings and protective policies and objectives set out in both the *Galway City Development Plan 2017*-2023/ *2023-2029* and the overarching *Galway County Development Plan 2015-2021/ 2022-2028* will further moderate the potential for losses of suitable Barn owl habitat beyond the Assessment Boundary. Therefore, there are no other projects that are likely to cumulatively increase the residual effects of the Project on Barn owl above the predicted local geographic scale.

8.9 Compensation

Where there are significant residual biodiversity impacts as a result of the Project, despite the mitigation measures proposed, compensatory measures are proposed to offset or reduce the predicted impacts[163]. These are not compensatory measures in the context of the requirements of Article 6(4) of the Habitats Directive as they are not compensating for an impact that would adversely affect the integrity of any European site. As concluded in the updated NIS, the Project will not result in such an impact on any European site.

Since the 2018 EIAR, there have been minor changes to Compensation measures based on minor changes to the design of the Project, changes in land usage, and natural ecological succession in the landscape. This has resulted in slight amendments to habitat loss calculations, and habitats that did not have a residual impact previously, including; Blanket bog (active) [*7130], Wet heath/Dry heath, Active blanket bog [4010/4030/*7130], Limestone pavement/Calcareous grassland mosaic [*8240/6210], and Dry heath/Wet heath mosaic [4030/4010].

The likely significant residual effects of the Project relate to habitat loss, the potential permanent loss of a Peregrine falcon nest site, mortality impacts on Barn owl, and impacts on the local bat populations. Each of these are discussed below with regard to whether compensatory measures are feasible and likely to succeed in compensating for the potential impacts of the Project.

It should be noted from the outset, that whilst additional measures were recommended within the Ecological Impact Assessment Report undertaken by the ecologists appointed by ABP, Dr. Arnold, [appended (as Appendix 4) to the ABP Inspector's Report, dated 22 June 2021], the following was also recognised by Dr. Arnold:

"the mitigation and compensation measures do lessen the severity or likelihood of many of the identified impacts, and many of the measures such as the use of viaducts and tunnels, habitat creation and the provision of overpasses and underpasses are beneficial."

8.9.1 Habitat loss

Limestone pavement [*8240] has a clint and gryke, or shattered pavement, structure which supports the vegetation characteristic of this habitat type. This underlying rock structure is created over millennia by geological and weathering processes and cannot be artificially recreated and is effectively a non-renewable habitat resource. Therefore, the losses of Limestone pavement habitat associated with the Project cannot be compensated.

Petrifying springs [*7220] are a product of the interaction of groundwater and the underlying geology to create a tufa forming spring that supports the associated species assemblage to correspond to this priority Annex I habitat type. Such features cannot readily be artificially recreated with any degree of certainty and, as per Limestone pavement, are effectively a non-renewable habitat resource. Therefore, the loss of four Petrifying springs associated with the Project cannot be compensated.

Wet heath [4010] is a habitat type that forms on shallow peats with impeded drainage. In the western part of the study area, this is due to the underlying bedrock and undulating topography retaining a water table near to the surface. Wet heath cannot readily be artificially recreated with any degree of certainty. Therefore, the loss of Wet heath associated with the Project cannot be directly compensated.

The areas of Residual alluvial forest [*91E0], Dry heath [4030], Calcareous grassland [6210] and *Molinia* meadow [6410] that will be lost as a result of the Project will be compensated. In each case the area of each habitat type being provided is greater than that being lost. In relation to Dry heath, the area of habitat being provided (c.4.10ha) is greater than the combined losses associated with this habitat type and this habitat type when it occurs in a mosaic with Blanket Bog (active) [*7130], Wet heath [4010] and *Molinia* meadows [6410] (c.3.18ha). Although this does not reduce the residual impact associated with the loss of Wet heath or Blanket bog habitat (i.e. the excess Dry heath habitat being provided is not considered as compensating for Wet heath or Blanket bog habitat loss). This is summarised below in Table 8.47.

[163] "Compensation describes measures taken to make up for residual effects resulting in the loss of, or permanent damage to ecological features despite mitigation" (CIEEM, 2016)

The full details of the Compensatory Habitat Management Plans for each of the Annex I habitat types being compensated for, including monitoring, are presented in Appendix A.8.27. The areas where compensatory habitats will be created are shown on Figures 8.38.1 to 8.38.15.

In compensating for the losses of these habitat types, the Project is not likely to result in a significant residual effect, at any geographic scale, on Residual alluvial forest [*91E0], Dry heath [4030], Calcareous grassland [6210] or *Molinia* meadow [6410].

Table 8.47 Summary of Residual Priority Annex I/Annex I Habitat Loss after Compensation

Annex I Habitat Type	Permanent Area of Habitat Loss	Area of Compensatory Habitat Created	Residual Habitat Loss	Residual Impact Significance Post-Compensation
Blanket bog (active) [*7130]	c.0.01 a	N/A	c.0.01ha	Likely significant residual effect at the international geographic scale
Wet heath/Dry heath/Active Blanket Bog [4010/4030/*7130]	c.0.01ha	N/A	c.0.01ha	Likely significant residual effect at the international geographic scale
Petrifying springs [*7220]	Four Petrifying spring features	N/A	Four Petrifying spring features	Likely significant residual effect at the county geographic scale
Residual alluvial forest [*91E0]	c.0.14ha	c.0.17ha	None	No likely significant residual effect
Limestone pavement [*8240]	c.1.54ha	N/A	c.1.54ha	Likely significant residual effect at the international geographic scale
Limestone pavement/Calcareous grassland mosaic [*8240/6210]	c.0.03ha	N/A	c.0.03ha	Likely significant residual effect at the international geographic scale
Wet heath [4010]	c.2.54ha	N/A	c.2.54ha	Likely significant residual effect at the national geographic scale
Dry heath [4030]	c.1.76ha	c.4.10ha	None	No likely significant residual effect
Dry heath/Wet heath mosaic [4030/4010]	c.0.96 ha	N/A	c.0.96ha[55]	Likely significant residual effect at the national geographic scale
Wet heath/Dry heath/Molinia mosaic [4010/4030/6410]	c.0.45ha	N/A	c.0.45ha[164]	Likely significant residual effect at the national geographic scale
Calcareous grassland [6210]	c.0.25ha	c.7.98ha	None	No likely significant residual effect
Molinia meadow [6410]	c.0.29ha	c.0.49ha	None	No likely significant residual effect

[164] Considered as Wet heath habitat for the purposes of the impact assessment, the loss of which cannot be directly compensated for.

There are a number of habitat types of a local biodiversity importance that will be permanently lost as a result of the Project, and where significant residual negative effects are likely:

- Calcareous springs (FP1)
- Dry-humid acid grassland (GS3)
- Poor fen and flush (PF2)
- (Mixed) broadleaved woodland (WD1)
- Hedgerows (WL1)
- Treelines (WL2)

Of these, the planting proposed in the landscape design will compensate for the loss of the areas of (mixed) broadleaved woodland (WD1), hedgerows (WL1) and treelines (WL2) by providing a greater area to that being permanently lost to the Project, as follows:

- (Mixed) broadleaved woodland (WD1) - > 2.09ha
- Hedgerows (WL1) - > 7.88km
- Treelines (WL2) - > 4.05km

In compensating for the losses of these habitat types, the Project is not likely to result in a significant residual effect, at any geographic scale, on (mixed) broadleaved woodland (WD1), hedgerows (WL1) and treelines (WL2).

However, the Project is likely to have a significant residual negative effect, at the local geographic scale, as a result of the permanent loss of 18 Calcareous spring features (FP1), c.5.24 of Dry-humid acid grassland (GS3) and c.1.19 of Poor fen and flush habitat (PF2).

8.9.1.1 Compensatory Habitat Management Plans (CHMPs)

Compensatory Habitat Management Plans (hereafter referred to as "CHMPs") have been prepared in order to compensate for loss of specific Annex I habitats.

Areas of compensatory habitat will be created, managed and monitored as set out in the CHMPs in Appendix A.8.27 with locations of donor and receptors sites shown on Figures 8.38.1 to 8.38.15.

In all cases the area of lands proposed for habitat creation are those necessary to ensure the aims and targets set out in Appendix A.8.27 are achieved in terms of habitat creation and mitigating the likely significant effects on Annex I habitats associated with the Project. Best practice is to have habitat replacement ratios greater than one-to-one to ensure delivery of the target habitat type in terms of extent, quality and diversity due to the uncertainties inherent in habitat creation (i.e. the habitat creation sites should be greater than the sites being translocated or removed). Appendix A.8.27 includes for the long-term management and maintenance of the created habitat areas so they achieve the desired habitat type and quality in each location for the life of the Project.

Given the changing baseline environment, the CHMPs set out in Appendix A.8.27 of this updated EIAR are live documents which will need to be updated by the appointed contractor by way of pre-construction surveys.

The Ecology Site Management Plans, to be updated and finalised by the appointed contractor based on the detailed principles set out in this chapter and Appendix A.8.27, will set out the longer-term management regime for each of the habitats being translocated/created as part of the Project, for the lifetime of the Project.

Ecology Site Management Plans for compensatory habitats will be prepared by the contractor prior to the commencement of works, in accordance with the principles set out in Appendix A.8.27 of this updated EIAR.

In addition, the specific measures below will be incorporated into the Ecology Site Management Plans:

- Soils and plant material (including turves) from all 4030 donor sites will be the primary method used for dry heath habitat translocation and creation. The locations of all 4030 donor and receptor sites are presented in Appendix A.8.27
- Monitoring immediately after the turves are placed in the receptor sites will be undertaken every three weeks and after a heavy rainfall event until such time as the Dry heath is established, with an adaptive corrective plan put in place if evidence shows that it is not successful
- A minimum 100m translocated soils/turve depth will be provided at each 4030 receptor site
- The pH of the top 400mm layer of material in MDAs, where it directly underlies areas proposed for dry heath habitat creation, will be below 6.5
- The preferred method of habitat translocation is for direct translocation of turves and soil/peat from donor to receptor sites. However, the construction phasing may not facilitate this in every instance. Where direct translocation of turves to receptor sites is not possible, they will be handled and stored based on documented best practice and proven case studies for peatland turve translocation which include:
  - Ensuring turves are as large in size and depth as possible
  - If necessary, use of specially designed digger buckets suitable for the purpose
  - Use of low ground pressure vehicles for turve removal, especially for wetter donor sites such as the 4010 and *7130 donor sites, and if necessary operating on bog mats
  - Storage of turves for the minimum time possible and placement at receptor sites at the earliest possible opportunity
  - Storage of turves in a single layer to avoid crushing and to maintain their integrity
  - Storage of turves on a flat surface placed on top of either a geotextile membrane, on bog mats or similar
  - Regular watering (with rainwater) and monitoring of the turves for the duration of the storage time
  - Storing turves end to end (i.e. with no gaps) to avoid edges drying out and if necessary using silt fencing or geotextile membranes along any vertical exposed edges of turves
- In the case of some of the dry heath receptor sites the nature of the ericaceous vegetation, shallow soils and outcropping granite, may make intact turve removal difficult. In these situations, trimming the ericaceous vegetation (and retaining this cut material for use as brash and a source of seed to assist in vegetation regeneration at the receptor sites) may assist in extracting intact turves. Where turves cannot be extracted intact in these areas then the scraw (mixture of soils, root stock, seed bank etc) will still be valuable for use as soils to be translocated to the receptor sites
- Similarly, where direct translocation of soil/peat to receptor sites is not possible, it will be handled and stored in the following manner to ensure it is protected:
  - Use of low ground pressure vehicles for soil removal, especially for wetter donor sites such as the 4010 and *7130 donor sites, and if necessary operating on bog mats
  - All wet peaty soils (e.g. this will be likely from the 4010 and *7130 donor sites) will be transported in sealed trucks to avoid loss of wet peat in transit
  - Storage of soil/peat for the minimum time possible and placement at receptor sites at the earliest possible opportunity
  - Storage of soils/peat from donor sites in dedicated area(s) within construction compounds for the Project west of the River Corrib, on top of a geotextile layer, no higher than 1.5m to avoid compaction

  - Turves from donor sites will be 'thatched' on top of the stored soil/peat areas to seal and protect it for the duration of the storage period

- Turves will be placed end to end with no gaps. Where necessary receptor sites will be protected from erosion, and vegetation regeneration will be encouraged through the following means:
  - Use of geocoir (on flat surface) or geojute (on sloped areas) on areas of bare soil, pinned down with 0.5m steel pegs or similar
  - Spreading heather clippings which have been harvested from donor sites on bare soil
  - Re-seeding, preferably with seeds collected from donor sites prior to turves/soil being removed, or if necessary with additional dry heath native seed material from a reputable supplier. Where seeds are collected from donor sites prior to turves/soil being removed, they will be collected a minimum of one summer/autumn season prior to construction works commencing, during warm, dry conditions. Until such time as they are required to be planted at the receptor sites, seeds will be stored in suitable conditions to ensure their survival. These will be used for inclusion in the seed mix for planting later at the appropriate time of year at dry heath receptor sites.
- Minimising risks of erosion or escape of translocated soil/peat by:
  - Undertaking all translocation works and handling of turves and soils/peats during dry weather conditions
  - Undertaking these activities during dry conditions at the start of the vegetation growing season (i.e. spring) to encourage rapid establishment of plant growth prior to the winter season
  - Implement the measures set out in the Sediment, Erosion and Pollution Control Plan (SEPCP) which summarises the procedures and technical practices for implementing effective sediment, erosion and pollution control through a variety of delivery methods for the construction phase of the Project is presented in Section 8 of the CEMP (Appendix A.7.5)
  - All wet peaty soils (e.g. this will be likely from the 4010 and *7130 donor sites) will be transported in sealed trucks to avoid loss of wet peat in transit
- The following measures will be implemented as part of the habitat translocation and creation measures to ensure that *Daboecia cantabrica* becomes established at the dry heath receptor sites:
  - Seeds from mature plants of *Daboecia cantabrica* will be collected from the sites within the Assessment Boundary where it has been recorded, from August/September onwards (in a year prior to construction works commencing), during warm, dry conditions. Seeds will be stored in suitable conditions to ensure their survival. These will be used for inclusion in the seed mix for planting later at the appropriate time of year at dry heath receptor sites
  - Where it is possible to translocate turves from dry heath donor sites containing *Daboecia cantabrica*, all specimens of *Daboecia cantabrica* will be located in the centre of turves to ensure their successful translocation
  - All existing soils/peat at dry heath donor sites will be translocated for placement as the substrate at the dry heath receptor sites, thereby retaining the seedbank, including for *Daboecia cantabrica*, to allow natural regeneration of the species at the receptor site
  - Heather clippings will be harvested at all dry heath donor sites and this material will include clippings from *Daboecia cantabrica* specimens.

The calcareous grassland ecological recreation areas at Lackagh Quarry will be managed in perpetuity by the local authority, are not accessible to the public and will be fenced off. There will be a minimum of two maintenance visits each year as set out in Appendix A.8.27 (CHMPs) of this updated EIAR.

8.9.2 Bats

It should be noted that all of the mitigation measures detailed in Section 8.6.5.2, and all of the compensation measures detailed below, are included in the Bat Derogation Licence application for the Project (Appendix A.8.25). It is noted here that a Bat Derogation Licence for the Project was granted by NPWS on 10 April 2024, based on an application made in March 2024, and no issues were raised regarding the mitigation or compensation strategies proposed therein. As the 2024 Bat Derogation Licence expired on 31 December 2024 a new derogation licence application was submitted to the NPWS on 1 April 2025 (included in Appendix A.8.25 Part 2 of this updated EIAR).

8.9.2.1 Compensation for loss of bat roosts

Loss of the more "significant" roosts (e.g. maternity roosts or roosts used by Lesser horseshoe bats) will be mitigated by the erection of replacement structures (artificial roosts) in locations close to the original roost.

There is a dual purpose to the artificial roosts. Firstly, to ensure that there is no net loss of roosting opportunities for the bats confirmed to be roosting within the Assessment Boundary. Secondly, it has been recognised that there will be an inevitable increase in mortality rates due to road collisions as suggested by scientific evidence (see Section 8.5.7.2.2). The second function of the replacement roosts is to create improved conditions for bats to breed and to offset the likely increase in mortality.

Four artificial roost structures are proposed as set out below. The detailed specifications of these artificial roosts will follow the recommendations of an experienced bat ecologist and further consultation with the Vincent Wildlife Trust will take place to ensure that their experiences in these techniques are taken into account.

There will be a need to screen structures from the effects of construction phase disturbance by means of solid hoarding or brushwood screens with an appropriate buffer zone around the roost. The dimensions of the planting will depend on the local topography and surrounding landscape and will be decided on a case-by-case basis by the bat ecologist.

It should be noted that the mitigation strategy, outlined above in Section 8.6.5.2, has included ensuring that passage across the Project in the vicinity of the roosts has been facilitated by including culverts in locations as close to the roosts as possible.

Proposed Aughnacurra maternity/hibernation roost for Lesser horseshoe bats and Brown long-eared bats

The proposed replacement roost will be located close to the existing Aughnacurra roost (PBR178) structure.

Whilst this roost was not confirmed during the 2023 surveys, this replacement roost has been retained in the mitigation strategy, taking a conservative approach. This is due to both to the high levels of localised Lesser horseshoe bat foraging and commuting activity recorded in area PBR178 (although 2023 surveys returned low to negligible evidence of confirmed entry/exit of Lesser horseshoe bats at the property) connecting to a previously known Lesser horseshoe bat satellite roost at Menlo Castle (PBR06). While it cannot be wholly-ruled out that Lesser horseshoe bats would return to the property, the roost area is within a sub-optimal building (garage) in terms of the preferred building type for this species, and its occupation by bats may be a reflection of the lack of availability of better roost opportunities in the area.

The proposed roost within the Assessment Boundary will be temporarily screened with brushwood fencing or similar semi-solid screens *c*.2m high for the construction stage and will also be planted up around it as soon as the roost is constructed to provide long-term screening during the operation of the Project. Non-native ornamental species may be used to provide screening in this case as it is in keeping with the suburban setting.

The design of the roost will take account of the Vincent Wildlife Trust (VWT) guidance[165] and will follow the following design parameters (as shown in drawing GCOB-3000-D-001 in Appendix K of Appendix A.8.25 of this updated EIAR):

[165] Vincent Wildlife Trust (2015) *Lesser Horseshoe Bat: Conservation Handbook.*

- The template for the design will be taken from the roost at Garryland, Co. Galway constructed for the N18 Oranmore to Gort road scheme which has been shown to have worked successfully since its completion in 2011
- Single storey structure with southwest orientation for maximum solar gain on the pitched roof
- Location as set out in Plate 8.5 below in corner of garden to be acquired
- Rendered block wall structure with natural slate roof. The exterior walls can be clad with rough stone or a material designed to have no adverse visual impact
- The building will have a footprint of c.10m x 8m with a steep pitched slate roof, partitions in the ground floor and roof space and an attic floor laid down with an open hatches for access for bats
- Plywood partitions will be installed within the roof voids to create bat "hotboxes" and separate roosting spaces for different species so that the brown long-eared bat roost can also be accommodated in the same building
- The interior of the roof will be lined with BS 747 bituminous felt. All ceilings on the ground floor will be fitted with rough wood
- The entry point for bats shall be on the western side away from the Project and close to the vegetation on the eastern perimeter which will be retained and enhanced. The entry point will be c.500mm x 300mm with bars set 125mm apart and lead flashing to be placed over the window sill under the hatch to prevent predator entry
- The northern corner will include a hibernation room at ground level which will be lined with concrete blocks and insulated to provide suitable conditions for hibernation. Plywood partitions will hang down from the ceiling to provide sheltered pockets at ceiling level. An earth floor will maintain humidity and some of the guttering will be piped inside to create an optional water-filled trough along one wall so that humidity levels can be adjusted if needed
- No water or electricity services are required
- Access for surveyors will be via a door on the southern side. Bats will be allowed to fly around the ground floor via an open hatch in the attic floor near the entry point

The proposed location (within the Assessment Boundary) is close to vegetation which is important cover for bats entering and leaving. Additional planting is proposed to link the roost to the perimeter and to connecting features in the wider landscape.

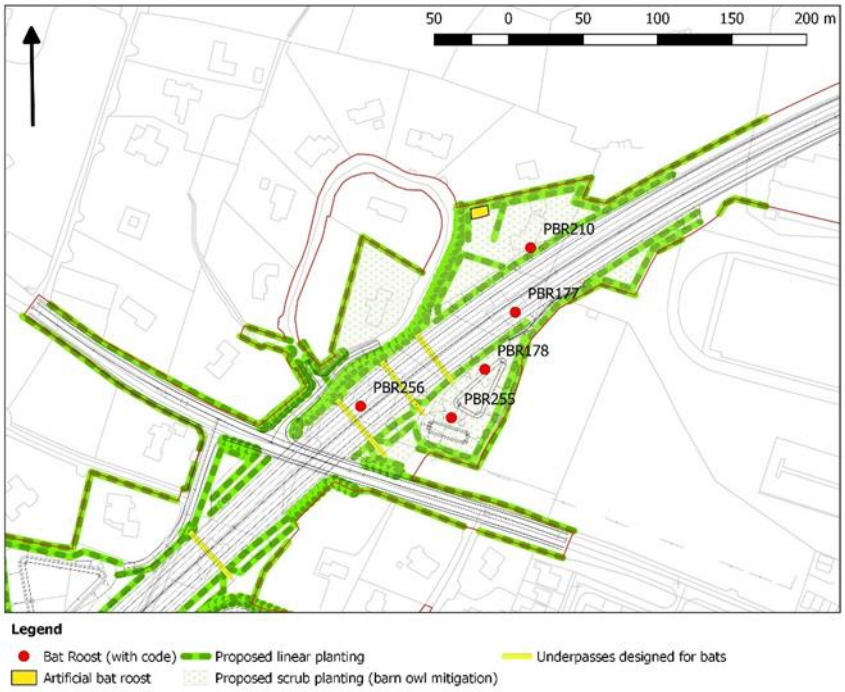

Plate 8.5 Proposed Location of Aughnacurra Artificial Roost Structure (*not to scale*)

Menlo Castle alternative roost - Lesser Horseshoe maternity/hibernation roost

This roost is not replacing any specific loss of roost but is a critical part of the bat compensation measures. It will assist to increase the recruitment in the local Lesser horseshoe bat population so as to offset any increases in mortality as a result of the potential impacts of the Project. Prior to 2020, the current roost in the chimney of the castle (PBR06) was unstable, inadequate and vulnerable to being lost if the castle fell into further disrepair. A series of renovation works has been conducted at Menlo Castle since that time, including in 2023. The new Menlo Castle roost would be better in design and aim to increase natural birth rates and thereby neutralise or overturn any negative impacts of the Project. The preferred location is in a field to the east of the castle. The key design parameters will include the following.

The design of the roost has taken account of the Vincent Wildlife Trust (VWT) guidance and following consultation with Dr Kate McAney and Ruth Hanniffy (VWT) and will follow the following design parameters (and as shown in drawing GCOB-3000-D-001 in Appendix K of Appendix A.8.25 of this updated EIAR):

- The template for the design will be taken from the roost at Garryland, Co. Galway constructed for the N18 Oranmore to Gort road scheme which has been shown to have worked successfully since its completion in 2011
- Single storey structure with southern orientation for maximum solar gain on the pitched roof
- Location as set out in Plate 8.6 below in the northwest corner of the field close to Menlo Castle (PBR06)
- Rendered block wall structure with natural slate roof. The exterior walls can be clad with rough stone or a material designed to have no adverse visual impact. Additional planting around the perimeter of the building will also screen it from view
- The building will have a footprint of c.10m x 8m with a steep pitched slate roof, partitions in the ground floor and roof space and an attic floor laid down with an open hatches for access for bats. All ceilings on the ground floor will be fitted with rough wood

- Plywood partitions will be installed within the roof voids to create bat “hotboxes” and separate roosting spaces for different species so that other bat species roost can also be accommodated in the same building.
- 4 no. wooden Kent bat boxes will be erected on the gable end of the structure to provide roosting opportunities for Daubenton’s and Pipistrelle bat species. See: https://cdn.bats.org.uk/pdf/Bat-Box-Information-Pack.pdf?mtime=20181101151309
- The interior of the roof will be lined with BS747 bituminous felt or equivalent bituminous felt
- The entry point for bats shall be on the west gable end sides away from the Project and close to the vegetation on the eastern perimeter which will be retained and enhanced. The entry point will be *c*.500mm x 300mm with bars set 125mm apart and lead flashing to be placed over the window sill under the hatch to prevent predator entry
- The northern corner will include a hibernation room at ground level. This will be lined with concrete blocks and insulated to provide suitable conditions for hibernation. Plywood partitions will hang down from the ceiling to provide sheltered pockets at ceiling level. An earth floor will maintain humidity and some of the guttering be piped inside to create an optional water-filled trough along one wall so that humidity levels can be adjusted if needed
- No water or electricity services are required
- Access for surveyors will be via a door on the southern side. Bats will be allowed to fly around the ground floor via an open hatch in the attic floor near the entry point
- The proposed location within the Assessment Boundary is close to vegetation which is important cover for bats entering and leaving. Additional planting is proposed to link the roost to the perimeter and to connecting features in the wider landscape

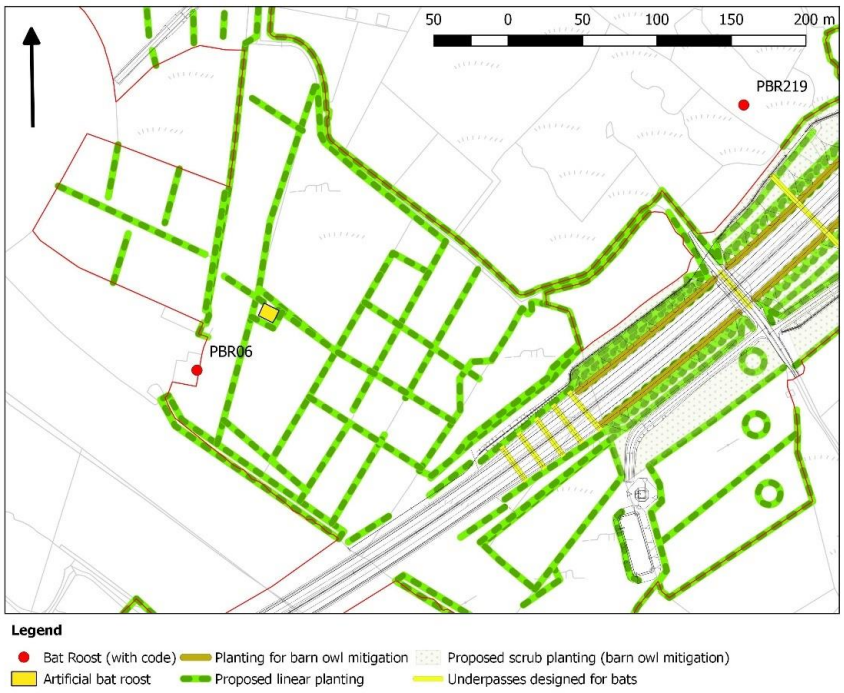

Plate 8.6 Proposed Location of Menlo Castle Artificial Roost Structure

Menlough Woods Replacement Night roost for Lesser horseshoe bats and Soprano pipistrelle and Brown long-eared bats roosts

This is to replace a night roost for Lesser horseshoe bats (PBR219) and Soprano Pipistrelle bats (PBR179). It will be located near the edge of the Assessment Boundary west of Bóthar Nua and will be a simple wooden shed type structure (1m wide, 2.5m high, 2m deep) modelled on the Vincent Wildlife Trust design[166] and is shown in drawing GCOB-3000-D-002 in Appendix K of Appendix A.8.25 of this updated EIAR. The footprint will be much smaller than the area symbol indicated below on Plate 8.7. The design parameters include:

- Steep pitched slate roof facing southeast
- Plywood "ceiling" with access open hatch 300mm x 300mm for bats
- Access for bats via gap over access door 500mm x 500mm
- Access for birds prevented by installing plywood baffle 1m behind access gap
- Roof lined with BS747 bituminous felt

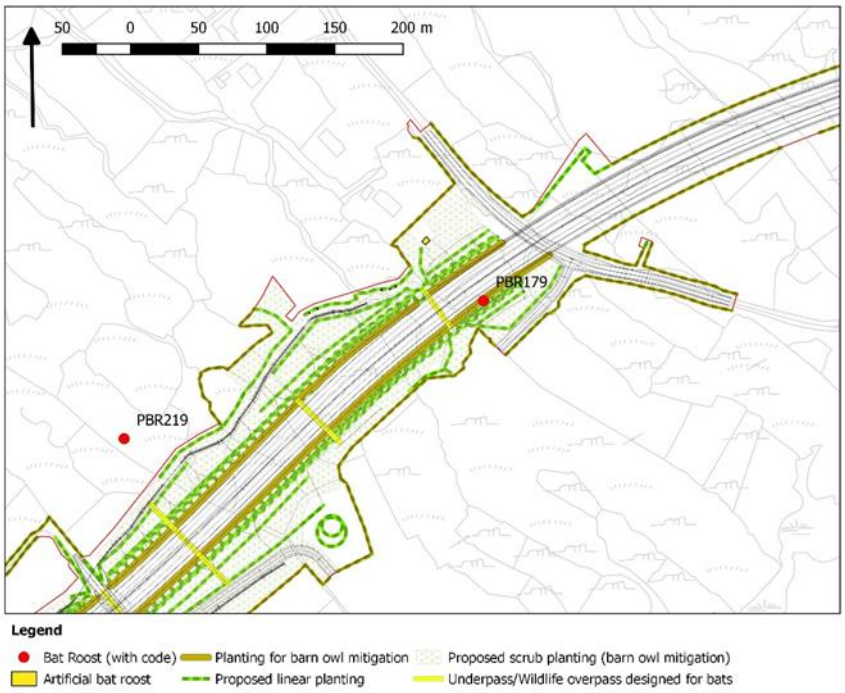

Plate 8.7 Proposed Location of Menlough Woods Artificial Night Roost Structure

Ballindooley Night/Day roost for Brown long-eared, Leisler's bats ***and Pipistrelle bat and night/day/hibernation roost for Lesser horseshoe bats***

This roost is to replace a Soprano Pipistrelle day/night roost on the N84 Headford Road (PBR179), to replace roosts for Brown long-eared bats (PBR204) Leisler's bats (PBR196), and Lesser horseshoe bat roost at PBR219. The structure will be a small block building (e.g. 6m x 8m footprint) with natural slate roof and some external features e.g. Kent bat boxes for use by other bats species. Drawing ref GCOB-3000-D-002 in Appendix K of Appendix A.8.25 of this updated EIAR shows the design of this roost.

The design parameters include:

- Single storey structure with southwest orientation for maximum solar gain

[166] http://www.vwt.org.uk/wp-content/uploads/2015/04/lesser-horseshoe-night-roost-design.pdf

- Location as set out in Plate 8.8 below abutting the vegetation for good connections to foraging and shelter
- Rendered block wall structure with natural slate roof and can be clad and designed so as to have no adverse visual impact
- The building would have a footprint in the region of 6m x 8m with a steep pitched slate roof, partition wall in the ground floor and roof space and an attic floor laid down with an open hatch for access for bats[167]
- Plywood partitions may be installed within the roof voids to create bat "hotboxes" and separate roosting spaces for different species
- The interior of the roof should be lined with BS747 bituminous felt
- Entry points for bats shall be on the northeast facing sides away from the Project and close to vegetation which will be retained and enhanced
- The northern corner will include a hibernation room at ground level which will be lined with concrete blocks and insulated to provide suitable conditions for hibernation. Plywood partitions will hang down from the ceiling to provide sheltered pockets at ceiling level. An earth floor will maintain humidity and some of the guttering will be piped inside to create an optional water-filled trough along one wall so that humidity levels can be adjusted if needed
- No water or electricity services are required
- Access for surveyors will be via a door on the southern side

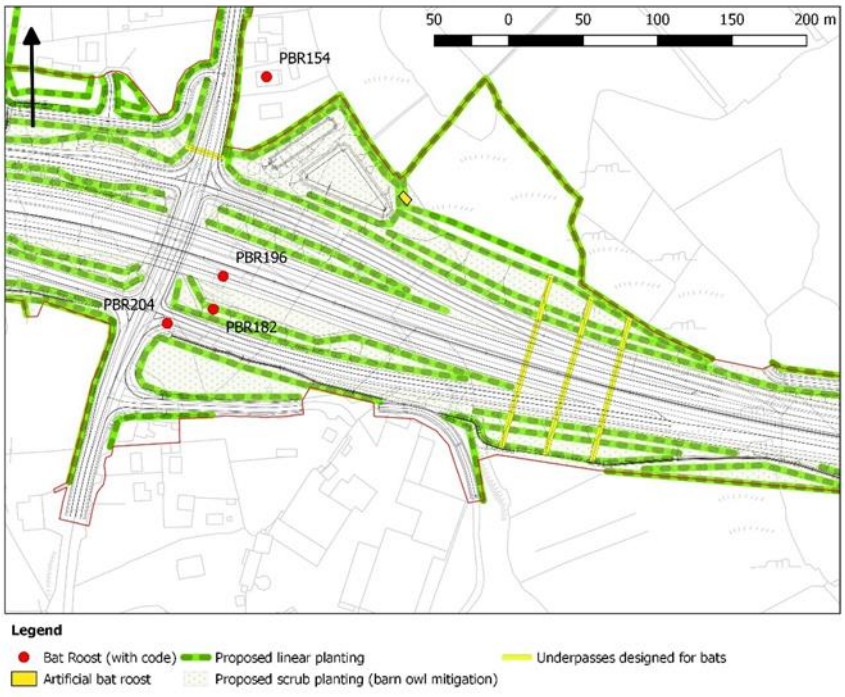

Plate 8.8 Proposed Location of Ballindooley Artificial Night Roost Structure Options

[167] Vincent Wildlife Trust (2015) *Lesser Horseshoe Bat: Conservation Handbook*.

Retrofitting Retained Buildings for Bats

At Ch. 12+960 of the proposed N6 GCRR the detached converted garage to the south of the Project is to be retained and converted for use by several species including Brown long-eared bats and Lesser horseshoe bats. This building is in a strategically-important location as it will connect to the linear planting on the south side of the Project and is just c.250m from the proposed wildlife overpass in Castlegar in and within a local ecological corridor leading to Cooper's Cave, a proven hibernation and mating site for Lesser horseshoe bats. This structure will undergo minor interior and exterior modifications to create warm areas in the roof space for summer roosting and breeding and also cold conditions for hibernation. These modifications are shown in drawing GCOB-3000-D-003 in Appendix K of Appendix A.8.25 of this updated EIAR. Plate 8.9 shows this location below:

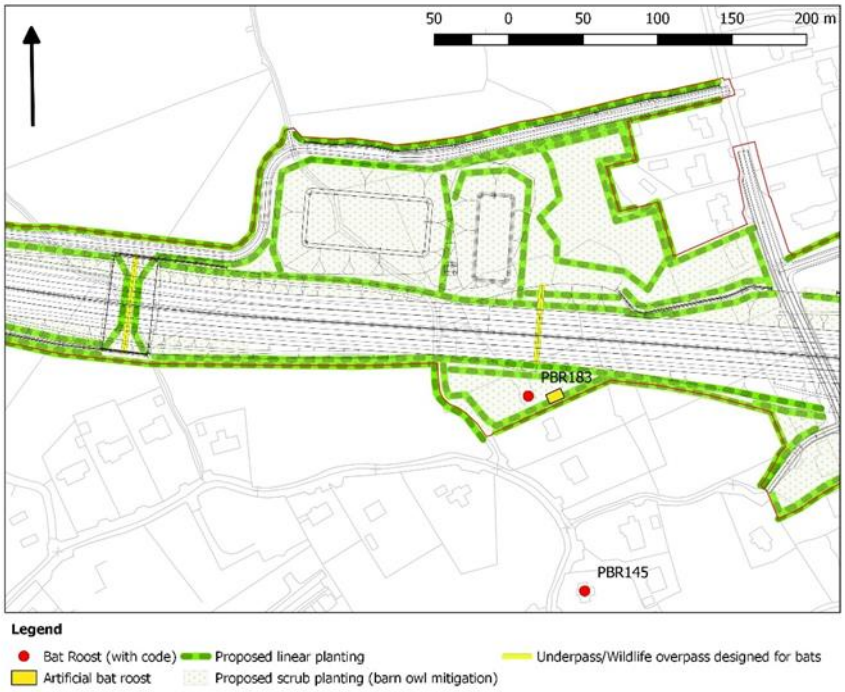

Plate 8.9 Retrofitted Roost near PBR183, Castlegar

Bat Boxes

Bat boxes will be located near the roosts to be lost but not immediately adjacent to the Project where risk of collision with vehicles is highest.

Bat boxes will be erected by, or under the supervision of, a bat specialist.

These bat boxes will target Common and Soprano pipistrelle bats and Brown long-eared bats and will consist of Schwegler Type 1FF and 2FN bat boxes (or equivalent) mounted on wooden poles set into concrete bases adjacent to treelines and hedgerows as these have been demonstrated as being successful for these species in Ireland[168]. Mounting boxes on poles close to the edge of tree canopies will also allow the long-term retention of the boxes, as opposed to mounting boxes on small trees which have limited longevity.

A rocket box (as shown on Drawing GCOB-3000-D-002 in Appendix K of Appendix A.8.25 of this updated EIAR) will be installed at Ch. 3+320 of the proposed N6 GCRR near the roost at PBR241, rather than a bat box fixed to the building itself, so as not to detract from its cultural heritage value.

Box locations, as shown on Figure 8.39.1 to 8.39.15, will include the following:

[168] McAney K. and Hanniffy, R. (2015) *The Vincent Wildlife Trust's Irish Bat Box Schemes* http://www.mammals-in-ireland.ie/wp-content/uploads/2015/11/Ireland-Bat-Box-Project-Report-WEB.pdf

- A rocket box (as shown on Drawing GCOB-3000-D-002 in Appendix K of Appendix A.8.25 of this updated EIAR) will be installed at Ch. 3+320 of the proposed N6 GCRR near the roost at PBR241, rather than a bat box fixed to the building itself, so as not to detract from its cultural heritage value. The main residential building at PBR241 complex is to be retained for Lesser horseshoe bats and protected from adverse impacts
- Ch. 10+050 of the proposed N6 GCRR: 5 boxes to be erected along the edge of the tree canopy near the underpass
- Ch. 11+400 of the proposed N6 GCRR: 5 boxes to be erected on the entrance road into Lackagh Quarry
- Ch. 15+100 of the proposed N6 GCRR: 5 bat boxes to be erected south of Galway Racecourse

In the case of bat boxes provided as replacements for bat tree roosts to be felled, boxes will be Schwegler Type 1F bat boxes (or equivalent) erected on suitable trees or structures retained within the Assessment Boundary in the vicinity of the tree to be lost where possible. The type and siting of any bat boxes required will be determined by the bat specialist at that time but preliminary areas for bat boxes have been identified in the areas of woodland around Menlough, Coolagh, on retained structures and the quarry walls at Lackagh Quarry, and in areas near attenuation ponds.

All new roosts, retrofitted structures and bat boxes will be erected in advance of the commencement of site clearance so that replacement roosts are available to bats and that there is reasonable chance that they will have discovered them prior to loss of the existing roost. Boxes can be erected at any time of year and preferably as soon as the necessary consents are in place for the Project.

Protection of proposed artificial roosts during construction works

- Newly-created roosts and bat boxes within the Assessment Boundary will require protection from the adverse effects of noise and lighting during the construction phase. It is an essential element of the mitigation strategy that they are accessible and usable by bats during this time
- All existing and proposed artificial roosts retained within the Assessment Boundary will be surrounded with wooden panels to a height that allows shading and shelter of key roost access features
- Planting around the existing and proposed artificial roosts retained within the Project will include fast growing shrub species, or fast-growing willow if the ground conditions permit. Planting will aim to guide bats away from the open construction zone toward linear features. Use of non-native species may be appropriate in some locations where it is important to get vegetation established
- All structures will be locked and not used for other purposes such as storage of materials or shelter without agreement from the Ecological Clerk of Works
- The maintenance of the existing and proposed artificial roosts retained within the Assessment Boundary, in a state that they are accessible and usable by bats, will be carried out by the Contractor until the completion of the Project whereby it will be taken in charge by the local authority. Maintenance will include standard building repairs over time and responding to the results of the roost monitoring (e.g. increasing or reducing humidity)

8.9.2.2 Compensation for loss of foraging habitat

Approximately 7ha of woodland-pasture-hedgerow-scrub habitat will be removed from the area between the River Corrib and Bóthar Nua in Menlough. This habitat is used by the Lesser horseshoe bat population and therefore there is a risk that there may be reduced breeding success if replacement planting is not made available.

An area of land has been identified which is within the known core foraging area of the Menlo Castle roost (PBR06) but is not optimal feeding habitat. It is composed of open fields of varying size used for low density cattle grazing. It is proposed to enhance lands at Menlo to enhance feeding areas for bats as a result of impacts to Lesser horseshoe bats potentially caused by the construction and operation of the Project.

The project team analysed the usage of lands near the maternity roost at Menlo Castle to identify if they met the following requisite criteria to allow them to be considered as part of the lands for this purpose:

a. The lands must be capable of being accessed by the Lesser horseshoe bats roosting at Menlo Castle and from the proposed artificial roost nearby. Linear features such as hedgerows and woodland edges must connect the roost and the newly created habitat

b. The lands must show some evidence of use by Lesser horseshoe bats to demonstrate that they can access the area

c. The lands should not already contain areas of optimal Lesser horseshoe bat foraging habitat such as woodland, scrub and wetlands and should be capable of being enhanced using planting and landscaping to increase the suitability as a feeding resource

d. Any proposed changes to the lands must not depreciate its ecological value and there is a general assumption that lands within a Special Area of Conservation (SAC) should not be used for planting purposes.

Specifically, hedgerows in this area will be augmented and thickets of hazel, hawthorn, holly and oak will be provided in several of the fields to create pockets of wood and grassland habitat. Grazing will continue on the lands as it has been shown that foraging over grazed land is preferred to ungrazed lands (Downes *et al*, 2016). Connectivity to foraging areas will also be secured through tying the proposed planting strips to hedgerows and woodland edges.

In addition, smaller fields to the east of Menlo Castle and the proposed artificial roost (Area A3 in Plate 1 in the Statement of Evidence Responses to EIA Biodiversity Objection/Submissions Document, shown in of Appendix A.8.25 – Part 2 Bat Derogation Licence application) were identified as being capable of further subdivision to provide enhanced foraging habitat and connectivity close to the roost (PBR06) and possibly reduce the need for bats to cross the Project.

Finally, another area within the former Lough Corrib SAC area (the boundary of the Lough Corrib SAC was revised by NPWS in April 2018) was investigated by means of automatic bat detectors and deemed to already have suitable foraging habitat for Lesser horseshoe bats. Sensitive wetland habitats and species were present in this area which could be adversely affected by interventions associated with the measures, such as planting or alteration to local drainage. As such, it was decided that it would not be appropriate to include this area within the proposed habitat planting area for bats.

Planting of new hedgerows in fields between the Project and Menlo Castle will improve the foraging resources of this core foraging area and provide connectivity underneath the proposed N6 GCRR. Such planting will include additional native hedgerows planted across the existing fields to increase the lengths of hedgerows close to the proposed new roost for Lesser horseshoe bats (refer to Section 8.6.5.2) near Menlo Castle. The fields will still be grazed and the hedgerows can be fitted with field gates as required provided gaps are kept to a minimum.

The area of habitat enhancement for the purposes of off-setting the loss of suitable bat foraging habitat and landscape connectivity due to the Project amounts to c.8.8ha (refer to Figure 8.39.7).

8.9.2.3 Proposed Monitoring Programme

The monitoring programme described in Section 8.6.5.2 above also relates to the compensation measures for bats described in this section.

8.9.3 Peregrine falcon

While artificial nest sites for Peregrine falcon can, and have been proven to, be successful, they require suitable cliff face or building of sufficient height at the proposed nest site. However, providing such nest sites does not guarantee that they will be taken up by either the Peregrine pair being displaced or occupied by another breeding pair in the future; particularly when they would likely be remote from the existing site, by at least a few kilometres, due to the topography of the surrounding land and the type and height of building structures nearby.

8.10 Summary

The key changes to the biodiversity chapter since the 2018 EIAR involve updating:

- the description of the receiving environment to take account of the results of the surveys undertaken between 2022 and 2024
- the figures and appendices to reflect the updated data and assessment
- the chapter to take account of points raised in the RFI response dated 30 August 2019, the Brief of Evidence presented to An Bord Pleanála (ABP) at the oral hearing in 2020 and from the ABP Inspector's Report dated 22 June 2021

The Project, despite the implementation of the mitigation and compensation measures proposed, will have the following likely significant residual effects on biodiversity where changes have occurred since the 2018 EIAR, this has been detailed below:

- A likely significant residual effect, at the international geographic scale, for the permanent loss of c.0.01ha of the priority Annex I habitat Blanket bog (active) [*7130] (additional since the 2018 EIAR)
- A likely significant residual effect, at the international geographic scale, for the permanent loss of c.0.01ha of the mosaic containing the priority Annex I habitat Blanket bog (active) [*7130], Wet heath [4010] and Dry heath [4030] (additional since the 2018 EIAR)
- A likely significant residual effect, at the international geographic scale, for the permanent loss of c.1.54ha of the priority Annex I habitat Limestone pavement [*8240] (increase in loss since 2018 EIAR by c.1ha)
- A likely significant residual effect, at the international geographic scale, for the permanent loss of c.0.03ha of the habitat mosaic containing the priority Annex I habitat Limestone pavement [*8240] and Calcareous grassland [6210] (additional since 2018 EIAR)
- A likely significant residual effect, at the national geographic scale, for the permanent loss of c.3.95ha of the Annex I habitat Wet heath [4010][169] (increase in loss by c.1.02ha)
  - A likely significant residual effect, at the county geographic scale, for the permanent loss of four Petrifying spring [*7220] features at Lackagh Quarry
  - Likely significant residual effects on Habitat Clusters 1-12 ranging from the local to international scale, dependent upon the potential impacts of the Project on each of the individual ecological receptors that make up the biodiversity resource within a given habitat cluster (additional since 2018 EIAR).
  - A likely significant residual effect for the loss of local populations of the red-listed bryophyte species Imbricate bog moss *Sphagnum affine* at the national geographic scale (additional since the 2018 EIAR)
  - A likely significant residual effect for the loss of local populations of the red-listed bryophyte species Woodsy thyme *moss Plagiomnium cuspidatum*, Lesser striated feathermoss *Plasteurhynchium striatulum* and Red bog-moss *Sphagnum capillifolium* at the county geographic scale (additional since the 2018 EIAR)
  - A likely significant residual effect for the loss of local populations Eyebright *Euphrasia arctica* at a local geographic scale (additional since the 2018 EIAR)
  - A likely significant residual effect, at the local geographic scale, for the potential permanent loss of a Barn Owl nest site at Menlough (additional since 2018 EIAR)

[169] As noted in Table 8.4, this comprises c.2.54ha of Wet heath dominated habitat and an additional c.1.41ha of habitat mosaic which contains Wet heath.

- A likely significant residual effect, at the county geographic scale, for the potential permanent loss of a Peregrine falcon nest site at Lackagh Quarry
- A likely significant residual effect, at the local geographic scale, on all bat species (including lesser horseshoe bat) due to the presence of the Project within their foraging areas
- A likely significant residual effect, at the local geographic scale, for the permanent loss of 18 calcareous springs (FP1) (Non-Annex I habitat type) at Lackagh Quarry (loss of 15 in 2018 EIAR), c.5.24ha of Dry-humid acid grassland (GS3) (Non-Annex I habitat type) (decrease in loss by c.2.57ha since 2018 EIAR) and c.1.30ha of Poor fen and flush habitat (PF2) (Non-Annex I habitat type) (increase in loss by c.1.17ha since 2018 EIAR)

These significant residual impacts will also affect the following local biodiversity areas:

- Coast Road (R336) to the N59 Moycullen Road local biodiversity area
  - Residual impact at the national geographic scale for the loss of Wet heath [4010] and Blanket bog (active) [*7130] habitat
  - Residual impact at the local geographic scale for the loss of Dry-humid acid grassland (GS3) and Poor fen and flush habitat (PF2) along with impacts on bat species present here
- River Corrib and the Coolagh Lakes local biodiversity area
  - Residual impact at the local geographic scale due to impacts on bat species present here
- Menlough to Coolough Hill local biodiversity area
  - Residual impact at the international geographic scale for the loss of Limestone pavement [*8240] habitat
  - Residual impact at the county geographic scale for the loss of Petrifying springs [*7220] and impact on the Peregrine falcon
  - Residual impact at the local geographic scale from the loss of Calcareous springs (FP1) and along with impacts on bat species present here
- Ballindooley – Castlegar local biodiversity area
  - Residual impact at the national geographic scale on Lesser horseshoe bat
  - Residual impact at the local geographic scale due to impacts on bat species present here
- Doughiska local biodiversity area
  - Residual impact at the international geographic scale for the loss of Limestone pavement [*8240] habitat
  - Residual impact at the local geographic scale due to impacts on bat species present here
- Cooper’s Cave Terryland local biodiversity area
  - Residual impact at the national geographic scale on Lesser horseshoe bat
- Terryland Glenanail local biodiversity area.
  - Residual impact at the national geographic scale on Lesser horseshoe bat
  - Residual impact at the local geographic scale on bat species other than the Lesser horseshoe bat
- City Canal System local biodiversity area
  - Residual impact at the national geographic scale on lesser horseshoe bat
  - Residual impact at the local geographic scale on bat species other than the Lesser horseshoe bat

- Waterbody local biodiversity area
  - Residual impact at the national geographic scale on lesser horseshoe bat
  - Residual impact at the local geographic scale on bat species other than the Lesser horseshoe bat

Although the significant residual effects associated with the losses of Limestone pavement and Wet heath habitat cannot be directly compensated for, areas of related habitats will be created to provide an overall biodiversity gain for both peatland habitats containing dry heath and limestone associated habitats locally. The area of Dry heath habitat being provided is c.4.10ha which is greater than the combined losses of peatland habitats containing dry heath (i.e. [4030], and the mosaics [4030/4010], [4030/4010/*7130] and [4030/4010/6410]) combined (c.3.18ha). The area of Calcareous grassland habitat being provided is c.7.98ha which is greater than the combined losses of Limestone pavement and Calcareous grassland habitat combined (c.1.82ha).

Table 8.48 presents an overall summary of the ecological receptors, their valuation and potential impacts. It presents the proposed mitigation measures for these potential impacts, the residual impacts, proposed compensation measures where applicable and the overall residual impact significance post-compensation.

Table 8.48 Summary of the Likely Significant Residual Effects of the Project on Biodiversity (*post-compensation*)

Ecological Receptor	Ecological Valuation (after National Roads Authority, 2009)	Impacts with the Potential to Result in Likely Significant Effects	Potential Impact Significance	Mitigation Measures	Residual Impact Significance	Compensation	Residual Impact Significance Post-compensation
Designated Areas for Nature Conservation							
Lough Corrib SAC (including Lough Corrib pNHA)	International (National)	**Construction** Habitat loss Habitat degradation – tunnelling/excavation Habitat degradation – hydrogeology Habitat degradation – hydrology Habitat degradation – air quality Habitat degradation – non-native invasive plant species Mortality risk **Operation** Habitat degradation – hydrogeology Habitat degradation – air quality Habitat degradation – non-native invasive plant species Mortality risk	Likely significant effect at the international geographic scale	see Section 10 of the updated NIS and Section 8.6.2.1, above	No likely significant residual effect		
Galway Bay Complex SAC	International (National)	**Construction** Habitat degradation – hydrology	Likely significant effect at the international geographic scale	see Section 10 of the updated NIS and Section 8.6.2.1, above	No likely significant residual effect		

Ecological Receptor	Ecological Valuation (after National Roads Authority, 2009)	Impacts with the Potential to Result in Likely Significant Effects	Potential Impact Significance	Mitigation Measures	Residual Impact Significance	Compensation	Residual Impact Significance Post-compensation
(including Galway bay Complex pNHA)		Habitat degradation – non-native invasive plant species Barrier effect Mortality risk					
Lough Corrib SPA (including Lough Corrib pNHA)	International (National)	**Construction** Habitat degradation – hydrogeology Habitat degradation – hydrology Disturbance/displacement **Operation** Habitat degradation – hydrogeology	Likely significant effect at the international geographic scale	see Section 10 of the updated NIS and Section 8.6.2.1, above	No likely significant residual effect		
Inner Galway Bay SPA including Galway bay Complex pNHA)	International (National)	**Construction** Habitat degradation – hydrogeology Habitat degradation – hydrology Disturbance/displacement **Operation** Habitat degradation – hydrogeology	Likely significant effect at the international geographic scale	see Section 10 of the updated NIS and Section 8.6.2.1, above	No likely significant residual effect		
Inishmore Island SAC, Kilkieran Bay and Island SAC	International	**Construction** Habitat degradation – hydrology	Likely significant effect at the international geographic scale	see Section 10 of the updated NIS and Section 8.6.2.1, above	No likely significant residual effect		

Ecological Receptor	Ecological Valuation (after National Roads Authority, 2009)	Impacts with the Potential to Result in Likely Significant Effects	Potential Impact Significance	Mitigation Measures	Residual Impact Significance	Compensation	Residual Impact Significance Post-compensation
Ardrahan Grassland SAC, Castletaylor Complex SAC, Cregganna Marsh SPA, Kiltiernan Turlough SAC, Lough Fingall Complex SAC, Rahasane Turlough SPA, Rahasane Turlough SAC	International	**Construction** Habitat degradation – hydrogeology Habitat degradation – hydrology Habitat degradation – air quality Habitat degradation – non-native invasive plant species	Likely significant effect at the international geographic scale	see Section 10 of the updated NIS and Section 8.6.2.1, above	No likely significant residual effect		
Inishmore Island pNHA	National	**Construction** Habitat degradation – hydrology	Likely significant effect at the national geographic scale	Water quality during construction – Section 8.6.3.4	No likely significant residual effect		
Cregganna Marsh pNHA	National	**Construction** Habitat degradation – hydrogeology Habitat degradation – hydrology Habitat degradation – air quality Habitat degradation – non-native invasive plant species	Likely significant effect at the national geographic scale	Groundwater quality and quantity- Section 8.6.3.5 Water quality during construction – Section 8.6.3.4 Air quality during construction - Section 8.6.3.3 Non-native invasive plant species during construction and operation – Section 8.6.3.6 and Appendix A.7.5	No likely significant residual effect		

Ecological Receptor	Ecological Valuation (after National Roads Authority, 2009)	Impacts with the Potential to Result in Likely Significant Effects	Potential Impact Significance	Mitigation Measures	Residual Impact Significance	Compensation	Residual Impact Significance Post-compensation
Castletaylor Complex pNHA	National	**Construction** Habitat degradation – hydrology Habitat degradation – air quality Habitat degradation – non-native invasive plant species	Likely significant effect at the national geographic scale	Water quality during construction – Section 8.6.3.4 Air quality during construction - Section 8.6.3.3 Non-native invasive plant species during construction and operation – Section 8.6.3.6 and Appendix A.7.5	No likely significant residual effect		
Furbogh Wood pNHA, Kiltullagh Turlough pNHA, Ballycuirke Lough pNHA, Drimcong Wood pNHA, Turloughcor pNHA	National	**Construction** Habitat degradation – hydrogeology Habitat degradation – hydrology Habitat degradation – air quality Habitat degradation – non-native invasive plant species	Likely significant effect at the national geographic scale	Groundwater quality and quantity- Section 8.6.3.5 Water quality during construction – Section 8.6.3.4 Air quality during construction - Section 8.6.3.3 Non-native invasive plant species during construction and operation – Section 8.6.3.6 and Appendix A.7.5	No likely significant residual effect		

Ecological Receptor	Ecological Valuation (after National Roads Authority, 2009)	Impacts with the Potential to Result in Likely Significant Effects	Potential Impact Significance	Mitigation Measures	Residual Impact Significance	Compensation	Residual Impact Significance Post-compensation
Moycullen Bogs NHA	National	**Construction** Habitat degradation – air quality Habitat degradation – non-native invasive plant species Habitat degradation – hydrology **Operation** Habitat degradation – non-native invasive plant species	Likely significant effect at the national geographic scale	Air quality during construction - Section 8.6.3.3 Non-native invasive plant species during construction and operation – Section 8.6.3.6 and Appendix A.7.5 Water quality during construction – Section 8.6.3.4	No likely significant residual effect		
Habitats (outside of designated areas for nature conservation)							
Limestone pavement [*8240]	International Importance	**Construction** Habitat loss Habitat degradation – air quality Habitat degradation – non-native invasive plant species **Operation** Habitat degradation – air quality Habitat degradation – non-native invasive plant species	Likely significant effect at the international geographic scale	To reduce the scale of habitat loss – see Section 8.6.3.1 Air quality during construction - Section 8.6.3.3 Non-native invasive plant species during construction and operation – Section 8.6.3.6 and Appendix A.7.5	Likely significant residual effect at the international geographic scale	No	Likely significant residual effect at the international geographic scale

Ecological Receptor	Ecological Valuation (after National Roads Authority, 2009)	Impacts with the Potential to Result in Likely Significant Effects	Potential Impact Significance	Mitigation Measures	Residual Impact Significance	Compensation	Residual Impact Significance Post-compensation
Blanket bog (active) [*7130]	International Importance	**Construction** Habitat loss Habitat degradation – air quality Habitat degradation – non-native invasive plant species **Operation** Habitat degradation – non-native invasive plant species Habitat degradation - groundwater	Likely significant effect at the international geographic scale	To reduce the scale of habitat loss – see Section 8.6.3.1 Air quality during construction - Section 8.6.3.3 Non-native invasive plant species during construction and operation – Section 8.6.3.6 and Appendix A.7.5	Likely significant effect at the international geographic scale	No	Likely significant effect at the international geographic scale
Petrifying springs [*7220]	International Importance	**Construction** Habitat loss	Likely significant effect at the county geographic scale (see Section 8.5.5.3 under petrifying springs)	To reduce the scale of habitat loss – see Section 8.6.3.1	Likely significant residual effect at the county geographic scale (see Section 8.7.3)	No	Likely significant residual effect at the county geographic scale
Calcareous grassland [*6210/6210]	International/National Importance	**Construction** Habitat loss Habitat degradation – air quality Habitat degradation – non-native invasive plant species **Operation**	Likely significant effect at the national geographic scale (No *6210 affected – see Section 8.5.4.3 under Calcareous grassland))	To reduce the scale of habitat loss – see Section 8.6.3.1 Air quality during construction - Section 8.6.3.3 Non-native invasive plant species during construction and	Likely significant residual effect at the national geographic scale (see Section 8.7.3)	Yes, see Section 8.9 and Appendix A.8.27	No likely significant residual effect

Ecological Receptor	Ecological Valuation (after National Roads Authority, 2009)	Impacts with the Potential to Result in Likely Significant Effects	Potential Impact Significance	Mitigation Measures	Residual Impact Significance	Compensation	Residual Impact Significance Post-compensation
		Habitat degradation – air quality Habitat degradation – non-native invasive plant species		operation – Section 8.6.3.6 and Appendix A.7.5			
Dry heath [4030]	National Importance	**Construction** Habitat loss Habitat degradation – air quality Habitat degradation – non-native invasive plant species **Operation** Habitat degradation – air quality Habitat degradation – non-native invasive plant species	Likely significant effect at the national geographic scale	To reduce the scale of habitat loss – see Section 8.6.3.1 Air quality during construction - Section 8.6.3.3 Non-native invasive plant species during construction and operation – Section 8.6.3.6 and Appendix A.7.5	Likely significant residual effect at the national geographic scale (see Section 8.7.3)	Yes, see Section 8.9 and Appendix A.8.27	No likely significant residual effect
Wet heath [4010][170]	National Importance	**Construction** Habitat loss Habitat degradation – air quality Habitat degradation – groundwater **Operation** Habitat degradation – air quality	Likely significant effect at the national geographic scale	To reduce the scale of habitat loss – see Section 8.6.3.1 Air quality during construction - Section 8.6.3.3 Groundwater during construction and	Likely significant residual effect at the national geographic scale (see Section 8.7.3)	No	Likely significant residual effect at the national geographic scale

[170] Including areas of Wet heath/Dry heath/*Molinia* meadow [4010/4030/6410] mosaic

Ecological Receptor	Ecological Valuation (after National Roads Authority, 2009)	Impacts with the Potential to Result in Likely Significant Effects	Potential Impact Significance	Mitigation Measures	Residual Impact Significance	Compensation	Residual Impact Significance Post-compensation
		Habitat degradation – groundwater		operation – Section 8.6.3.5			
Molinia meadow [6410]	National Importance	**Construction** Habitat loss Habitat degradation – air quality Habitat degradation – non-native invasive plant species **Operation** Habitat degradation – non-native invasive plant species	Likely significant effect at the national geographic scale	To reduce the scale of habitat loss – see Section 8.6.3.1 Air quality during construction - Section 8.6.3.3 Groundwater during construction and operation – Section 8.6.3.5	Likely significant residual effect at the national geographic scale (see Section 8.7.3)	Yes, see Section 8.9 and Appendix A.8.27	No likely significant residual effect
Residual alluvial forest [*91E0]	International Importance	**Construction** Habitat loss Habitat degradation – air quality Habitat degradation – non-native invasive plant species **Operation** Habitat degradation – non-native invasive plant species	Likely significant effect at the international geographic scale	Air quality during construction - Section 8.6.3.3 Non-native invasive plant species during construction and operation – Section 8.6.3.6 and Appendix A.7.5	Likely significant residual effect at the international geographic scale (see Section 8.7.3)	Yes, see Section 8.9 and Appendix A.8.27	No likely significant residual effect
Turloughs [*3180]	International Importance	**Construction** Habitat loss Habitat degradation – surface water quality	Likely significant effect at the international geographic scale	To reduce the scale of habitat loss – see Section 8.6.3.1	No likely significant residual effect		

Ecological Receptor	Ecological Valuation (after National Roads Authority, 2009)	Impacts with the Potential to Result in Likely Significant Effects	Potential Impact Significance	Mitigation Measures	Residual Impact Significance	Compensation	Residual Impact Significance Post-compensation
		Habitat degradation – groundwater Habitat degradation – air quality Habitat degradation – non-native invasive plant species **Operation** Habitat degradation – groundwater Habitat degradation – air quality Habitat degradation – non-native invasive plant species		Air quality during construction - Section 8.6.3.3 Water quality during construction – Section 8.6.3.4 Groundwater during construction and operation – Section 8.6.3.5 Non-native invasive plant species during construction and operation – Section 8.6.3.6 and Appendix A.7.5			
Hard water lakes [3140]	National Importance	**Construction** Habitat degradation – surface water quality (Ballindooley Lough)	Likely significant effect at the national geographic scale	Water quality during construction – Section 8.6.3.4	No likely significant residual effect		
Mesotrophic lakes (FL4) *Part of Ballindooley complex*	County Importance[171]	**Construction** Habitat degradation – surface water quality	Likely significant effect at the county geographic scale	Water quality during construction – Section 8.6.3.4	No likely significant residual effect		

[171] On the basis that it forms part of the wetland complex at Ballindooley Lough

Ecological Receptor	Ecological Valuation (after National Roads Authority, 2009)	Impacts with the Potential to Result in Likely Significant Effects	Potential Impact Significance	Mitigation Measures	Residual Impact Significance	Compensation	Residual Impact Significance Post-compensation
Eutrophic lakes (FL5) Part of Ballindooley complex	County Importance[172]	**Construction** Habitat degradation – surface water quality Habitat degradation – groundwater	Likely significant effect at the county geographic scale	Water quality during construction – Section 8.6.3.4 Groundwater during construction – Section 8.6.3.5	No likely significant residual effect		
Calcareous springs (FP1) Non-Annex I habitat type	Local Importance (Higher Value)	**Construction** Habitat loss	Likely significant effect at the local geographic scale	To reduce the scale of habitat loss – see Section 8.6.3.1	Likely significant residual effect at the local geographic scale	No	Likely significant residual effect at the local geographic scale
Cladium fen [*7210]	International Importance	**Construction** Habitat degradation – surface water quality (Ballindooley Lough)	Likely significant effect at the international geographic scale	Water quality during construction – Section 8.6.3.4	No likely significant residual effect		
Hydrophilous tall herb [6430]	International Importance	(see Lough Corrib SAC above) **Construction** Habitat degradation – hydrogeology Habitat degradation – hydrology **Operation** Habitat degradation – hydrogeology	Likely significant effect at the international geographic scale	see Section 10 of the updated NIS	No likely significant residual effect		

[172] On the basis that it forms part of the wetland complex at Ballindooley Lough

Ecological Receptor	Ecological Valuation (after National Roads Authority, 2009)	Impacts with the Potential to Result in Likely Significant Effects	Potential Impact Significance	Mitigation Measures	Residual Impact Significance	Compensation	Residual Impact Significance Post-compensation
Alkaline fens [7230]	National Importance	**Construction** Habitat degradation – surface water quality (Ballindooley Lough)	Likely significant effect at the national geographic scale	Water quality during construction – Section 8.6.3.4	No likely significant residual effect		
Reed and large sedge swamps (FS1) Non-Annex I habitat type	Local Importance (Higher Value)	**Construction** Habitat degradation – surface water quality	Likely significant effect at the local geographic scale	Water quality during construction – Section 8.6.3.4	No likely significant residual effect		
Tall-herb swamps (FS2) Non-Annex I habitat type	Local Importance (Higher Value)	None	No likely significant effect at any geographic scale	None	No likely significant residual effect		
Eroding/upland rivers (FW1)	Local Importance (Higher Value)	**Construction** Habitat degradation – surface water quality	Likely significant effect at the local geographic scale	Water quality during construction – Section 8.6.3.4	No likely significant residual effect		
Depositing/lowland rivers (FW2) River Corrib	International Importance	The River Corrib forms part of see Lough Corrib SAC (see above and updated NIS)	Likely significant effect at the international geographic scale	see Section 10 of the updated NIS	No likely significant residual effect		
Terryland River	Local Importance (Higher Value)	None	No likely significant effect at any geographic scale	None	No likely significant residual effect		
Drainage ditches (FW4)	Local Importance (Higher Value)	None	No likely significant effect at any geographic scale	None	No likely significant residual effect		

Ecological Receptor	Ecological Valuation (after National Roads Authority, 2009)	Impacts with the Potential to Result in Likely Significant Effects	Potential Impact Significance	Mitigation Measures	Residual Impact Significance	Compensation	Residual Impact Significance Post-compensation
Marsh (GM1)	Local Importance (Higher Value)	None	No likely significant effect at any geographic scale	None	No likely significant residual effect		
Dry calcareous and neutral grassland (GS1) Non-Annex I habitat type	Local Importance (Higher Value)	None	No likely significant effect at any geographic scale	None	No likely significant residual effect		
Dry meadows and grassy verges (GS2) Non-Annex I habitat type	Local Importance (Higher Value)	None	No likely significant effect at any geographic scale	None	No likely significant residual effect		
Dry-humid acid grassland (GS3) Non-Annex I habitat type	Local Importance (Higher Value)	**Construction** Habitat loss Habitat degradation – air quality Habitat degradation – non-native invasive plant species **Operation** Habitat degradation – non-native invasive plant species	Likely significant effect at the local geographic scale	Air quality during construction - Section 8.6.3.3 Non-native invasive plant species during construction and operation – Section 8.6.3.6 and Appendix A.7.5	Likely significant residual effect at the local geographic scale	No	Likely significant residual effect at the local geographic scale
Wet grassland (GS4) Non-Annex I habitat type	Local Importance (Higher Value)	None	No likely significant effect at any geographic scale	None	No likely significant residual effect		

Ecological Receptor	Ecological Valuation (after National Roads Authority, 2009)	Impacts with the Potential to Result in Likely Significant Effects	Potential Impact Significance	Mitigation Measures	Residual Impact Significance	Compensation	Residual Impact Significance Post-compensation
Rich fen and flush (PF1) Non-Annex I habitat type	County Importance	**Construction** Habitat degradation – surface water quality Habitat degradation – air quality	Likely significant effect at the county geographic scale	Water quality during construction – Section 8.6.3.4 Air quality during construction - Section 8.6.3.3	No likely significant residual effect		
Poor fen and flush (PF2) Non-Annex I habitat type	Local Importance (Higher Value)	**Construction** Habitat loss Habitat degradation – air quality **Operation** Habitat degradation – groundwater	Likely significant effect at the local geographic scale	Air quality during construction - Section 8.6.3.3	Likely significant residual effect at the local geographic scale	No	Likely significant residual effect at the local geographic scale
(Mixed) broadleaved woodland (WD1)	Local Importance (Higher Value)	**Construction** Habitat loss Habitat degradation – air quality Habitat degradation – non-native invasive plant species **Operation** Habitat degradation – non-native invasive plant species	Likely significant effect at the local geographic scale	To reduce the scale of habitat loss – see Section 8.6.3.1 Air quality during construction - Section 8.6.3.3 Non-native invasive plant species during construction and operation – Section 8.6.3.6 and Appendix A.7.5	Likely significant residual effect at the local geographic scale	Yes, see Section 8.9	No likely significant residual effect
Mixed broadleaved/conifer woodland (WD2)	Local Importance (Higher Value)	None	No likely significant effect at any geographic scale	None	No likely significant residual effect		

Ecological Receptor	Ecological Valuation (after National Roads Authority, 2009)	Impacts with the Potential to Result in Likely Significant Effects	Potential Impact Significance	Mitigation Measures	Residual Impact Significance	Compensation	Residual Impact Significance Post-compensation
(Mixed) conifer woodland (WD3)	Local Importance (Higher Value)	None	No likely significant effect at any geographic scale	None	No likely significant residual effect		
Hedgerows (WL1)	Local Importance (Higher Value)	**Construction** Habitat loss Habitat degradation – air quality Habitat degradation – non-native invasive plant species **Operation** Habitat degradation – non-native invasive plant species	Likely significant effect at the local geographic scale	To reduce the scale of habitat loss – see Section 8.6.3.1 Air quality during construction - Section 8.6.3.3 Non-native invasive plant species during construction and operation – Section 8.6.3.6 and Appendix A.7.5	Likely significant effect at the local geographic scale	Yes, see Section 8.9	No likely significant residual effect
Treelines (WL2)	Local Importance (Higher Value)	**Construction** Habitat loss Habitat degradation – air quality Habitat degradation – non-native invasive plant species **Operation** Habitat degradation – non-native invasive plant species	Likely significant effect at the local geographic scale	To reduce the scale of habitat loss – see Section 8.6.3.1 Air quality during construction - Section 8.6.3.3 Non-native invasive plant species during construction and operation – Section 8.6.3.6 and Appendix A.7.5	Likely significant effect at the local geographic scale	Yes, see Section 8.9	No likely significant residual effect

Ecological Receptor	Ecological Valuation (after National Roads Authority, 2009)	Impacts with the Potential to Result in Likely Significant Effects	Potential Impact Significance	Mitigation Measures	Residual Impact Significance	Compensation	Residual Impact Significance Post-compensation
Oak-ash-hazel woodland (WN2) Non-Annex I habitat type	Local Importance (Higher Value)	**Construction** Habitat degradation – air quality Habitat degradation – non-native invasive plant species	Likely significant effect at the local geographic scale	Air quality during construction - Section 8.6.3.3 Non-native invasive plant species during construction and operation – Section 8.6.3.6 and Appendix A.7.5	No likely significant residual effect		
Scrub (WS1) Non-Annex I habitat type	Local Importance (Higher Value)	None	No likely significant effect at any geographic scale	None	No likely significant residual effect		
Clusters of Important Habitats							
Important Habitat Clusters 1-12	The value of the biodiversity receptors recorded within the Assessment Boundary across the habitat clusters 1 - 12, range from Local Importance (Lower Value) to Internationally Important	Combinations of all of the potential impacts noted above in Habitats (outside of designated areas for nature conservation) and Rare and Protected Flora. The specific impacts are related to and dependent upon the potential impacts of the Project on each of the individual ecological receptors that make up the biodiversity resource within a given habitat cluster.	Likely significant effects from local up to the international geographic scale	All of the mitigation measures included within Section 8.6.3 and 8.6.4 The specific mitigation measures are related to and dependent upon the potential impacts of the Project on each of the individual ecological receptors that make up the biodiversity resource within a	Likely significant effects from local up to the international geographic scale Refer to Section 8.7.3.1 for breakdown by habitat cluster	Yes, see Section 8.9.1 for habitats	Yes, see Section 8.10 for details

Ecological Receptor	Ecological Valuation (after National Roads Authority, 2009)	Impacts with the Potential to Result in Likely Significant Effects	Potential Impact Significance	Mitigation Measures	Residual Impact Significance	Compensation	Residual Impact Significance Post-compensation
				given habitat cluster			
Rare and Protected Flora Species							
Imbricate bog-moss *Sphagnum affine*	National importance	**Construction** Loss of local population through removal Loss of local population - hydrogeological or hydrological effects Loss of local population - air quality effects Loss of local population - non-native invasive plant species **Operation** Loss of local population through removal Loss of local population - hydrogeological or hydrological effects Loss of local population - air quality effects Loss of local population - non-native invasive plant species	Likely significant effect at the national geographic scale	Sections 8.6.3 (8.6.3.3, 8.6.3.5, 8.6.3.6) and 8.6.4	Likely significant effect at the national geographic scale	No	Likely significant effect at the national geographic scale
Red bog-moss *Sphagnum capillifolium*	National importance	**Construction**	Likely significant effect at the national geographic scale	Sections 8.6.3 (8.6.3.3, 8.6.3.5, 8.6.3.6) and 8.6.4	Likely significant effect at the county	No	Likely significant effect at the county

Ecological Receptor	Ecological Valuation (after National Roads Authority, 2009)	Impacts with the Potential to Result in Likely Significant Effects	Potential Impact Significance	Mitigation Measures	Residual Impact Significance	Compensation	Residual Impact Significance Post-compensation
		Loss of local population through removal Loss of local population - hydrogeological or hydrological effects Loss of local population - air quality effects Loss of local population - non-native invasive plant species **Operation** Loss of local population through removal Loss of local population - hydrogeological or hydrological effects Loss of local population - air quality effects Loss of local population - non-native invasive plant species			geographic scale		geographic scale
Woodsy thyme moss *Plagiomnium cuspidatum*	National importance	**Construction** Loss of local population through removal Loss of local population - air quality effects Loss of local population - non-native invasive plant species **Operation**	Likely significant effect at the county geographic scale	Sections 8.6.3 (8.6.3.3, 8.6.3.5, 8.6.3.6) and 8.6.4	Likely significant effect at the county geographic scale	No	Likely significant effect at the county geographic scale

Ecological Receptor	Ecological Valuation (after National Roads Authority, 2009)	Impacts with the Potential to Result in Likely Significant Effects	Potential Impact Significance	Mitigation Measures	Residual Impact Significance	Compensation	Residual Impact Significance Post-compensation
		Loss of local population through removal Loss of local population - air quality effects Loss of local population - non-native invasive plant species					
Lesser striated feathermoss *Plasteurhynchium striatulum*	National importance	**Construction** Loss of local population through removal Loss of local population - air quality effects Loss of local population - non-native invasive plant species **Operation** Loss of local population through removal Loss of local population - air quality effects Loss of local population - non-native invasive plant species	Likely significant effect at the county geographic scale	Sections 8.6.3 (8.6.3.1, 8.6.3.2, 8.6.3.3, 8.6.3.5, 8.6.3.6) and 8.6.4	Likely significant effect at the county geographic scale	No	Likely significant effect at the county geographic scale
Spring gentian *Gentiana verna*	National importance	**Construction** Loss of local population through removal Loss of local population - air quality effects Loss of local population - non-native invasive plant species	Likely significant effect at the local geographic scale	Sections 8.6.3 (8.6.3.1, 8.6.3.2, 8.6.3.3, 8.6.3.5, 8.6.3.6) and 8.6.4	Likely significant effect at the local geographic scale	No	Likely significant effect at the local geographic scale

Ecological Receptor	Ecological Valuation (after National Roads Authority, 2009)	Impacts with the Potential to Result in Likely Significant Effects	Potential Impact Significance	Mitigation Measures	Residual Impact Significance	Compensation	Residual Impact Significance Post-compensation
		Operation Loss of local population through removal Loss of local population - air quality effects Loss of local population - non-native invasive plant species					
Eyebright *Euphrasia arctica*	Local importance	**Construction** Loss of local population through removal Loss of local population - air quality effects Loss of local population - non-native invasive plant species **Operation** Loss of local population through removal Loss of local population - air quality effects Loss of local population - non-native invasive plant species	Likely significant effect at the local geographic scale	Sections 8.6.3 (8.6.3.1, 8.6.3.2, 8.6.3.3, 8.6.3.5, 8.6.3.6) and 8.6.4	Likely significant residual effect at the local geographic scale	No	Likely significant residual effect at the local geographic scale
Fauna Species							
Badger	Local Importance (Higher Value)	**Construction** Loss of breeding/resting sites Disturbance/displacement	Likely significant effect at the local geographic scale	Measures to protect Badger during construction – Section 8.6.5.3	No likely significant residual effect		

Ecological Receptor	Ecological Valuation (after National Roads Authority, 2009)	Impacts with the Potential to Result in Likely Significant Effects	Potential Impact Significance	Mitigation Measures	Residual Impact Significance	Compensation	Residual Impact Significance Post-compensation
		Operation Habitat severance/barrier effect Mortality risk		Measures to protect Badger during operation – Section 8.6.5.3			
Otter	International Importance	**Construction** Habitat degradation - water quality **Operation** Habitat severance/barrier effect Mortality risk	Likely significant effect at the local geographic scale	Measures to protect Otter during construction – Section 8.6.5.1 Measures to protect Otter during operation – Section 8.6.5.1	No likely significant residual effect		
Other mammal species protected under the Wildlife Acts	Local Importance (Higher Value)	**Construction** Habitat degradation - water quality **Operation** Habitat severance/barrier effect Mortality risk	Likely significant effect at the local geographic scale	Measures to protect other mammal species (excl. bats) during construction – Section 8.6.5.4 Measures to protect other mammal species (excl. bats) during operation – Section 8.6.5.4	No likely significant residual effect		
Lesser horseshoe bat	National Importance	**Construction** Roost loss Habitat loss Habitat fragmentation	Likely significant effect at the national geographic scale	Measures to protect bats during construction – Section 8.6.5.2 Measures to protect bats	Likely significant effect at the national geographic scale	Yes, see Section 8.9	Likely significant residual effect at the local geographic scale

Ecological Receptor	Ecological Valuation (after National Roads Authority, 2009)	Impacts with the Potential to Result in Likely Significant Effects	Potential Impact Significance	Mitigation Measures	Residual Impact Significance	Compensation	Residual Impact Significance Post-compensation
		Disturbance/displacement **Operation** Mortality Barrier/severance effects Disturbance/displacement		during operation – Section 8.6.5.2			
All other bat species	Local Importance (Higher Value)		Likely significant effect at the local geographic scale	Measures to protect bats during construction – Section 8.6.5.2 Measures to protect bats during operation – Section 8.6.5.2	Likely significant effect at the local geographic scale	Yes, see Section 8.9	Likely significant residual effect at the local geographic scale
Marsh whorl snail	Local Importance (Higher Value)	**Construction** Habitat degradation – surface water quality Habitat degradation – groundwater **Operation** Habitat degradation – groundwater	Likely significant effect at the local geographic scale	Measures to protect the Marsh whorl snail during construction – Section 8.6.6.2 Measures to protect the Marsh whorl snail during operation – Section 8.6.6.2	No likely significant residual effect		
Marsh fritillary butterfly	National Importance	**Construction** Mortality risk	Likely significant effect at the local geographic scale	Measures to protect the Marsh fritillary butterfly during construction – Section 8.6.6.3	No likely significant residual effect		
SCI bird species	International	see Lough Corrib SPA and Inner Galway Bay SPA above	Likely significant effect at the international geographic scale	see Section 10 of the updated NIS	No likely significant residual effect		
Barn owl	County Importance	**Construction** Disturbance/displacement	Likely significant effect at the county geographic scale	Measures to protect breeding birds during	Likely significant residual effect	No	Likely significant residual effect

Ecological Receptor	Ecological Valuation (after National Roads Authority, 2009)	Impacts with the Potential to Result in Likely Significant Effects	Potential Impact Significance	Mitigation Measures	Residual Impact Significance	Compensation	Residual Impact Significance Post-compensation
		Operation Mortality risk		operation – Section 8.6.7.1	at the local geographic scale		at the local geographic scale
Peregrine falcon	County Importance	**Construction** Loss of nest site Disturbance/displacement **Operation** Disturbance/displacement	Likely significant effect at the county geographic scale	Measures to protect breeding birds during construction – Section 8.6.7.1 Measures to protect breeding birds during operation – Section 8.6.7.1	Likely significant residual effect at the county geographic scale	Yes, see Section 8.9	Likely significant residual effect at the county geographic scale
All other breeding bird species (non SCI)	Local Importance (Higher Value)	**Construction** Mortality risk Disturbance/displacement **Operation** Mortality risk Disturbance/displacement	Likely significant effect at the local geographic scale	Measures to protect breeding birds during construction – Section 8.6.7.1 Measures to protect breeding birds during operation – Section 8.6.7.1	No likely significant residual effect		
All other wintering bird species (non-SCI)	Local Importance (Higher Value)	**Construction** Disturbance/displacement (Ballindooley Lough) Habitat degradation – surface water quality Habitat degradation – groundwater	Likely significant effect at the local geographic scale	Measures to protect wintering birds during construction – Section 8.6.7.2 Measures to protect wintering birds during operation – Section 8.6.7.2	No likely significant residual effect		

Ecological Receptor	Ecological Valuation (after National Roads Authority, 2009)	Impacts with the Potential to Result in Likely Significant Effects	Potential Impact Significance	Mitigation Measures	Residual Impact Significance	Compensation	Residual Impact Significance Post-compensation
Smooth newt Common frog	Local Importance (Higher Value)	**Construction** Habitat loss Disturbance & mortality risk Habitat degradation – surface water quality **Operation** Habitat severance/barrier effect	Likely significant effect at the local geographic scale	Measures to protect amphibians during construction – Section 8.6.8 Measures to protect amphibians during operation – Section 8.6.8	No likely significant residual effect		
Common lizard	Local Importance (Higher Value)	**Construction** Habitat loss Disturbance & mortality risk **Operation** Habitat severance/barrier effect	Likely significant effect at the local geographic scale	Measures to protect reptiles during construction – Section 8.6.9 Measures to protect reptiles during operation – Section 8.6.9	No likely significant residual effect		
Atlantic salmon European eel	International Importance	**Construction** Habitat degradation – surface water quality Habitat degradation – groundwater	Likely significant effect at the local geographic scale	Measures to protect fish species during construction – Section 8.6.10	No likely significant residual effect		
All other fish species recorded	Local Importance (Higher Value)	**Construction** Habitat degradation – surface water quality Habitat degradation – groundwater	Likely significant effect at the local geographic scale	Measures to protect fish species during construction – Section 8.6.10	No likely significant residual effect		
Local Biodiversity Areas							

Ecological Receptor	Ecological Valuation (after National Roads Authority, 2009)	Impacts with the Potential to Result in Likely Significant Effects	Potential Impact Significance	Mitigation Measures	Residual Impact Significance	Compensation	Residual Impact Significance Post-compensation
Local biodiversity areas	The value of the biodiversity receptors recorded in the vicinity of the Project, across the local biodiversity areas, range from Local Importance (Lower Value) to Internationally Important	Combinations of all of the potential impacts noted above The specific impacts are related to and dependent upon the potential impacts of the Project on each of the individual ecological receptors that make up the biodiversity resource within a given local biodiversity area	Likely significant effects from local up to the international geographic scale	All of the mitigation measures included within Section 8.6 The specific mitigation measures are related to and dependent upon the potential impacts of the Project on each of the individual ecological receptors that make up the biodiversity resource within a given local biodiversity area	Likely significant effects from local up to the national geographic scale Refer to Section 8.7.11 for breakdown by local biodiversity area	Yes, see Section 8.9.1 for habitats and Section 8.9.2 for bats	Yes, see Section 8.10 for details

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