Large Scale Residential Development at Dunboyne North, Co. Meath

CHAPTER 13 Biodiversity

August 2023

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CHARTERED PLANNING CONSULTANTS

Appendix 13.1 Relevant Legislation and Policy

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Appendix 13.1 – Relevant Legislation and Policy

International Legislation

EU Birds Directive

The Birds Directive constitutes a level of general protection for all wild birds throughout the European Union. Annex I of the Birds Directive includes a total of 194 bird species that are considered rare, vulnerable to habitat changes or in danger of extinction within the European Union. Article 4 establishes that there should be a sustainable management of hunting of listed species, and that any large scale non-selective killing of birds must be outlawed. The Directive requires the designation of Special Protection Areas (SPAs) for: listed and rare species, regularly occurring migratory species and for wetlands which attract large numbers of birds. There are 25 Annex I species that regularly occur in Ireland.

EU Habitats Directive

The Habitats Directive aims to protect some 220 habitats and approx. 1000 species through-out Europe. The habitats and species are listed in the Directives annexes where Annex I covers habitats and Annex II, IV and V cover species. There are 59 Annex I habitats in Ireland and 33 Annex IV species which require strict protection wherever they occur. The Directive requires the designation of Special Areas of Conservation (SACs) for areas of habitat deemed to be of European interest. The SACs together with the SPAs from the Birds Directive from a network of protected sites called Natura 2000.

Bern and Bonn Convention

The Convention on the Conservation of European Wildlife and Natural Habitats (Bern Convention 1982) was enacted to conserve all species and their habitats. The Convention on the Conservation of Migratory Species of Wild Animals (Bonn Convention 1979, enacted 1983) was introduced in order to give protection to migratory species across borders in Europe.

Ramsar Convention

The Ramsar Convention on Wetlands is an intergovernmental treaty signed in Ramsar, Iran, in 1971. The treaty is a commitment for national action and international cooperation for the conservation of wetlands and their resources. In Ireland there are currently 45 Ramsar sites which cover a total area of 66,994ha.

Water Framework Directive

The EU Water Framework Directive (WFD) 2000/60/EC is an important piece of environmental legislation which aims to protect and improve water quality. It applies to rivers, lakes, groundwater, estuaries, and coastal waters. The Water Framework Directive was agreed by all individual EU member states in 2000, and its first cycle ran from 2009 – 2015. The Directive runs in 6-year cycles; the second cycle ran from 2016 – 2021, and the current (third) cycle runs from 2022-2027. The aim of the WFD is to prevent any deterioration in the existing status of water quality, including the protection of good and high-water quality status where it exists. The WFD requires member states to manage their water resources on an integrated basis to achieve at least 'good' ecological status, through River Basin Management Plans (RBMP), by 2027.

National Legislation

Wildlife Act 1976 and amendments

The Wildlife Act 1976 was enacted to provide protection to birds, animals, and plants in Ireland and to control activities which may have an adverse impact on the conservation of wildlife. With regard to the listed species, it is an offence to disturb, injure or damage their breeding or resting place wherever these occur without an appropriate licence from the National Parks and Wildlife Service (NPWS). This list includes all wild birds along with their nests and eggs. Intentional destruction of an active nest from the building stage up until the chicks have fledged is an offence. This includes the cutting of hedgerows from the 1st of March to the 31st of August. The act also provides a mechanism to give statutory protection to Natural Heritage Areas (NHAs). The Wildlife Amendment Act 2000 widened the scope of the Act to include most species, including the majority of fish and aquatic invertebrate species which were excluded from the 1976 Act.

The current list of plant species protected by Section 21 of the Wildlife Act, 1976 (and amendments) is set out in the Flora (Protection) Order, 2015 (S.I. No. 356/2015). The Flora (Protection) Order affords protection to several species of plant in Ireland, including 68 vascular plants, 40 mosses, 25 liverworts, 1 stonewort and 1 lichen. This Act makes it illegal for anyone to uproot, cut or damage any of the listed plant species and it also forbids anyone from altering, interfering, or damaging their habitats. This protection is not confined to within designated conservation sites and applies wherever the plants are found.

EU Habitats Directive 1992 and EC (Birds and Natural Habitats) Regulations 2011

The EU Directive on the Conservation of Natural Habitats and of Wild Fauna and Flora (Habitats Directive 1992) provides protection to particular species and habitats throughout Europe. The Habitats Directive has been transposed into Irish law through the EC (Birds and Natural Habitats) Regulations 2011.

Annex IV of the EU Habitats Directive provides protection to a number of listed species, wherever they occur. Under Regulation 23 of the Habitats Directive, any person who, in regard to the listed species, *"Deliberately captures or kills any specimen of these species in the wild, deliberately disturbs these species particularly during the period of breeding, rearing, hibernation and migration, deliberately takes or destroys eggs from the wild or damages or destroys a breeding site or resting place of such an animal shall be guilty of an offence."*

Invasive Species Legislation

Certain plant species and their hybrids are listed as Invasive Alien Plant Species in Part 1 of the Third Schedule of the European Communities (Birds and Natural Habitats) Regulations 2011 (SI 477 of 2011, as amended). In addition, soils and other material containing such invasive plant material, are classified in Part 3 of the Third Schedule as vector materials and are subject to the same strict legal controls.

Failure to comply with the legal requirements set down in this legislation can result in either civil or criminal prosecution, or both, with very severe penalties accruing. Convicted parties under the Act can be fined up to €500,000.00, jailed for up to 3 years, or both.

Extracts from the relevant sections of the regulations are reproduced below.

"49(2) Save in accordance with a licence granted [by the Department of Arts, Heritage and the Gaeltacht], any person who plants, disperses, allows or causes to disperse, spreads or otherwise causes to grow in anyplace [a restricted non-native plant], shall be guilty of an offence.

49(3) … it shall be a defence to a charge of committing an offence under paragraph (1) or (2) to prove that the accused took all reasonable steps and exercised all due diligence to avoid committing the offence.

50(1) Save in accordance with a licence, a person shall be guilty of an offence if he or she […] offers or exposes for sale, transportation, distribution, introduction, or release—
(a) an animal or plant listed in Part 1 or Part 2 of the Third Schedule,
(b) anything from which an animal or plant referred to in subparagraph (a) can be reproduced or propagated, or
(c) a vector material listed in the Third Schedule, in any place in the State specified in the third column of the Third Schedule in relation to such an animal, plant or vector material."

National Biodiversity Action Plan 2017-2021

The National Biodiversity Plan (NBAP) 2017-2021, the third such plan for Ireland, captures the objectives, targets and actions for biodiversity that will be undertaken by a wide range of government, civil society and private sectors to achieve Ireland's Vision for Biodiversity. The NBAP provides a framework to track and assess progress towards Ireland's Vision for Biodiversity over a five-year timeframe from 2017 to 2021. To achieve the Vision, seven strategic objectives were identified in the second NBAP "Actions for Biodiversity 2011-2016". The continued implementation of the objectives from the second NBAP has been retained for the new NBAP of 2017-2021. Actions required to achieve the strategic objectives as well as the lead and key partners responsible for their implementation are set out for each of the objectives and their targets (Table A1).

Table A1: Objectives and targets of the National Biodiversity Action Plan 2017-2021.

Objective	Target
1: Mainstream biodiversity into decision-making across all sectors	1.1: Shared responsibility for the conservation of biodiversity and the sustainable use of its components is fully recognised, and acted upon, by all sectors.
	1.2: Strengthened legislation in support of tackling biodiversity loss in Ireland.
2: Strengthen the knowledge base for conservation, management and sustainable use of biodiversity	2.1: Knowledge of biodiversity and ecosystem services has substantially advanced our ability to ensure conservation, effective management, and sustainable use by 2021.
3: Increase awareness and appreciation of biodiversity and ecosystems services	3.1: Enhanced appreciation of the value of biodiversity and ecosystem services amongst policy makers, businesses, stakeholders, local communities, and the general public.
4: Conserve and restore biodiversity and ecosystem services in the wider countryside	4.1: Optimised opportunities under agriculture and rural development, forestry and other relevant policies to benefit biodiversity.
	4.2: Principal pollutant pressures on terrestrial and freshwater biodiversity substantially reduced by 2020.

	4.3: Optimised benefits for biodiversity in Flood Risk Management Planning and drainage schemes.
	4.4: Harmful invasive alien species are controlled and there is reduced risk of introduction and/or spread of new species
	4.5: Improved enforcement of wildlife law
5: Conserve and restore biodiversity and ecosystem services in the marine environment	5.1: Progress made towards good ecological and environmental status of marine waters over the lifetime of this Plan.
	5.2. Fish stock levels maintained or restored to levels that can produce maximum sustainable yield, where possible, no later than 2020.
6: Expand and improve management of protected areas and species	6.1: Natura 2000 network designated and under effective conservation management by 2020.
	6.2: Sufficiency, coherence, connectivity, and resilience of the protected areas network substantially enhanced by 2020.
	6.3: No protected species in worsening status by 2020; majority of species in, or moving towards, favourable status by 2021.
7: Strengthen international governance for biodiversity and ecosystem services	7.1: Strengthened support for biodiversity and ecosystem services in external assistance.
	7.2: Enhanced contribution to international governance for biodiversity and ecosystem services.
	7.3: Enhanced cooperation with Northern Ireland on common issues.
	7.4. Reduction in the impact of Irish trade on global biodiversity and ecosystem services.

Meath County Development Plan 2021-2027

Policies and objectives of the Meath County Development Plan (MCDP) 2021 – 2027 that are of relevance to this EcIA are outlined below:

Overall policies and objectives on Biodiversity:

- HER POL 27: "To protect, conserve and enhance the County's biodiversity where appropriate."
- HER POL 28: "To integrate in the development management process the protection and enhancement of biodiversity and landscape features wherever possible, by minimising adverse impacts on existing habitats (whether designated or not) and by including mitigation and/or compensation measures, as appropriate."
- HER POL 31: "To ensure that the ecological impact of all development proposals on habitats and species are appropriately assessed by suitably qualified professional(s) in accordance with best practice guidelines – e.g. the preparation of an Ecological Impact Assessment (EcIA), Screening Statement for Appropriate Assessment, Environmental Impact Assessment, Natura Impact Statement (NIS), species surveys etc. (as appropriate)."
- HER OBJ 30: "To implement, in partnership with the Department of Culture, Heritage and the Gaeltacht, relevant stakeholders and the community, the objectives and actions of Ireland's National Biodiversity Action Plan 2017 - 2021 which relate to the remit and functions of Meath County Council."

- HER OBJ 31: "To implement, in partnership with the Department of Culture, Heritage and the Gaeltacht, relevant stakeholders and the community, the objectives and actions of the County Meath Biodiversity Plan 2015-2020 and any revisions thereof."

Protecting Biodiversity in Meath – Sites Designated for Nature Conservation

- HER OBJ 32: "To actively support the implementation of the All Ireland Pollinator Plan 2021-2025 and any revisions thereof."
- HER POL 32: "To permit development on or adjacent to designated Special Areas of Conservation, Special Protection Areas, Natural Heritage Areas, Statutory Nature Reserves or those proposed to be designated over the period of the Plan, only where the development has been subject to the outcome of the Appropriate Assessment process and has been carried out to the satisfaction of the Planning Authority, in consultation with National Parks and Wildlife."
- HER POL 33: "To have regard to the views and guidance of the National Parks and Wildlife Service in respect of proposed development where there is a possibility that such development may have an impact on a designated European or National site or a site proposed for such designation."
- HER POL 34: "To undertake appropriate surveys and collect data to provide an evidence-base to assist the Council in meeting its obligations under Article 6 of the Habitats Directives (92/43/EEC) as transposed into Irish Law, subject to available resources."
- HER OBJ 33: "To ensure an Appropriate Assessment in accordance with Article 6(3) and Article 6(4) of the Habitats Directives (92/43/EEC) and in accordance with the Department of Environment, Heritage and Local Government Appropriate Assessment of Plans and Projects in Ireland – Guidance for Planning Authorities, 2009 and relevant EPA and European Commission guidance documents, is carried out in respect of any plan or project not directly connected with or necessary for the management of the site but likely to have a significant effect on a Natura 2000 site(s), either individually or in-combination with other plans or projects, in view of the site's conservation objectives."
- HER OBJ 34: "To protect and conserve the conservation value of candidate Special Areas of Conservation, Special Protection Areas, Natural Heritage Areas and proposed Natural Heritage Areas as identified by the Minister for the Department of Culture, Heritage and the Gaeltacht and any other sites that may be proposed for designation during the lifetime of this Plan in accordance with the provisions of the Habitats and Birds Directives and to permit development in or affecting same only in accordance with the provisions of those Directives as transposed into Irish Law."

Protecting Biodiversity – Non-designated sites:

- HER POL 35: "To ensure, where appropriate, the protection and conservation of areas, sites, species and ecological/networks of biodiversity value outside designated sites and to require an appropriate level of ecological assessment by suitably qualified professional(s) to accompany development proposals likely to impact on such areas or species."

Protected Species:

- HER POL 36: "To consult with the National Parks and Wildlife Service and take account of their views and any licensing requirements, when undertaking, approving or authorising development which is likely to affect plant, animal or bird species protected by law."
- HER OBJ 35: "To ensure that development does not have a significant adverse impact, incapable of satisfactory avoidance or mitigation, on plant, animal or bird species protected by law."

Woodlands, Hedgerows and Trees:

- HER POL 37: "To encourage the retention of hedgerows and other distinctive boundary treatments in rural areas and prevent loss and fragmentation, where practically possible. Where removal of a hedgerow, stone wall or other distinctive boundary treatment is unavoidable, mitigation by provision of the same type of boundary will be required."
- HER POL 38: "To promote and encourage planting of native hedgerow species in new developments and as part of the Council's own landscaping works."
- HER POL 39: "To recognise the archaeological importance of townland boundaries including hedgerows and promote their protection and retention."
- HER POL 40: "To protect and encourage the effective management of native and semi-natural woodlands, groups of trees and individual trees and to encourage the retention of mature trees and the use of tree surgery rather than felling, where possible, when undertaking, approving or authorising development."
- HER POL 41: "To protect trees the subject of Tree Preservation Orders (see Map 9.3), Champion and Heritage Trees identified on the Tree Register of Ireland and Heritage Tree Database when undertaking, approving, or authorising development."

Invasive Species:

- HER POL 43: "To promote best practice in the control of invasive species in the carrying out its functions in association with relevant authorities including TII and the Department of Transport, Tourism and Sport."
- HER POL 44: "To require all development proposals to address the presence or absence of invasive alien species on proposed development sites and (if necessary) require applicants to prepare and submit an Invasive Species Management Plan where such a species exists to comply with the provisions of the European Communities (Birds and Natural Habitats) Regulations 2011-2015."

Green Infrastructure:

- HER POL 55: "To require that all Land Use Plans protect, manage and provide where possible green infrastructure in an integrated and coherent manner."
- HER OBJ 60: "To encourage, pursuant to Article 10 of the Habitats Directive (92/43/EEC), the management of features of the landscape, such as traditional field boundaries, important for the ecological coherence of the Natura 2000 network and essential for the migration, dispersal and genetic exchange of wild species."

County Meath Biodiversity Action Plan 2015-2020

The main function of the County Meath Biodiversity Action Plan (BAP) 2015-2020 is to provide a framework and series of actions to conserve, enhance and raise awareness of Meath's rich biodiversity and to maximise the contribution that it makes to the social, economic and environmental well being of the county, taking into account local, national and international, including European priorities.

The County Meath BAP contains four main objectives:

- Objective 1: To raise awareness of biodiversity in Meath, its value and the issues facing it.
- Objective 2: To better understand the biodiversity of Meath.
- Objective 3: To conserve and enhance habitats and species in Meath, taking account of national and local priorities.

- Objective 4: To foster active participation to help biodiversity in Meath, encouraging a partnership approach to help our species and habitats.

The BAP includes a total of 28 action items to meet these objectives, ranging from monitoring projects to preparing guidance documents and increasing public awareness.

Appendix 13.2 Value of Ecological Resources

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Appendix 13.2 – Value of Ecological Resources

The criteria outlined in the table below, taken from the Guidelines for Assessment of Ecological Impacts of National Road Schemes published by the NRA, were used for assigning value to designated sites, habitats and species within the Site of the Proposed Development and surrounding area.

Table B1. Description of values for ecological resources based on geographic hierarchy of importance (NRA, 2009b).

Importance	Criteria

International Importance	- 'European Site' including Special Area of Conservation (SAC), Site of Community Importance (SCI), Special Protection Area (SPA) or proposed Special Area of Conservation.
	- Proposed Special Protection Area (pSPA). - Site that fulfils the criteria for designation as a 'European Site' (see Annex III of the Habitats Directive, as amended).
	- Features essential to maintaining the coherence of the Natura 2000 Network
	- Site containing 'best examples' of the habitat types listed in Annex I of the Habitats Directive.
	- Resident or regularly occurring populations (assessed to be important at the national level) of the following:
	  o Species of bird, listed in Annex I and/or referred to in Article 4(2) of the Birds Directive; and/or
	  o Species of animal and plants listed in Annex II and/or IV of the Habitats Directive
	- Ramsar Site (Convention on Wetlands of International Importance Especially Waterfowl Habitat 1971).
	- World Heritage Site (Convention for the Protection of World Cultural & Natural Heritage, 1972).
	- Biosphere Reserve (UNESCO Man & The Biosphere Programme)
	- Site hosting significant species populations under the Bonn Convention (Convention on the Conservation of Migratory Species of Wild Animals, 1979).
	- Site hosting significant populations under the Berne Convention (Convention on the Conservation of European Wildlife and Natural Habitats, 1979).
	- Biogenetic Reserve under the Council of Europe.
	- European Diploma Site under the Council of Europe.
	- Salmonid water designated pursuant to the European Communities (Quality of Salmonid Waters) Regulations, 1988, (S.I. No. 293 of 1988).

National Importance	- Site designated or proposed as a Natural Heritage Area (NHA).
	- Statutory Nature Reserve.
	- Refuge for Fauna and Flora protected under the Wildlife Acts.
	- National Park.
	- Undesignated site fulfilling the criteria for designation as a Natural Heritage Area (NHA); Statutory Nature Reserve; Refuge for Fauna and Flora protected under the Wildlife Act; and/or a National Park.
	- Resident or regularly occurring populations (assessed to be important at the national level) of the following:
	  o Species protected under the Wildlife Acts; and/or
	  o Species listed on the relevant Red Data list.
	  o Site containing 'viable areas' of the habitat types listed in Annex I of the Habitats Directive

County Importance	- Area of Special Amenity. - Area subject to a Tree Preservation Order. - Area of High Amenity, or equivalent, designated under the County Development Plan.

	- Resident or regularly occurring populations (assessed to be important at the County level) of the following:
	  o Species of bird, listed in Annex I and/or referred to in Article 4(2) of the Birds Directive;
	  o Species of animal and plants listed in Annex II and/or IV of the Habitats Directive;
	  o Species protected under the Wildlife Acts; and/or
	  o Species listed on the relevant Red Data list.
	  o Site containing area or areas of the habitat types listed in Annex I of the Habitats Directive that do not fulfil the criteria for valuation as of International or National importance.
	- County important populations of species; or viable areas of semi-natural habitats; or natural heritage features identified in the National or Local BAP; if this has been prepared.
	- Sites containing semi-natural habitat types with high biodiversity in a county context and a high degree of naturalness, or populations of species that are uncommon within the county.
	- Sites containing habitats and species that are rare or are undergoing a decline in quality or extent at a national level.

Local Importance (higher value)	- Locally important populations of priority species or habitats or natural heritage features identified in the Local BAP, if this has been prepared;
	- Resident or regularly occurring populations (assessed to be important at the Local level) of the following:
	  o Species of bird, listed in Annex I and/or referred to in Article 4(2) of the Birds Directive;
	  o Species of animal and plants listed in Annex II and/or IV of the Habitats Directive;
	  o Species protected under the Wildlife Acts; and/or o
	  o Species listed on the relevant Red Data list.
	  o Sites containing semi-natural habitat types with high biodiversity in a local context and a high degree of naturalness, or populations of species that are uncommon in the locality;
	- Sites or features containing common or lower value habitats, including naturalised species that are nevertheless essential in maintaining links and ecological corridors between features of higher ecological value.

Local Importance (lower value)	- Sites containing small areas of semi-natural habitat that are of some local importance for wildlife; - Sites or features containing non-native species that is of some importance in maintaining habitat links.

Appendix 13.3 EPA Impact Assessment Criteria

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1.1 Appendix 13.3 – EPA Impact Assessment Criteria

In line with the draft EPA Guidelines (EPA 2022), the following terms are defined when evaluating and quantifying the quality, significance, extent/context, probability and duration/frequency of effects.

Table C1. Definition of quality, significance, extent/context, probability and duration/frequency of effects.

Term	Definition
Quality of Effects	
Positive	A change which improves the quality of the environment (for example, by increasing species diversity, or improving the reproductive capacity of an ecosystem, or by removing nuisances or improving amenities).
Neutral	No effects or effects that are imperceptible, within normal bounds of variation or within the margin of forecasting error.
Negative/Adverse	A change which reduces the quality of the environment (for example, lessening species diversity or diminishing the reproductive capacity of an ecosystem, or damaging health or property or by causing nuisance).
Significance of Effects	
Imperceptible	An effect capable of measurement but without significant consequences.
Not Significant	An effect which causes noticeable changes in the character of the environment but without significant consequences.
Slight	An effect which causes noticeable changes in the character of the environment without affecting its sensitivities.
Moderate	An effect that alters the character of the environment in a manner that is consistent with existing and emerging baseline trends.
Significant	An effect which, by its character, magnitude, duration or intensity, alters a sensitive aspect of the environment.
Very Significant	An effect which, by its character, magnitude, duration or intensity, significantly alters most of a sensitive aspect of the environment.
Profound	An effect which obliterates sensitive characteristics. No effects or effects that are imperceptible, within normal bounds of variation or within the margin of forecasting error
Extent and Context of Effects	
Extent	Describe the size of the area, the number of sites and the proportion of a population affected by an effect.
Context	Describe whether the extent, duration or frequency will conform or contrast with established (baseline) conditions (is it the biggest, longest effect ever?)

Probability of Effects	
Likely	The effects that can reasonably be expected to occur because of the planned project if all mitigation measures are properly implemented.
Unlikely	The effects that can reasonably be expected not to occur because of the planned project if all mitigation measures are properly implemented.
Duration and Frequency of Effects	
Momentary	Effects lasting from seconds to minutes.
Brief	Effects lasting less than a day
Temporary	Effects lasting less than a year.
Short-term	Effects lasting one to seven years.
Medium-term Effects	Effects lasting seven to fifteen years.
Long-term	Effects lasting fifteen to sixty years.
Permanent	Effects lasting over sixty years.
Reversible	Effects that can be undone, for example through remediation or restoration.
Frequency	Describe how often the effect will occur (once, rarely, occasionally, frequently, constantly – or hourly, daily, weekly, monthly, annually).

Appendix 13.4 Bat Survey Results Metadata

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Appendix 13.4 – Bat Survey Results Metadata

Table D1. Bat Survey Metadata 2021 Dusk Transect Survey

Table D2. Bat Survey Metadata 2022 Dusk Transect Survey

Table D3. Bat Survey Metadata 2023 Dusk Transect Survey

N.B. Please note that Static (SM4) Metadata has not been included in this Appendix due to the large volume of data collected over the course of the 5 nights the detector was deployed. This data can be provided should it be requested.

Table D1. Bat Survey Metadata 2021 Dusk Transect Survey

Recording	Timestamp	Species Text	Calls [#]	Mean Peak Frequency [kHz]	Mean Max Frequency [kHz]	Mean Min Frequency [kHz]	Mean Call Length [ms]	Mean Call Distance [ms]	Temperature [°C]	Latitude [WGS84]	Longitude [WGS84]
3750000	23/09/2021 19:23	Noise	0	0	0	0	0	0	17	53.43279	-6.47495
3750001	23/09/2021 19:27	Noise	0	0	0	0	0	0	16	53.43329	-6.47349
3750002	23/09/2021 19:28	Noise	0	0	0	0	0	0	16	53.43353	-6.47361
3750003	23/09/2021 19:29	Noise	0	0	0	0	0	0	16	53.43361	-6.47382
3750004	23/09/2021 19:32	Noise	0	0	0	0	0	0	16	53.43279	-6.47494
3750006	23/09/2021 19:34	Noise	0	0	0	0	0	0	16	53.43216	-6.4739
3750007	23/09/2021 19:47	Pipistrellus pipistrellus	1	45	51.8	43.5	3.2	0	16	53.43317	-6.46928
3750008	23/09/2021 19:48	Noise	0	0	0	0	0	0	15	53.43317	-6.46929
3750009	23/09/2021 19:52	Pipistrellus pipistrellus	2	44.4	58.3	44.1	4.3	92	15	53.43323	-6.46938
3750010	23/09/2021 19:53	Pipistrellus pipistrellus	2	47.4	60.6	46.7	2.9	82	15	53.43305	-6.46903
3750011	23/09/2021 19:53	Pipistrellus pipistrellus	2	51	59.1	47.8	3.2	86	15	53.43304	-6.469
3750012	23/09/2021 19:55	Noise	0	0	0	0	0	0	15	53.43267	-6.46891
3750013	23/09/2021 19:56	Pipistrellus pipistrellus	2	45.2	58.9	44.1	4.3	82	14	53.43316	-6.46924
3750014	23/09/2021 20:02	Nyctalus leisleri	9	21.9	22.5	21	19	453	15	53.432	-6.47024
3750015	23/09/2021 20:06	Noise	0	0	0	0	0	0	14	53.43179	-6.47315
3750016	23/09/2021 20:06	Pipistrellus pipistrellus	77	48.5	56.6	47.2	7	90	14	53.43179	-6.47314

Recording	Timestamp	Species Text	Calls [#]	Mean Peak Frequency [kHz]	Mean Max Frequency [kHz]	Mean Min Frequency [kHz]	Mean Call Length [ms]	Mean Call Distance [ms]	Temperature [°C]	Latitude [WGS84]	Longitude [WGS84]
03750000cmt	23/09/2021 20:07	-	0	0	NaN	NaN	NaN	NaN	14	53.43179	-6.47317
3750017	23/09/2021 20:09	Pipistrellus pipistrellus	9	48.7	51.5	48	7	180	14	53.43253	-6.47431
3750018	23/09/2021 20:09	Pipistrellus pipistrellus	2	49.1	50.3	47.8	7.5	284	14	53.43253	-6.47431
3750019	23/09/2021 20:11	Noise	0	0	0	0	0	0	14	53.43254	-6.47547
3750020	23/09/2021 20:12	Nyctalus leisleri	16	27.6	35.1	26.6	5	113	14	53.4323	-6.4757
3750021	23/09/2021 20:13	Noise	0	0	0	0	0	0	13	53.43278	-6.475
3750022	23/09/2021 20:15	Noise	0	0	0	0	0	0	13	53.43267	-6.47429
3750023	23/09/2021 20:16	Pipistrellus pipistrellus	19	46.2	64	45.2	4	94	13	53.433	-6.47377
3750024	23/09/2021 20:16	Pipistrellus pipistrellus	5	44.6	49.1	43.4	5	143	13	53.43299	-6.47374
3750025	23/09/2021 20:16	Pipistrellus pipistrellus	4	46	50.1	44.5	7	131	13	53.43299	-6.47373
3750026	23/09/2021 20:16	Pipistrellus pipistrellus	26	45.5	60.2	44.4	6	96	13	53.43299	-6.47371
03750027_1	23/09/2021 20:16	Pipistrellus pipistrellus	28	45	58.5	44.1	7	105	13	53.433	-6.47373
03750027_2	23/09/2021 20:16	Pipistrellus pygmaeus	14	55	61.7	54.2	6	90	13	53.433	-6.47373
3750028	23/09/2021 20:16	Pipistrellus pipistrellus	23	45.1	53.8	44	6	96	13	53.43299	-6.47374
3750029	23/09/2021 20:17	Pipistrellus pipistrellus	37	45.5	64.5	44	6	94	13	53.43298	-6.47374
3750030	23/09/2021 20:17	Pipistrellus pipistrellus	19	45.7	56.1	44.5	7	100	13	53.43299	-6.47374
3750031	23/09/2021 20:17	Pipistrellus pipistrellus	10	45	54.5	44	7	190	13	53.43298	-6.47374
03750032_2	23/09/2021 20:17	Pipistrellus pipistrellus	36	55	58.8	54.2	6	90	13	53.43298	-6.47374
3750032	23/09/2021 20:17	Pipistrellus pygmaeus	36	55	58.8	54.2	6	90	13	53.43298	-6.47374

Recording	Timestamp	Species Text	Calls [#]	Mean Peak Frequency [kHz]	Mean Max Frequency [kHz]	Mean Min Frequency [kHz]	Mean Call Length [ms]	Mean Call Distance [ms]	Temperature [°C]	Latitude [WGS84]	Longitude [WGS84]
3750033	23/09/2021 20:17	Pipistrellus pipistrellus	24	45.8	55.2	44.6	5	100	14	53.43298	-6.47374
03750001cmt	23/09/2021 20:17	-	0	0	NaN	NaN	NaN	NaN	14	53.43306	-6.47375
3750034	23/09/2021 20:17	Pipistrellus pipistrellus	2	44.8	46.3	43.7	6.4	262	14	53.43306	-6.47376
3750035	23/09/2021 20:18	Pipistrellus pipistrellus	3	44.4	50	43.9	5	229	14	53.43307	-6.47376
3750036	23/09/2021 20:18	Pipistrellus pipistrellus	11	41.6	44.4	40.9	7	235	14	53.4332	-6.47357
3750037	23/09/2021 20:18	Pipistrellus pipistrellus	12	41.9	45.3	41.3	6	130	14	53.43325	-6.47352
3750038	23/09/2021 20:18	Pipistrellus pipistrellus	17	42.1	52.1	41.6	6	115	14	53.43325	-6.47351
3750039	23/09/2021 20:19	Pipistrellus pipistrellus	31	42.4	67.5	41.7	6	100	14	53.43325	-6.47351
3750040	23/09/2021 20:19	Pipistrellus pipistrellus	16	43	62.9	41.9	5	100	14	53.43326	-6.47351
3750041	23/09/2021 20:19	Pipistrellus pipistrellus	25	43	66.1	41.9	5	96	14	53.43327	-6.47349
3750042	23/09/2021 20:19	Pipistrellus pipistrellus	34	42.9	75.3	42.2	5	100	14	53.43327	-6.47348
3750043	23/09/2021 20:19	Pipistrellus pipistrellus	12	42.7	57.6	41.8	6	165	14	53.43335	-6.47344
3750044	23/09/2021 20:19	Pipistrellus pipistrellus	56	42.2	54.3	41.5	7	110	14	53.43335	-6.47344
3750045	23/09/2021 20:20	Pipistrellus pipistrellus	68	42.3	68.2	41.7	6	110	14	53.43335	-6.47345
3750046	23/09/2021 20:20	Pipistrellus pipistrellus	17	42.9	80.3	42.3	5	100	14	53.43334	-6.47344
3750047	23/09/2021 20:20	Pipistrellus pipistrellus	47	42.7	70.7	42.1	5	95	14	53.43334	-6.47343
3750048	23/09/2021 20:20	Pipistrellus pipistrellus	17	44.2	73.5	42.8	5	94	14	53.4334	-6.47339
3750049	23/09/2021 20:20	Pipistrellus pipistrellus	70	43.1	71.9	42.3	5	100	14	53.43343	-6.47336
3750050	23/09/2021 20:21	Pipistrellus pipistrellus	17	42.7	51.9	42	4	100	14	53.43344	-6.47337

Recording	Timestamp	Species Text	Calls [#]	Mean Peak Frequency [kHz]	Mean Max Frequency [kHz]	Mean Min Frequency [kHz]	Mean Call Length [ms]	Mean Call Distance [ms]	Temperature [°C]	Latitude [WGS84]	Longitude [WGS84]
3750051	23/09/2021 20:21	Pipistrellus pipistrellus	37	43.2	74.8	42.6	5	106	14	53.43346	-6.47336
3750052	23/09/2021 20:21	Pipistrellus pipistrellus	26	43	62.4	42.3	5	90	14	53.43345	-6.47337
3750053	23/09/2021 20:21	Pipistrellus pipistrellus	29	45.6	85.3	44.5	5	60	14	53.43346	-6.47336
3750054	23/09/2021 20:21	Pipistrellus pipistrellus	9	48	64.8	46.9	5	90	14	53.43347	-6.47335
3750055	23/09/2021 20:21	Pipistrellus pipistrellus	18	48.9	65.5	47.7	6	90	14	53.43348	-6.47339
3750056	23/09/2021 20:21	Noise	0	0	0	0	0	0	14	53.4335	-6.47346
3750057	23/09/2021 20:21	Noise	0	0	0	0	0	0	14	53.43351	-6.47349
3750058	23/09/2021 20:21	Noise	0	0	0	0	0	0	14	53.43352	-6.47352
3750059	23/09/2021 20:22	Noise	0	0	0	0	0	0	14	53.43361	-6.4738
3750060	23/09/2021 20:23	Noise	0	0	0	0	0	0	14	53.43359	-6.47443
03750002cmt	23/09/2021 20:23	-	0	0	NaN	NaN	NaN	NaN	14	53.43353	-6.47452
3750061	23/09/2021 20:25	Nyctalus leisleri	2	21.4	21.9	20.8	9.3	864	13	53.43279	-6.47495
3750062	23/09/2021 20:25	Noise	0	0	0	0	0	0	13	53.43271	-6.4748
3750063	23/09/2021 20:27	Noise	0	0	0	0	0	0	13	53.43207	-6.47377
3750064	23/09/2021 20:27	Noise	0	0	0	0	0	0	13	53.43204	-6.47373
3750065	23/09/2021 20:28	Noise	0	0	0	0	0	0	13	53.4319	-6.47357
3750066	23/09/2021 20:29	Noise	0	0	0	0	0	0	13	53.43179	-6.47317
3750067	23/09/2021 20:29	Noise	0	0	0	0	0	0	13	53.43179	-6.47318
3750068	23/09/2021 20:30	Noise	0	0	0	0	0	0	13	53.43179	-6.47317

Recording	Timestamp	Species Text	Calls [#]	Mean Peak Frequency [kHz]	Mean Max Frequency [kHz]	Mean Min Frequency [kHz]	Mean Call Length [ms]	Mean Call Distance [ms]	Temperature [°C]	Latitude [WGS84]	Longitude [WGS84]
3750069	23/09/2021 20:30	Noise	0	0	0	0	0	0	13	53.43179	-6.47318
3750070	23/09/2021 20:30	Noise	0	0	0	0	0	0	13	53.43179	-6.47318
3750071	23/09/2021 20:30	Noise	0	0	0	0	0	0	13	53.43179	-6.47318
3750072	23/09/2021 20:31	Noise	0	0	0	0	0	0	13	53.43179	-6.47317
3750073	23/09/2021 20:31	Pipistrellus pipistrellus	27	51	62	49.8	5	90	13	53.43181	-6.47316
3750074	23/09/2021 20:36	Pipistrellus pipistrellus	6	46.7	51.8	46.1	3	165	14	53.43331	-6.46954
3750075	23/09/2021 20:36	Pipistrellus pipistrellus	12	45.8	57.7	44.3	4	163	14	53.43331	-6.46953
3750076	23/09/2021 20:36	Pipistrellus pipistrellus	10	44	53.6	43.4	5	260	14	53.43331	-6.4695
3750077	23/09/2021 20:36	Pipistrellus pipistrellus	8	44.1	48.6	43.6	5.3	201	14	53.43332	-6.46949
3750078	23/09/2021 20:36	Pipistrellus pipistrellus	15	45.8	54.1	44.4	3	90	14	53.43332	-6.46947
3750079	23/09/2021 20:37	Pipistrellus pipistrellus	7	44.4	55.9	43.4	5	339	14	53.43332	-6.46945
3750080	23/09/2021 20:37	Pipistrellus pipistrellus	24	44.8	61.3	43.9	4	80	14	53.43332	-6.46944
3750081	23/09/2021 20:37	Pipistrellus pipistrellus	30	44.2	59.7	43.5	5	100	14	53.43331	-6.46943
3750082	23/09/2021 20:37	Pipistrellus pipistrellus	9	45.9	53.5	44.8	6	378	14	53.43331	-6.46944
3750083	23/09/2021 20:37	Pipistrellus pipistrellus	7	43.2	49.7	42.4	5	374	14	53.43331	-6.46943
3750084	23/09/2021 20:39	Pipistrellus pipistrellus	11	48	56.6	47	4	253	14	53.43312	-6.46905
3750085	23/09/2021 20:39	Pipistrellus pipistrellus	4	48.6	55.2	47	3	445	14	53.4331	-6.46904
3750086	23/09/2021 20:40	Pipistrellus pipistrellus	2	47.6	50.3	47.3	5.1	375	14	53.43311	-6.46905
3750087	23/09/2021 20:40	Pipistrellus pipistrellus	1	48	60.8	47.3	3.2	0	14	53.4331	-6.46905

Recording	Timestamp	Species Text	Calls [#]	Mean Peak Frequency [kHz]	Mean Max Frequency [kHz]	Mean Min Frequency [kHz]	Mean Call Length [ms]	Mean Call Distance [ms]	Temperature [°C]	Latitude [WGS84]	Longitude [WGS84]
3750088	23/09/2021 20:40	Pipistrellus pipistrellus	3	49.9	56.6	49.3	2.5	123	14	53.4331	-6.46905
03750003cmt	23/09/2021 20:40	-	0	0	NaN	NaN	NaN	NaN	14	53.43302	-6.46896
3750089	23/09/2021 20:40	Pipistrellus pipistrellus	0	0	0	0	0	0	14	53.43302	-6.46895
3750090	23/09/2021 20:41	Pipistrellus pipistrellus	5	47.1	58.4	46.2	3.5	551	14	53.43302	-6.46895
3750091	23/09/2021 20:41	Pipistrellus pipistrellus	7	47.4	59.9	46.1	6	120	14	53.43303	-6.46895
3750092	23/09/2021 20:41	Pipistrellus pipistrellus	2	46.3	57.2	44.3	5.9	159	14	53.43303	-6.46893
3750093	23/09/2021 20:43	Noise	0	0	0	0	0	0	14	53.43301	-6.46895
3750094	23/09/2021 20:43	Pipistrellus pipistrellus	0	0	0	0	0	0	14	53.43301	-6.46891
03750095_1	23/09/2021 20:44	Pipistrellus pygmaeus	9	56.6	81.4	53.2	2	80	14	53.43301	-6.46893
03750095_2	23/09/2021 20:44	Pipistrellus pipistrellus	3	47.3	60.3	46.6	4.6	183	14	53.43301	-6.46893
3750096	23/09/2021 20:44	Noise	0	0	0	0	0	0	14	53.43301	-6.46895
3750097	23/09/2021 20:45	Noise	0	0	0	0	0	0	14	53.433	-6.46895
3750098	23/09/2021 20:45	Noise	0	0	0	0	0	0	14	53.433	-6.46895
3750099	23/09/2021 20:45	Nyctalus leisleri	11	23.4	25.9	22.2	12	456	14	53.43301	-6.46894
3750100	23/09/2021 20:47	Noise	0	0	0	0	0	0	14	53.43265	-6.46937
3750101	23/09/2021 20:55	Pipistrellus pygmaeus	15	53.7	66.5	52.5	5	85	13	53.43182	-6.47313
3750102	23/09/2021 20:55	Noise	0	0	0	0	0	0	13	53.43173	-6.47333
3750103	23/09/2021 21:06	Noise	0	0	0	0	0	0	13	53.4337	-6.47417
3750104	23/09/2021 21:09	Pipistrellus pipistrellus	1	49.1	51.8	47.3	4.3	0	13	53.43267	-6.47422

Recording	Timestamp	Species Text	Calls [#]	Mean Peak Frequency [kHz]	Mean Max Frequency [kHz]	Mean Min Frequency [kHz]	Mean Call Length [ms]	Mean Call Distance [ms]	Temperature [°C]	Latitude [WGS84]	Longitude [WGS84]
3750105	23/09/2021 21:11	Noise	1	27	27.4	26.3	5.3	0	13	53.4328	-6.47494
3750106	23/09/2021 21:11	Noise	0	0	0	0	0	0	13	53.43277	-6.4751

Table D2. Bat Survey Metadata 2022 Dusk Transect Survey

Recording	Timestamp	Species Text	Calls [#]	Mean Peak Frequency [kHz]	Mean Max Frequency [kHz]	Mean Min Frequency [kHz]	Mean Call Length [ms]	Mean Call Distance [ms]	Temperature [°C]	Latitude [WGS84]	Longitude [WGS84]
03750000cmt	06/09/2022 19:30	-	0	0	NaN	NaN	NaN	NaN	15	53.43269	-6.47415
03750001cmt	06/09/2022 19:44	-	0	0	NaN	NaN	NaN	NaN	16	53.43268	-6.47413
03750002cmt	06/09/2022 19:55	-	0	0	NaN	NaN	NaN	NaN	16	53.43269	-6.4741
3750000	06/09/2022 19:57	Noise	1	69.4	70.5	68.3	9.1	0	16	53.43269	-6.47414
3750001	06/09/2022 19:58	Noise	0	0	0	0	0	0	16	53.43269	-6.47409
3750002	06/09/2022 20:02	Noise	0	0	0	0	0	0	16	53.43324	-6.47348
3750003	06/09/2022 20:02	Noise	0	0	0	0	0	0	16	53.43325	-6.47352
3750004	06/09/2022 20:03	Noise	0	0	0	0	0	0	17	53.43332	-6.47336
3750005	06/09/2022 20:03	Noise	0	0	0	0	0	0	17	53.43344	-6.47328
3750006	06/09/2022 20:07	Noise	0	0	0	0	0	0	17	53.43385	-6.47276
3750007	06/09/2022 20:07	Noise	1	31.1	31.5	29.3	4.3	0	17	53.43402	-6.47285
03750003cmt	06/09/2022 20:08	-	0	0	NaN	NaN	NaN	NaN	16	53.43427	-6.47337
3750008	06/09/2022 20:08	Noise	0	0	0	0	0	0	16	53.43433	-6.47352
3750009	06/09/2022 20:10	Noise	0	0	0	0	0	0	16	53.43379	-6.47379
3750010	06/09/2022 20:11	Noise	1	79.1	79.5	78	6.9	0	16	53.43375	-6.47366
3750011	06/09/2022 20:12	Noise	0	0	0	0	0	0	16	53.43357	-6.47326
3750012	06/09/2022 20:12	Noise	0	0	0	0	0	0	16	53.43341	-6.47344
3750013	06/09/2022 20:13	Noise	1	82.1	82.9	82.1	4.8	0	16	53.43326	-6.47364
3750014	06/09/2022 20:14	Noise	2	78.4	79.1	77.6	4.8	0	16	53.43335	-6.47399

Recording	Timestamp	Species Text	Calls [#]	Mean Peak Frequency [kHz]	Mean Max Frequency [kHz]	Mean Min Frequency [kHz]	Mean Call Length [ms]	Mean Call Distance [ms]	Temperature [°C]	Latitude [WGS84]	Longitude [WGS84]
3750015	06/09/2022 20:14	Noise	0	0	0	0	0	0	16	53.43339	-6.47411
3750016	06/09/2022 20:16	Noise	0	0	0	0	0	0	16	53.43343	-6.47468
3750017	06/09/2022 20:16	Noise	0	0	0	0	0	0	16	53.43342	-6.47469
3750018	06/09/2022 20:16	Pipistrellus pygmaeus	19	56	72.2	55.1	6	75	16	53.43331	-6.4748
3750019	06/09/2022 20:17	Noise	0	0	0	0	0	0	15	53.43328	-6.47483
3750020	06/09/2022 20:17	Noise	0	0	0	0	0	0	15	53.43325	-6.47485
3750021	06/09/2022 20:17	Noise	0	0	0	0	0	0	15	53.4332	-6.47489
03750004cmt	06/09/2022 20:18	-	0	0	NaN	NaN	NaN	NaN	15	53.43305	-6.47504
3750022	06/09/2022 20:21	Pipistrellus pygmaeus	21	56.3	67.9	55.2	3	73	15	53.43266	-6.4743
3750023	06/09/2022 20:22	Pipistrellus pygmaeus	94	56.8	92.2	54.3	5	75	15	53.43266	-6.47429
3750024	06/09/2022 20:22	Pipistrellus pygmaeus	69	55	96.2	54.1	5	80	15	53.43265	-6.47429
3750025	06/09/2022 20:22	Pipistrellus pygmaeus	33	54.8	94.2	53.9	5	80	15	53.43266	-6.47419
03750005cmt	06/09/2022 20:23	-	0	0	NaN	NaN	NaN	NaN	15	53.43268	-6.47407
3750026	06/09/2022 20:23	Pipistrellus pygmaeus	31	55.4	71.1	54.5	3	80	15	53.43267	-6.47405
3750027	06/09/2022 20:23	Pipistrellus pygmaeus	9	54.8	64.2	53.9	4	65	15	53.43266	-6.47406
3750028	06/09/2022 20:24	Pipistrellus pygmaeus	7	53.5	75	52.4	5	174	15	53.43281	-6.47397
3750029	06/09/2022 20:26	Noise	0	0	0	0	0	0	15	53.4332	-6.47355
3750030	06/09/2022 20:27	Pipistrellus pygmaeus	0	0	0	0	0	0	15	53.43351	-6.47329
3750031	06/09/2022 20:29	Noise	0	0	0	0	0	0	15	53.43369	-6.47269
3750032	06/09/2022 20:32	Noise	0	0	0	0	0	0	15	53.43346	-6.47141

Recording	Timestamp	Species Text	Calls [#]	Mean Peak Frequency [kHz]	Mean Max Frequency [kHz]	Mean Min Frequency [kHz]	Mean Call Length [ms]	Mean Call Distance [ms]	Temperature [°C]	Latitude [WGS84]	Longitude [WGS84]
3750033	06/09/2022 20:33	Noise	0	0	0	0	0	0	15	53.43337	-6.47115
3750034	06/09/2022 20:35	Noise	1	74.3	74.6	72.8	5.9	0	15	53.43326	-6.47104
3750035	06/09/2022 20:35	Noise	2	60.4	64.1	59.3	5.3	0	15	53.43334	-6.47091
3750036	06/09/2022 20:36	Noise	0	0	0	0	0	0	15	53.43339	-6.47053
3750037	06/09/2022 20:36	Noise	2	62.6	64.5	60.4	6.9	0	15	53.43345	-6.47037
3750038	06/09/2022 20:38	Nyctalus leisleri	6	23.8	24.5	22.5	16	365	15	53.43334	-6.46952
3750039	06/09/2022 20:38	Nyctalus leisleri	5	25.5	26.6	24.4	8	398	15	53.43333	-6.46951
3750040	06/09/2022 20:39	Noise	0	0	0	0	0	0	15	53.43331	-6.46944
3750041	06/09/2022 20:42	Pipistrellus pygmaeus	3	54.5	60.3	53.8	3.4	152	15	53.43278	-6.46885
3750042	06/09/2022 20:42	Pipistrellus pygmaeus	12	54.4	59.7	53.7	3	70	15	53.43278	-6.46884
3750043	06/09/2022 20:42	Pipistrellus pygmaeus	10	54.1	61.1	53.4	3	60	15	53.43277	-6.46885
3750044	06/09/2022 20:42	Pipistrellus pygmaeus	3	54.8	60.6	54.1	3.2	134	15	53.43277	-6.46884
3750045	06/09/2022 20:42	Pipistrellus pygmaeus	13	55.6	62.7	54.9	3	74	15	53.43276	-6.46884
3750046	06/09/2022 20:42	Pipistrellus pygmaeus	5	55.2	61.3	54.4	3	70	15	53.43275	-6.46884
3750047	06/09/2022 20:42	Pipistrellus pygmaeus	9	56.5	63.6	55.7	2	80	15	53.43273	-6.46884
3750048	06/09/2022 20:42	Pipistrellus pygmaeus	70	55.1	68.8	54.2	4	95	15	53.43272	-6.46884
3750049	06/09/2022 20:43	Pipistrellus pygmaeus	99	55.8	83.5	54.6	4	75	15	53.43268	-6.46885
3750050	06/09/2022 20:43	Pipistrellus pygmaeus	73	55.4	83.7	54.5	4	80	15	53.43264	-6.46885
3750051	06/09/2022 20:43	Pipistrellus pygmaeus	23	55.5	72.9	54	3	70	15	53.43264	-6.46884
3750052	06/09/2022 20:43	Pipistrellus pygmaeus	21	54.6	62.7	53.9	3	66	15	53.43263	-6.46886

Recording	Timestamp	Species Text	Calls [#]	Mean Peak Frequency [kHz]	Mean Max Frequency [kHz]	Mean Min Frequency [kHz]	Mean Call Length [ms]	Mean Call Distance [ms]	Temperature [°C]	Latitude [WGS84]	Longitude [WGS84]
3750053	06/09/2022 20:43	Pipistrellus pygmaeus	22	54.5	66.9	54	4	80	15	53.43263	-6.46889
3750054	06/09/2022 20:43	Pipistrellus pygmaeus	10	54.7	61.5	53.9	3	116	15	53.43261	-6.46892
3750055	06/09/2022 20:43	Pipistrellus pygmaeus	19	54.6	65.1	54	3	60	15	53.43256	-6.46894
3750056	06/09/2022 20:44	Pipistrellus pygmaeus	6	54.8	61.3	54.3	4	109	15	53.43256	-6.469
3750057	06/09/2022 20:44	Pipistrellus pygmaeus	7	54.8	60.4	54.3	3	70	15	53.43253	-6.46902
03750006cmt	06/09/2022 20:44	-	0	0	NaN	NaN	NaN	NaN	15	53.43246	-6.46907
3750058	06/09/2022 20:53	Noise	2	90.4	91.5	88.9	5.3	0	15	53.43234	-6.47156
3750059	06/09/2022 20:57	Noise	2	70.1	70.5	69	6.9	0	15	53.4315	-6.47176
3750060	06/09/2022 21:00	Pipistrellus pipistrellus	29	42.4	65.4	41.8	5	100	15	53.43171	-6.47344
3750061	06/09/2022 21:02	Noise	0	0	0	0	0	0	15	53.4313	-6.47268
3750062	06/09/2022 21:02	Pipistrellus pipistrellus	21	42.2	55.1	41.4	6	115	15	53.43119	-6.4725
3750063	06/09/2022 21:05	Noise	0	0	0	0	0	0	15	53.43052	-6.47195
3750064	06/09/2022 21:06	Pipistrellus pipistrellus	3	47.3	58.4	46.6	4.1	155	15	53.43047	-6.47192
3750065	06/09/2022 21:06	Pipistrellus pipistrellus	20	46.1	66.2	45.2	4	95	15	53.43045	-6.47192
3750066	06/09/2022 21:06	Pipistrellus pipistrellus	23	48.2	66.1	47.2	3	96	15	53.43044	-6.47192
3750067	06/09/2022 21:08	Pipistrellus pipistrellus	36	42.6	66.6	42	5	104	15	53.42989	-6.47201
3750068	06/09/2022 21:09	Noise	2	95.6	96	94.9	6.7	84	15	53.43014	-6.47191
3750069	06/09/2022 21:10	Pipistrellus pipistrellus	16	42.8	50.4	42.2	4	149	15	53.43054	-6.47201
3750070	06/09/2022 21:11	Pipistrellus pipistrellus	26	42.7	52.6	42	4	110	15	53.43063	-6.47208
3750071	06/09/2022 21:11	Pipistrellus pipistrellus	29	42.3	58	41.6	5	110	15	53.43067	-6.4721

Recording	Timestamp	Species Text	Calls [#]	Mean Peak Frequency [kHz]	Mean Max Frequency [kHz]	Mean Min Frequency [kHz]	Mean Call Length [ms]	Mean Call Distance [ms]	Temperature [°C]	Latitude [WGS84]	Longitude [WGS84]
3750072	06/09/2022 21:12	Nyctalus leisleri	2	21.6	22.1	20.1	17.9	769	15	53.43084	-6.47223
3750073	06/09/2022 21:12	Nyctalus leisleri	2	21.6	23.4	19.9	18.4	659	15	53.43086	-6.47225
3750074	06/09/2022 21:12	Nyctalus leisleri	2	21.4	21.6	18	18.4	652	15	53.43087	-6.47225
3750075	06/09/2022 21:12	Nyctalus leisleri	2	21.4	21.9	19.7	18.9	882	15	53.43087	-6.47225
3750076	06/09/2022 21:12	Pipistrellus pipistrellus	24	47.4	86.3	46.9	4	180	15	53.43087	-6.47225
3750077	06/09/2022 21:12	Pipistrellus pipistrellus	21	51.1	87.1	50.5	6	93	15	53.43088	-6.47227
3750078	06/09/2022 21:13	Pipistrellus pipistrellus	23	47.3	92.3	46	4	95	15	53.431	-6.47237
3750079	06/09/2022 21:13	Pipistrellus pipistrellus	21	50.8	79.2	49.8	6	90	15	53.43129	-6.47271
03750007cmt	06/09/2022 21:14	-	0	0	NaN	NaN	NaN	NaN	15	53.43141	-6.47292
3750080	06/09/2022 21:14	Pipistrellus pipistrellus	24	44.9	70.1	44	6	100	15	53.4316	-6.47321
03750081_3	06/09/2022 21:15	Pipistrellus pipistrellus	1	44.3	58.5	43.5	8	0	14	53.43176	-6.47338
03750081_1	06/09/2022 21:15	Pipistrellus pygmaeus	73	53.3	85.4	52.4	5	80	14	53.43176	-6.47338
03750081_2	06/09/2022 21:15	Pipistrellus pygmaeus	6	33.6	64.1	29.7	15.1	355	14	53.43176	-6.47338
3750082	06/09/2022 21:16	Pipistrellus pygmaeus	27	52.6	69.2	51.7	6	86	14	53.43187	-6.47354
03750083_3	06/09/2022 21:16	Pipistrellus pygmaeus	20	53.9	93.1	53.2	5	83	14	53.43193	-6.47362
03750083_4	06/09/2022 21:16	Pipistrellus pygmaeus	3	21.8	33.9	18.3	10.1	394	14	53.43193	-6.47362
03750083_1	06/09/2022 21:16	Pipistrellus pipistrellus	20	44.1	83.9	43.4	4	90	14	53.43193	-6.47362
3750084	06/09/2022 21:16	Pipistrellus pipistrellus	4	45	52.5	44.5	3	178	14	53.43209	-6.47379
3750085	06/09/2022 21:16	Pipistrellus pipistrellus	13	44.9	85.9	44.4	4	100	14	53.4321	-6.47379
3750086	06/09/2022 21:17	Pipistrellus pygmaeus	40	51.5	77.5	50.8	6	95	14	53.43233	-6.47408

Recording	Timestamp	Species Text	Calls [#]	Mean Peak Frequency [kHz]	Mean Max Frequency [kHz]	Mean Min Frequency [kHz]	Mean Call Length [ms]	Mean Call Distance [ms]	Temperature [°C]	Latitude [WGS84]	Longitude [WGS84]
3750087	06/09/2022 21:17	Pipistrellus pipistrellus	10	48.9	51.5	48.5	6	100	14	53.4324	-6.47417
03750088_3	06/09/2022 21:17	Pipistrellus pipistrellus	4	25.4	36	16.9	9.2	711	14	53.43247	-6.47422
03750088_1	06/09/2022 21:17	Pipistrellus pipistrellus	20	49.4	63.6	48.7	7	90	14	53.43247	-6.47422
03750088_2	06/09/2022 21:17	Pipistrellus pygmaeus	6	55.7	88.1	54.4	5	150	14	53.43247	-6.47422
3750089	06/09/2022 21:17	Pipistrellus pipistrellus	4	49.3	52.8	48.8	4.5	193	14	53.43252	-6.47425
3750090	06/09/2022 21:17	Pipistrellus pipistrellus	35	50.3	71.5	49.6	5	90	14	53.43255	-6.47427
3750091	06/09/2022 21:18	Pipistrellus pygmaeus	15	51.6	64.6	50.5	6	90	14	53.43257	-6.47428
3750092	06/09/2022 21:18	Pipistrellus pipistrellus	11	49.9	63.3	49	5	95	14	53.43256	-6.47429
3750093	06/09/2022 21:18	Pipistrellus pipistrellus	59	47.5	68.3	46.9	5	100	14	53.43257	-6.47432
3750094	06/09/2022 21:18	Pipistrellus pipistrellus	18	50.7	61.1	49.6	4	80	14	53.43257	-6.47432
3750095	06/09/2022 21:18	Pipistrellus pipistrellus	7	49.4	54.1	48.8	4.8	157	14	53.4326	-6.47441
3750096	06/09/2022 21:19	Pipistrellus pipistrellus	24	51.3	68	50.5	5	90	14	53.43282	-6.47495
3750097	06/09/2022 21:20	Noise	0	0	0	0	0	0	14	53.43292	-6.47482
3750098	06/09/2022 21:21	Pipistrellus pipistrellus	3	47.9	48.6	47.4	6.8	190	14	53.43301	-6.47458
3750099	06/09/2022 21:25	Pipistrellus pipistrellus	17	44.3	62.1	43.6	5	105	14	53.43286	-6.4749
3750100	06/09/2022 21:25	Pipistrellus pipistrellus	9	44.4	54.6	43.8	3	200	14	53.43286	-6.47493
3750101	06/09/2022 21:27	Pipistrellus pipistrellus	8	46.4	54.1	45.6	5	200	14	53.43198	-6.47618
3750102	06/09/2022 21:28	Noise	0	0	0	0	0	0	14	53.43217	-6.47653
3750103	06/09/2022 21:39	Noise	0	0	0	0	0	0	14	53.43171	-6.47823
3750104	06/09/2022 21:40	Pipistrellus pipistrellus	3	47.3	53.4	46.8	4.3	436	14	53.43169	-6.47818

Recording	Timestamp	Species Text	Calls [#]	Mean Peak Frequency [kHz]	Mean Max Frequency [kHz]	Mean Min Frequency [kHz]	Mean Call Length [ms]	Mean Call Distance [ms]	Temperature [°C]	Latitude [WGS84]	Longitude [WGS84]
3750105	06/09/2022 21:40	Pipistrellus pipistrellus	14	46.8	53.7	46.2	4	95	14	53.43167	-6.47819
3750106	06/09/2022 21:41	Pipistrellus pipistrellus	25	47.3	65.7	46.3	4	94	14	53.43166	-6.47819
3750107	06/09/2022 21:41	Pipistrellus pipistrellus	7	47.9	53.8	47.3	3	90	14	53.43162	-6.47817
3750108	06/09/2022 21:41	Pipistrellus pipistrellus	30	47.2	62.1	46.5	4	80	14	53.4316	-6.47817
3750109	06/09/2022 21:41	Pipistrellus pipistrellus	23	47.2	78.7	46.5	4	97	14	53.4316	-6.47817
3750110	06/09/2022 21:41	Pipistrellus pipistrellus	14	46.7	54.4	46	3	90	14	53.4316	-6.47817
3750111	06/09/2022 21:41	Pipistrellus pipistrellus	3	49.3	58.3	48.1	3.6	180	14	53.43162	-6.47812
3750112	06/09/2022 21:41	Pipistrellus pipistrellus	2	47.8	56.1	47.1	3.2	178	14	53.43164	-6.47803
3750113	06/09/2022 21:41	Pipistrellus pipistrellus	7	47.4	53.1	46.8	3	211	14	53.43164	-6.47803
3750114	06/09/2022 21:41	Pipistrellus pipistrellus	20	47.5	64.1	46.8	3	90	14	53.43164	-6.47803
3750115	06/09/2022 21:43	Pipistrellus pipistrellus	7	47.7	54.1	47.3	3	173	14	53.43171	-6.47798
3750116	06/09/2022 21:43	Pipistrellus pipistrellus	5	46.7	51.8	46.1	4	155	14	53.4317	-6.47799
3750117	06/09/2022 21:43	Pipistrellus pipistrellus	2	48.2	55.1	47.4	2.7	186	14	53.43168	-6.47804
3750118	06/09/2022 21:43	Pipistrellus pipistrellus	23	47	57.8	46.3	4	100	14	53.43165	-6.47812
03750008cmt	06/09/2022 21:44	-	0	0	NaN	NaN	NaN	NaN	14	53.43157	-6.47828
3750119	06/09/2022 21:44	Noise	0	0	0	0	0	0	14	53.43158	-6.47828
3750120	06/09/2022 21:58	Pipistrellus pipistrellus	9	44.9	49.5	44.4	4	133	14	53.42894	-6.46996
3750121	06/09/2022 21:58	Pipistrellus pipistrellus	9	44.6	47.6	43.9	6	180	14	53.42892	-6.46998
3750122	06/09/2022 21:59	Pipistrellus pipistrellus	18	45.2	53.3	44.5	5	97	14	53.42892	-6.46999
3750123	06/09/2022 21:59	Pipistrellus pipistrellus	5	44.6	49.5	44.2	4.9	191	14	53.42889	-6.47

Recording	Timestamp	Species Text	Calls [#]	Mean Peak Frequency [kHz]	Mean Max Frequency [kHz]	Mean Min Frequency [kHz]	Mean Call Length [ms]	Mean Call Distance [ms]	Temperature [°C]	Latitude [WGS84]	Longitude [WGS84]
3750124	06/09/2022 21:59	Pipistrellus pipistrellus	32	46	57.1	45.3	3	90	14	53.42888	-6.47
3750125	06/09/2022 21:59	Pipistrellus pipistrellus	23	45.5	58.9	44.8	5	95	14	53.42884	-6.46999
3750126	06/09/2022 21:59	Pipistrellus pipistrellus	9	44.6	49.5	44.1	5	80	14	53.42883	-6.47
3750127	06/09/2022 21:59	Pipistrellus pipistrellus	12	44.6	52.2	44	4	90	14	53.42885	-6.47001
3750128	06/09/2022 21:59	Pipistrellus pipistrellus	9	44.4	49.1	43.8	5	100	14	53.42884	-6.47002
3750129	06/09/2022 21:59	Pipistrellus pygmaeus	18	51.4	56.9	50.7	6	90	14	53.42887	-6.47016
3750130	06/09/2022 21:59	Pipistrellus pygmaeus	16	52	58.6	51.4	3	75	14	53.42888	-6.47021
3750131	06/09/2022 21:59	Pipistrellus pygmaeus	14	51.8	64.3	51.2	4	85	14	53.42887	-6.47026
3750132	06/09/2022 21:59	Pipistrellus pygmaeus	3	53.6	59.3	53	2.7	158	14	53.42885	-6.47031
3750133	06/09/2022 21:59	Pipistrellus pygmaeus	32	51.3	65.6	50.2	7	90	14	53.42884	-6.47033
3750134	06/09/2022 21:59	Pipistrellus pygmaeus	56	51.3	60.7	50.3	7	90	14	53.42882	-6.47036
3750135	06/09/2022 22:00	Pipistrellus pygmaeus	76	52.1	68.5	50.4	6	85	14	53.42878	-6.4704
3750136	06/09/2022 22:00	Pipistrellus pygmaeus	30	53	70.4	52.3	5	85	14	53.42874	-6.47038
3750137	06/09/2022 22:00	Pipistrellus pygmaeus	18	54.9	74.4	54.1	5	80	14	53.42866	-6.47032
3750138	06/09/2022 22:00	Pipistrellus pygmaeus	7	55.7	60.5	54.9	3	213	14	53.42862	-6.4703
3750139	06/09/2022 22:00	Pipistrellus pygmaeus	6	55.4	62.8	54.7	4	146	14	53.4286	-6.47029
3750140	06/09/2022 22:00	Pipistrellus pygmaeus	57	55	73	54.2	6	85	14	53.4286	-6.47029
3750141	06/09/2022 22:01	Pipistrellus pygmaeus	13	55	76.3	54.2	5	209	14	53.4286	-6.47028
3750142	06/09/2022 22:01	Pipistrellus pygmaeus	43	54.4	74.3	53.4	6	83	14	53.42859	-6.47027
3750143	06/09/2022 22:01	Pipistrellus pygmaeus	29	54.5	75.9	53.7	6	80	14	53.42859	-6.47026

Recording	Timestamp	Species Text	Calls [#]	Mean Peak Frequency [kHz]	Mean Max Frequency [kHz]	Mean Min Frequency [kHz]	Mean Call Length [ms]	Mean Call Distance [ms]	Temperature [°C]	Latitude [WGS84]	Longitude [WGS84]
3750144	06/09/2022 22:01	Pipistrellus pygmaeus	51	51.6	64.5	50.6	6	90	14	53.42858	-6.47027
03750145_1	06/09/2022 22:01	Pipistrellus pygmaeus	137	50.8	70.2	49.8	6	84	14	53.42871	-6.47034
03750145_3	06/09/2022 22:01	Nyctalus leisleri	2	24.2	25.3	22.3	10.9	850	14	53.42871	-6.47034
03750145_2	06/09/2022 22:01	Pipistrellus pipistrellus	140	50.8	70.2	49.8	6	84	14	53.42871	-6.47034
3750146	06/09/2022 22:02	Pipistrellus pipistrellus	50	52.2	77.4	51	7	84	14	53.42874	-6.47034
03750146_2	06/09/2022 22:02	Pipistrellus pygmaeus	50	52.2	77.4	51	7	84	14	53.42874	-6.47034
3750147	06/09/2022 22:02	Pipistrellus pygmaeus	17	51.8	55.8	51.3	6	85	14	53.42881	-6.47038
3750148	06/09/2022 22:02	Pipistrellus pygmaeus	16	52	63.4	51.2	5	83	14	53.42885	-6.47041
3750149	06/09/2022 22:02	Pipistrellus pygmaeus	5	51.8	54.3	51	7	90	14	53.42888	-6.47046
3750150	06/09/2022 22:02	Pipistrellus pygmaeus	15	50.8	54.8	49.2	8	90	14	53.42888	-6.47047
3750151	06/09/2022 22:12	Pipistrellus pygmaeus	3	50.3	52.4	49.9	6.8	170	14	53.42897	-6.4702
3750152	06/09/2022 22:12	Pipistrellus pygmaeus	9	50.7	54.5	50.1	7.5	216	14	53.42892	-6.47023
3750153	06/09/2022 22:12	Pipistrellus pipistrellus	27	47.8	54.6	47.1	5	90	14	53.4289	-6.47024
03750153_2	06/09/2022 22:12	Pipistrellus pygmaeus	27	47.8	54.6	47.1	5	90	14	53.4289	-6.47024
3750154	06/09/2022 22:12	Pipistrellus pygmaeus	6	51.5	54.9	51.1	4.4	306	14	53.4289	-6.47025
3750155	06/09/2022 22:12	Pipistrellus pygmaeus	2	51	54.2	50.6	5.3	90	14	53.4289	-6.47025
3750156	06/09/2022 22:12	Pipistrellus pygmaeus	43	51.2	59.6	50.5	7	160	14	53.42889	-6.47025
3750157	06/09/2022 22:12	Pipistrellus pygmaeus	38	51	57.5	50.3	7	93	14	53.42886	-6.47029
3750158	06/09/2022 22:13	Pipistrellus pygmaeus	28	51.3	56.5	50.6	7	86	14	53.42886	-6.47029
3750159	06/09/2022 22:13	Pipistrellus pygmaeus	36	50.9	58.6	50.2	5	84	14	53.42886	-6.47029

Recording	Timestamp	Species Text	Calls [#]	Mean Peak Frequency [kHz]	Mean Max Frequency [kHz]	Mean Min Frequency [kHz]	Mean Call Length [ms]	Mean Call Distance [ms]	Temperature [°C]	Latitude [WGS84]	Longitude [WGS84]
3750160	06/09/2022 22:13	Pipistrellus pygmaeus	10	50.9	54.3	49.9	7	90	14	53.42885	-6.47028
3750161	06/09/2022 22:13	Pipistrellus pygmaeus	3	50.5	52.3	49.9	8.7	157	14	53.42885	-6.47029
3750162	06/09/2022 22:13	Pipistrellus pygmaeus	5	52.5	64.7	51.7	4.2	87	14	53.42885	-6.4703
3750163	06/09/2022 22:13	Pipistrellus pygmaeus	28	50.5	53.5	49.7	7	90	14	53.42885	-6.4703
3750164	06/09/2022 22:13	Pipistrellus pygmaeus	15	51.3	56.9	50.4	6	86	14	53.42885	-6.47028
3750165	06/09/2022 22:13	Pipistrellus pygmaeus	18	50.6	54.1	49.5	7	95	14	53.42885	-6.47029
3750166	06/09/2022 22:13	Pipistrellus pygmaeus	11	50.1	52.8	49.5	6	218	14	53.42885	-6.47029
3750167	06/09/2022 22:13	Pipistrellus pipistrellus	47	47.9	72.4	46.5	5	90	14	53.42884	-6.47029
03750167_2	06/09/2022 22:13	Pipistrellus pygmaeus	47	47.9	72.4	46.5	5	90	14	53.42884	-6.47029
3750168	06/09/2022 22:14	Pipistrellus pygmaeus	35	51.2	57.1	50.4	7	84	14	53.42885	-6.47031
3750169	06/09/2022 22:14	Pipistrellus pygmaeus	21	50.7	54.8	50.1	6	90	14	53.42884	-6.4703
3750170	06/09/2022 22:14	Pipistrellus pygmaeus	18	51.2	56.7	50.5	6	165	14	53.42884	-6.4703
3750171	06/09/2022 22:14	Pipistrellus pygmaeus	19	50.7	55.3	50.1	6	90	14	53.42884	-6.47029
3750172	06/09/2022 22:14	Pipistrellus pygmaeus	16	50.8	55.2	50.2	5	227	14	53.42885	-6.47029

Table D3. Bat Survey Metadata 2023 Dusk Transect Survey

Temperature [°C]	Recording	Timestamp	Species Text	Calls [#]	Mean Peak Frequency [kHz]	Mean Max Frequency [kHz]	Mean Min Frequency [kHz]	Mean Call Length [ms]	Mean Call Distance [ms]	Latitude [WGS84]	Longitude [WGS84]
14	3750106	16 Aug 2023 22:38:41	Common Pipistrelle	38	43.7	53	42.7	5	95	53.43352	-6.46996
15	3750002	16 Aug 2023 21:17:22	Soprano Pipistrelle	8	59.3	65.9	58.2	3	190	53.43301	-6.47382
15	3750003	16 Aug 2023 21:21:48	Soprano Pipistrelle	19	54.6	73.1	53.5	6	90	53.43303	-6.47372
15	3750004	16 Aug 2023 21:22:30	Common Pipistrelle	11	46.2	59.7	45.1	4	90	53.43305	-6.47372
15	3750005	16 Aug 2023 21:22:48	Soprano Pipistrelle	10	57.1	70.4	56	3	80	53.43303	-6.47373
15	3750006	16 Aug 2023 21:23:30	Soprano Pipistrelle	14	56.9	112.6	55.3	3	75	53.43304	-6.4737
15	3750007	16 Aug 2023 21:23:58	Soprano Pipistrelle	16	57.1	72.6	56.3	3	75	53.43304	-6.4737
15	3750008	16 Aug 2023 21:24:24	Soprano Pipistrelle	8	56.1	92.2	55.4	5	163	53.43303	-6.47371
15	3750009	16 Aug 2023 21:26:06	Common Pipistrelle	40	45.9	62.6	45	4	85	53.43305	-6.47371
15	3750010	16 Aug 2023 21:32:14	Common Pipistrelle	38	55.8	89.9	55.1	4	90	53.43268	-6.47422
15	3750011	16 Aug 2023 21:33:22	Soprano Pipistrelle	24	57	90.3	56.3	5	86	53.43268	-6.4742
15	3750012	16 Aug 2023 21:33:40	Soprano Pipistrelle	4	63.6	80.1	61.3	2.7	237	53.43267	-6.4742
15	3750013	16 Aug 2023 21:34:00	Soprano Pipistrelle	7	59.3	97.8	55.9	6	209	53.43265	-6.4742
15	3750014	16 Aug 2023 21:34:07	Common Pipistrelle	24	46.6	67.8	45.8	6	90	53.43267	-6.47418
15	3750015	16 Aug 2023 21:34:13	Soprano Pipistrelle	26	53.1	69.8	52.3	6	85	53.43268	-6.47417
15	3750016	16 Aug 2023 21:35:15	Soprano Pipistrelle	26	56.3	85.5	55.3	6	85	53.43267	-6.47419
15	3750017	16 Aug 2023 21:36:31	Soprano Pipistrelle	21	51.7	68.2	51	7	90	53.43265	-6.4742
15	3750018	16 Aug 2023 21:36:38	Soprano Pipistrelle	38	53	85.8	51.6	5	80	53.43266	-6.47422
15	3750019	16 Aug 2023 21:37:53	Soprano Pipistrelle	27	53.7	59.9	52.5	6	90	53.43286	-6.47484

Temperature [°C]	Recording	Timestamp	Species Text	Calls [#]	Mean Peak Frequency [kHz]	Mean Max Frequency [kHz]	Mean Min Frequency [kHz]	Mean Call Length [ms]	Mean Call Distance [ms]	Latitude [WGS84]	Longitude [WGS84]
15	3750020	16 Aug 2023 21:39:36	Common Pipistrelle	5	48.7	50.8	47.7	6	129	53.43257	-6.47431
15	3750021	16 Aug 2023 21:41:43	Soprano Pipistrelle	25	51.7	59.8	51	6	90	53.43176	-6.47326
15	3750022	16 Aug 2023 21:41:51	Soprano Pipistrelle	19	51.1	53.6	50.4	7	90	53.43177	-6.47323
14	3750023	16 Aug 2023 21:44:00	Common Pipistrelle	9	46.1	61.8	45.3	4	100	53.43178	-6.47319
14	3750024	16 Aug 2023 21:45:56	Soprano Pipistrelle	11	53	54.8	52.4	5	188	53.43178	-6.47319
14	3750025	16 Aug 2023 21:50:39	Common Pipistrelle	9	45.7	48.8	45.1	6	253	53.43179	-6.47319
14	3750026	16 Aug 2023 21:51:39	Common Pipistrelle	0	0	0	0	0	0	53.43175	-6.47318
14	3750027	16 Aug 2023 21:54:35	Soprano Pipistrelle	18	55.1	60.5	54.5	5	174	53.43067	-6.47183
13	3750033	16 Aug 2023 22:12:36	Leisler's Bat	8	27.7	32.5	26.3	9.5	375	53.43072	-6.47023
13	3750034	16 Aug 2023 22:14:32	Soprano Pipistrelle	24	58.3	72.4	57.7	4	90	53.43118	-6.46991
13	3750041	16 Aug 2023 22:21:01	Soprano Pipistrelle	4	58.9	63	58.2	4.7	279	53.43248	-6.46907
13	3750042	16 Aug 2023 22:21:09	Soprano Pipistrelle	12	59	64.7	58.3	4	70	53.43254	-6.46902
13	3750043	16 Aug 2023 22:21:16	Soprano Pipistrelle	3	58.3	62.6	57.5	9.2	405	53.43258	-6.46899
13	3750044	16 Aug 2023 22:21:23	Soprano Pipistrelle	3	59.6	62.1	59.1	2.8	81	53.43258	-6.46899
13	3750045	16 Aug 2023 22:21:31	Soprano Pipistrelle	2	24.8	25.1	21.4	2.1	0	53.43258	-6.46899
13	3750046	16 Aug 2023 22:21:33	Soprano Pipistrelle	1	59.6	63	59.3	3.2	0	53.43259	-6.46899
13	3750049	16 Aug 2023 22:22:17	Soprano Pipistrelle	1	58.9	59.3	58.5	3.2	0	53.43259	-6.46898
13	3750051	16 Aug 2023 22:22:25	Soprano Pipistrelle	3	59	63.4	58.3	5.7	103	53.43259	-6.46897
13	3750053	16 Aug 2023 22:23:04	Soprano Pipistrelle	3	58.8	63.4	58.1	6	272	53.43259	-6.46897
13	3750054	16 Aug 2023 22:23:33	Common Pipistrelle	12	47.9	52.5	47	5	160	53.43259	-6.46898
13	3750057	16 Aug 2023 22:25:08	Soprano Pipistrelle	1	58.5	60.8	58.1	2.7	0	53.43259	-6.46897

Temperature [°C]	Recording	Timestamp	Species Text	Calls [#]	Mean Peak Frequency [kHz]	Mean Max Frequency [kHz]	Mean Min Frequency [kHz]	Mean Call Length [ms]	Mean Call Distance [ms]	Latitude [WGS84]	Longitude [WGS84]
13	3750059	16 Aug 2023 22:26:17	Soprano Pipistrelle	3	53.1	56.9	52.8	5.3	218	53.43259	-6.46897
14	3750060	16 Aug 2023 22:26:32	Soprano Pipistrelle	12	54.2	58.9	53.3	5	75	53.4326	-6.46898
14	3750061	16 Aug 2023 22:26:43	Soprano Pipistrelle	9	54.7	59.3	53.9	4	70	53.43259	-6.46898
14	3750062	16 Aug 2023 22:26:52	Soprano Pipistrelle	5	53.9	56.9	53	5.6	180	53.43259	-6.46898
14	3750063	16 Aug 2023 22:27:00	Soprano Pipistrelle	27	54.3	69.7	53.7	4	80	53.43259	-6.46897
14	3750064	16 Aug 2023 22:27:07	Soprano Pipistrelle	26	54.3	67.2	53.7	5	83	53.43258	-6.46896
14	3750065	16 Aug 2023 22:27:11	Soprano Pipistrelle	12	54.1	58.8	53.4	4	90	53.43258	-6.46896
14	3750066	16 Aug 2023 22:27:16	Soprano Pipistrelle	32	54.1	65.2	53.4	5	83	53.43258	-6.46895
14	3750067	16 Aug 2023 22:27:27	Soprano Pipistrelle	26	53.9	68	53.1	6	90	53.43258	-6.46896
14	3750068	16 Aug 2023 22:27:36	Soprano Pipistrelle	22	54	64.3	53.3	5	80	53.43257	-6.46897
14	3750069	16 Aug 2023 22:27:42	Soprano Pipistrelle	27	54.2	69.6	53.5	6	80	53.43257	-6.46897
14	3750070	16 Aug 2023 22:27:53	Soprano Pipistrelle	24	54.2	65.1	53.5	4	80	53.43258	-6.46897
14	3750071	16 Aug 2023 22:28:03	Soprano Pipistrelle	55	53.9	64.9	53.3	5	90	53.43258	-6.46897
14	3750072	16 Aug 2023 22:28:12	Soprano Pipistrelle	5	53.8	57.5	53.1	5.2	246	53.43258	-6.46896
14	3750073	16 Aug 2023 22:28:15	Soprano Pipistrelle	22	54.2	70	53.3	6	80	53.43258	-6.46896
14	3750074	16 Aug 2023 22:28:22	Soprano Pipistrelle	22	54.2	64.8	53.5	5	85	53.43258	-6.46897
14	3750075	16 Aug 2023 22:28:29	Soprano Pipistrelle	40	53.7	64.5	53.1	6	85	53.43258	-6.46897
14	3750076	16 Aug 2023 22:28:39	Soprano Pipistrelle	19	53.5	66.6	52.9	6	100	53.43258	-6.46897
14	3750077	16 Aug 2023 22:28:46	Soprano Pipistrelle	46	54.3	72	53.5	6	90	53.43259	-6.46897
14	3750078	16 Aug 2023 22:28:58	Soprano Pipistrelle	20	54	67.1	53.2	6	90	53.43259	-6.46896
14	3750079	16 Aug 2023 22:29:05	Soprano Pipistrelle	23	54.1	67.9	53.5	6	80	53.43259	-6.46897

Temperature [°C]	Recording	Timestamp	Species Text	Calls [#]	Mean Peak Frequency [kHz]	Mean Max Frequency [kHz]	Mean Min Frequency [kHz]	Mean Call Length [ms]	Mean Call Distance [ms]	Latitude [WGS84]	Longitude [WGS84]
14	3750080	16 Aug 2023 22:29:09	Soprano Pipistrelle	15	54	60.3	53.4	4	85	53.43359	-6.46896
14	3750081	16 Aug 2023 22:32:33	Common Pipistrelle	2	42.4	43.3	42	7.2	1218	53.43335	-6.46959
14	3750082	16 Aug 2023 22:33:23	Common Pipistrelle	10	43.6	48.6	42.8	6.1	110	53.43351	-6.46994
14	3750083	16 Aug 2023 22:33:47	Common Pipistrelle	24	42.4	43.7	41.8	8	114	53.43352	-6.46995
14	3750084	16 Aug 2023 22:34:09	Common Pipistrelle	13	43.9	50	42.8	5	94	53.43352	-6.46995
14	3750085	16 Aug 2023 22:34:17	Common Pipistrelle	20	42.8	47.9	42.3	5	180	53.43351	-6.46994
14	3750086	16 Aug 2023 22:34:27	Common Pipistrelle	33	42.8	46.8	41.7	7	110	53.43352	-6.46994
14	3750087	16 Aug 2023 22:34:38	Common Pipistrelle	10	42.4	43.7	41.6	7	110	53.43352	-6.46996
13	3750088	16 Aug 2023 22:34:48	Common Pipistrelle	22	42.6	45.4	41.5	9	110	53.43352	-6.46995
14	3750089	16 Aug 2023 22:35:18	Common Pipistrelle	9	43.5	47.2	42.8	5	100	53.43352	-6.46995
14	3750090	16 Aug 2023 22:35:21	Common Pipistrelle	21	45.6	48.5	44.8	6	104	53.43353	-6.46995
14	3750091	16 Aug 2023 22:35:27	Common Pipistrelle	69	45.8	66.5	45	5	100	53.43353	-6.46995
14	3750092	16 Aug 2023 22:35:42	Common Pipistrelle	7	44.9	50.1	44.3	5	100	53.43354	-6.46992
14	3750093	16 Aug 2023 22:35:47	Common Pipistrelle	20	44.9	50.2	44.1	6	103	53.43354	-6.46992
14	3750094	16 Aug 2023 22:35:52	Common Pipistrelle	6	44.7	47.8	43.9	6	203	53.43354	-6.46993
14	3750095	16 Aug 2023 22:35:55	Common Pipistrelle	43	45.7	61.9	44.7	6	95	53.43354	-6.46993
14	3750096	16 Aug 2023 22:36:10	Common Pipistrelle	9	44.6	52.8	43.7	5	90	53.43353	-6.46994
14	3750097	16 Aug 2023 22:36:13	Common Pipistrelle	57	44.7	56.1	44	6	90	53.43353	-6.46994
14	3750098	16 Aug 2023 22:36:32	Common Pipistrelle	10	42.8	44.3	41.9	7	100	53.43353	-6.46995
14	3750099	16 Aug 2023 22:36:49	Common Pipistrelle	43	46.2	76.9	45.4	4	84	53.43353	-6.46995
14	3750100	16 Aug 2023 22:37:07	Common Pipistrelle	16	42.7	44.8	42	7	110	53.43353	-6.46996

Temperature [°C]	Recording	Timestamp	Species Text	Calls [#]	Mean Peak Frequency [kHz]	Mean Max Frequency [kHz]	Mean Min Frequency [kHz]	Mean Call Length [ms]	Mean Call Distance [ms]	Latitude [WGS84]	Longitude [WGS84]
14	3750101	16 Aug 2023 22:37:20	Common Pipistrelle	13	43.2	47.6	42.4	6	110	53.43353	-6.46996
14	3750102	16 Aug 2023 22:37:47	Common Pipistrelle	4	44.4	50.1	43.7	4.7	233	53.43353	-6.46996
14	3750103	16 Aug 2023 22:37:58	Common Pipistrelle	4	42.9	46.9	42.4	6.7	308	53.43353	-6.46996
14	3750104	16 Aug 2023 22:38:12	Common Pipistrelle	16	43.4	46.3	42.2	7	120	53.43353	-6.46996
14	3750105	16 Aug 2023 22:38:26	Common Pipistrelle	8	43	45.2	42.1	6	198	53.43353	-6.46995
14	3750107	16 Aug 2023 22:39:30	Common Pipistrelle	7	42.1	42.8	41.5	9	356	53.43351	-6.46995
14	3750108	16 Aug 2023 22:39:33	Common Pipistrelle	27	42.5	44.7	41.3	8	100	53.43351	-6.46995
14	3750109	16 Aug 2023 22:39:48	Common Pipistrelle	17	42.7	45.6	42.2	6	110	53.43351	-6.46995
13	3750110	16 Aug 2023 22:40:41	Common Pipistrelle	12	46	61.1	44.8	6	235	53.43352	-6.46995
13	3750111	16 Aug 2023 22:41:16	Common Pipistrelle	20	42.5	44.1	41.9	7	110	53.43352	-6.46995
13	3750112	16 Aug 2023 22:41:25	Soprano Pipistrelle	8	52	52.8	51.3	8	90	53.43352	-6.46995
13	3750113	16 Aug 2023 22:41:28	Soprano Pipistrelle	11	52	57.9	51.2	9	170	53.43352	-6.46995
14	3750114	16 Aug 2023 22:41:37	Common Pipistrelle	23	43.3	50	42.4	6	96	53.43351	-6.46996
14	3750115	16 Aug 2023 22:41:41	Common Pipistrelle	5	46.7	55.2	44.4	4.3	191	53.43351	-6.46996
14	3750116	16 Aug 2023 22:41:58	Common Pipistrelle	22	42.7	44.6	41.6	7	110	53.43351	-6.46996
14	3750117	16 Aug 2023 22:43:33	Leisler's Bat	11	25.5	27.1	24.4	9	340	53.43336	-6.47078
13	3750119	16 Aug 2023 23:04:41	Leisler's Bat	7	23.7	24.5	23	12	637	53.43257	-6.47406
13	3750120	16 Aug 2023 23:14:38	Leisler's Bat	6	24.7	26.7	22.6	9.7	708	53.43175	-6.47329
13	3750121	16 Aug 2023 23:15:43	Common Pipistrelle	33	46	79.3	45	5	104	53.43173	-6.47326
13	3750122	16 Aug 2023 23:16:46	Common Pipistrelle	23	44.1	72.2	43.4	5	90	53.43173	-6.47329
13	3750123	16 Aug 2023 23:17:52	Common Pipistrelle	16	47.7	72.9	46.9	6	100	53.43173	-6.47332

Temperature [°C]	Recording	Timestamp	Species Text	Calls [#]	Mean Peak Frequency [kHz]	Mean Max Frequency [kHz]	Mean Min Frequency [kHz]	Mean Call Length [ms]	Mean Call Distance [ms]	Latitude [WGS84]	Longitude [WGS84]
13	3750124	16 Aug 2023 23:19:28	Common Pipistrelle	15	45.9	54	44.2	7	104	53.43173	-6.47332
13	3750125	16 Aug 2023 23:20:04	Common Pipistrelle	6	45.9	61.5	44.7	7.2	381	53.43174	-6.47332
13	3750128	16 Aug 2023 23:21:33	Common Pipistrelle	24	46.8	69.4	45.8	5	95	53.4317	-6.4733

Appendix 13.5 Hedgerow Appraisal Report

August 2023

McCutcheon Halley
CHARTERED PLANNING CONSULTANTS

Enviroguide CONSULTING

Hedgerow Appraisal Report

PRESENTED TO

Marina Quarter Ltd.
Proposed Large-scale Residential Development at Dunboyne, Co. Meath

DATE

September 2023

DOCUMENT CONTROL SHEET

Client	Marina Quarter Ltd.
Project Title	Proposed Large-scale Residential Development at Dunboyne, Co. Meath
Document Title	Hedgerow Appraisal Report

Revision	Status	Author(s)	Reviewed	Approved	Issue Date
00	Draft for internal Review	YM *Ecologist*	LG *Senior Ecologist*	-	-
01	Draft for Client	YM *Ecologist*	LG *Senior Ecologist*	-	-
02	Final	YM *Ecologist*	LG *Senior Ecologist*	BL *Principal Ecologist*	13/09/2023

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The methodology adopted and the sources of information used by Enviroguide in providing its services are outlined in this Report.

The work described in this Report is based on the conditions encountered and the information available during the said period of time. The scope of this Report and the services are accordingly factually limited by these circumstances.

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Unless otherwise stated in this Report, the assessments made assume that the site and facilities will continue to be used for their current or stated proposed purpose without significant changes.

The content of this report represents the professional opinion of experienced environmental consultants. Enviroguide does not provide legal advice or an accounting interpretation of liabilities, contingent liabilities or provisions.

If the scope of work includes subsurface investigation such as boreholes, trial pits and laboratory testing of samples collected from the subsurface or other areas of the site, and environmental or engineering interpretation of such information, attention is drawn to the fact that special risks occur whenever engineering, environmental and related disciplines are applied to identify subsurface conditions. Even a comprehensive sampling and testing programme implemented in accordance with best practice and a professional standard of care may fail to detect certain conditions. Laboratory testing results are not independently verified by Enviroguide and have been assumed to be accurate. The environmental, ecological, geological, geotechnical, geochemical and hydrogeological conditions that Enviroguide interprets to exist between sampling points may differ from those that actually exist. Passage of time, natural occurrences and activities on and/or near the site may substantially alter encountered conditions.

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1 INTRODUCTION

1.1 Background

Enviroguide Consulting was commissioned by Marina Quarter Ltd. to undertake a Hedgerow Appraisal (the 'Report') to inform the Biodiversity Chapter of an Environmental Impact Assessment Report (EIAR) for a Proposed Large-scale Residential Development (LRD) at Bennetstown, Dunboyne, Co. Meath (the 'Site').

The purpose of this Report is to summarise the results of a Hedgerow Assessment Survey carried out by Enviroguide Consulting. The results of this survey will accompany and inform the results of the impact assessment and recommendations, which will focus on the potential impact of the Proposed Development upon the hedgerow ecology of the Site and the local area.

1.2 Quality Assurance and Competence

All surveying and reporting have been carried out by qualified and experienced ecologists and environmental consultants. YM, Enviroguide Ecologist/botanist undertook the hedgerow appraisal at the Site. YM has a B.Sc. in Botany from Tokyo University of Agriculture and a M.Sc. in Botany from Hokkaido University, and has experience in desktop research, reporting and GIS work, as well as practical field experience including flora surveys, rare and protected plant species surveys, phytosociological vegetation surveys, habitat mapping and invasive species surveys. YM has completed and prepared several Hedgerow Appraisal Reports. YM is also a Qualifying member of the Chartered Institute of Ecology and Environmental Management (CIEEM).

1.3 Relevant Legislation

1.3.1 Wildlife (Amended) Act 2000

The Wildlife Act 1976 was enacted to provide protection to birds, animals, and plants in Ireland and to control activities which may have an adverse impact on the conservation of wildlife. With regard to the listed species, it is an offence to disturb, injure or damage their breeding or resting place wherever these occur without an appropriate licence from the National Parks and Wildlife Service (NPWS). This list includes all wild birds along with their nests and eggs. Intentional destruction of an active nest from the building stage up until the chicks have fledged is an offence.

This includes the cutting of hedgerows from the 1st of March to the 31st of August. The act also provides a mechanism to give statutory protection to Natural Heritage Areas (NHAs). The Wildlife Amendment Act 2000 widened the scope of the Act to include most species, including the majority of fish and aquatic invertebrate species which were excluded from the 1976 Act.

1.3.2 Invasive Species

Certain plant species and their hybrids are listed as Invasive Alien Plant Species in Part 1 of the Third Schedule of the European Communities (Birds and Natural Habitats) Regulations 2011 (SI 477 of 2011, as amended). In addition, soils and other material containing such

invasive plant material, are classified in Part 3 of the Third Schedule as vector materials and are subject to the same strict legal controls.

Failure to comply with the legal requirements set down in this legislation can result in either civil or criminal prosecution, or both, with very severe penalties accruing. Convicted parties under the Act can be fined up to €500,000.00, jailed for up to three years, or both.

Extracts from the relevant sections of the regulations are reproduced below.

"49(2) Save in accordance with a licence granted [by the Department of Arts, Heritage and the Gaeltacht], any person who plants, disperses, allows or causes to disperse, spreads or otherwise causes to grow in anyplace [a restricted non-native plant], shall be guilty of an offence.

49(3) … it shall be a defence to a charge of committing an offence under paragraph (1) or (2) to prove that the accused took all reasonable steps and exercised all due diligence to avoid committing the offence.

50(1) Save in accordance with a licence, a person shall be guilty of an offence if he or she […] offers or exposes for sale, transportation, distribution, introduction, or release—

(a) an animal or plant listed in Part 1 or Part 2 of the Third Schedule,

(b) anything from which an animal or plant referred to in subparagraph (a) can be reproduced or propagated, or

(c) a vector material listed in the Third Schedule, in any place in the State specified in the third column of the Third Schedule in relation to such an animal, plant or vector material."

1.4 Relevant Policies and Objectives

Policies and objectives of the Meath County Development Plan 2021-2027, that are of relevance to local hedgerows, are detailed below:

1.4.1 Chapter 08. Cultural and Natural Heritage Strategy

- **HER POL 37**: To encourage the retention of hedgerows and other distinctive boundary treatments in rural areas and prevent loss and fragmentation, where practically possible. Where removal of a hedgerow, stone wall or other distinctive boundary treatment is unavoidable, mitigation by provision of the same type of boundary will be required.
- **HER POL 38**: To promote and encourage planting of native hedgerow species in new developments and as part of the Council's own landscaping works.
- **HER POL 39**: To recognise the archaeological importance of townland boundaries including hedgerows and promote their protection and retention.
- **HER POL 40**: To protect and encourage the effective management of native and semi-natural woodlands, groups of trees and individual trees and to encourage the retention of mature trees and the use of tree surgery rather than felling, where possible, when undertaking, approving or authorising development.
- **HER POL 41**:To protect trees the subject of Tree Preservation Orders (TPOs), Champion and Heritage Trees identified on the Tree Register of Ireland and Heritage Tree Database when undertaking, approving, or authorising development.

- **HER POL 42**: To promote the preservation of individual trees or groups of trees as identified on the Heritage Maps in Volume 2 and to manage these trees in line with arboricultural best practice. It is an objective of the Council:
- **HER OBJ 36**: To promote awareness, understanding and best practice in the management of the County's woodland, tree and hedgerow resource.

Additionally, the Chapter states:

"*Roadside boundaries, whether hedgerows, sod and stone bank, stone wall or other boundaries, provide important features that are elements of both the landscape and ecology of rural areas. The retention of such boundary treatments assists in absorbing new rural housing into its surroundings and should generally be encouraged. Occasionally, the removal of substantial lengths of roadside boundaries is proposed as part of an element of improving visibility at the junction of a new entrance onto a road. Where an alternative site is available and otherwise suitable, applicants and Planning Authorities should consider a location that avoids the necessity for widespread boundary removal*."

1.4.2 Chapter 09. Rural Development Strategy

- **RD OBJ 9**: To promote the retention of field boundaries and mature trees and hedgerows to protect the rural character of the area.
- **RD OBJ 10**: To ensure that proposals for infill development take account of the character of the area and where possible retain existing features such as building line, height, railings, hedgerows, trees, gateways etc.
- **RD OBJ 18**: To review and update the current list of TPOs and explore the option of making additions having regard to the recommendations set down in the County Meath Tree, Woodland and Hedgerow Survey (2011) and having due regard to the Council's policies and objectives elsewhere in this County Development Plan.
- **RD POL 41**: To avoid the removal of existing roadside boundaries where they are more than 3 m from the road edge (edge of carriageway), except to the extent that this is needed for a new entrance, and where required for traffic safety reasons. (Please refer to policies contained in Section 8.9.7 Woodlands, Hedgerows and Trees in this regard).

1.4.3 Chapter 11. Development Management Standards and Land Use Zoning Objectives

- **DM OBJ 11**: Existing trees and hedgerows of biodiversity and/or amenity value shall be retained, where possible.
- **DM POL 9**: To support the retention of field boundaries for their ecological/habitat significance, as demonstrated by a suitably qualified professional. Where removal of a hedgerow, stone wall or other distinctive boundary treatment is unavoidable, mitigation by provision of the same boundary type will be required.

1.5 Hedgerow Definition

According to Foulkes et al. (2013), hedgerows are defined as linear strips of woody plants with a shrubby growth form that cover more than 25% of the length of a field or property boundary that have been deliberately established or managed. They often have associated banks, walls, ditches (drains), or trees. Hedges that have developed into lines of trees which no longer display a shrubby growth-form (remnant hedgerows) are also included. A remnant hedgerow

is generally indicated by a (broken) line of mature or senescent plants in tree, rather than shrub form. These almost invariably have a high percentage of gaps, although may have bits of shrubby growth (including brambles) along their length.

Foulkes' definition of a hedgerow correlates with Fossitt (2000), which defines hedgerows as: "*linear strips of shrubs, often with occasional trees, that typically form field or property boundaries. Dimensions of hedgerows are taken here as being mainly less than 5m high and 4m wide. When wider or taller than this, or dominated by trees, the habitat should be considered as a narrow strip of scrub or woodland, or as a treeline - WL2. Some hedgerows may be overgrown or fragmented if management has been neglected, but they should still be considered in this category unless they have changed beyond recognition. Linear strips of low scrub are included in this category if they occur as field boundaries.*"

It should be noted that gaps that are filled with brambles (*Rubus* spp.) and/or non woody vegetation were still recorded as gaps in this report following Foulkes *et. al* (2013). All hedgerows and treelines that were surveyed at the Site were assessed as being 'hedgerows' according to the above definitions.

1.5.1 Irish Hedgerows

Networks of dense hedgerows are a distinct characteristic of the Irish landscape, and reflect many centuries of planting, border establishment, and cultural practice. Hedgerows are most widespread semi-natural habitats in the country and are multi-functional and represent a potentially vital source of biodiversity that has yet to be comprehensively quantified and fully understood.

Hedgerows are used as/for:

- Agricultural barriers and boundaries,
- Historic townland boundary markers,
- Livestock control,
- Shade and shelter provision,
- Archives of cultural and archaeological history,
- Aesthetic, sense of place,
- Habitat provision for wildlife species,
- Biodiversity refugia and corridors.

In addition, the network of hedgerows provides several recognised Ecosystem Services in Ireland:

- Provisioning Services (i.e., food and fuel).
- Regulation Services (i.e., air quality, climate moderation, water quality, soil erosion control, disease management, pest control and pollination).
- Cultural Services (i.e., aesthetic value, educational and recreational).
- and Support Services (i.e., soil formation, photosynthesis, and nutrient cycling).

2 METHODOLOGY

2.1 Desk Study

A desktop study was carried out to collate and review available information, datasets, and documentation sources relevant for the completion of the Hedgerow Assessment Survey. The desktop study, completed in August 2023 relied on the following sources:

- National Parks and Wildlife Service (NPWS) datasets.
- Geological Survey Ireland (GSI) online datasets and mapping.
- Environmental Protection Agency (EPA) mapping and datasets.
- OSI aerial imagery and Discovery Series mapping.
- Satellite imagery from various sources and dates (Google, Digital Globe, Bing).
- The Status of EU Protected Habitats in Ireland (NPWS).
- Office of Public Works (OPW) Flood Plans (*https://www.floodinfo.ie/map/floodplans/*).
- Department of Agriculture, Food, and the Marine Forestry Licence Viewer (*https://forestry-maps.apps.rhos.agriculture.gov.ie/*).

2.2 Field Survey

The Hedgerow Assessment Survey conducted was an adaptation of the Hedgerow Appraisal System (HAS) by Foulkes et al., 2013. In addition, the Hedgerow Evaluation and Grading System (HEGS) by Clements and Toft (1992) was supplementally implemented in the assessment at the same time. The survey was conducted on 28th June 2023.

The hedgerows on the Site were divided into three distinct hedgerows (H1 to H3 (Figure 1)), with nodes or connections to adjacent hedgerows demarcating the extent of any single hedgerow.

The route of each length of hedgerow was then walked and surveyed. Hedgerows can be said to be of three floristic layers, each of which was visually inspected, and species/condition recorded:

i. The tree layer, in which trees within the hedge are distinct from the shrub layer.

ii. The shrub layer, which includes thorns, woody climbers/lianas, shrubby trees (a result of cutting or laying).

iii. The ground flora are herbaceous, broadleaved plants, rushes, grasses, and ferns found at the base of the hedge. Some of these species are indicators of hedgerow antiquity.

2.2.1 Hedgerow Appraisal System (Foulkes et al. 2013)

It was necessary to modify the HAS approach as the objective of Foulkes et al. (2013) was originally to devise a national database of hedgerows, whereby samples from 1 km² areas are surveyed, rather than hedgerows associated with a particular site. Hence, the following criteria (as per Foulkes) were included:

- Adjacent land use.
- History.

- Links to semi-natural habitat and/or designated sites.
- Construction of the hedgerow (ditches, banks, walls).
- Structure/condition.
- Species present.

The field data collected was also used to assess the condition of each hedgerow based on the following categories (after Foulkes et al. 2013):

- Structural variables.
- Continuity.
- Negative indicators/degradation/issues affecting long term viability etc.

The condition of the hedgerow is ranked on a scale of 0 to 3, where 0 is unfavourable, 1 is adequate, 2 is favourable and 3 is highly favourable. The higher the score, the more favourable the condition of the hedgerow in question. A score of 0 in any category is indicative of a hedgerow that is in an unfavourable condition overall at present (Foulkes et al. 2013).

The aforementioned three categories, representing Structural variables, Continuity and other Negative Indicators, are divided into several criteria for each which are assessed with the rank 0 to 3 individually. Overall score for each category is calculated as the average of the rank values for each criteria. If the average value is a fraction, it is rounded up.

2.2.2 Hedgerow Evaluation and Grading System (HEGS) (Clements and Toft 1992)

The Hedgerow Evaluation and Grading System (HEGS) (Clements and Toft 1992) broadly follows the methodology of the Hedgerows Regulations 1997 of England and Wales and provides a greater level of detail when assessing a hedgerow's ecological features. It has been applied mainly in the UK but has not been validated for Irish conditions, however, it has been applied here to give insight to the ecological value of any given hedgerow on Site.

The methodology provides a score between 0 (bad) and 4 (good) for hedgerow features with a final grade assigned based on the scoring results, as indicated below. Grades above 2 are classed as being of nature conservation priority.

- Grade 1 – High to very high value;
- Grade 2 – Moderately high to high value;
- Grade 3 – Moderate value; and
- Grade 4 – Low value.

Survey sheets are presented in Appendix II. This is based on the hedgerow recording and evaluation criteria and scoring matrix as prepared by the HEGS (Clements and Toft 1992).

For the assessment, the following data were collected on the following in accordance with the criteria outlined in Schedule 1, Part II of the above Hedgerow Regulations:

- Number of woody species, on average, in each 30m strip;
- Presence of rare tree species;
- Number of standard trees, on average, within each 50 m section;
- Number of gaps in the hedgerow;
- Presence of woodland ground flora species listed in Schedule 2 of the Regulations;
- Presence of ditches, banks or walls;
- Number of connections with other hedgerows, ponds or woodland;
- Presence of parallel hedges within 15 m of the hedgerow; and

- Presence of bridleways, footpaths, byways or public paths.

2.2.3 Floristic Recording

For the assessment in both methodologies, floristic data was recorded from the entire length of each hedgerow and from two non-concurrent 30m strips randomly selected along the length of each hedgerow following the HAS System.

Data was collected on:

- Records of all species on tree, shrub and ground flora layers, following Stace (2010);
- Relative abundance for each species;
    - Abundance was measured by eye using percentage cover scales (dominant to rare or absent, with a percentage estimate to reduce subjectivity)-a modified version of the method used for detecting charcoal in archaeobotanical light fraction samples.
    - The DAFOR scale was employed to measure abundance when developing species lists for each site, along with the growth form (e.g., shrub or field layer, single, clumps, tussock). In this method, the surveyor assigns one of the following categories to the abundance of the species; Dominant, Abundant, Frequent, Occasional or Rare.
- Number of woody species as present and the dominant species within each 30m strip and along the entire length of each hedgerow.

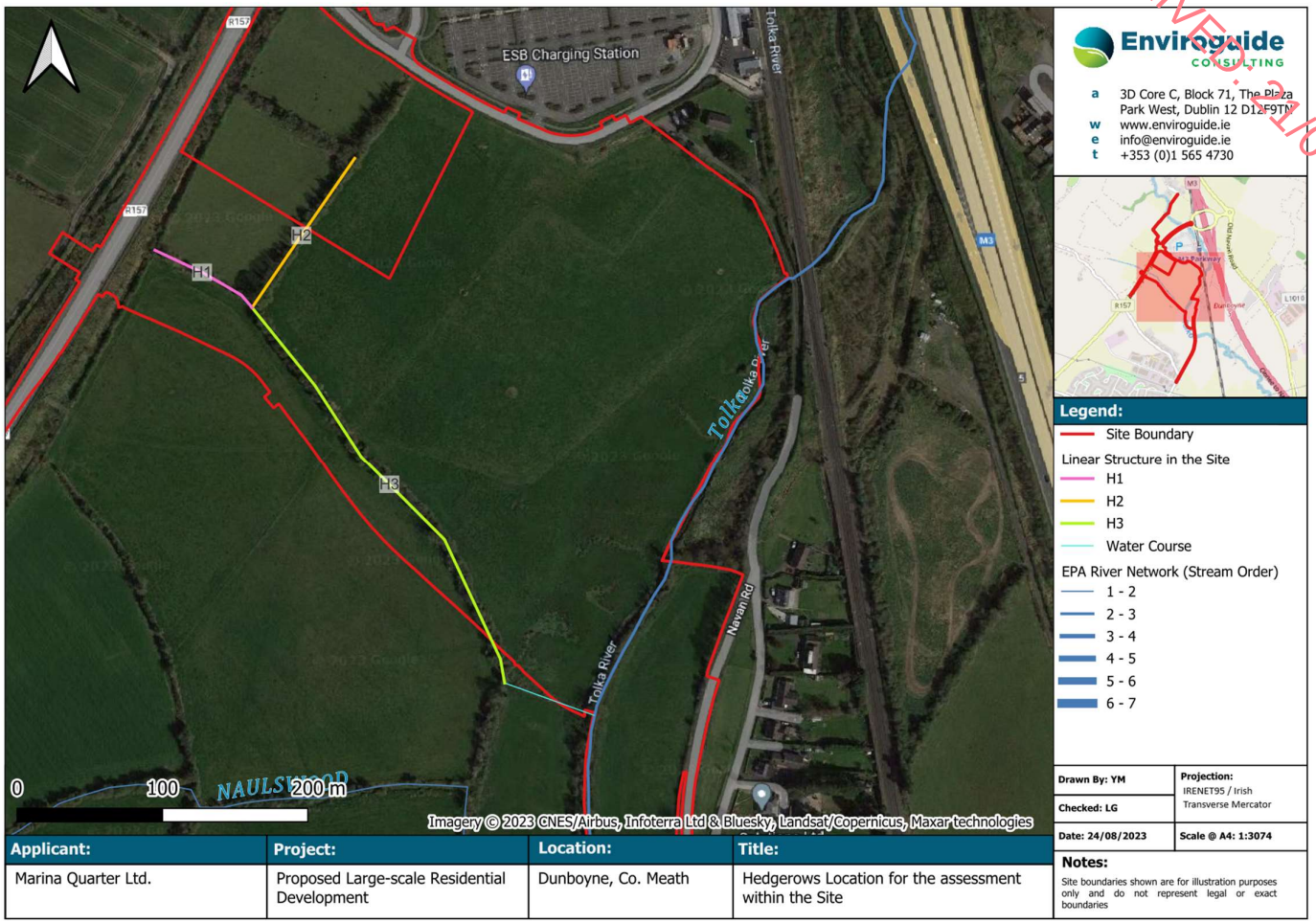

FIGURE 1: HEDGEROW H1 TO H3 AND SITE BOUNDARY FOR THE PROPOSED DEVELOPMENT.

2.3 Limitations

Although efforts were made to identify all flowering species along the survey routes, there is always the possibility that, due to limitations of time and resources, some species may have been missed. In addition, access was partially limited for a short section of the south-western side of H3, due to the presence of livestock (Cattle) within the field. However, the entirety of the south-eastern side of this section was accessible and this limitation is not deemed to be a significant one in terms of the Hedgerow Appraisal. As such, as a precaution, the results of the hedgerow appraisals should be considered as indicative rather than comprehensive.

3 RESULTS

All raw data are presented in Appendix I, with a detailed description provided below.

3.1 H1

H1 (Figure 2 to Figure 9) is an internal farm boundary between the two pasture fields used by sheep at the Site. H1 is 80m in length with aspect side one being north-northeast. The hedgerow consists of two rows of trees on half banks with native Irish hedgerow species such as Hawthorn *Crataegus monogyna* and Blackthorn *Prunus spinosa*. There is a wet internal drainage ditch (1.5m depth, with flow) within the hedgerow, flowing from the north-west from under the R157 Dunboyne Bypass, ultimately into the River Tolka (IE_EA_09T010600) in the south-east.

In summary, H1 is a straight, shrubby, 'escaped'[1] hedge with lightly pruned sides, with dense bases covered by Brambles *Rubus fruticosus* agg. Both sides are fenced by post and wire fencing, with sheep wire (poly wire and plastic stakes) also installed 1.5m away from H1, along its northern side, creating a grassy hedge margin (Figure 5).

As negative indicators, it was identified that there were 15% gaps along the entire length, including a path for agricultural vehicles, and three young stands of Sycamore *Acer pseudoplatanus*, which is classed as Invasive Species – risk of Medium Impact by NBDC.

[1] Escaped hedge is described by Teagasc as bellow:

"Escaped hedge where the individual plants have grown up, become single stem mature trees with gaps in between and thin at the base, but has sufficient stems, one every metre or so. It can be very successfully rejuvenated into a hedge with a dense base by either coppicing or laying."

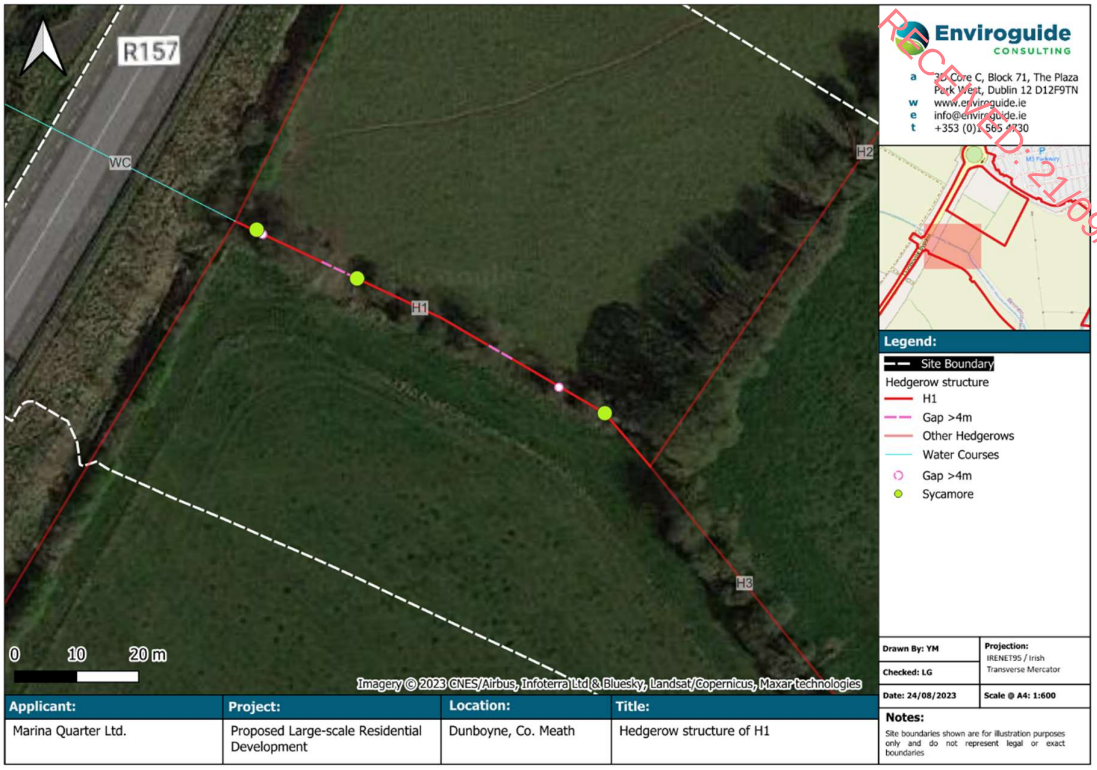

FIGURE 2: H1 EXTENT.

As a result of hedgerow appraisals, H1 was assessed as 2- Favourable in the HAS and Grade 1 High to very high value in the HEGS (Table 1 and Table 2).

The following are the overall results of Hedgerow Assessment for H1:

TABLE 1: H1 OVERALL ASSESSMENT SCORE USING THE MEAN OF CONDITION SCORES (HAS AND HEGS).

Assessment Criteria to Determine Hedgerow Condition	H1
Structural	2- Favourable
Continuity	1- Adequate
Negative indicators/Degradation	2- Favourable
HAS Score Overall (the mean of the above scores)	2- Favourable
HEGS Score	Grade 1 High to very high value

Further detail is provided in Table 2:

TABLE 2: H1 ASSESSMENT FURTHER DETAIL (HAS).

Assessment Criteria to Determine Hedgerow Condition	H1	Assessment Score
Structural		
Height	3-5m	2- Favourable
Width	2-3m	2- Favourable
Profile	Top heavy / undercut, Straight sided	3- Highly favourable
Basal density Porosity to light of woody shrubs? (N)	Dense with Brambles Y	2- Favourable
Continuity		
% Gaps	*c.* 15%	0- Unfavourable
Specific Gaps	Individual four gaps: 1.5m 2.5m, 4m, 4m	1- Adequate
Negative Indicators		
Degradation of bank/wall	Minor, densely vegetated by Brambles	2- Favourable
% Canopy dominated by ivy	<1%	3- Highly favourable
Unfavourable species composition	*c.* 6% of woody growth (Sycamore, Field Maple)	1- Adequate
>20% evidence herbicide use	No evidence	3- Highly favourable
>20% nutrient rich species	<5% of ground flora layer (Common Nettle)	3- Highly favourable
Alien invasives?	N	3- Highly favourable
Degraded margin	North side 1.5m grassy margin	1- Adequate

	South side no margin	

The following plant species were recorded at H1:

TABLE 3: H1 PLANT SPECIES LIST.

Layer	Common name	Scientific name	DAFOR
Tree	Eared Willow[2]	*Salix aurita*	O
	Rusty Willow	*Salix cinerea subsp. Oleifolia*	O
	Cherry sp.	*Prunus* sp.	R
Shrub	Hawthorn	*Crataegus monogyna*	D
	Blackthorn	*Prunus spinosa*	A
	Elder	*Sambucus nigra*	O
	Dog Rose	*Rosa canina* agg.	O
	Wych Elm	*Ulmus glabra*	R
	Cherry sp.	*Prunus* sp.	R
	Spindle	*Euonymus europaeus*	R
	Rusty Willow	*Salix cinerea* subsp. *oleifolia*	R
	Sycamore^[3,4]	*Acer pseudoplatanus*	R
	Field Maple#[5]	*Acer campestre*	R
Herbaceous	Bramble	*Rubus fruticosus* agg.	D
	Common Bent	*Agrostis capillaris*	A
	Creeping Bent	*Agrostis stolonifera*	A
	Meadow Sweet	*Filipendula ulmaria*	R
	False Brome[6]	*Brachypodium sylvaticum*	R
	Meadow Buttercup	*Ranunculus acris*	R
	Great Willowherb	*Epilobium hirsutum*	R
	Common Nettle[7]	*Urtica dioica*	R
	Soft Shield-fern	*Polystichum setiferum*	R

[2] : Species listed in the current hedgerow survey list of native trees, shrubs and climbers (Foulkes et al. 2013).

[3] ^: Naturalised species defined in the guideline of the HAS (Foulkes et al. 2013).
A: Unfavourable species, e.g. not listed as legislative invasive species but classed as Invasive Species by NBDC or non-native species.

[4] Although Sycamore is classed as Invasive Species-risk of Medium Impact by NBDC, it is defined as Naturalised species in the guideline of the HAS and not listed as legislative invasive species. Therefore, it is ruled out from Alien invasives in the HAS assessment and treated as an unfavourable species.

[5] #: Non-native species defined in the guideline of the HAS (Foulkes et al. 2013).

[6] : Species listed in "The current hedgerow survey list of ground flora species" (Foulkes et al. 2013) or listed in "Schedule 2 Woodland Species List" for the Hedgerows Regulations 1997 of England and Wales.

[7] **A**: **Nutrient rich species** defined in the guideline of the HAS (Foulkes et al. 2013).

FIGURE 3: H1, THE SOUTH SIDE.

FIGURE 4: H1, POST AND WIRE AND FENCING ALONG THE SOUTH SIDE

FIGURE 5: H1, GRASSY MARGIN ALONG THE NORTH SIDE (IMAGE TAKEN FROM WEST TO EAST).

FIGURE 6: H1, CROSS-SECTION (IMAGE TAKEN FROM WEST, AT THE WESTERN GAP) WITH SYCAMORE PRESENT.

FIGURE 7: H1, CROSS-SECTION SECTION (IMAGE TAKEN FROM THE EAST, AT THE WESTERN GAP).

FIGURE 8: H1, END POINT TO THE WEST

FIGURE 9: H1, CULVERT PIPE FOR A WATERCOURSE CROSSING UNDERNEATH THE DUNBOYNE BYPASS INTO H1.

3.2 H2

H2 (Figure 10 to Figure 21) is an internal farm boundary between the two pasture fields for sheep and cattle. H2 is 118m in length with north-west and south-east aspects. From the northern end point to the middle, the hedgerow is composed of almost a single row of trees, on a half hedge-bank on the south-east side. To the southern end point, it is almost a double line of hedgerows, with a Sycamore tree line on the north-west side and an incomplete line with Elder and Hawthorn on the south-east side. There is a wet vegetated internal drainage ditch (1.5-2m depth, almost stagnant during the survey).

In summary, H2 is an escaped hedge developing into a line of trees with semi-open grassy bases mowed annually. Both sides are fenced by sheep wire with a 1m margin on both sides. Ground flora on the half bank, included pasture species such as Perennial Rye-grass *Lolium perenne*, and several species of woodland ground flora, e.g. Wood Avens *Geum urbanum*, Lords-and-Ladies *Arum maculatum* and Soft Shield-fern *Polystichum setiferum*, were identified (Table 6), although their dominance is low.

As negative indicators, Sycamore tree lines occupy half the length of the entire hedge mainly on the north-west side. Furthermore, there were three gaps, and the hedge-line has an incomplete and broken structure, especially on the south-east side in the middle of the hedge (Figure 19 and Figure 20). It is deemed that this structure was created mainly by falling Ash dieback trees.

FIGURE 10: H2 EXTENT.

As a result of hedgerow appraisal, H2 was assessed as 2- Favourable in the HAS and Grade 2- Moderately high to high value in the HEGS (Table 4 and Table 5).

The following are the overall results of the Hedgerow Assessment for H2:

TABLE 4: H2 OVERALL ASSESSMENT SCORE USING THE MEAN OF CONDITION SCORES (HAS AND HEGS).

Assessment Criteria to Determine Hedgerow Condition	H2
Structural	2- Favourable
Continuity	1- Adequate
Negative indicators/Degradation	2- Favourable
HAS Score Overall	2- Favourable
HEGS Score	Grade 2- Moderately high to high value

Further detail is provided in Table 5:

TABLE 5: H2 ASSESSMENT FURTHER DETAIL (HAS).

Assessment Criteria to Determine Hedgerow Condition	H2	Assessment Score
Structural		
Height	4-5m	2- Favourable
Width	2-3m	2- Favourable
Profile	Top heavy / undercut	3- Highly favourable
Basal density	Open	0- Unfavourable
Continuity		
% Gaps	5%	1- Adequate
Specific Gaps	Individual three gaps: 1.5m, 2m, 2m	1- Adequate
Negative Indicators		
Degradation of bank/wall	None	3- Highly favourable
% Canopy dominated by ivy	<1%	3- Highly favourable
Unfavourable species composition	*c.* 50% of woody growth (Sycamore)	0- Unfavourable
>20% evidence herbicide use	None	3- Highly favourable
>20% nutrient rich species	>20% of ground flora layer (Common Nettle, Creeping Thistle, Spear Thistle)	0- Unfavourable
Alien invasives?	N	3- Highly favourable
Degraded margin	Grassy margins 1m	1- Adequate

The following plant species were recorded at H2:

TABLE 6: H2 PLANT SPECIES LIST.

Layer	Common name[8]	Scientific name	DAFOR
Tree	Sycamore^	*Acer pseudoplatanus*	D
	Ash	*Fraxinus excelsior*	F
	Common Ivy	*Hedera helix*	O
Shrub	Hawthorn	*Crataegus monogyna*	D
	Blackthorn	*Prunus spinosa*	F
	Common Ivy	*Hedera helix*	O
	Dog Rose	*Rosa canina agg.*	O
	Ash	*Fraxinus excelsior*	R
	Wych Elm	*Ulmus glabra*	R
Herbaceous	Creeping Thistle	*Cirsium arvense*	D
	Perennial Rye-grass	*Lolium perenne*	D
	Common Nettle	*Urtica dioica*	A
	False Oat-grass	*Arrhenatherum elatius*	F
	Creeping Bent	*Agrostis stolonifera*	O
	Yorkshire-fog	*Holcus lanatus*	O
	Cock's Foot	*Dactylis glomerata*	O
	Herb-Robert	*Geranium robertianum*	R
	Dandelion	*Taraxacum agg.*	R
	Viola sp.	*Viola sp.*	R
	Hogweed	*Heracleum sphondylium*	R
	Field Horsetail	*Equisetum arvense*	R
	Creeping Buttercup	*Ranunculus repens*	R
	Common Sorrel	*Rumex acetosa*	R

[8] : Species listed in the current hedgerow survey list of native trees, shrubs and climbers (Foulkes et al. 2013).

^: Naturalised species defined in the guideline of the HAS (Foulkes et al. 2013).

A: Unfavourable species, e.g. not listed as legislative invasive species but classed as Invasive Species by NBDC or non-native species.

Although Sycamore is classed as Invasive Species-risk of Medium Impact by NBDC, it is defined as Naturalised species in the guideline of the HAS and not listed as legislative invasive species. Therefore, it is ruled out from Alien invasives in the HAS assessment and treated as an unfavourable species.

#: Non-native species defined in the guideline of the HAS (Foulkes et al. 2013).

: Species listed in "The current hedgerow survey list of ground flora species" (Foulkes et al. 2013) or listed in "Schedule 2 Woodland Species List" for the Hedgerows Regulations 1997 of England and Wales.

A: **Nutrient rich species** defined in the guideline of the HAS (Foulkes et al. 2013).

	Smooth Sow-thistle	*Sonchus oleraceus*	R
	Common Mouse-ear	*Cerastium fontanum*	R
	Cow Parsley	*Anthriscus sylvestris*	R
	Cleavers	*Galium aparine*	R
	Spear Thistle	*Cirsium vulgare*	R
	Wood Avens	*Geum urbanum*	R
	Lords-and-Ladies	*Arum maculatum*	R
	False Brome	*Brachypodium sylvaticum*	R
	Soft Shield-fern	*Polystichum setiferum*	R

FIGURE 11: H2, END POINT IN THE NORTH-EAST.

FIGURE 12: H2, THE NORTH-WEST SIDE.

FIGURE 13: H2, CONDITION OF INTERNAL DRAINAGE.

FIGURE 14: H2, SYCAMORE TREE LINE ALONG THE NORTH-WEST SIDE.

FIGURE 15: H2, NODE OF THE INTERNAL DRAINAGE WITH H1 AND H3 IN SOUTH-WEST.

FIGURE 16: H2, THE SOUTH-EAST SIDE.

FIGURE 17: H2, THE SOUTH-EAST SIDE (TAKEN FROM H3).

FIGURE 18: H2, OPEN BASE

FIGURE 19: H2, CONDITION OF GAP (TAKEN FROM THE NORTH-WEST SIDE)

FIGURE 20: H2, CONDITION OF GAP (TAKEN FROM THE SOUTH-EAST SIDE)

FIGURE 21: H2, <2M GRASSY MARGIN IN THE SOUTH-EAST SIDE.

3.3 H3

H3 (Figure 22 to Figure 30) is an internal farm boundary between the two pasture fields for sheep and cattle. H3 is 305m in length with north-east and south-west aspects. There is a wet internal drainage ditch (1.5-2m depth, flowing). The drainage ditch was flowing from the north-west under the R157 Dunboyne Bypass then ultimately into the River Tolka (IE_EA_09T010600) (Figure 22).

In summary, H3 is an escaped hedge with semi-mature Hawthorn shrubs and dieback Ash trees. The sides have been pruned lightly in the past. The base structure is open, or 'leggy' managed by suspected infill planting with Hawthorn or Blackthorn (Figure 27). Neither side is fenced. Ground flora along the margins and on the half banks, includes pasture grass species and eight species of woodland ground flora were identified (Table 6), including frequent Ground Ivy *Glechoma hederacea* and fern species such as *Polypodium* sp., Hart's-tongue *Asplenium scolopendrium* and Soft Shield-fern on the slopes of the wet, deep drainage ditch.

As negative indicators, two stands of mature Sycamore trees were found. Furthermore, the margins and banks have been poached; mainly by cattle on the north-east side and slightly by sheep on the south-west side, consequently, disturbed bare ground accounted for 40% of the entire margins (Figure 28 and Figure 29). In addition, it is deemed that trees falling from Ash dieback had occurred, forming gaps in the hedge (Figure 30).

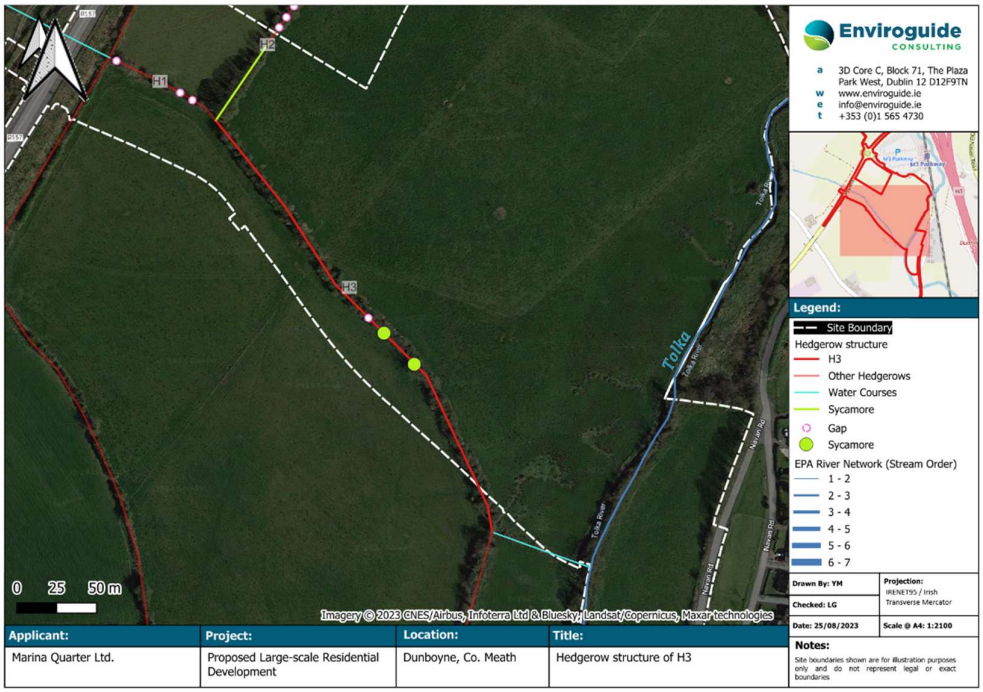

FIGURE 22: H3 EXTENT.

As a result of hedgerow appraisals, H3 was assessed as 2- Favourable in the HAS and Grade 1 High to very high value in the HEGS (Table 7 and Table 8).

The following are the overall results of the Hedgerow Assessment for H3:

TABLE 7: H3 OVERALL ASSESSMENT SCORE USING THE MEAN OF CONDITION SCORES (HAS AND HEGS)

Assessment Criteria to Determine Hedgerow Condition	H3
Structural	2- Favourable
Continuity	2- Favourable
Negative indicators/Degradation	1- Adequate
HAS Score Overall	2- Favourable
HEGS Score	Grade 1 High to very high value

Further detail is provided in Table 8:

TABLE 8: H3 ASSESSMENT FURTHER DETAIL (HAS).

Assessment Criteria to Determine Hedgerow Condition	H3	Assessment Score
Structural		
Height	3-5m Excluding dieback Ash trees	2- Favourable
Width	2-3m	2- Favourable
Profile	Top heavy / undercut, irregular	3- Highly favourable
Basal density	Semi-translucent (Mixture of Open and Semi-Opaque)	1- Adequate
Continuity		
% Gaps	<5%	2- Favourable
Specific Gaps	Individual gap: 3.5m	1- Adequate
Negative Indicators		
Degradation of bank/wall	Severe by livestock poaching 40% of the entire margins	0- Unfavourable
% Canopy dominated by ivy	<5%	2- Favourable
Unfavourable species composition	3% of woody growth (Sycamore)	2- Favourable
>20% evidence herbicide use	None	3- Highly favourable
>20% nutrient rich species	>20% of ground flora layer (Spear Thistle, Creeping Thistle, Common Nettle, Broad-	0- Unfavourable

	leaved Dock, Common Ragwort)	
Alien invasives?	N	3- Highly favourable
Degraded margin	No grassy margin	0- Unfavourable

The H3 plant species lists is presented in Table 9 as follows:

TABLE 9: H3 PLANT SPECIES LIST.

Layer	Common name[9]	Scientific name	DAFOR
Tree	Ash[10]	*Fraxinus excelsior*	A
	Sycamore^	*Acer pseudoplatanus*	R
	Common Ivy	*Hedera helix*	R
	Hawthorn	*Crataegus monogyna*	R
Shrub	Hawthorn	*Crataegus monogyna*	D
	Common Ivy	*Hedera helix*	D
	Dog Rose	*Rosa canina* agg.	A
	Elder	*Sambucus nigra*	F
	Blackthorn	*Prunus spinosa*	O
	Spindle	*Euonymus europaeus*	R
	Wych Elm	*Ulmus glabra*	R
Herbaceous	Bramble	*Rubus fruticosus* agg.	D
	Common Ivy	*Hedera helix*	D
	Spear Thistle	*Cirsium vulgare*	D
	Perennial Rye-grass	*Lolium perenne*	D
	Creeping Thistle	*Cirsium arvense*	A
	Ground Ivy	*Glechoma hederacea*	A
	Common Nettle	*Urtica dioica*	F
	Dandelion	*Taraxacum* agg.	F
	Broad-leaved Dock	*Rumex obtusifolius*	F
	Creeping Bent	*Agrostis stolonifera*	F

[9] : Species listed in the current hedgerow survey list of native trees, shrubs and climbers (Foulkes et al. 2013).
^: Naturalised species defined in the guideline of the HAS (Foulkes et al. 2013).
A: Unfavourable species, e.g. not listed as legislative invasive species but classed as Invasive Species by NBDC or non-native species.
Although Sycamore is classed as Invasive Species-risk of Medium Impact by NBDC, it is defined as Naturalised species in the guideline of the HAS and not listed as legislative invasive species. Therefore, it is ruled out from Alien invasives in the HAS assessment and treated as an unfavourable species.
#: Non-native species defined in the guideline of the HAS (Foulkes et al. 2013).

: Species listed in "The current hedgerow survey list of ground flora species" (Foulkes et al. 2013) or listed in "Schedule 2 Woodland Species List" for the Hedgerows Regulations 1997 of England and Wales.
A: **Nutrient rich species** defined in the guideline of the HAS (Foulkes et al. 2013).

[10] : Dieback tree although composes part of the hedgerow structure.

	Hawthorn	*Crataegus monogyna*	O
	Blackthorn	*Prunus spinosa*	O
	Silverweed	*Potentilla anserina*	O
	Annual Meadow-grass	*Poa annua*	O
	Herb-Robert	*Geranium robertianum*	R
	Wych Elm	*Ulmus glabra*	R
	Cow Parsley	*Anthriscus sylvestris*	R
	Lesser Water-parsnip	*Berula erecta*	R
	Viola sp.	*Viola* sp.	R
	Lords-and-ladies	*Arum maculatum*	R
	Common Ragwort	*Jacobaea vulgaris*	R
	Clustered Dock	*Rumex conglomeratus*	R
	Bush Vetch	*Vicia sepium*	R
	Tall Fescue	*Schedonorus arundinaceus*	R
	Hart's-tongue	*Asplenium scolopendrium*	R
	Scaly Male Fern	*Dryopteris affinis* agg.	R
	Polypodium sp.	*Polypodium* sp.	R
	Soft Shield-fern	*Polystichum setiferum*	R

FIGURE 23: H3, THE SOUTH-WEST SIDE (TAKEN FROM H1 TO THE SOUTH).

FIGURE 24: H3, OPEN BASE ALONG THE SOUTH-WEST SIDE.

FIGURE 25: H3, CONDITION OF INTERNAL DRAINAGE DITCH.

FIGURE 26: H3, DIEBACK ASH TREES DISTRIBUTED THROUGHOUT.

FIGURE 27: H3, INFILL PLANTING WITH HAWTHORN AND/OR BLACKTHORN AT BASE.

FIGURE 28: H3, MARGIN POACHED BY LIVESTOCK ON THE NORTH-EAST SIDE.

FIGURE 29: H3, MARGIN POACHED BY LIVESTOCK ON THE NORTH-EAST SIDE.

FIGURE 30: H3, FALLING ASH DIEBACK TREES WITH GAP.

FIGURE 31: H3, CROSS-SECTION (TAKEN FROM THE GATE AT THE MIDDLE POINT).

FIGURE 32: H3, END POINT OF SOUTH-EASTERN SIDE (CONFLUENCE WITH DRAINAGE CHANNEL FLOWING INTO TOLKA).

4 HEDGEROW CONDITION SCORING

4.1 Scoring Hedgerow Condition

The condition of the hedgerows at the Site are ranked on a scale of 0 to 3, where 0 is unfavourable, 1 is adequate, 2 is favourable and 3 is highly favourable. The higher the score, the more favourable the condition of the hedgerow in question. A score of 0 in any category is indicative of a hedgerow that is in an unfavourable condition overall at present (Foulkes et al. 2013).

Table 10 outlines the collated condition scores of hedgerows at the Site.

TABLE 10: COLLATED HEDGEROW SCORES

Hedgerow	Condition Score (HAS)	Condition Score (HEGS)
H1	2- Favourable	Grade 1 High to very high value
H2	2- Favourable	Grade 2- Moderately high to high value
H3	2- Favourable	Grade 1 High to very high value
Median Score	2- Favourable	Grade 1 High to very high value

As can be seen, median scores of the three hedgerows have been allocated Favourable condition assessment using the HAS, and Grade 1 High to very high value using the HEGS. Hedgerows scored well as regards to structural variables, such as width, height, and having escaped profiles and deep wet internal drainages, as well as biodiversity.

5 IMPACT OF THE PROPOSED DEVELOPMENT

5.1 Removal Hedgerows

The majority of the hedge structures are semi-mature standards, consisting of native Irish hedgerow species and woodland ground flora, with the deep internal drainages, open to leggy basal sections and lacking in adequate grassy margins.

To allow for the Proposed Development, H1 and H2 are proposed to be removed entirely. H3 will be partially removed to facilitate the Proposed Development and the southern link-road. The retained H3 section will be included in the landscape design in the Proposed Development as preserved hedgerow segments and drainage ditch (Figure 33 and **Error! Reference source not found.**). The internal drains are proposed to be retained with culverts where the hedges will be removed. In total, the approximate lengths of removed hedgerows for the Proposed Development will be *c*. 68% of the baseline lengths (Table 11), namely the half-length mostly.

FIGURE 33: LANDSCAPE DESIGN MASTERPLAN OF THE PROPOSED DEVELOPMENT (IRLA DRWG NO: 1000).

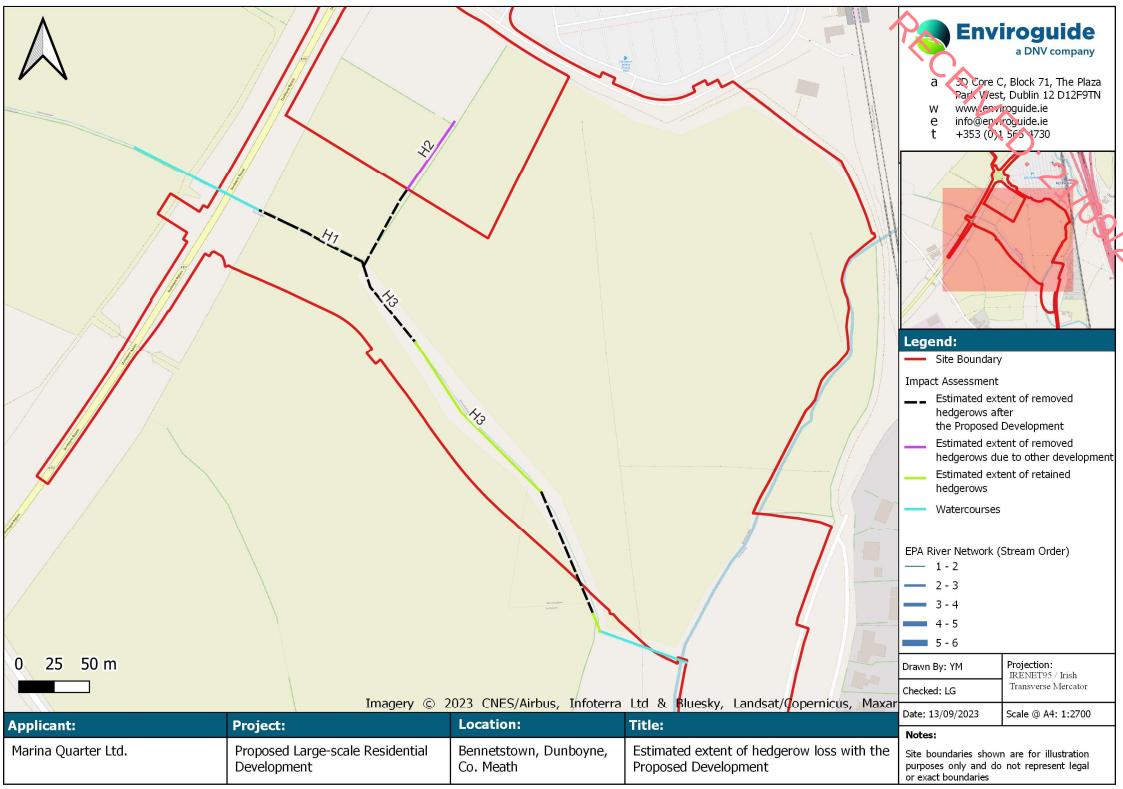

FIGURE 34: ESTIMATED EXTENT OF HEDGEROW LOSS WITH THE PROPOSED DEVELOPMENTS.

TABLE 11: THE BASELINE LENGTH AND POTENTIALLY REMOVED LENGTH BY THE PROPOSED DEVELOPMENT IN EACH HEDGEROW IN THE SITE

Hedgerow no.	H1	H2	H3	Total
Baseline Length	*c.* 80m	*c.* 66m (Although the surveyed length was 118m, the rest is within the adjacent development site)	*c.* 305m	*c.* 451m
Potentially removed length	*c.* 80m	*c.* 66m	*c.* 160m	*c.* 306m (*c.* 68% for the baseline length)

Therefore, the loss of some hedgerows and open wet habitat feature will result in a significantly reduced habitat for commuting and foraging bats, mammal species, local breeding bird populations, and also invertebrates and woodland flora supported by the wet drainage within the Site. In addition, it will have a negative effect on connectivity with other local hedgerows.

However, the landscape strategy for the Proposed Development encompasses the recreation / reinforcement of hedgerows within the east of the Site. This serves as a mitigation and compensation measure to address the impact on hedgerow habitats at the Site and to enhance the retained hedge sections, replacing those affected by Ash dieback. Furthermore, the impact on wet habitats due to the partial culverting of internal drainage will be mitigated

through the incorporation of Sustainable Urban Drainage Systems (SUDs) within the landscape design.

5.2 Damage to the retained trees

National Roads Authority (NRA) (2006) states in *Guidelines for the Protection and Preservation of Trees, Hedgerows and Scrub Prior to, During and Post Construction of National Road Schemes* examples for the expected disturbances to trees during construction works as:

- Mechanical damage to bark, limbs or roots;
- Compaction of the Root Protection Area (RPA)[11] as the result of vehicular and pedestrian activity and/or the storage of materials within this area; and
- Altered ground levels affecting the hydrological regime.

These types of disturbances could lead to the potential of additional impacts on any retained hedges at the Site.

5.3 Invasive species

Sycamore was identified within all three hedgerows (Figure 2, Figure 10 and Figure 22) on Site. Although Sycamore is not a regulated invasive plant species listed in the Third Schedule of the European Communities (Birds and Natural Habitats) Regulations 2011, as amended, it is classed as 'Invasive species – risk of Medium impact' in the NBDC database.

Where necessary Sycamore stands within the hedgerows will be removed as part of the Proposed Development (bar selected trees that are to be retained in the landscape design). Among them, H2 and H3 accommodate young, mature and fruiting trees.

5.4 Impact assessment

In the context of the aforementioned impacts, in the worst-case scenario without any mitigation and compensation measures, this impact is considered to be **permanent, negative and significant** at the Local scale.

However, the aforementioned landscape strategy of the Proposed Development includes the replacement of the removed hedgerows by planting in the east of the Site as mitigation/compensation. Therefore, the removal of hedgerows to facilitate the Proposed Development and the disturbance caused by the accompanying works, will represent a **short to medium-term, negative, slight** impact at the Local scale until the replacement hedgerows have been planted and become established. The recreated mature hedgerows will result in **a long-term neutral – slight positive** effect, depending on the species composition and success of establishment.

In addition, the mitigation measure to address the impacts via damage to retained trees should be taken.

[11] RPA is a calculated area of ground that lies immediately under a tree and just beyond the extent of its crown. It is intended to help avoid damage to the tree's rooting system (Woodland Trust 2021).

6 MITIGATION AND COMPENSATION RECOMMENDATIONS

To minimize the potential impacts, as assessed in Section 5 the following mitigation measures are recommended below.

6.1 Construction Phase

6.1.1 Protection of retained trees

For any retained trees and hedgerows, in accordance with British Standards BS 5837:2012 'Trees in relation to design, demolition and construction – Recommendations' (The British Standards Institution 2012), protective tree fencing will be erected prior to any Construction works being undertaken to prevent damage to the canopy and root protection areas. The fencing should be signed off by a qualified arborist prior to Construction to ensure it has been properly erected. No ground clearance, earthworks, stock-piling or machinery movement will be undertaken within these areas.

All trees that are being retained within the Site must be protected by barriers and ground protection prior to the construction phase as below. The measures should be carried out following NRA (2006) and BS 5837:2012:

- Barriers and protection should be put in place prior to any development work or soil excavations being carried out.
- Prior to installation of barriers, calculate the RPA for the retained trees, then protect the area with fencing barriers and/or ground protection measures from pedestrian and vehicle activities. The formulas are stated in NRA (2006).
- Where all works can be excluded from the RPA, it is desirable that fences will be erected outside of the RPA to create the exclusion zone around all retained existing hedges.
- Where construction activities are needed within the RPA, ground protection will be installed there.
- As per NRA (2012), the barrier will consist of a vertical and horizontal scaffold frames and should be at least 2.3m in height. Scaffold frames and welded mesh panels are recommended as materials in BS 5837:2012.
- Examples of ground protection include a layer of bark mulching, single thickness scaffolding boards and so on. The selection should be decided following the guidelines of NRA (2006) and BS 5837:2012 and depend on a type of the activities within the RPA, namely: merely pedestrians or including vehicles.
- Ground alteration in the vicinity of the retained hedges could lead the change of soil hydrology. Therefore, where it is needed, an Ecological Clerk of Works (ECoW) should assess the impact and advise a measurement.

6.1.2 Timing of Hedgerow Removal

As the hedgerows have been deemed suitable for supporting various types of wildlife, including birds and small mammals (see the Biodiversity Chapter of EIAR (Enviroguide, 2023)), vegetation clearance should be ideally carried out within the months of September and October. This will avoid the main breeding seasons for birds and other small fauna (e.g. mammals and reptiles), as well as the hibernation season.

Where this seasonal restriction cannot be observed, a check for active nests will be carried out by a suitably qualified ECoW a maximum of 24h prior to removal. Where a breeding bird and an active nest is found, the nest will be protected, and no further works will take place in the vicinity of the nest until the young have fledged.

In addition, all vegetation clearance must take place in a phased manner to prevent entrapment of fauna potentially present. Full details of the phased approach are given in the Biodiversity Chapter of the EIAR for this application.

Furthermore, it is recommended that where feasible, berry-bearing trees such as Hawthorns and Blackthorns are left in place until January/February to retain some level of an all-important food source for birds and any remaining other fauna for the duration of the first winter of works at the Site.

6.2 Construction/Post-construction Phase Hedgerow Recreation

Given the local policies on hedgerow retention and protection (see Section 1.4), it is recommended to replant hedgerows within the wider Site area to mitigate and compensate the impact of hedgerows removal for the Proposed Development. This is proposed along in the eastern part of the Site, within the River Tolka flood plain. The proposed plan for hedgerow recreation is outlined below.

6.2.1 Targets

To mitigate and compensate the impact of the Proposed Development towards hedgerows on Site, it is recommended to manage recreated/retained hedgerows so that they will be assessed as the same/higher condition scores with the original ones in the Site, namely: **overall score should be 2- Favourable at the least or 3- Highly favourable where possible** in the HAS.

To get the high overall score, the new hedgerows should pass criteria with 2- Favourable or 3- Highly favourable in each condition, which is showed in Table 12. In summary, the hedgerows on Site after the Proposed Development should be ultimately 2.5m height and 2m width at the least, and have >2m margin on one side at the least and <5% gaps. Regarding the negative indicator in ground flora, it should avoid getting 0- Unfavourable to control noxious/non-native species. In addition, it would be desirable to be dominated by various native species for woodland listed in the HAS Best Practice Guidance and Schedule 2 for the Hedgerows Regulations 1997 of England and Wales, both in tree/shrub and ground flora layers.

Generally, hedgerows with high ecological values can be divided mainly into two types of profiles, namely: escaped hedges which remain un-topped but can be side-trimmed, and topped hedges which trim to A-shaped cross-section with a wide base excluding occasional trees. Both should have a flowering canopy. Although the original hedgerows have the profile of escaped hedges without the dense base, the choice will depend on the feasibility with the Proposed Development.

TABLE 12: TARGET SCORE AND CRITERIA FOR THE CONDITION OF THE NEW HEDGEROWS

Structural Variables	2	3
Dimensions	Favourable	Highly favourable
Height	2.5 – 4m	>4m

Width	2- 3m	>3m	
Profile	Boxed/A-shaped; Straight sided	Overgrown; Top heavy/undercut; Outgrowths at base	
Basal density	Semi-opaque	Opaque/Dense	
Continuity	**2**	**3**	
	Favourable	**Highly favourable**	
% gaps	<5%	Continuous	
Specific gaps	No gaps	No gaps	
Negative Indicators	**0**	**2**	**3**
	Unfavourable	**Favourable**	**Highly favourable**
% of canopy dominated by Ivy (Floristic)	>25%	-	-
% gaps	>10%	<5%	Continuous
Ground Flora/Hedge Base	>10% of woody growth volume comprised of unfavourable species	-	-
	> 20% of ground layer showing evidence of Herbicide Use	-	-
	Contain Noxious weeds > 20% Dominated by Nutrient Rich Species	-	-
	Presence of alien invasive species	-	-
Degraded Margin	-	(grassy) margin (2 m or greater on one side of the hedge)	(grassy) margins (2 m or greater on both sides of the hedge)

6.2.1.1 Length

To compensate the loss of hedges fully, the minimum linear length of created hedges will be **the same or greater in length than hedgerows which will be lost by the Proposed Development,** and this should be in a single continuous length. Where it is deemed to be difficult to create a single linear feature, several hedgerows can be created as long as possible, provided they connect with other hedgerows (either within the Site on adjacent lands).

6.2.1.2 Location

If possible, it is desirable that the new hedgerows are planted along a small bank, or with an associated ditch within the Site to consider drainages at the outset and support wildlife movement and wet habitats throughout the Site.

In addition, it is recommended to restore/recreate the connectivity with other hedgerows or isolated patches within the Site after the development; to provide the wildlife corridors to the local area. However, the final placement will also depend on the design of the Proposed Development.

This is proposed in the east of the Site, where new hedgerow corridors are proposed to link up with the Tolka's riparian corridor, providing habitat connectivity across what is currently open grazed fields.

6.2.1.3 Species

Barr *et. al* (2005) in *Hedgerow Management and Costs*, states the recommendation for planting mixed species within hedgerows as *"The idea that mixed species hedges are of more benefit to wildlife than single species lines is long established".*

Therefore, to maximise the ecological value of the new hedgerows, they should comprise multiple (at least five) species to enhance overall species richness of the hedgerow resource, but with composition based on hedgerows present in the local area. Therefore, the hedgerow should include, Hawthorn *Crataegus monogyna*, Wych Elm *Ulmus glabra*, Spindle *Euonymus europaeus*, Wild Cherry *Prunus avium*, Blackthorn *Prunus spinosa* and Pedunculate Oak *Quercus robur*. These are more likely to thrive in the local climate and soils and to be in keeping with the character of the landscape. **At the very least trees should be purchased from a company growing their stock within Ireland**. Imported tree stock has been responsible for the introduction of invasive species such as New Zealand flatworm and likely expedited the spread of ash dieback in the country.

6.2.1.4 Period, Frequency and Intensity of the Management

The period, frequency and intensity of management will depend on the choice of whether escaped hedges, managed with coppicing and laying, or topped hedges are being proposed. In any case, it is desirable that partial cutting/laying is carried out every year, e.g., a third of the entire length of the hedge annually and done in multi-year (three years at the minimum) rotation, and that the management and maintenance is continued in perpetuity, with monitoring conducted until the new hedges achieve the targeted overall scores. Details are shown in each section.

6.2.2 Methods

To achieve the conditions shown in Table 12, methods for how to create the new hedges and margins, reinforce the retained hedges and manage them are recommended below.

6.2.2.1 Create the new hedgerows

General recommendations for methods to plant new hedgerows are as follows.

- Clear any grass and vegetation where the new hedges will be planted. Where they will be planted on the existing ditches or hedges with gaps, any works including clearing litter should be implemented September and October (see section 6.1.2).
- If there is no available existing ditches, dig out ditches/drains where possible.
- Bare-root stock can be planted between the end of October and the end of March. Generally, it's best to plant early in the season, before January, to allow the plants more time to establish a network of feeder roots before the onset of spring.
- Never plant during freezing weather or if the ground is waterlogged. Ideally plant on a still, moist day, to minimise root drying and stress to the plants.
- Do not bury the stem or expose the roots when planting.
- Plant in species of local provenance. It is desirable that the hedgerows include Hawthorn, Wych Elm, Spindle, Pedunculate Oak and Blackthorn. Trees should be purchased from a company growing their stock within Ireland.

- Young plants should be closely spaced (50 cm maximum). As a guide, it is suggested that at least 40cm is left between each row and that four to six plants are planted per metre, mixing several species.
- Hedgerows should be planted in a double staggered row which tends to be better for wildlife than single rows as they are wider and provide more shelter and habitat. Or they should be planted on a herringbone/zigzag line, not a straight line (Heritage Council 2016).

6.2.2.2 Restoration of retained hedgerows

To maintain and restore the retained hedgerows, several recommendations are provided here.

- Noxious weeds, such as Spear Thistle, Creeping Thistle and Common Nettle listed in the HAS guidance as nutrient rich species, existing in/around the retained hedges should be controlled properly following the guideline "*The Management of Noxious Weeds and Non-Native Invasive Plant Species on National Roads*" (NRA 2010). It should be noted that they are native species supporting the local wildlife, so the target should not be their eradication but their population control to aim the coverage under 20% at the least.
- If tree felling is required to restore the retained hedges, a ECoW will be present to identify the usage potential for bats/birds prior to felling.
- Where <5m gaps are found within the new hedgerows, close the gap up with native shrubs such as Hawthorn or Blackthorn. Where >5m gaps, close the gap with mixture of shrubs and tall trees. This is to retain connectivity and aim to have no gaps, which is a condition of **2- Favourable or 3- Highly favourable** for Continuity.
- In any case, it should be noted to avoid shading existing young trees of native species via new planting. In addition, young planted woody species should be protected, using an appropriate tree guard or fencing as mentioned in 6.2.2.1 Create the new hedgerows.

6.2.2.3 Create the herbaceous margins

All original hedgerows assessed didn't have adequate margins (>2m with ground flora), which is one of criteria to be assessed **2- Favourable or 3- Highly favourable for Negative Indicator** (Table 12). Therefore, it is recommended new hedgerow(s) have a >2m margins dominated by native herbaceous species along both new and retained hedgerows aiming to compensate or gain the value of local hedgerows in the future.

- A strip of grassland at least 2m wide on either side of any newly planted hedgerow will greatly increase its value for wildlife.
- It is preferable if herbaceous margins contain a good range of broad leaved herbs and grasses. However, All-Ireland Pollinator Plan does not recommend the use commercial wildflower seed mixes as they have a risk containing non-native species (NBDC 2023).
- Instead, natural regeneration is desirable; to collect seeds from native species in the local areas and sow them into the margins in autumn, or to depend on native species colonizing naturally without sowing. However, the choice should also depend on the invasive/unfavourable species control, which is more likely to be a problem on heavy soils.

- Mow the margins infrequently (no more than once per year, after mid-July) to encourage a natural succession of native species.

6.2.2.4 Restore and Manage hedgerows

As options to maximize the ecological value of hedgerows, the following methods are recommended:

1) Escaped hedge

Escaped hedge is described by Teagasc as bellow:

"Escaped hedge where the individual plants have grown up, become single stem mature trees with gaps in between and thin at the base, but has sufficient stems, one every metre or so. It can be very successfully rejuvenated into a hedge with a dense base by either coppicing or laying."

The best practice for the escaped hedge is as below:

- Trim the sides, never cut the top of trees.
- Side trim should be carried out on a three year cycle in rotation, e.g. a third annually, resulting in some areas producing blossom each year. That is because frequent trimming could reduce the biodiversity benefits of hedges, for example, due to cutting the previous year's stems of Hawthorn whose flowers are produced on them (Hedgerows Ireland 2023), or due to tight trimming leading to patchy and frail hedgerows.
- Enhance the rejuvenation to create dense bases by laying or coppicing.

The above methods will promote the creation of the outgrowth of trees and dense bases, which correspond with **3- Highly favourable for Structure Variables** (Table 12).

Management methods for escaped hedges to bring back to a desirable height include are mentioned below.

a) Hedge-laying

Hedge-laying is a method that allows the creation of high value hedges with tall over trees and thick base, encouraging rejuvenation. The structure of the laid hedge is ideal for local nesting birds.

The general principles are as below:

- Cut stems at the base, as low to the ground as possible, 1/2 to 2/3 of the way through to avoid snapping of the trunk. Stems are left attached to the cut stump by a long living hinge.
- After cutting, stems are laid at an angle of 35-45 degrees running up the slope, producing a hedge approximately 1.2m in height.
- Always lay a hedge uphill if the ground slopes to get better transpiration of moisture so the sap rises and the hedge remains living.
- The timing for laying is when the hedge becomes open at the base or stems are 5-10cm in diameter and 2.5-5.0m height (Lake et. al 2015).
- It is good practice to leave some mature trees or straight stems uncut within the hedge.

- Lay approx. 50m to 100m of the entire length every year and after 10-15 years the length is completed, and you start again at the beginning.

Further information is present on the websites of Teagasc – "How to lay a hedge" (Teagasc 2020) and Hedgerows Ireland – "Hedgerow Planting & Management" (Hedgerows Ireland 2023).

b) Coppicing

Similarly to hedge laying, coppicing involves cutting a tree to stimulate rejuvenation of hedgerows. In coppicing, the entire stem is cut to just above ground level and the cut stump is encouraged to re-shoot. Coppicing will enhance the light condition for ground flora and promote rejuvenation.

However, most coppiced hedges will not return to a flowering mode for a number of years. Therefore, it is recommended not to cut the entire hedgerows at the same time (ideally no more than 5% of a hedge should be coppiced annually) to avoid creating gaps within the hedges and to retain habitats for the wildlife.

Hedgerows Ireland (2023) and Teagasc (2020) mentions the following general principles for coppicing:

- Identify a few occasional trees that will be left uncut and let grow into mature single-stem trees above with a full canopy above the body of the hedge.
- Cut down stems to 2-3 inches above ground level (not right into the soil, just above the soil to produce new shoots).
- All vegetative debris must be cleared from underneath the hedge to get as clean a base as possible. If possible, ivy, bramble and briars should be removed from the ground.
- Fill in gaps with new plants - four per metre with native shrubs such as Hawthorn or Blackthorn.
- No more than 5% of the entire length should be coppiced every year to avoid making gaps within the hedges and losing the resources, structure and function.

Further information are present in the websites of Teagasc – "How to coppice a hedge" (Teagasc 2020) and Hedgerows Ireland – "Hedgerow Planting & Management" (Hedgerows Ireland 2023).

2) Topped hedge

Topped hedge is routinely cut by hedge cutters annually or every few years. It doesn't need rejuvenation.

The best practice for a topped hedge is as below:

- Side trim from a wide base to a A-shaped profile, which creates a bushy top for maximum protection from wind. This will encourage the development of a dense hedge (Heritage Council 2016).
- Trim the top a little above the previous year's cut and aim to grow up to at least 2.5m, to gradually reduce cutting intensity each year; cut taller and wider.

- Leave Hawthorn/Blackthorn trees out of rotational cutting on occasion, so that mature trees with a full canopy intermix in every hedge to provide food resources throughout the hedgerow.
- Cut your hedge on a three year cycle in rotation, e.g. a third annually, resulting in some areas producing blossom each year.

The above method allows to create hedges with A-shaped profile and dense bases, which correspond with the condition to get **2- Favourable or 3- Highly Favourable in Structure Variables** (Table 12).

Further information can be found on the website of Hedgerows Ireland – "Hedgerow Planting & Management" (Hedgerows Ireland 2023).

3) Common notes

The following should be noted during the management of new hedgerows:

- Where possible, it is desirable to install fences along the new hedgerows or clear hard tubes around the base of the saplings while the trees are young to prevent deer, hares and rabbits from grazing and browsing on them.
- Do not apply herbicides, pesticides or fertilisers within 1.5m of a hedgerow, as this can lead to nutrient enrichment that can enhance populations for noxious species and invasive species, which affects **scores for Negative Indicator** (Table 12). On the other hand, good weed control is required to protect young growth trees from being excluded by aggressive colonisation and shading by unfavourable species. Management to achieve good weed control should be a priority in the first year. Cut regularly in the first spring/summer to top annual grass weeds and encourage perennial grasses to tiller.
- If any invasive species were found, consult how to deal with them in an ecologically sensitive way by consulting a suitably qualified ecologist.
- During maintenance, if >5m gaps were found within the new hedgerows, close the gap up with native shrubs such as Hawthorn or Blackthorn to retain connectivity and aim to have no gaps, which is a condition of **2- Favourable or 3- Highly favourable for Continuity.**

4) Machine

General recommendations for the machines to manage hedges are as follows.

- A circular saw should only be considered for coppicing and must not be used for general hedgerow maintenance.
- Finger bar cutters with a pair of reciprocating blades are suitable for trimming young growth.
- A flail cutter should only be used on soft growth of thorny species, and never on heavy woody growth: the resulting ragged ends are unsightly and invite disease.

6.2.3 Monitoring

In the post-construction phase, two years of annual monitoring to assess the ecological value of the new hedgerows should be carried out by a suitably qualified Ecologist/Botanist until the hedgerows have become established. Management of the new hedgerows should be carried

out as part of the Proposed Development landscape maintenance program and should be based on the same methods as used in this Report, namely, the HAS and if at all possible, supplemented by the HEGS, depending on the outcomes and recommendations made by the surveying Ecologist/Botanist over the first two years. The results of monitoring can be shared with Meath CoCo, and corrective measures shall be agreed and implemented on the recommendations of ecologists if required.

7 CONCLUSION

In total three hedgerows were recorded and assessed within the Site, of which all three hedgerows were found to be in '2- Favourable' condition in accordance with the HAS.

As a result of Proposed, the entire length of two hedgerows and approx. half the length of the third hedgerow assessed will be lost. Without any mitigation and/or compensation measures, this impact is considered to be **permanent, negative and significant at the Local scale**.

However, the aforementioned landscape strategy of the Proposed Development includes the replacement of the removed hedgerows with new hedgerow corridors planted in the east of the Site to provide new wildlife corridors and connectivity with the Tolka. Additionally, it is recommended to maintain and manage the replaced/retained hedgerows in the Site with high quality to minimise and mitigate the impact. Additional mitigation and compensation measures consider the disturbance and other impacts from removal of the existing hedgerows, and provide a number of recommendations for planting and management to create the hedgerows with the same or higher quality outcomes after a period of establishment with **slight negative impacts in the short term**.

Provided all mitigation and compensation measures are implemented and recommendations are adhered to, it is anticipated that the loss and eventual replanting on the assessed hedgerows in new locations will result in an overall **long-term and neutral impact**. **Slightly positive, long-term impacts** can be expected if the resulting hedgerows are managed and maintained in a way that promotes higher quality hedgerows than what is currently present.

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APPENDIX I – HEDGEROW DATA SHEETS FOR THE HEDGEROW APPRAISAL SYSTEM

H1

Hedgerow code	H1
Surveyor	YM
Date	18/08/2023
Distance between node and strip/strip and next strip	27m: Start node to 1st 30m strip
	23m: 1st strip to end node
Context	**H1**
Land Cover Classification (CORINE)	231 - Pastures
Soil Type (Deep? Well drained? Brown soil?)	TLs, Grey-brown soil
GPS start point	
GPS end point	
Elevation max (m)	67.7
Elevation min (m)	67.2
Aspect side 1 (N/S/E/W etc.)	NNE
Aspect side 2	SSW
1. Adjacent Land Use (Tick where relevant)	
Tillage	
Dairy	
Cattle	
Sheep	X
Mixed stock	
Equine	
Other	
Fodder	
Curtilage	
Amenity/golf course/pitch	
Parkland	
2. History (Tick where relevant)	
Internal farm boundary	X
Townland/parish boundary	
Canal side boundary	
Railway line boundary	
Farm boundary	
Road	

Stream	
Recently established	
First OS edition on which boundary is present (Insert Year)	1995
Connects to site or monument? (Y/N and provide details)	N
Connects to historical woodland? OS map (Y/N and provide details)	N
3. Road class (Tick where relevant)	
NP National Primary	
NS National Secondary	
R Regional	
L Local	
U Unclassified	
F Farm Road/Track	X
C Coillte Road	
4. Habitat Link Classification (Tick where relevant)	
Arable	
Improved grassland	X
Neglected pasture	
Semi-natural grassland	
Non-native woodland	
Semi-natural woodland/scrub	
Transitional woodland	
Curtilage/ built land	
Peatlands	
Lake/pond	
Watercourse	X
Hedgerow	X
Earth bank	
Re-colonising bare ground	
Other	
5. Designated site (Tick where relevant)	
Annex I habitat	
Designated site	
Designated woodland	
6. Hedgerow/Boundary Function	
Hedgerow redundant	

Active and functional boundary	X (Internal farm boundary and stockproof)
Construction	**H1**
7. Outline (Tick where relevant)	
Linear	X
Non-linear	
2. Linearity of shrub	
Single line hedge	
Double line hedge	X
Random line	
3. Bank, wall, shelf (include rough size: <0.5m, 0.5 – 1m, >1m)	
Bank	0m (Half-bank with internal drainage)
Wall	
Shelf	
Other	
4. Drain (include rough size: 0.5m, 0.5 – 1m, >1m & whether wet or dry)	
External drain	
Internal drain	X (1.5m depth, wet, flowing into south-east)
Internal path/track	
Other	
5. Boundary classification	
WL1 Hedgerow	X
WL2 Treeline	
Structure/Condition	**H1**
1. Profile	
Remnant	
Derelict/relict	
Boxed/A-shaped	
Overgrown/irregular	
Top heavy/undercut	X
Straight sided	X
Wind-shaped	
2. Base	
Losing basal structure	
Outgrowths at base	
3. Base structure	
Open	
Semi-open	
Semi-opaque with vegetation	X (With Bramble)

Opaque/dense	
4. Height	
<1.5m	
1.5-2.5m	
2.5-4m	X
4-5m	
5m+	
5. Width	
<1m	
1-2m	
2-3m	X
3m+	
6. % Gaps	
Complete	
< 5% gaps	
5-10%	
10-25%	X
25-50%	
>50%	
7. Bank degradation degree and extent	
None	
Minor	X (No collapse but covered by Bramble)
Severe	
Drain blocked/waterlogged	
Degradation >10%?	N
Degradation isolated?	
Trees	**H1**
8. Tree Quantity	
None	
Up to 15%	X
15-30%	
31-75%	
>75%	
9. Tree Age	
All mature	
Predominantly mature	
Predominantly immature	X
Mixed age range	
10. Tree height (max)	

<3m	
3-5	X
5-10	
10-20	
>20m	
Hedge Margin	**H1**
11. Margin/verge width (both sides)	
<1m	
1-2	X (North north-east side)
2-4	
4m+	
none	X (South south-west side)
12. Margin/verge degradation (both sides)	
None	X
Poached within 2m	
Ploughed within 2m	
Herbicide use >2m	
13. Condition	
Poor	
Average	X
Good	
Evidence of disease	
Management	**H1**
14. Management	
Cut box profile	
Cut A shape	
Cut on one side	
Cut on both sides	
Topped	
Laid	
Coppiced	
Short term unmanaged	X
Long term unmanaged	
Infill planting	
Pruned	X (In the past)
Cropped	
Other	
Out of season? (cut between 1st March and 31st August)	-
15. Management Stage	

Over trimmed, gaps, stems sparse	
Over trimmed, infrequent stems far apart	
Recently laid, coppiced, or planted hedgerow	
Dense, healthy, frequent stems >2m	
>3m height, trimmed on rotation	
Non-intervention hedge (intentionally untrimmed)	X
Mature, tall hedgerow with spreading tops	
Over mature with tops dying back	
Hedge developed into line of trees	
16. Management method	
Flail	
Circular saw	
Bar cutter	
Hand tools	
Excavator	
other	
17. Evidence of rejuvenation?	
	N
18. Fencing	
none	
Electric	
Post and wire	
Sheep wire	X
Timber fence	
Concrete post and rail	
wall	

H2

Hedgerow code	H2
Surveyor	YM
Date	16/08/2023
Distance between node and strip/strip and next strip	22m: Start node to 1st 30m strip
	17m: 1st strip to 2nd 30m strip
	19m: 2nd strip to the end strip
Context	**H2**
Land Cover Classification (CORINE)	231 - Pastures
Soil Type (Deep? Well drained? Brown soil?)	TLs, Grey-brown soil
GPS start point	
GPS end point	
Elevation max (m)	68.5
Elevation min (m)	66.8
Aspect side 1 (N/S/E/W etc.)	NW
Aspect side 2	SE
1. Adjacent Land Use (Tick where relevant)	
Tillage	
Dairy	
Cattle	X
Sheep	X
Mixed stock	
Equine	
Other	
Fodder	
Curtilage	
Amenity/golf course/pitch	
Parkland	
2. History (Tick where relevant)	
Internal farm boundary	X
Townland/parish boundary	
Canal side boundary	
Railway line boundary	
Farm boundary	
Road	
Stream	
Recently established	

First OS edition on which boundary is present (Insert Year)	1995
Connects to site or monument? (Y/N and provide details)	N
Connects to historical woodland? OS map (Y/N and provide details)	N
3. Road class (Tick where relevant)	
NP National Primary	
NS National Secondary	
R Regional	
L Local	
U Unclassified	
F Farm Road/Track	X
C Coillte Road	
4. Habitat Link Classification (Tick where relevant)	
Arable	
Improved grassland	X
Neglected pasture	
Semi-natural grassland	
Non-native woodland	
Semi-natural woodland/scrub	
Transitional woodland	
Curtilage/ built land	
Peatlands	
Lake/pond	
Watercourse	X
Hedgerow	X
Earth bank	
Re-colonising bare ground	
Other	
5. Designated site (Tick where relevant)	
Annex I habitat	
Designated site	
Designated woodland	
6. Hedgerow/Boundary Function	
Hedgerow redundant	
Active and functional boundary	X (Internal farm boundary and stockproof)
Construction	**H2**
7. Outline	

(Tick where relevant)	
Linear	X
Non-linear	
2. Linearity of shrub	
Single line hedge	
Double line hedge	
Random line	X
3. Bank, wall, shelf (include rough size: <0.5m, 0.5 – 1m, >1m)	
Bank	0m (Half-bank with the internal drainage)
Wall	
Shelf	
Other	
4. Drain (include rough size: 0.5m, 0.5 – 1m, >1m & whether wet or dry)	
External drain	
Internal drain	X (1.5-2m depth, wet, not flowing during the survey)
Internal path/track	
Other	
5. Boundary classification	
WL1 Hedgerow	X
WL2 Treeline	
Structure/Condition	**H2**
1. Profile	
Remnant	
Derelict/relict	
Boxed/A-shaped	
Overgrown/irregular	X
Top heavy/undercut	X
Straight sided	
Wind-shaped	
2. Base	
Losing basal structure	
Outgrowths at base	
3. Base structure	
Open	
Semi-open	X
Semi-opaque with vegetation	
Opaque/dense	
4. Height	

<1.5m	
1.5-2.5m	
2.5-4m	
4-5m	X
5m+	
5. Width	
<1m	
1-2m	
2-3m	X
3m+	
6. % Gaps	
Complete	
< 5% gaps	X
5-10%	
10-25%	
25-50%	
>50%	
7. Bank degradation degree and extent	
None	
Minor	X (No collapse but covered by Bramble partially)
Severe	
Drain blocked/waterlogged	
Degradation >10%?	N
Degradation isolated?	
Trees	**H2**
8. Tree Quantity	
None	
Up to 15%	
15-30%	X
31-75%	
>75%	
9. Tree Age	
All mature	
Predominantly mature	
Predominantly immature	X
Mixed age range	
10. Tree height (max)	
<3m	
3-5	

5-10	X
10-20	
>20m	
Hedge Margin	**H2**
11. Margin/verge width (both sides)	
<1m	
1-2	
2-4	
4m+	
none	X
12. Margin/verge degradation (both sides)	
None	X
Poached within 2m	
Ploughed within 2m	
Herbicide use >2m	
13. Condition	
Poor	
Average	X
Good	
Evidence of disease	
Management	**H2**
14. Management	
Cut box profile	
Cut A shape	
Cut on one side	
Cut on both sides	
Topped	
Laid	
Coppiced	
Short term unmanaged	X
Long term unmanaged	
Infill planting	
Pruned	
Cropped	
Other	X (Mowed ground flora)
Out of season? (cut between 1st March and 31st August)	-
15. Management Stage	
Over trimmed, gaps, stems sparse	
Over trimmed, infrequent stems far apart	

Recently laid, coppiced, or planted hedgerow	
Dense, healthy, frequent stems >2m	
>3m height, trimmed on rotation	
Non-intervention hedge (intentionally untrimmed)	X
Mature, tall hedgerow with spreading tops	
Over mature with tops dying back	
Hedge developed into line of trees	
16. Management method	
Flail	
Circular saw	
Bar cutter	
Hand tools	
Excavator	
other	
17. Evidence of rejuvenation?	
Sapling	X
18. Fencing	
none	
Electric	X
Post and wire	X
Sheep wire	
Timber fence	
Concrete post and rail	
wall	

H3

Hedgerow code	H3
Surveyor	YM
Date	16/08/2023
Distance between node and strip/strip and next strip	30m: Start node to 1st 30m strip
	69m: 1st strip to 2nd 30m strip
	71m: 2nd strip to 3rd 30m strip
	45m: 3rd strip to end node
Context	**H3**
Land Cover Classification (CORINE)	231 - Pastures
Soil Type (Deep? Well drained? Brown soil?)	TLs, Grey-brown soil
GPS start point	
GPS end point	
Elevation max (m)	69.3
Elevation min (m)	70.9
Aspect side 1 (N/S/E/W etc.)	NE
Aspect side 2	SW
1. Adjacent Land Use (Tick where relevant)	
Tillage	
Dairy	
Cattle	X
Sheep	X
Mixed stock	
Equine	
Other	
Fodder	
Curtilage	
Amenity/golf course/pitch	
Parkland	
2. History (Tick where relevant)	
Internal farm boundary	X
Townland/parish boundary	
Canal side boundary	
Railway line boundary	
Farm boundary	
Road	
Stream	
Recently established	

First OS edition on which boundary is present (Insert Year)	1995
Connects to site or monument? (Y/N and provide details)	N
Connects to historical woodland? OS map (Y/N and provide details)	N
3. Road class (Tick where relevant)	
NP National Primary	
NS National Secondary	
R Regional	
L Local	
U Unclassified	
F Farm Road/Track	X
C Coillte Road	
4. Habitat Link Classification (Tick where relevant)	
Arable	
Improved grassland	X
Neglected pasture	
Semi-natural grassland	X
Non-native woodland	
Semi-natural woodland/scrub	
Transitional woodland	
Curtilage/ built land	
Peatlands	
Lake/pond	
Watercourse	X
Hedgerow	X
Earth bank	
Re-colonising bare ground	X
Other	
5. Designated site (Tick where relevant)	
Annex I habitat	
Designated site	
Designated woodland	
6. Hedgerow/Boundary Function	
Hedgerow redundant	
Active and functional boundary	X (Internal farm boundary and stockproof)
Construction	**H3**
7. Outline	

(Tick where relevant)	
Linear	X
Non-linear	
2. Linearity of shrub	
Single line hedge	
Double line hedge	X
Random line	
3. Bank, wall, shelf (include rough size: <0.5m, 0.5-1m, >1m)	
Bank	0m (Half-bank with the internal drainage) <0.5m (Just in the middle on north side)
Wall	
Shelf	
Other	
4. Drain (include rough size: 0.5m, 0.5 – 1m, >1m & whether wet or dry)	
External drain	
Internal drain	X
Internal path/track	
Other	
5. Boundary classification	
WL1 Hedgerow	X
WL2 Treeline	
Structure/Condition	**H3**
1. Profile	
Remnant	
Derelict/relict	
Boxed/A-shaped	
Overgrown/irregular	X
Top heavy/undercut	X
Straight sided	
Wind-shaped	
2. Base	
Losing basal structure	
Outgrowths at base	
3. Base structure	
Open	
Semi-open	X
Semi-opaque with vegetation	
Opaque/dense	
4. Height	

<1.5m	
1.5-2.5m	
2.5-4m	X
4-5m	
5m+	
5. Width	
<1m	
1-2m	
2-3m	X
3m+	
6. % Gaps	
Complete	
< 5% gaps	X
5-10%	
10-25%	
25-50%	
>50%	
Specific or general?	
7. Bank degradation degree and extent	
None	
Minor	
Severe	X (35% poached by cattle)
Drain blocked/waterlogged	
Degradation >10%?	Y
Degradation isolated?	N
Trees	**H3**
8. Tree Quantity	
None	
Up to 15%	X
15-30%	
31-75%	
>75%	
9. Tree Age	
All mature	
Predominantly mature	
Predominantly immature	X
Mixed age range	
10. Tree height (max)	
<3m	

3-5	X
5-10	
10-20	
>20m	
Hedge Margin	**H3**
11. Margin/verge width (both sides)	
<1m	
1-2	
2-4	
4m+	
none	X
12. Margin/verge degradation (both sides)	
None	
Poached within 2m	X (By cattle)
Ploughed within 2m	
Herbicide use >2m	
13. Condition	
Poor	X
Average	
Good	
Evidence of disease	
Management	**H3**
14. Management	
Cut box profile	
Cut A shape	
Cut on one side	
Cut on both sides	
Topped	
Laid	
Coppiced	
Short term unmanaged	X
Long term unmanaged	
Infill planting	X (With Hawthorn and Blackthorn)
Pruned	X (In the past, mainly die back branches and thorns projected into the pasture)
Cropped	
Other	
Out of season? (cut between 1st March and 31st August)	-
15. Management Stage	
Over trimmed, gaps, stems sparse	

Over trimmed, infrequent stems far apart	
Recently laid, coppiced, or planted hedgerow	
Dense, healthy, frequent stems >2m	
>3m height, trimmed on rotation	
Non-intervention hedge (intentionally untrimmed)	X
Mature, tall hedgerow with spreading tops	
Over mature with tops dying back	
Hedge developed into line of trees	
16. Management method	
Flail	
Circular saw	
Bar cutter	
Hand tools	X
Excavator	
other	
17. Evidence of rejuvenation?	
Sapling	X
18. Fencing	
none	X
Electric	
Post and wire	
Sheep wire	
Timber fence	
Concrete post and rail	
wall	

APPENDIX II – HEDGEROW DATA SHEETS FOR THE HEGS

The assessment score of H1-H3 for the HEGS are present in Table 13.

TABLE 13: ASSESSMENT SCORE OF H1-H3 FOR THE HEGS

		STRUCTURE								CONNECTIVITY		
Q	6	1	2	3	4	5a	5b	7	8	9	10	11
Hedge Number	Length (m)	Recent	Height	Width	Cross-section	No. Mature	No Young	Mature per 100m	Young Per 100m	No. Gaps	No. Connections	No. Woody species
H1	80	0	3	3	3	2	3	2	3	4	4	11
H2	118	0	3	3	1	2	3	2	2	3	4	7
H3	305	0	3	3	3	5	6	2	2	2	4	8

	DIVERSITY		FEATURES			HEGS Score	Average Number of Species per 30m Section
Q	12	13	14	15	16		
Hedge Number	Native dominance	Woody Species	Bank	Ditch	Verge		
H1	4	4	2	3	0	1	3
H2	4	2	2	3	0	2	7
H3	4	3	2	3	0	-1	7